

AGRICULTURAL TRANSFORMATION IN OROMIA

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PREFACE

Oromia regional state has achieved remarkable growth in agricultural productivities of major crops and livestock over the past decades. Such an increment in productivity and production was obtained with limited investment in the sector. Besides, limited use of agricultural technologies and the associated management practices, efficient and effective extension and marketing systems, as well as limited agro-processing plants, masked the potential of agriculture in Oromia. Enhancing investment in the agricultural sector is critical to transform the current situation and thereby ensure growth in productivity and income leading to food security, import substitution, enhancing exportable products and job creation while maintaining the natural resource base.

The purpose of this document is, therefore, to identify key investment areas that can maximize the return from agricultural investment on a sustainable basis. The document highlights new initiatives and priorities, implementation strategies, partners, platforms, and financing modalities for production, research, development, and marketing.

I would like to acknowledge the Technical Teams that contributed to the development of the document, Agricultural Transformation in Oromia (ATO).

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GENERAL INTRODUCTION

Agricultural transformation comprises of two main processes, viz., the first being boosting productivity by modernizing farming and running farms as modern businesses (i.e. agriculture is to be seen as a business, not as a way of life), and the second, is strengthening the links between farms and other economic sectors in a mutually beneficial process. In transformed agriculture, farm outputs support manufacturing (through agro-processing), and other sectors support farming by providing modern manufactured inputs and services. According to the African Center for Agricultural Transformation, agricultural transformation is a process that leads to higher productivity on farms, commercially orients farming, and strengthening the link between farming and other sectors of the economy. As such, agricultural openness, agricultural commercialization, and product diversification, as well as sectoral & inter-sectoral integration, are key pillars of agricultural transformation. In simple terms, agricultural transformation involves mechanization¹, an increase in farm size to help intensification, & agricultural product (crop & livestock) diversification and sectoral and inter-sectoral integration.

Agricultural transformation is manifested by:

- Increased overall agricultural productivity on farms so that growers can produce enough for home consumption and both the domestic and export markets. Good to note that the increased agricultural productivity, in turn, contributes to the attainment of some of the targets set in Sustainable Development Goals (SDG), particularly (SDG1) (poverty reduction)², SDG2 (reduction of hunger & malnutrition & SDG10 (reduction of inequality)
- Increased rural income. The World Bank 2018 reports that growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors (<https://www.worldbank.org/en/topic/agriculture/overview>)
- Reduced poverty at the national, rural, and urban levels. Ethiopia is implementing one of the largest social protection programs in Sub-Saharan Africa – the Productive Safety net program (PSNP) since 2005, albeit with less effectiveness,

¹ As urbanization and rural labor availability declines, consolidating farms and farm services and increasing mechanization are means to raise agricultural production

² Agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity and feed the increasing human population, World Bank 2018; <https://www.worldbank.org/en/topic/agriculture/overview>

particularly with widespread poverty, relatively low levels of institutional capacity, and rapid scale-up of programs.

- Improved nutrition and food security
- Increased domestic and export markets of agricultural products. Market linkage is about orienting, linking and organizing producers and other value chain actors in an innovation platform to access and expand available market opportunity; it is about shifting from challenges of smallholder producers trying to find a market for what they can supply towards producing in response to particular market demands and moving from passive to active engagement to tap market opportunities.
- Expanded agro-processing industry
- Reduced income inequality between the rural and urban dwellers
- Change in consumption pattern; more of animal protein, vegetables, and fruits; more processed food
- Increased off-farm activities and businesses
- Enhanced job opportunity and reduced migration to urban and abroad

The outcomes of agricultural transformation include:

- increased share of agricultural export in agricultural value-added, i.e. increased agribusiness;
- increased share of processed agricultural products, fruits, green vegetables, and meats in all primary and processed agricultural products;
- The increased extent of diversification of agricultural produce/products;
- Increased and sustained income, which, in turn, contributes to the reduction of poverty and increased opportunity to access and secure food and nutrition.
- Decreased agricultural GDP and the corresponding drop in the percentage of economically active people engaged in agriculture as a share of the total workforce.
- Increased rural wages

The needs for agricultural transformation in Oromia are justified by the importance of agriculture in the regional economy (in terms of contribution to GDP, job creation, export market, and raw material for industries). The State also has a large population, below the poverty line, who is mostly food insecure and depends on emergency food aid, climate change, and environmental degradation. The contribution of Oromia agriculture in Ethiopia accounts for 37% of livestock production as well as nearly 50% and 70% of grain (cereals, pulses and oil crops) and coffee production, respectively.

Thus, the transformation of agriculture in Oromia would profoundly propel the overall agricultural transformation in the country.

The opportunities for agricultural transformation in Oromia include natural resources endowment (includes diverse agro-biodiversity, agro-ecology, tropical, subtropical and temperate climate to grow diverse crops); emerging agricultural commercial clusters, commodity value chains, and agro/industrial parks; and increasing urbanization as well as renewed government interest to invest in agriculture, including irrigation, mechanization, and tax exemption on imported agricultural capital goods.

On the other hand, agriculture in the region is constrained by the low level of adoption of existing proven technologies and hence low productivity, which is attributed to low levels of use of improved inputs as well as limited knowledge and skill of smallholder farmers. This is exacerbated by the traditional farming system, which is predominantly dependent on rain-fed and less mechanized. The diverse agro-ecology and farming systems is also a threat in the sense that it makes agricultural technology development expensive and limits economy of scale. Postharvest losses are estimated at 30% of agricultural products due to poor postharvest handling, processing, packaging, transportation, and storage. Limited input and output market, access to credit, poorly developed rural infrastructure, and weak institutional capacities are also among major factors hindering agricultural transformation. Also, low public investment in agriculture in general and in agricultural research for development (AR4D) in particular is significantly hindering agricultural transformation in Oromia. This is further worsened by poor integration and alignment within the agricultural sector and other sectors such as finance and markets.

Opportunities for agricultural transformation

- The government of Oromia is continuously committing and renewing its willingness to transform the agricultural sector with the promise to increase public investment in agriculture, including AR4D, infrastructure development such as irrigation schemes (small, medium and large) as well as rural road, although the large population of food-insecure people in the region is limiting investment in capital development

- Endowment³ with natural resources (agro-biodiversity, agro-ecological diversity, productive soils, conducive environment and climate for agriculture, surface and groundwater sources for irrigation and population)
- Emerging agricultural commercial clusters (ACC)⁴, easing out extension service delivery, producing at scale and market linkage
- Expanding urbanization & rising middle class, demanding diversified and nutritious food, such as vegetables, fruits, meat, fish and chicken
- Emerging commodity value chains (e.g. malt barely), agro-industrial parks, and market linkage of fruit and vegetable production with their stands as well as with supermarkets
- Growing agro-industry, including agro-industrial parks, that demand for large quantities of quality agricultural raw products as inputs

Challenges constraining agricultural transformation in Oromia

1. Low level of adoption of existing proven full package of agricultural technologies: This is primarily due to low capacity & capability to scale up/out of existing proven full package agricultural technologies; also constrained by limited multiplication, promotion, marketing, and distribution of major commodities along the value chain. Bachewe et al (2015) analyzed drivers of cereal production in Ethiopia and reported that an average cereal producing household is less than half as efficient as optimally producing households, and, consequently, there is considerable opportunity for additional growth in cereal production in Ethiopia. Access to information and extension services as well as access to agricultural inputs and raising the literacy level of farmers could contribute to increased productivity and efficiency in production. Currently, the use of improved agricultural technologies, particularly improved seed, is below 20%. Hence, a significant number of smallholder farmers are not accessing existing proven and improved agricultural technologies, with full packages of production.

³ Note: Many lines of evidence justifies the fact that in spite of Oromia' enormous potential in agricultural resources, the take-off for the agricultural sector remains with little support.

⁴ Note: The increasing ACCs and contract farms as well as consequent increase of agro-processing industries would demand high quality, uniform, traceable and high volume of products, which entails the development of strong and dynamic AR&D

2. High post-harvest loss⁵ and food wastage due to the low level of product value addition (i.e. warehouse management, processing, packaging).
3. Low level of productivity (land, labor, and total factor productivity). Factors contributing to low productivity include genetic potential, biotic stresses (diseases, insects, and weeds), abiotic stresses (soil acidity and salinity, waterlogging in Vertisols) as well as low level of use of other inputs⁶ such as fertilizers, crop protection chemicals, irrigation, and mechanization. The low productivity is also due to inadequate resource development & management capacity (human, physical, finance) for AR4D as well as limited participation of the private sector in agricultural research, including variety development and seed sector. Furthermore, low productivity (esp. labor) is also attributed to the low level of agricultural mechanization.
4. Low knowledge, skills, and management of smallholder farmers, due to the low level of rural literacy rate (49%)
5. Subsistence production system, resulting in low competitiveness both in the domestic & export markets. Many of the farmers are having small landholdings ⁷ (less than 0.50 ha for grain crops, for instance in Oromia)⁸, limiting economy of scale for mechanization and commercialization, which is further exacerbated by increasing urbanization at the expense of productive agricultural lands. The subsistence nature of farming makes farmers have a low purchasing power of inputs and the inability to invest to develop their farms.
6. Dependence on rain-fed agriculture⁹, which is often irregular in its onset and off-set and erratic in its amount & temporal and spatial distributions. To worsen things, rainfall variability between and within seasons is projected to increase due to increasing climate change.

⁵ The level of value addition and crop processing of agricultural commodities is low and postharvest losses in Ethiopia/Oromia is 30% on average of total production. Indeed, many foodstuffs are currently already being lost in the fields or after harvesting due to pests and diseases

⁶ Note: agricultural inputs particularly quality seeds of improved variety, fertilizers, crop protection chemicals

⁷ Note: Experiences of many countries indicate that land consolidation and property rights, including land user right, is one of the success factors in agricultural transformation

⁸ Calculated from CSA 2017/2018 area and number of households for grain crops

⁹ Agriculture is highly dependent on rainfall, and hence the onset, duration, amount and distribution of the rainfall determines the performance of the agriculture sector and the economy of the country in general.

7. Inefficient agricultural input & output markets & poor market structures; and price volatility for raw agricultural products like coffee, sesame, wheat, etc.
8. The inadequate interactive institutional system, viz. agricultural research, extension education, input and credit providers, etc.
9. Limited public and private capital investment¹⁰ in:
 - a. agricultural research for development,
 - b. input and output value chains, including technology multiplication (e.g. seed, heifers) and value addition through processing and packaging (e.g. dairy products, coffee products)
 - c. infrastructure, such as irrigation, road/transport (including rural road), market & market structures, telecommunication, electrification (including rural electrification)
 - d. Private investment in agricultural research & development is limited both from domestic private and attracting foreign direct investment. Such investment is particularly needed in seed systems, horticulture, and forage
10. Poorly developed policy and institutions¹¹ :
 - a. Inadequate policy environment (including political stability and commitment of leadership, which needs to be dynamic, evolving and accommodative)
 - b. Misalignment of sectoral and inter-sectoral institutions and organizations,
 - c. Inadequate extension services of promoting proven production technologies to small scale farmers, particularly in marginal areas
 - d. Low level of transformation readiness factors (institutional, organization and political)

10 Note: It is often recommended that developing countries must invest 20-25% of their GDP agriculture, including AR4D; China is noted to invest over 40%.

¹¹ Institutional constraints have negative direct consequences on productivity, income and investment, and this on food security and poverty reduction. Institutions are the rules of the game in a society, or, more formally, are humanly devised constraints that shape human interactions. Institutions include both formal rules, such as constitutions and laws, and informal rules, such as conventions and norms. They durable systems of established and embedded social rules that structure social interactions (Hodgson, 2015). It is to be noted decades of efforts on institutional change pre-date historical agricultural transformations that delivered significant increase in agricultural productivity of many countries, such as the USA, Netherlands, Republic of South Korea, Brazil and China.

CHAPTER I: TECHNOLOGY GENERATION SERVICE

1.1 INTRODUCTION

1.1.1 The role of agricultural technologies in agricultural transformation

As shown in the above sections of this document and drawn many lines of evidence from other countries (e.g. Brazil, Republic of Korea) that have successfully transformed and revolutionized their agricultural production, agricultural transformation is driven by multitudes of factors, which are often inter-related and complex. In subsequent sections, we limit ourselves to show the role of agricultural research for development (AR4D) in generating technologies and production practices to increase agricultural productivity. It is noted that one of the determinants of agricultural transformation is boosting agricultural productivity using technologies and production practices generated through AR4D. We also show the institutional capacity of IQQO (human, infrastructure, and finance) to substantially and sustainably undertake AR4D for the different commodities and diverse agro-ecologies.

1.1.2 The concept of AR4D

In many African countries (including Ethiopia) and other parts of the world, agricultural research has been in evolution over the past 50-60 years. There has been a transition from on-station to on-farm trials, then to the commodity-based research program, and then to participatory, demand-driven, and client-oriented research. The process of these transitions new understandings of the relationship between researchers and users have been manifested. In the course of the evolution, the naming has also been on changing depending on the context, viz. agricultural research, agricultural research and development (AR&D), and agricultural research for development (AR4D). More recently integrated agricultural research for development (IAR4D) based on the Innovation Platform (IP) approach is appearing in the literature and soon will become in common use.

The AR4D and IAR4D use participatory technology generation, evaluation, multiplication, and dissemination along the value chain of major commodities (crop, livestock, natural resource management practices, and farmer resource allocation) as a key strategy. Establishing and operationalizing the IP for mutual learning, knowledge, and resource sharing would add substantial value to the AR4D. The IP should bring together various important partners and stakeholders, including a wide range of private, NGO, university, and public sector organizations, and confirm their synergy.

Conventional linear transfer of technology approach has a narrow focus on supply-driven research by scientists and its transfer to farmers through extensions agents. Some argue that the focus on linear technology transfer has been a central cause of the stagnation of agricultural productivity growth and development in Sub-Saharan Africa (Adekunle and Fatunbi, 2014; Olarinde et al., 2013). By contrast, AR4D succeeds in achieving impact through implementing innovation platforms that engage multiple actors along the commodity value chains in seeking to innovate solutions to technological, institutional, and infrastructural constraints in the agricultural system. AR4D targets the immediate use of research outputs for development purposes and has become apparent since the late 2000s.

In this document due attention is given to AR4D as it is believed that it would contribute significantly to agricultural transformation in Oromia.

As opposed to the common framings of agricultural technologies and research outputs, the concept of agricultural research for development (AR4D) involves the process of (1) development of new and useful products; (2) partnership and collaboration; and 3) active involvement of stakeholders/users in the process of new product development. The development of new and useful products immediately brings the user into a center stage. In the context of AR4D, the new & useful products can be improved crop varieties or improved livestock breeds; new production practices and processes that save energy and time as well as increase effectiveness, efficiency, and economy of resource use; new services (extension, credit, input, and output marketing); and regulatory services, and so forth. The partnership¹² and collaboration¹³ across very diverse groups of research programs and development actors are essential for AR4D to have a positive impact on economic and social developments. Active involvement of stakeholders/users is required in the process of new product development (e.g. in research agenda setting, client-oriented research such as participatory plant breeding and on-farm trials). As such, the new product, practice, or service is assumed to provide something of value (even much more value) to the eventual users, starting with farmers and end-users. User involvement in new product development processes can also be conceived in terms of feedback into product development, testing, and marketing processes. The user involvement aims at improving new product development processes and its final

¹² New challenges such as climate change require a systematic and participatory approach to agricultural research to be developed with the aim to finding solutions to the specific problems in a given agro-ecological setting.

¹³ All stakeholders – including government, donors and the private sector – must align and target their investments towards a shared goal of sustainable and inclusive growth. Collaboration is critical for success. We need to provide farmers, agricultural professionals, agribusinesses, scientists, and local policy makers with the necessary information, as well as the space to meaningfully cooperate.

acceptability for wide-scale adoption. In general, three possible roles and users within the new product development can be identified as (1) resource (the user as a source of innovation); (2) co-creator (the user as a participant in the product design and development); and (3) user (relating to user involvement in product testing, and validation).

The development and marketing of new products and services are the lifeblood of agricultural transformation. AR4D is a version of the agricultural innovation system proposed as a new approach, a set of good practices, or a new model for organizing research and facilitating innovation to address complex problems of agricultural development, food security, and poverty (FARA, 2003). It is interesting to note that experiences from Brazil, China, and several Asian countries (e.g. Japan, Republic of Korea, Malaysia and Indonesia) show that the development of the agricultural sector holds the potential to generate a faster rate of poverty reduction than any other sector (Alen & Coulibaly, 2009). The AR4D focuses on integration across value chain stakeholders and perspectives to attempt to overcome the many non-bio-physical technological factors that have been constraining agricultural development in Ethiopia. Key components of AR4D are productivity increase, natural resources management, markets, and policy. AR4D has positive impacts on productivity, income, food and nutrition security, and poverty reduction (Siziba et al., 2013; Ngaboyisonga et al., 2014) as well as social capital (van Rijn et al., 2015).

In the following section, the role of agricultural productivity, which depends on the outputs of AR4D is discussed.

1.1.3 Agricultural productivity growth for agricultural transformation

Besides many other factors, agricultural transformation necessitates substantial productivity¹⁴ (land, labor, and total factor productivity) increment both in crop and livestock production. Increased productivity in agriculture is a requirement for (1) attaining food and nutrition security and produce surplus both for domestic and export market so that income is increased, (2) providing raw products for agro-processing industries, and (3) releasing labor for industry. If the agriculture of Oromia is to be productive at scale, then land, labor, capital, and science would all have to come together in an orchestrated effort.

¹⁴ Note: Increased agricultural productivity and agricultural transformation will contribute to SDG 1 (poverty reduction), SDG 2 (reduction of hunger and malnutrition and doubling agricultural productivity), and SDG 10 (reduction of income inequality).

The increase in agricultural productivity, in turn, demands a vibrant and dynamic AR4D, which continuously provides improved technologies and knowledge to steadily increase the productivity of crops and livestock, fishery and apiculture as well as natural resource base management. As such, AR4D is one of the main factors contributing to agricultural transformation by delivering technologies and production management practices that would boost productivity. Appropriate agricultural technologies such as high yielding varieties, production practices, mechanization, and postharvest handling practices have greatly contributed to agricultural transformation in Brazil, China, India, Republic of Korea, Japan and Vietnam, resulting in reduced poverty, increased food, and nutrition security, in the face of population growth, natural resources degradation, and climate change. Indeed, various impact assessments have shown that AR4D is one of the most effective investments when it comes to increasing agricultural production. Thus, investing in AR4D is important for agricultural development in Oromia to overcome the challenges of food and nutrition insecurity, low income and poor livelihood of smallholder farmers, while limiting the negative impacts on the environment.

Agricultural transformation necessitates the use of improved agricultural technologies and environmentally-sustainable management practices as well as knowledge and skills. In this endeavor, building capacity and capability in AR4D is vital. That there is no greater engine for driving growth and thereby reducing hunger and poverty than investing in agriculture, esp. in AR4D and innovation. The internal rate of return on investment in agricultural research has been remarkably high, averaging about 20-40%¹⁵.

The increase in agricultural productivity not only entails the generation of improved technologies, but also multiplication, demonstration, and wide-scale use (i.e. adoption) of the new improved technologies generated by AR4D. Indeed, many lines of evidence demonstrate agricultural productivity can be boosted with a full package adoption of existing agricultural technologies. Results further show a substantial productivity gap among full package users, average producers, and poor farmers, implying that production might well be further boosted if average producers and poor farmers succeed in adopting the technologies and management practices of the more efficient farmers and research recommendations.

15 Waibel, H. (2006). Impact Assessment of Agricultural Research for Development and Poverty Reduction. Working Paper 2006 No. 2 Development and Agricultural Economics. Faculty of Economics and Management, University of Hanover, Germany

In Oromia, as in other parts of Ethiopia, a substantial share of the highland area has limited potential to expand the arable land for agriculture. Many areas are already reaching their environmental threshold level to increase production through land expansion. This is exacerbated by the expansion of cities, towns, and even the emerging of new rural towns at the expense of productive arable land. This calls for increased intensification on less and less arable land through optimization of production inputs as well as producing two or more times in a year using irrigation. Moreover, increased urbanization demands the creation of new agricultural innovations, such as peri-urban & urban agriculture, roof farming, vertical agriculture, new knowledge, and thinking as well as new markets (e.g. super-markets with fresh agricultural products like fruits and vegetables as well as beef, honey, and fish).

The increasing agricultural commercialization clusters and contract farms, as well as the consequent increase of agro-processing industries, agro-industrials parks, and agribusiness, would demand high quality, uniform, a traceable, and a large volume of products. The development of such products entails, in return, the development of strong and dynamic agricultural technology generation and wide-scale utilization.

The need to increase agricultural productivity makes AR4D a key priority for the government of Oromia, policymakers, development partners, and donors as well as the management of IQQO. Hence, AR4D in the region should be a key investment priority for food and nutrition security, and poverty reduction as well as overall economic growth and development.

In the subsequent chapters, we analyze IQQO's readiness (organizational, research programs, human resource, research infrastructure, and budget) as well as linkage and partnership to do AR4D in a way that significantly contributes to agricultural transformation in the region.

1.2 Current status of IQQO to make a meaningful contribution to agricultural transformation

1.2.1 Organization set up

Established in 2001, IQQO has currently 17 research centers and 7 research sectors. From 1995 to 2000, it served as a research coordination unit within the Oromia Bureau of Agriculture (OBoA). Four of the 17 research centers are soil labs; 3 are agricultural engineering research centers; one each is specializing in apiculture and fishery research.

Only three of the 17 centers are dealing with livestock research, although livestock is both economically and culturally very important sub-sector in Oromia. It is to be noted that a substantial part of the regional land is inhabited by agro-pastoral and pastoral communities, where livestock is the major livelihood and where a considerable proportion of the regional population is food insecure (under Productive Safety Net Program/PSNP) and largely depend on emergency food aid. Even though 8 of the 17 centers are having a crop research program, only two are known for developing and releasing crop varieties, along with their agronomic and crop protection practices.

Each of the 17 research centers is led by a Center Director, who is accountable to the IQQO's Director General at Head office in Finfinne. The Director-General is assisted by the deputy director-general and 7 research sector directors plus support directorates (HR, planning, finance, legal, & public relation).

1.2.2 Centre development

- At its establishment, two full-fledged research centers (Bako and Sinana) and one sub-center (Adami Tulu) were transferred from EIAR to IQQO. Immediately, Adami Tulu was upgraded from the sub-center to a research center level. Then the institute acquired and upgraded the existing entities into a research center. These include 4 soil labs (Bedele, Batu, Nekemte, and Fiche), 4 rural technology multiplication centers (Bako, Jimma, Asella and Harar), 1 apiculture training center (Holeta) and 1 fishery center (Batu). Further, to address the unaddressed areas/zones of the Oromia region, IQQO opened 4 new research centers (Machara, Bore, Haro-Sabu, and Yabello). In general, IQQO currently administers 17 research centers.
- The operation of IQQO in remote zones of Oromia together with existing EIAR centers in the region has stimulated the technology needs of farmers throughout the region. This is further enhanced by the pre-extension demonstration by both IQQO and EIAR (either alone or jointly), which increased seed and other improved technology demand in the region. The increased seed demand has prompted the establishment of Oromia Seed Enterprise by Oromia government in 2008, which was spearheaded by IQQO.

1.2.3 Human resource (focus on researchers and technicians)

Agricultural transformation needs AR4D as an input, while effective AR4D, in turn, requires qualified and experienced human resources¹⁶ (particularly researchers and technicians). Experiences of many countries (e.g. Brazil, Republic of South Korea, China), which transformed their agriculture show that they have invested and built their AR4D capacity. Concerning human resource capacity, full-time equivalent¹⁷ (FTE) researchers in agricultural and related sciences plus their qualification and gender balance are very important if AR4D is required to meaningfully expedite agricultural transformation.

At the beginning of 2019, IQQO has a total of 1844 employees, of which 496 (26.9%) are FTE researchers and 1348 are support staff (73.1%). Analysis of the qualification of the researchers shows that 50% of the researchers are just BSc-qualified (Table 1). The proportion of Ph.D. holder researchers of IQQO is less than that of EIAR, for instance (Figure 1 & 2).

Age-wise distribution of the researchers further shows that most of the researchers are young (ca. <35), who lack experience and skill. Hence, they require mentoring, short term training courses, and graduate-level education, i.e., BSc to MSc to Ph.D. At the moment IQQO has limited critical mass of senior researchers (i.e. Ph.D. qualified) needed for effective AR4D. Such researchers are necessary to set research agenda, plan & lead research programs as well as to mentor & train BSc and MSc level researchers and technicians.

Still, because of necessity, 7 of the 17 Ph.D. holders (41%) are engaged in research management at the head office and even those at the center are engaged in program management and spend less in fieldwork. It is interesting to note that a minimum of a Ph.D. qualified scientist is generally considered necessary for the conception, planning, designing, execution, and management of high-quality research & for effective communication with policymakers, donors, and other stakeholders. Gender inequality in the total number of researchers is extremely high, in that only 2% of the researchers are female. According to ASTI (2016), female researchers and managers offer different insights from their male counterparts, and their input provides an important perspective in addressing the unique and pressing challenges of smallholder farmers, particularly issues related to women farmers.

¹⁶ Many lines of evidence indicate that human capital (including training, education and health), contributes to worker productivity and agricultural growth

¹⁷ FTE (full-time equivalents) takes into account the proportion of time that researchers spend on research activities.

None of the management positions of IQQO (both at the head office and center level) is currently occupied by a woman researcher, implying that women have less influence in policy- and decision-making processes of research, potentially creating a bias in decision making and priority setting. Consequently, IQQO must recruit a balance of male and female researchers as much as possible.

Table 1 Number of IQQO researchers by qualification in 2019

Category	Number of IQQO researchers by qualification	%
Ph.D.	17	3.42
MSc	230	46.28
BSc	250	50.30
Total	497	100.00

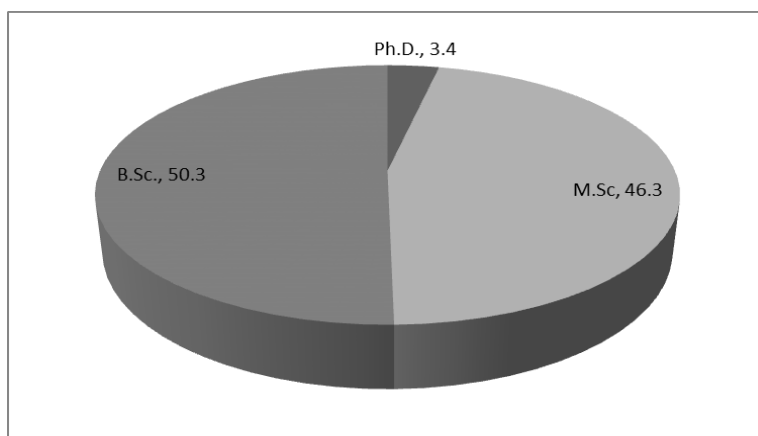


Figure 1 Percentage of IQQO Researchers by qualification in 2019

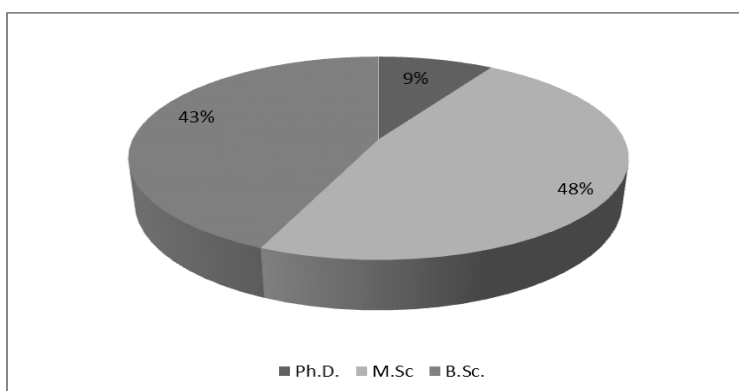


Figure 2 Percentage of EIAR Researchers by qualification in 2019

Even at the national research system (EIAR, RARIs), the research human capital development needs due attention (Table 2). According to ASTI (2016), Ethiopia has one of the fastest-growing, yet youngest and least-qualified pools¹⁸ of agricultural researchers in Africa, in that many of the researchers employed at EIAR and the RARIs are only trained to the BSc level and hence require strong leadership, mentorship, and—ultimately—further training. As of 2016, more than half the country’s agricultural researchers held only BSc degrees, and 37 percent were under 31 years old. ASTI (2016) went and concluded that turnover among the country’s MSc- and PhD-qualified agricultural researchers has been high. This is particularly true for qualified plant breeders, for which global demand is high both in the public (including CGIAR centers) and private sectors. Concerning gender balance, Ethiopia (EIAR + RARIs) is noted to employ a low number of female researchers, ranging between 2-10%, while Lesotho, Mauritius, Namibia, and South Africa employ as high as over 44% female researchers (ASTI, 2016).

Table 2 Comparison of qualification of Ethiopia/Oromia researchers with some countries

Country	MSc + PhD	Source
Ethiopia	56.5	EIAR, 2019
Oromia	49.7	IQQO, 2019
Kenya	85	ASTI, 2018
Uganda	81	ASTI, 2018
Tanzania	77	ASTI, 2018

Key challenges of IQQO in building critical research staff

- Retention of its MSc & Ph.D. research staff is perhaps the greatest challenge of IQQO¹⁹. IQQO mostly employs BSC holders and trains them to the MSc level, but either returnee are low or attrition rate is high after obtaining MSc and Ph.D.
- Limited budget available to recruit MSc and Ph.D. qualified researchers. Thus, IQQO is compelled to recruit junior BSc holders, for which budget is often

¹⁸ The introduction and expansion of graduate programs was a key factor in expanding the research output of Brazil, for instance.

¹⁹ Note: EMBRAA’s charter included a proviso that it did not have to follow civil service hiring practices and it was free to hire whoever was considered most qualified at national and international wage rates

available. Note that building the capacity of researchers to MSc and Ph.D. levels is an inherently expensive, long-term process.

- Limited opportunity for Ph.D. training both in-country and abroad
- Absence of adequate staff incentives (e.g. salary scale, housing, loan guarantee, health insurance) and reward mechanisms for staff retention
- Almost lack of senior researchers to mentor young researchers
- Lack of attractive salary to employ Ph.D. & MSc level researchers relative to salary at competing organizations such as CGIAR centers, NGOs, development projects, and private.
- The remoteness of IQQO centers, lacking delivery of social services (e.g. school for children, health, transport, market, and employment for family members) difficult for family members of senior staff

1.2.4 Public research spending (budget)

Investments in AR4D are known to greatly contribute to economic growth, agricultural development, and poverty reduction in developing countries compared with other types of public spending, such as education, health, and rural roads (IFPRI, 2017). In general, funding sources for AR4D are derived from a variety of sources, including national governments, donors, loans from the African Development Bank, the World Bank, sub-regional organizations, producer organizations, the private sector, and internally generated revenues as well as royalty from research services. Countries like Brazil, the Republic of Korea, China, and India have become successfully transformed their agriculture partly through heavily investing in their AR4D. In Ethiopia too, further growth in agricultural productivity and production is expected to come from productivity (land, labor, and total factor productivity)²⁰ as productive agricultural land is diminishing fast because of the increasing human population, expansion of urbanization, and land degradation.

It has been well-documented that investment in AR4D has a positive impact on agricultural productivity growth and it has higher returns compared with many other types of agricultural and non-agricultural public spending (Fuglie and Rada 2016). In recognition of the

²⁰ Total factor productivity is generally defined in accounting terms, namely the ratio of an aggregate of total outputs to an aggregate of total conventional inputs and hence the efficiency with which inputs are transformed into outputs. TFPP is preferable to other partial-productivity measures, such as yield/ha (land productivity) or outputs per worker (labor productivity), because such partial measures account for only a single production factor, whereas TFP accounts for the contributions of all measureable inputs, principally land, labor, capital and materials.

importance of agriculture for poverty reduction and its positive effect on the growth of other sectors of the economy, Maputo declaration 2003 by AU member states on agriculture and food security has launched Comprehensive Africa Agriculture Development Program (CAADP) in which the countries have established a commitment to spend at least 10% of their national budgets on agriculture to ensure 6% sectoral growth per year. Moreover, they have committed to spend at least 1% of the agricultural GDP on AR4D. Agricultural spending (excluding the private for-profit sector²¹ is one of the indicators to measure the AR4D capacity and capability of a country.

However, IQQO is suffering from an increasingly declining trend of public research spending for experiments and capital investment (Table 3/Figure 3). During the last two fiscal years, about two-thirds of the IQQO's budget went only for recurrent budget, which largely constitutes staff salary, including researchers, technicians, and support staff.

Table 3 IQQO budget from 2002-2011 EC fiscal years (birr)

Budget year (EC)	Recurrent budget	Experimental Budget	Capacity building budget	Total
2002	29,753,638	16,997,077	26,641,700	73,392,415
2003	32,062,576	12,364,700	34,691,600	79,118,876
2004	50,532,520	24,853,100	55,832,922	131,218,542
2005	62,936,975	35,536,680	21,461,600	119,935,255
2006	66,723,942	34,536,680	22,461,600	123,722,222
2007	74,775,748	39,355,020	17,177,479	131,308,247
2008	95,225,505	46,453,900	34,082,557	175,761,962
2009	101,386,272	52,334,708	26,461,547	180,182,527
2010	126,942,659	46,494,188	23,972,629	197,409,476
2011	157,287,816	52,313,339	25,049,049	234,650,204

21 Purchasing power parity (PPP) index, measures the relative purchasing power of currencies across countries by eliminating national differences in pricing levels for a wide range of goods and services. The largest components of a country's agricultural research expenditures are staff salaries and local operating costs, rather than internationally traded capital investments

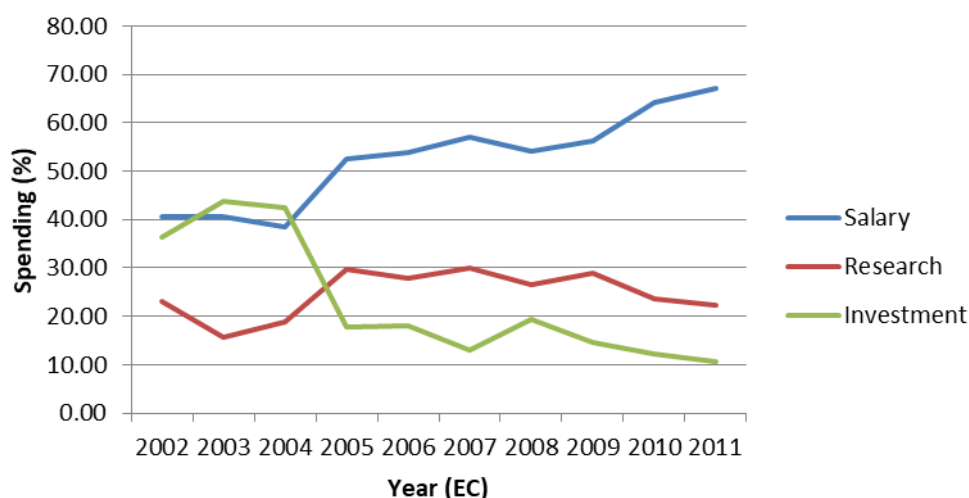


Figure 3 Trend in agricultural research spending (staff salary vs research and investment) in Oromia over the last 10 years

Clearly shows that limited budget allocation for experimental activities and capital investment by IQQO, hindering its research capacity to generate demand-driven modern and improved agricultural technologies and respond to emerging problems, such as crop and livestock diseases and increasing decline in soil health management, including soil acidity and salinity as well as drainage in Vertisols.

Using Oromia's total GDP and AgGDP of 2014/2015 (i.e. 2007 EC) and considering the CAADP criterion of public investing of at least 1% of AgGDP in AR4D, Table 4 shows that Oromia spent only 0.07% of its AgGDP for its AR4D. According to 1% AgGDP allocation for AR4D, IQQO should have received on average 1.74 billion birr per annum, but actually, IQQO received 117.06 million birr, which is not only desperately lower than the expectation but also tends to decline with time. It is to be noted that agricultural research intensity ratio, i.e., agricultural research spending as a share of its AgGDP²²²³ is one of the indicators to measure a country's commitment to supporting AR4D.

²² The minimum investment target set by the African Union and the United nations is 1%

²³ Spending intensity ratio is another useful comparison is the commitment to public AR&D investments across countries is to measure total public AR&D spending as a percentage of AgGDP; NEPED's national R&D investment target is at least 1% of GDP

Table 4 Agricultural GDP and level of agricultural research spending in Oromia (2003-2007 EC)

Year (EC)	AgGDP (Billion Birr)	IQQO's budget (Million Birr)	Actual research spending (% of AgGDP)	Desired research spending 1% AgGDP (Billion Birr)
2003	101.85	79.12	0.08	1.02
2004	155.51	131.22	0.08	1.56
2005	174.42	119.94	0.07	1.74
2006	203.11	123.72	0.06	2.03
2007	234.34	131.31	0.06	2.34
<i>Mean</i>	<i>173.85</i>	<i>117.06</i>	<i>0.07</i>	<i>1.74</i>

Even public research spending is low at the country level. A study conducted to assess the level of spending on agricultural research by 40 SSA countries showed that Ethiopia was spending about 0.3% of its agricultural GDP on agricultural research in 2014 (IFPRI, 2017), which is much lower than Kenya (0.48%) and Uganda (0.62%). On the other hand, Brazil invested 1.28% of its AgGDP on AR4D. This reveals that Ethiopia investing lower in AR4D ads compared to its neighboring countries.

The level of spending on agricultural research by the Oromia Regional State (Table 4) is much lower than both the CAADP recommendation and relative to national expenditure on AR4D and less than several other countries (Table 5). On average, the region has been spending only about 0.07% of its annual agricultural GDP on agricultural research. Moreover, the majority of the budget allocated for agricultural research has been spent on salary while the budget available for research work and associated investment has been declining from time to time (Figure 3). For instance, about 67% of the budget allocated for OARI in 2011 EC goes to salary indicating how much research work is constrained by a serious shortage of budget in the region.

Another note is that countries with greater agro-ecological diversity, like Ethiopia/Oromia, require higher research investments compared to countries with greater agro-ecological

homogeneity. Countries with more homogeneous agro-ecologies exploit the economy of scale from return on investment in AR4D²⁴.

Table 5 Comparison of Ethiopia with other countries (ASTI, 2018)

Category	Ethiopia	Oromia	Kenya	Tanzania	Uganda
AR4D spending (Million USD)	162.1	7.1	222.7	68.5	99.4
AR4D spending as share of AgGDP	0.29%	0.07%	0.48%	0.17%	0.62%
# of Researchers (FTE)	3,025	497	1158	785	4559
% MSc + Ph.D. researchers	56.3	49.7	85	77	81

1.2.5 Key challenges of IQQO in financing AR4D

- The total annual budget allocated to IQQO is desperately very low that it covers only staff salary and only the limited amount remaining is spent on operational and capital investment.
- IQQO is not autonomous to administer the limited budget allocated for the institute
- IQQO is not authorized to reinvest the internal revenue it generates and hence low incentive to raise its revenue (e.g. revenues from sales of basic/pre-basic seeds, farm machinery, beehives, research by-products, and other services/supplies)
- IQQO has limited capacity to communicate, advocate and publicize its research contributions in AR4D and return on research investment in Oromia to win the heart of policy and decision-makers to convince them to increase budget allocation
- IQQO has limited access, linkage, networking, and partnership with donor and international development partners because of a shortage of senior staff members.

The analysis makes the case for greater investment in AR4D by Government of Oromia as a crucial prerequisite to raising agricultural productivity and competitiveness, increasing rural incomes and ensuring food and nutrition security, reducing poverty and food-import dependence, and halting environmental degradation.

²⁴ More recommendable target for large countries like Nigeria and Ethiopia is 0.4-0.5% of AgGDP (ASTI, 2018 & IQQO 2018)

1.2.6 Research infrastructure of IQQO

Even though IQQO was established 25 years ago, it has very limited research infrastructure, and facilities as well as logistics to effectively undertake AR4D in a way that can support agricultural transformation in the region. This limitation is mainly emanated from low public investment for IQQO. As a result, the institute has:

- Limited field vehicles (50 vehicles for 18 research centers, including the headquarter, which is on average less than 3 vehicles per center) and service buses, limiting the extent of on-farm experimentation and demonstration of newly released agricultural technologies. Most of the vehicles under operations are very old and require frequent maintenance, which puts greater pressure on the already under-budgeted Institute. IQQO has only about 3 service buses/vans to provide a shuttle for its staff to and from office to home. The change is more critical for those research centers that are located far away from the nearby town.
- Limited farm machinery, for instance, has seven tractors for all centers; but has no other machinery like row planters, plot planters, plot harvester, combine harvester, bailers, seed cleaner, tractor mounted sprayers, etc.
- Limited irrigation infrastructure to advance two or more generations of breeding cycles in a year and undertake seed production activities during the off-season.
- A limited number of laboratories (e.g. soil and plant nutrition, microbiology, plant pathology, animal health/veterinary, animal nutrition, tissue culture, biotechnology, apiculture, and fishery). The available laboratories do not have adequate equipment, consumables, and lack continuous maintenance services. Skilled laboratory technicians are also limited.
- Limited research infrastructures (greenhouse, lath house, animal barns, workshops, sheds, garages) and warehouses (e.g. cold stores for germplasm, seed, and property stores).
- The insufficient number and poorly furnished offices, staff residence house for research centers located away from towns such as Sinana, Bako and Adami Tulu, etc.

Almost all research centers require rehabilitation and upgrading of research infrastructures such as labs, offices, staff residences, and field infrastructure (fence and farm roads). There

is a need for upgrading of Fiche and Bedele soil labs to full-fledged research centers to address the research needs of North Shewa and Buno Bedele Zones, respectively.

In a nutshell, the standards of research infrastructures, facilities, logistics, and farm machinery currently owned by IQQO are dismally inadequate to significantly contribute to the agricultural transformation needs of the region.

1.2.7 Research technologies generated by IQQO

Over the last two decades, IQQO has developed and deployed several agricultural technologies that contributed to enhanced agricultural production, productivity, quality, and operational efficiency. The achievements of IQQO can be summarized as follows:

1.2.7.1 Crop based technology development

- About 116 improved crop varieties on cereals, pulses, horticultural crops, oilseeds, and seed spices have been released along with improved crop, soil, and water management practices (Figure 4). Hundreds of other crop varieties jointly released at the national level, which are proved to be adaptable in different areas of Oromia.

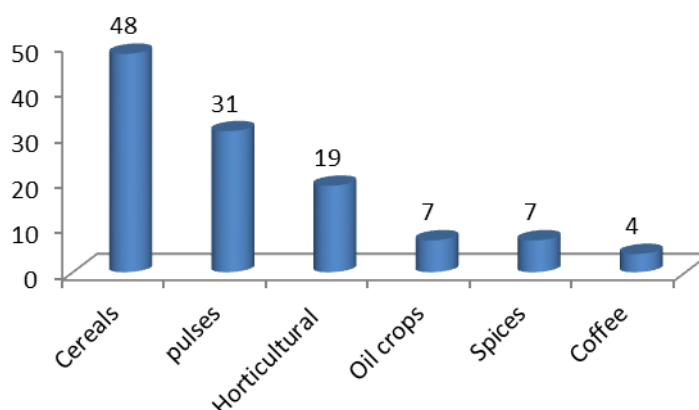


Figure 4 Number of varieties released by crop types

1.2.7.2 Livestock based technology development

- From long-term crossbreeding of selected local cattle breeds (Boran, Horro, Arsi) with Holstein Friesian, crosses with 50 to 62.5% exotic blood level (with more than 2000 liters of milk per lactation) be suitable and recommended for smallholder farmers. Full management packages (feeding, health care, housing, product handling, and processing) have been recommended for the crossbreds.

- Nine high yielding and well-adapted forage varieties (belonging to oats, vetch, pigeon pea, and *Dolichos lablab*) have been released with their full production and utilization packages. Overall, the national research in Ethiopia has so released and recommended a total of 53 different forage varieties belonging to grasses (25), herbaceous legumes (18), browse trees and shrub legumes (10) for the different agro-ecological zones of the country (Figure 5). Oromia is in an advantageous position to make use of these technologies as most of the federal research centers are located in the region.

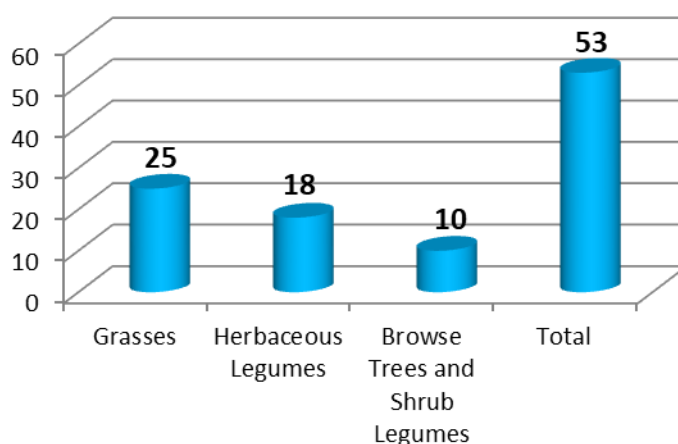


Figure 5 Number of released forage varieties in Ethiopia

- Weight gain and reproductive performances of Horro sheep have been improved with the use of selected elite rams in a community-based breed improvement scheme.
- Feeding systems that enable selected local cattle breeds (Boran and Arsi bulls) to attain the desired export market weight of 300kg at an early age have been determined.
- Five distinct honeybee races (*A. m. bandasii*, *A. m. jementica*, *A. m. scutellata*, *A. m. monticola* and *A. m. woyi-gambella*) identified in different agro-ecologies of Oromia region. Nine specialty honey types with a distinct aroma, odor and quality identified; and techniques to differentiate floral honey from adulterated honey and methods of retarding the undesired granulation of table honey developed. Moreover, quality control and grading systems of honey and beeswax developed and endorsed by the Ethiopian Standard Authority.

- Physico-chemical, as well as biological properties of the major water bodies in Oromia, have been characterized and their suitability for fish production established. Moreover, the status of the fishery, fish species abundance, distribution, and biology has been studied in different lakes of Oromia and appropriate management options recommended for sustainable utilization of the resource.
- More other technological recommendations are there in various aspects of livestock production which can be used as important inputs for package development and/or refinement.

1.2.7.3 Natural resource management

- Integrated nutrient management for different cropping systems and agro-ecologies determined,
- Conjunctive use of chemical and organic fertilizers studied to harness the potential productivity of different crops,
- Phosphorus critical values determined for maize, bread wheat and teff in various agro-ecologies based on soil test and crop response method,
- Integrated soil acidity management (lime and balanced fertilizer application) improved crop productivity and production of maize and wheat,
- Integrated watershed management for sustainable natural resource use and rangeland developed

1.2.7.4 Farm power and agricultural machinery

- Various animal and mechanical powers drove improved technologies, land preparation implements, row planters, cultivators, chemical applicators, crops, and fruits harvesters, mobile threshers, and shellers designed, developed, modified and or adapted, multiplied and distributed to users

1.2.7.5 Post-harvest and food

- Several technologies of seed cleaning and grading machines, grain, potato and onion storage structures, groundnut decorticators, milk processing, honey processing, Kocho processing, animal feed processing, different carts for farm product transportation developed, modified and/or adapted, multiplied and distributed to users

1.2.7.6 Rural energy

- Different improved biomass utilization stoves, bio-fuel oil pressing and utilization equipment, biogas generation and utilization stoves, small scale hydropower structures (turbine, penstock, hydram) and utilization equipment, solar heat collectors and utilization technologies developed, multiplied and distributed for household use

1.2.7.7 Agricultural economics, extension, and gender

Pre-extension demonstration: Since the last ten years about 259 crop technologies, 89 livestock technologies, 19 natural resource management technologies and 45 agricultural engineering technologies have been demonstrated to more than 8298 farmers/pastoralists

Pre-scaling up popularization: More than 138 crop technologies, 26 livestock, 17 natural resource and 8 agricultural engineering technologies have been disseminated to more than 16,100 farmers, pastoralists and agro-pastoralists in different agro-ecologies of the region

1.2.7.7.1 Agricultural economics

Production systems constraints and opportunities identified and prioritized for wheat, barley, coffee, livestock, beekeeping, and fishery in selected zones and districts of the region.

- Economic efficiency, productivity and profitability of maize, sorghum, potato and tomato production in selected zones and districts of the region
- Factors affecting adoption of teff, soya bean, sesame, onion, *chefeka* and modern beehives, rainwater harvesting and agricultural mechanization technologies identified for selected zones and districts of the region
- Value chain studies conducted on wheat, soya bean, potato, head cabbage, camel, highland sheep, beef cattle, milk, and milk products in selected zones and districts of the region
- The information generated on the contribution of non-timber forest product to household food security, farmers' perception on soil erosion, soil fertility improvement, soil and water conservation practices for selected zones and districts of the region

1.2.7.7.2 Agricultural extension and gender

- Factors hindering effective linkage between actors working in agriculture and rural development identified for East Shewa Zone
- Indigenous knowledge on beekeeping, crop production management, and pest control methods identified and documented for selected districts of the region
- Information generated on gender participation in production and marketing of bee products, gender roles, and responsibilities, access to and control over resources, gender-based production constraints and opportunities, women access to agricultural extension services for selected and representative zones and districts of Oromia.
- About 50 research journals, 45 proceeding and working papers and 30 thesis research reports produced on various research areas of agricultural economics, extension, and gender.
- Early generation seeds (breeder, pre-basic and basic seed), seedlings and cuttings of various improved food and forage crop varieties and tree species were produced and distributed to seed multipliers
- Different improved breeds of livestock, poultry, fish and honey bee colony multiplied and distributed to users
- Farm machinery, seed and grain processing equipment, soil and water management devices, energy-saving equipment, grain storage, and beehive structures were developed, and prototypes were distributed to users and multipliers
- Capacity building supports on the multiplication of various agricultural technologies were given to the users and large-scale multipliers

The achievements of IQQO over the last two decades is appreciable given the constraints it has in terms of a low number of qualified researchers (refer to section 6.3), low annual budget allocation (refer to section 6.4), poorly developed research infrastructure (refer to section 6.5), thinly spread efforts and resources and inadequate sectoral and inter-sectoral linkage and integration (refer to chapter 7 and chapter 8 below). Note that several technologies, knowledge, and information generated through collaborative research programs and projects with the national research system are considered in this document. However, the proper identification, adaptation to target locality, and utilization of technologies generated by EIAR and other regional agricultural research institutes and

universities are equally important for the agricultural transformation of Oromia. Technology shopping and adaptation need to be done from abroad as well.

Another important point to consider is that all these research technologies are developed using conventional research tools and procedures, with minimal use of modern research techniques, such as biotechnology, ICT, and GIS. Hence, there is a strong need to develop biotechnological tools such as marker-assisted selection.

Unless AR4D provides appropriate modern technologies to boost agricultural production and productivity as quickly as possible, food and nutrition insecurity, as well as poverty, persist, agriculture-based off-farm activities remain stagnant and cannot absorb rural workforces, resulting in increased unemployment and migration. This will affect the overall economic development of the region in particular and that of the country in general. Oromia with its large agro-ecological diversity requires high research investments in human resource development, research infrastructure, including modern research techniques and tools.

1.2.8 Research focus/priority setting

Despite a limited budget, infrastructure, and qualified researchers, IQQO has been attempting to research various sectors and programs. Consequently, research resources (human, finance, logistics) are thinly distributed. This is exacerbated by poorly integrated research system in the region, involving EIAR, and universities. Experiences in many countries show that focusing on key export commodities and staple food crops is crucial to bring about breakthroughs, which in turn, pulls development in other commodities and sectors of the economy.

For example, Brazil focused first on coffee, orange, sugarcane, soybean, beef and forage; the Republic of Korea focused on rice; Malaysia focused on rice, rubber, oil palm, and cocoa; Japan on rice and silk; etc. India achieved self-sufficiency in 20 years, with 16 years of a concerted effort of pushing wheat and rice yields (1960-1981). China prioritized first rice and wheat for its AR4D. Indonesia AR4D first mainly focused on five specifically identified food commodities, namely rice, soybean, maize, sugarcane, and beef²⁵.

²⁵ Note: Gleaned from "The evolution of agricultural education and training: Global insights of relevance for Africa, The World Bank, 2006.

Despite its limited capacity, IQQO intends to focus on a wide range of researchable problems. Hence, lack of focus/prioritization, thereby often exceeding the limits of its capacity; exacerbated with its weak linkage and integration with EIAR and Universities in Oromia. The absence of private sector engagement in the AR4D and seed sector is another shortcoming of AR4D in Ethiopia/Oromia. Hence, future investment in regional AR4D must be backed by rigorous priority setting and proper integration.

1.2.9 Linkage and partnership in AR4D for agricultural transformation

Establishing fruitful linkage and partnership/cooperation with various in-country institutions such as HLIs, regional and international organizations is essential to undertake efficient and effective AR4D for agricultural transformation. Indeed, many research organizations of several countries have initially benefited from linkage and partnership with various national and international research institutions, universities, seed producers, governmental and non-governmental organizations, agro-processors, farmer cooperatives/unions/federations, development partners and private sectors. It is noted that sectoral and inter-sectoral partnership and integration are some of the requirements for agricultural transformation.

Likewise, IQQO needs to establish strong linkage, integration, and alignment as well as a partnership with the following entities’:

- EIAR, CGIAR centers, Ethiopian Agricultural Research Council Secretariat, universities in Oromia, other RARIs and Ethiopian Institute of Biodiversity: This partnership and integration are essential to reduce duplication of efforts, create synergy and share resources (including germplasm) and make effective use of graduate researches, which is increasing nowadays. Since most EIAR centers are located in Oromia, the agricultural transformation agenda in Oromia should take advantage of the research outputs, interventions, and investments being made by the EIAR. These research centers are also responsible to multiply initial quantities of newly developed/recommended technologies, including early generation seeds (EGS), tree seedlings, and animal breeds. Further collaboration with other RARIs (e.g. ARARI, SARI, and TARI) helps to introduce technologies developed by these institutes for adaptation and adoption to intended agro-ecologies in Oromia, which is often regarded as a cheap and fast method of technology application. Besides educating potential researchers and postgraduate students, HLIs can greatly contribute to agricultural transformation through research and community services as well as facilitating change and innovation processes. Fragmented core

institutions (research, HLI, and extension) are hindering the effective use of the available resources in Ethiopia. The Ethiopian Agricultural Research Council Secretariat is expected to ensure fair sharing of research funds provided by donors to the country. EIB undertakes tremendous work in the exploration, collection, and conservation of plant genetic resources. These resources are available to research organizations that can properly utilize the genetic resources for research purposes, particularly for quality and abiotic and biotic stress tolerances.

- Agricultural growth program (AGP), multifaceted investment program supporting agricultural productivity and commercialization focusing on high agricultural potential areas to address some of the key constraints to agricultural growth and thereby contribute to overall economic growth and transformation in surplus producing districts. The partnership with the Agricultural Growth Programme (AGP) should be strengthened for IQQO to sustainably develop the capacity to adapt and/or generate technologies, conduct effective pre-extension demonstration and source technology multiplication.
- Ethiopian Agricultural Transformation Agency (ATA), mandated to sustainably increase the production, productivity, and income of smallholder farmers by transforming the agriculture sector towards a commercially oriented system through the agricultural commercialization clusters (ACC) initiative and focusing on priority commodities. Both AGP and ATA promote increased productivity and commercialization of priority commodities. It is to be noted that farm productivity and commercialization are among the three key pillars of agricultural transformation; the third being commodity diversification.
- Productive Safety Net Programme (PSNP): Aimed at enabling the rural poor facing chronic food insecurity to resist shocks, create assets, and become food self-sufficient. IQQO's partnership with PSNP is essential if its research outputs are to bring a positive impact on this segment of society.
- Sustainable Land Management (SLM) Project: Aims to help achieve agriculture/food security, and poverty reduction through broadening our understanding of the impacts of the SLM program and informed policy/decision-making processes. Unlike with AGP, IQQO is less connected with PSNP & SLM, although the PSNP program addresses the neediest part of the society and SLM

focuses on the sustainability of the farming system and climate change mitigation and adaptation

- MoA and OBOA: IQQO needs to align and integrate its research programs and activities with the development plans of the government to bring a positive impact.
- Seed Producers and distributors (OSE, ESE, private, seed producer cooperatives and cooperative unions, farm service centers, agro-dealers): Proper linkage, alignment, and integration with seed producers and seed and other agricultural input dealers are requirements to enhance seed production of improved varieties for eventual timely distribution and wide-scale adoption of improved technologies.
- Federal and regional cooperative agencies, primary cooperatives, and unions: Partnership with this group is essential for promoting input and output marketing, as having an efficient marketing system is one of the requirements for agricultural transformation.
- Development partners (bilateral & multilateral) and NGOs: Several agriculture-based development partners are operating in Oromia. IQQO's partnership and fine-tuning with such organizations can enhance the effectiveness of the research generated technologies as well as the positive impact of the devolvement initiatives in the region.
- Private sector: Commercial farms, private seed (particularly vegetable seed) and other agricultural input importers (fertilizers, herbicides, pesticides) as well as farm machinery; and also agro-processors are key partners in agricultural transformation and IQQO needs to form a platform with such entities. Supporting private sector R&D, particularly in the seed sector and horticulture industry is crucially important to contribute to the transformation of agriculture in Oromia/Ethiopia. The absence of private sector engagement in the AR4D and seed sector is one of the factors constraining agricultural transformation in Ethiopia/Oromia. Evidence from many countries shows that the private sector plays a key role in AR4D and seed sector development. In Malaysia, for instance, agricultural research for plantation crops (rubber, palm, and cocoa) is done by the private sector since the early 1980s, while the public is focusing on staple food crops like rice (World Bank, 2006).
- Financial institutions: Create a partnership with financial institutions that are important in input and output financing, credit provision, and crop insurance, which is a key requirement in commodity value chain development. The development of

the commodity value chain, in turn, creates a demand for research outputs such as improved seed.

- Manufacturers and artisans: Manufacturers and artisans will fabricate and multiply agricultural engineering technologies (AET) as per the prototype design and standards identified by the agricultural engineering research program of IQQO. Several farm implements, including *maresha*, rippers, and soil and water conservation implements can be locally manufactured and distributed to the end-users.
- Public-private partnership (PPP) also plays a key role in agricultural transformation such as through technology multiplication by paying a royalty to research organizations. The PPP can be a public-private or private-public partnership (in that sequence of action). For instance, the USAID (2015)²⁶ has recently presented a study report, four different archetypes (public, private, public-private, and private-public) for early generation seed multiplication to minimize the shortage of basic seed supply in Africa, including Ethiopia.

1.2.10 AR4D governance & management

One of the requirements for agricultural transformation is ensuring integration and alignment within the sector and inter-sectoral organizations. The within sectoral organizations include mainly BoA and MoA, research institutes, seed enterprises, agricultural input, and output marketing and distribution entities; agricultural and other input regulatory authorities, cooperatives & unions. The other key sectoral organizations include transport, road, trade, and telecommunication and power (electrification).

AR4D governance and management are meant internal governance and management as well as collaboration, integration, and alignment with sectorial and other support sectors for agriculture and rural development. Such governance and management in AR4D should allow for transparency, participation, consensus-orientation, accountability, responsibility, inclusiveness, efficiency, and effectiveness for positive impact. Transformation can only be achieved if all stakeholders in AR4D demonstrate strong leadership and accountability. Moreover, IQQO needs to facilitate the establishment and operation of multi-stakeholder platforms to drive agricultural transformation, which is the characteristic role of integrated AR4D. The multi-stakeholder platform will form strong frameworks for consensus building,

²⁶ USAID (2015). Early Generation Seed Study
(<https://docs.gatesfoundation.org/documents/BMGF%20and%20USAID%20EGS%20Study%20Full%20Deck.pdf>)

ownership and task sharing, and collaboration with accountability between the government and non-government organizations, development partners, private sector, and other actors within the agricultural sector and related sectors.

The EARCS should also promote objectivity and independence in the coordination of the national agricultural research system. Experiences of countries that successfully transformed their agriculture show that in kick-starting agricultural transformations, coordination, integration, and alignment of initiatives of all sectoral and inter-sectoral stakeholders (including private-sector engagement) involved in prioritized commodity value chains is completely essential. Without this, the transformation may proceed more slowly, stall, or not reach scale.

Internally, IQQO has set its vision, mission, and goal as well as values that align with the regional and federal development plan. However, defining a timely research agenda and operationalizing the research programs are being limited by its capacity (human, infrastructure, logistics, and budget). Its linkage with other research institutes, extension, and the private sector—as well as universities within the region is weak.

IQQO must be free to formulate, adjust and manage its budget, to select its priorities and carry out research, and to formulate and administer its human resources policies, including:

- Succession plan of its leadership
- Hiring, retention, rewarding, and layoff system.
- Generating and using revenue from its goods and services, including royalty
- Public-private partnership

IQQO's linkage with other sectoral and other related sectors must be strengthened to foster its impact and it must serve as speed-boat in agricultural development initiatives. The success of any agricultural transformation relies on how well millions of smallholders and small- and medium-size agribusiness enterprises can be helped to change farming practices as quickly and effectively as possible. The critical enabler, without which agricultural transformation is likely to fail, is a frontline “change agent” that helps farmers modify their practices. Change agents are people who farmers trust and interact with regularly. The high-level objectives of a transformation are realized in practice only when they are effectively translated to smaller on-farm practices. The agricultural economics and extension directorate of IQQO must take step up beyond its conventional services of pre-extension demonstration

and adoption studies and act as a change agent or innovation facilitator to mobilize the entire commodity value chain of focus commodity in a target agro-ecology.

1.2.11 Summary of Situation Analysis for Oromia Agricultural Transformation

The foregoing analysis has shown that:

- Agricultural transformation is a process that leads to higher productivity on farms, commercial-oriented farming, diversification and strengthening the link between farming and other sectors of the economy
- Oromia has, on one hand, several opportunities that could contribute to the transformation of agriculture, and, on the other hand, constrained by a multitude of factors, including low levels of productivity and infrastructure development and weak institutions.
- Traditional agricultural research did not adequately enhance productivity and curve down poverty and its multiple consequences. Because it is regarded as the linear approach, based on three main actors, viz. research, extension system, and farmer, where improved technologies developed by the researchers could be disseminated by the extension system and delivered to the farmers (Adekunle and Fatunbi, 2012). As such, the linear research-extension-farmer approach has been criticized for being supply-driven, top-down, hierarchical, and for its limited impacts on the generation and diffusion of relevant knowledge and technologies. Instead, the agricultural research system must be linked and integrated with the sectoral and inter-sectoral organization if it is to contribute to agricultural transformation. It is noted that this type of agricultural research is to-date called agricultural research for development (AR4D), which involves extensive and intensive linkage and integration, including the establishment and facilitation of multi-stakeholder platforms. In that case, it even being called integrated agricultural research for development (IAR4D). The IAR4D aims to bring stakeholders together to generate network effects and stimulate innovation and transformation system. This helps consensus building, ownership, participation, inclusiveness, transparency, responsibility, and accountability of multi-stakeholders in the agricultural sector as a whole and its alignment with other support sectors.
- AR4D plays an indispensable role in increasing agricultural productivity, which is one of the requirements for agricultural transformation. Indeed, AR4D led

technological interventions in agriculture generates sufficient productivity growth to give high rates of return in Africa, Asia, and Latin America and has a substantial impact on poverty reduction.

- IQQO has been doing its best since the last two decades to deliver agricultural technologies to contribute to agricultural productivity, albeit in a piecemeal manner, which is further exacerbated by its limited linkage and partnership with other actors within agriculture and other sectors. Although agricultural research has generated several kinds of technology with a high potential for impact, the expected impact on farmers' productivity, livelihood, and quality of life has not been fully realized due to limited capacity and capability in technology demonstration, promotion, scaling, and multiplication
- IQQO is constrained by many factors to do AR4D, particularly human capital, research infrastructure, facility, and logistics as well as declining public spending. Hence, it is not in a position to adequately apply modern agricultural research tools and techniques such as biotechnology and ICT.

1.2.12 Strategic goals

To alleviate agricultural challenges and generate modern agricultural technologies that increase agricultural productivity and help agricultural transformation, the following strategic and specific goals are set.

1. Develop and adopt appropriate technologies that enhance productivity and quality and significantly contribute to food and nutrition security, export, raw materials for industries and import substitution

Crop based technologies:

- develop high yielding, disease-resistant and drought-tolerant crop varieties suitable for rain-fed and irrigated agriculture,
- optimize crop production systems to mitigate agricultural risks in the changing environment/climate
- enhance crop protection system and reduce post-harvest losses,
- develop and promote commercialization of under-utilized resources viz. vegetables and fruits, natural products, aromatics, gums, and resins,
- improve quality and yield through developments in food sciences and technologies,

- develop new food and non-food processes and products and improve the shelf life of agricultural products and foods

Livestock based technologies:

- generate and develop appropriate feeding, husbandry, and animal health management practices for potential indigenous breeds (such as Boran, Horro, Arsi, etc.) to exploit their full production potential to the maximum benefit of smallholder farmers, agro-pastoralists and pastoralists.
- Strengthen crossbreeding of selected local breeds with introduced exotic breeds to improve some production traits (e.g. milk production) mainly targeting market-oriented and commercial production systems. Strengthen the generation of suitable feeding, health care, and other husbandry technologies to enhance productivity and sustainable utilization of available chicken and small ruminant breeds. Strengthen the development of high yielding and adaptable forage varieties while similarly opting for promotion and utilization of the already developed technologies. Moreover, ensure efficient utilization of available feed resources via proper collection, processing, storage, and improvement practices. For instance, there are areas and seasons where feed availability is excess while other areas face critical shortages. So research should strive to map seasonal feed availability in the region and devise mechanisms for its efficient management and utilization strategies including mobilization from excess to deficit areas.

Natural Resource-Based technologies:

- generate technologies, information, and knowledge for the conservation and utilization of natural resources;
- develop appropriate technologies and information on soil fertility, acidity and salinity management,
- improve conservation agriculture systems,
- develop climate-smart agriculture to enable mitigation and adaption to climate change,
- improve water management and irrigation practices,
- enhance natural resources monitoring and characterization,
- enhance green technologies and processes to mitigate the impact of agriculture on the environment,

2. Enhance implementation capacity of pertinent actors to scale up/out existing outputs of AR4D to increase the average regional productivity by 50-100% within the next 3 years
3. Demonstrate and disseminate proven agricultural transformation technologies that are tailored for the Oromia farmers context;
 - transfer improved agricultural production technologies and information to smallholder farmers for sustainable production systems,
 - provide support to smallholder farmers and enhance their skills and capacity,
4. Build capacity of IQQO for AR4D to continually develop improved technologies

1.2.13 Strategic actions for Agricultural Transformation in Oromia

From the perspective of AR4D, the following actions are recommended to contribute to the transformation of agriculture in Oromia.

Action 1: Apply effectively existing proven agricultural technologies

Available yield records from pre-extension demonstration plots indicated that the regional crop productivity²⁷ (yield/ha) can increase significantly if existing technologies are used with their full production packages (Table 6). The increase can go as much as two-fold of the current average national and regional productivity for major food crops in potential agro-ecological zones. The increased productivity already realized by model farmers confirms the possibility of doubling productivity with the use of proven technology package, but the proportion of farmers, who applied improved packages, is less than a quarter of total farmers in Oromia (Table 7). This indicates the need to strengthen the capacity and capability to support the middle farmers to step up to model farmers' productivity level and the poor farmers to step up to middle farmers' productivity level, while maintaining the model farmers' productivity level; preferable push up further.

²⁷ **Note:** Boosting agricultural productivity (i.e., increasing yield) is a critical first step in any movement toward agricultural transformation.

Table 6 Yield gap between regional/national average yield and pre-extension demonstration plots

Crop	Regional average yield (quintal/ha)	National average yield (quintal/ha)	The yield on pre-extension demonstration plots
Tef	18	17	30
Barley	24	22	52
Wheat	30	27	60
Maize	41	39	90
Sorghum	28	27	50

Data in column 2 & 3 are from CSA (2010 EC), while data in the last column is from Dr. Dagnachew Leule of IQQO

Table 7 Productivity data from Oromia Bureau of Agriculture, show yield gap among three categories of farmers (Percentage in parenthesis is the proportion of farmers)

Crop	Productivity (quintal ha)			
	Regional average	Poor farmers (26%)	Middle farmers (53%)	Model farmers (21%)
Tef	18	7	17	31
Barley	24	12	24	60
Wheat	30	15	29	75
Maize	41	20	40	90

Data from Advanced Maize Seed Adoption Program (AMSAP), shows that farmers who adopted improved maize varieties have substantially increased productivity, harvesting 7.5 ton/ha compared to 2.2 ton with their traditional practices using local or old maize varieties. Similarly, Agajie Tesfaye (2018) analyzed trends of wheat production, consumption, and potential for expansion in Ethiopia and further showed that Ethiopia has wheat varieties that can potentially yield up 7 t/ha under intensive management. Such varieties can yield 4.2 t/ha on farmers' field, which is more than 50% and 40% increase relative to current national and regional average, respectively. Among the factors limiting wheat productivity, Agajie Tesfaye (2018) listed inadequate information through extension, inadequate access to inputs (e.g. quality seeds, fertilizer), inadequate agronomic, and crop protection practices. Varietal

change and seed replacement rate are known to belong, limiting the return on research investment. Similarly, (Abate et al., 2015) noted that use of high yielding varieties of maize with the recommended agronomic practices has greatly contributed to maize productivity in Ethiopia during the last one decade and recommended the need for further scaling up/out the adoption of modern maize varieties to tap the yield potential of maize varieties released in the country. It is interesting to note here that Warmer et al. (2015) made district level crop production ranking in Ethiopia using a pooled data approach and identified the top 25 districts, most of which are Oromia - for wheat (19/25), maize (15/25), barley (18/25), tef (10/25), sorghum (5), chickpea (10/25), sesame (8/25), coffee (18/25). Intensification of production of these crops in the identified potential districts needs to receive top priority, while further expanding full production technology package in the other districts.

Similarly, encouraging productivity levels are registered with the use of livestock technologies (Table 8). Moreover, model farmers who have used the available technologies like the improved dairy breeds at Selale and have achieved Up to 42 L/d during peak lactation. Such farmers have registered considerable livelihood gains indicating the possibility for bringing a meaningful improvement at both regional and country-level provided that available technologies, knowledge, and information are properly packed and made available to farmers. As the initial source of improved heifers has been the major limitation, Oromia Regional State should look for a possibility to establish improved heifer multiplication centers in potential areas. Chicken has also a similar impact on improving livelihoods provided that day-old-chicks of well-adapted breeds like Koekoek are multiplied and distributed at scale with dependable health care and other husbandry services.

Table 8 Potentially scalable livestock technologies

Commodity	Technology description	On-station	On-farm	Remark
Dairy	50% HF*Boran cross (Milk yield per lactation, Liter)	2335	Variable – higher than the on-station value in most cases	Farmers pay special management attention (feeding) as compared to the modest level of management under on-station due to budget limitation
	75% HF*Boran cross (Milk yield per lactation, Liter)	2800	Variable – higher than the on-station value in most	Same as above – There are few cases where model farmers get as high as 40L/day/cow in the milk shed areas like

			cases	Selale • Major limitation – lack of heifer multiplication centers in the country
Poultry	Well adapted dual-purpose chicken breed – Koekoek • Eggs/hen/year • Mature body wt (kg)	200-220 3-4	150-180 2.5-3.5	Focus on chicken multiplication centers for massive multiplication and dissemination
Feed	More than 50 well-adapted, high yielding and better quality forage varieties with their production packages for the different agro-ecologies (DMY/ha, tones)	7-20	5-15	• 3 to 5 fold productivity than that of natural pasture Major limitation • Low attention by development • Lack of seed production scheme
Beef	Feeding management recommendations for attaining the desired market weight as early as possible ~ 300 kg at 3 to 3.5 years			Lack of beef improvement ranches
Sheep	Feeding management recommendations for attaining the desired market weight as early as possible ~ 30 kg at 1 to 1.5 years			

The key productivity difference between model farmers and other farmers is associated with technical efficiency in technology application. This involves the adoption of all components of the package of the recommended technology *vis-à-vis* partial application of the components.

The scaling up/out of existing technologies should also include the management of acidic and saline soils as well as Vertisols, as the application of such technologies has increased yield substantially (Table 9). Alemu et al. (2016) have shown that liming and phosphate fertilizer application can double barley yield in Dendi District of West Shewa Zone of Oromia, Ethiopia.

Table 9 Effect of liming on the yield of some crops in Oromia

Crop	Yield (ton/ha)		
	Without liming & phosphate fertilizer application	With liming & phosphate fertilizer application	% yield advantage
Barley	1.4	4.0	185.7
Maize	2.2	6.2	181.8
Wheat	1.8	4.6	155.6
Faba bean	1.2	2.6	116.7

As can be observed from data provided in Table 9, huge productivity gains are possible and accrue where the government allocates the necessary resources to AR4D. As shown in section 6, public investment in AR4D is still far lower than needed.

In generating technologies and managing acidic soils, IQQO must learn from EMBRAPA how it had generated agricultural technologies that brought the “Cerrado miracle”.

Appropriate & new technologies developed by EMBRAPA transformed Brazilian agriculture by turning the Cerrado [part of Brazil known to be very acidic and highly degraded, encompassing nearly 25% of the total area of the country] into arable and pasture land, enabling the expansion of large-scale, intensive agricultural production, State-directed research carried out by EMBRAPA led to the successful development of new seed varieties and accompanying agricultural practices tailored to tropical conditions, thus making possible the emergence of a highly sophisticated and competitive agricultural sector in Brazil. This state-led technological innovation enabled Brazil to move away from the tropical products typically exported by developing countries (coffee, tea, sugar, bananas, etc.) to producing and exporting commodities (soybean, cotton, beef, chicken, pork) that directly compete with those of the world’s dominant agricultural producers – the US, EU and other countries of the Global North.

In attempting to do a similar miracle in acidic soils of Oromia, which is constituting 43% of the arable/cultivated land, IQQO must enter into a partnership with development partners to do action research, primarily involving investment in limestone crusher of a high standard, soil testing, logistics for lime transport and spreading and incorporating into the soil as well as identifying acid-tolerant crops and varieties. Similarly, action research is required for scaling up/out technologies for Vertisols, where waterlogging and consequently poor aeration is limiting crop production and productivity.

The wide-scale up/out entails the development of rural infrastructure development such as irrigation schemes, roads, bridges, and market and market structures (e.g. warehouses, market centers). Well-developed infrastructures, especially irrigation infrastructures in arid and semi-arid zones are requirements to be met if agricultural transformation is to take place in Oromia, as a large part of the regional arable land is located in arid and semi-arid agro-ecological zones.

There is also a need to incentivize and reward more successful villages or agricultural commercialization clusters (ACCs) as an effective stimulator, increasing healthy competition among villages and ACCs to promote more participation for better achievement. This needs to be done parallel with the already going on of rewarding model farmers. It is to be noted that the incentive for model farmers with good performance is promoting only individual farmers and does not have much in the way of promoting cooperation and collective action at the village level. Thus, future incentive needs to promote both individual and village level growth and development to be inclusive and minimize rural income gap.

Action 2: Enhance multiplication and supply of source technologies

Source technologies refer to starter materials like early generation seeds (i.e., breeder seed, pre-basic and basic seed), improved heifers, a prototype of farm implements, beehives, poultry, fingerlings, etc. Research organizations like IQQO are responsible for early generation seed (breeder and pre-basic and basic seeds) multiplication, which is a critical input for multiplication of certified seed to be distributed to farmers. Similarly, multiplication is highly required for livestock (day-old-chicks, dairy), forage seeds, farm machinery, beehives, seed cleaning machines, the prototype for grain storage, etc.

Hence, research organizations need to be well-resourced in terms of human resources, infrastructure, research facilities, and operational budget as well as irrigation and mechanization to enhance the multiplication of EGS and other initial technologies as input for wide-scale multiplication and distribution.

It is strongly recommended that the multiplication of EGS and other initial technologies within the research organization like IQQO is done as an enterprise (i.e. business entity), which can generate its revenue and re-invest its revenue to build its capacity and reward/incentivize its staff. Realizing this initiative entails the policy decision of the government, involving BOFED, revenue office, an audit office, which further necessitates the strength of IQQO management to be outward-looking and present convincing proposal/project to the regional government.

Further, the multiplication of EGS and other initial technologies must be done in a well-coordinated, integrated and aligned manner with certified seed producers, extension services, output marketing (including promotion and distribution) as well as linkage with entities that can manufacture farm machinery, beehives and construct store and market structures once they get the prototype. Doing this effectively also requires partnership with financial institutions for credit and insurance.

Action 3: Develop new improved technologies

With the fulfillment of action 6-8, IQQO together with its partners must develop improved technologies and innovations using advanced research methods (e.g. biotechnological tools and techniques), that are believed to increase precision, reduce time and widen frontiers of AR4D. There is a strong need to develop yield increasing technologies and production practices for intensification, given decreasing farmland because of the expansion of urbanization and the unsustainable use of marginal land for agricultural production²⁸. As such, boosting productivity requires more intensive use of modern inputs such as quality seeds of improved varieties, fertilizers and crop protection chemicals, irrigation and machinery and more widespread continuous cropping, while sustainably maintaining the natural resource base. IQQO must develop state-of-the-art capacity and capability, including human capital and research infrastructure and facility as well as logistics to

²⁸ Increasing farmer productivity and agricultural outputs per unit of land, labor, or capital is essential to realizing the potential of agriculture to reduce poverty.

steadily develop modern and improved technologies that can be regarded as outstanding/superior by the intended users. This entails substantial increment in public research funding, strong networking, and partnership as well as a public-private partnership. Lessons of exemplary research institutes in many other countries who transformed their agriculture and boosted productivity like the EMBRAPA of Brazil should be adopted to consolidate technological breakthroughs in agriculture of Oromia/Ethiopia. Developing the capacity to use modern research tools and techniques is no more a luxury venture, instead, it must be a routine practice. Application cutting-edge technologies such as modern biotechnological and molecular tools, precision agriculture, and satellite & GIS²⁹ are essential in such research programs such as crop & livestock breeding, crop protection, animal health, natural resource management, and soil health management.

There is a strong need to develop technologies responsive to emerging biotic and abiotic challenges (e.g. diseases, insect pests, invasive weeds, soil acidity and salinity, climate change and variability, etc.). Climate-smart agricultural technologies such as drought/heat tolerance and early maturing crop varieties are badly needed.

Technology development also needs to focus on addressing food and nutrition security, involving bio-fortification (esp. for iron and zinc) of crop varieties like some grain legumes, cereals, and root and tuber varieties. Context-specific agricultural technologies conducive for intensification, diversification, and urban agriculture need to be developed to meet the needs of different clients, including men, women, and youth.

Given the increasing use of irrigation³⁰ and, there is a need to develop package technologies suitable for irrigated agriculture in the region. Moreover, since the youth is disinterested in conventional way agricultural practices, there is a dire need to develop technologies related to agricultural mechanization.

The key requirements to develop state-of-the-art capacity and capability are increasing research funding, research staff training and retention mechanism, linkage, networking, and

²⁹ Satellites, GIS and advances in data analytics are making detailed soil maps affordable and allow farmers to receive location-specific recommendations for agronomic practices, including customizing fertilizer application to local soil conditions

³⁰ Microelectronics now enable more precise irrigation systems, smaller and more appropriate machinery

partnership (including ppp). There is also a strong need to develop well-equipped research data handling, storage, management, and analytical capacities and capabilities.

To materialize the agricultural transformation of Oromia, for the future priority AR4D areas for technology generation need to:

- Characterize and define agricultural resource bases for better technology targeting
- Develop and promote suitable agricultural technologies for different recommendation domains (smallholder farmers, large scale farmers, pastoral, and agro-pastoral production systems). This also includes developing technologies suitable intensification (double cropping, relay cropping, and multiple cropping as well as application responsive technologies with efficient use of production inputs).
- Focus and target technology development based on agroecological diversity, farming system, social needs of farmers and other end users (food and nutrition security, domestic & export markets, industrial raw material and environmental sustainability)
- Build research capacity and capability to develop crop varieties and livestock breeds based on hybrid technology, which is further expedited by applying molecular and ICT technologies. It is to be noted that the use of hybrid varieties is key in boosting the productivity of maize, sorghum, dairy, and several vegetable crops.
- Synergize productivity, sustainability, and inclusiveness (pro-poor, gender, youth, pastoral and agro-pastoral communities); these, in turn, are the drivers for sustained structural transformation and industrialization
- Promote demand-driven and market-based AR4D
- Aim for food & nutritional security as the highest priority
- Promote multi-stakeholder participation in AR4D
- Consider high value and export (coffee, sesame, pulse, oilseeds, vegetables, and fruits)
- Develop disease- and virus-free varieties through tissue culture for crops like potato, sweet potato, Enset and fruits and develop modality for the commercial level of propagation of such planting materials through a public-private partnership
- Develop more nutrient-rich crop varieties to combat malnutrition (e.g. high lysine and tryptophan in maize; beans high in minerals, sweet potato rich in vitamin A)

In general, AR4D should focus on increasing crop and livestock productivity, improving natural resource management, meeting market requirements, and responding to farmers' needs.

Action 4: Deploy appropriate technologies to reduce postharvest loss and increase value addition

Postharvest loss in Ethiopia/Oromia is on an average estimated to be 30%, due to lack of harvesting, threshing and cleaning machines, storage pests, inadequate storage structures, and transportation. This can easily be done by supporting/organizing service providers, wide scaling of proper storage structures (e.g. Grain Pro and PICs), importing farm machinery and combine harvesters for sale to farmers or farmer cooperatives, micro-enterprises at reduced interest loan; supporting machine leasing. Considerable post-harvest losses and adulterations are also encountered in livestock products like milk which require both research and development interventions.

This can be achieved by increasing the support for mechanization, building storage structures, and improving warehouse management. Encourage and support agro-processing industries, including small and medium scale enterprises to improve the processing and packaging of agricultural produce and livestock products to the required standards for by the emerging supermarket in big towns as well as for export. With an export-oriented policy in place, meeting international standards are critical. Develop agricultural value chain activities such as processing and exports so that agricultural-related jobs are attractive to the burgeoning youth population.

To help reduction of postharvest loss and enhance value addition AR4D is expected to: adapt and generate appropriate postharvest and value addition technologies; demonstrate and integrate the developed technologies into the region-wide agricultural extension and marketing system; and monitor, evaluate and modify technologies to meet contemporary needs.

Action 5: Increase public investment in AR4D

For IQQO to deliver modern technologies and innovations on a sustainable basis and contribute to the agricultural transformation of the region³¹, the government of Oromia must at least allocate at least 1% of its agricultural GDP for AR4D regularly. Also, IQQO needs to be allowed to generate and reinvest its revenue plus its formal budget allocated from the public treasury. Such revenue can be generated from sales of goods and services, such as sales of basic seed, farm machinery, cross-heifers, fish, honey, etc. Furthermore, IQQO needs to strengthen its partnership and networking to get funding in the form of donations, grants, and competitive projects. The technology multiplication unit of IQQO must work as an enterprise (self-financing + reasonable profit), which will enable it to receive a loan from a bank. If such a measure is taken the efficiency and incentive to provide quality and timely service would be enhanced, leading to customer satisfaction. The increase in AR4D investment must lead to take action 3 and action 4.

Action 6: Develop IQQO's human resource capital

IQQO must have an HR development plan, with much more proportion of Ph.D.-qualified, followed by MSc-qualified and less BSc qualified. The proportion of the latter must be defined taking into account retirement, attrition, and natural death, but should not exceed 5-10% of the total researchers. In any case, the sum of the proportion of Ph.D. & MSc should not be less than 85% if IQQO is to play a significant role in AR4D of the region.

Although achieving this desired level of qualification may take time the following measures must be taken as of now:

- Develop a mechanism to provide hands-on training and mentorship of young researchers and research technicians by hiring for short time seasoned agricultural

³¹ One landmark event in the agricultural development of Brazil is the establishment of the Brazilian Agricultural Research Corporation (EMBRAPA) in 1973 under the MoA, which pushed concerted efforts to develop the agricultural sector based on research, human resources development and the establishment of research centers. In Brazil three policies played a central role in the agricultural modernization process: subsidized credit, mainly for capital financing and the purchase of modern inputs; rural extension services; and support for agricultural research under EMBRAPA's leadership. Brazilian policymakers during 1950-1970 emphasized rural extension work but neglected research efforts on the premise that a vast array of technologies was already available for adoption. As new empirical findings began to appear that suggested the need for better technologies suitable for tropical areas in the 1970s, a virtuous cycle of tropical agricultural research was initiated and science-based technologies started to fuel the extension service

researchers, partnership with EIAR, universities and attracting volunteered Ethiopian diaspora for research leave and/or short visit

- Seek increased budget for training the BSC to MSC to Ph.D., including overseas training for knowledge and skill transfer in selected fields of specialization.
- Seek budget to hire competent MSc & Ph.D. than BSC, unlike the usual way as training the BSC to MSC to Ph.D. is costly and time-consuming
- Develop and apply a workable incentive package to retain existing MSC & Ph.D. holders
- Develop and apply workable incentive package to encourage senior researchers who have long time service at centers far away from adequate social services
- Develop ICT based technical capacity for large research data handling, management, and analysis as well as communication at different levels (technical, scientific, and policy)
- Seek and strengthen twinning/partnership with potential international agricultural research institutes and universities

Action 7: Build research infrastructure & procure logistics

IQQO needs to substantially invest in center development, rehabilitation, and renovation, infrastructure & facility development, as well as the acquisition of logistics, lab equipment, with its chemicals and other consumables. There is also a need to upgrade certain specialized research centers (e.g. Fitcha and Bedele Soil Labs) into full-fledged research centers.

Action 8: Enhance private engagement in AR4D

There is a strong need to create a conducive environment to encourage private involvement in technology generation, technology multiplication, marketing, and distribution. This can easily be done by twinning and supporting retired agricultural scientists with young graduates, which would also contribute to youth employment as well as attracting direct foreign investment in agriculture. Potential synergies between public and private research are high and must be fostered. Private research is not yet started in Ethiopia, when started it is focusing on areas where profit is appropriable, such as hybrid varieties and vegetables. Attempt to attract funding from the private sector and FDI through creating enabling policy

environment and incentives such as tax incentives, property protection (e., PVP/IPR), regulatory reforms to encourage the spill-over of international technology shopping.

Action 9: Revise and re-direct AR4D leadership and governance

To strengthen the coordination of the agricultural research system in Oromia, IQQO needs to develop regional AR4D strategy, with clear roles and responsibility based on the comparative advantage of the main actors (IQQO, EIAR, universities, and private). Such role differentiation needs to focus on reducing duplication of efforts, optimizing resource use, and addressing adequately the technology needs of the entire agro-ecologies in the region and thereby serving the marginalized parts of the region. The governance system of IQQO needs to consider enterprising some of its services such as technology multiplication to serve at scale.

Action 10: Build research leadership and commitment

Agricultural transformation entails stable and committed leadership at national as well as regional level. It also requires the active participation of representatives of stakeholders in the entire commodity value chain to come to form a platform. In the platform, the stakeholders need to discuss issues, build consensus, and gain ownership of the challenges and possible solutions, share roles and responsibilities with full accountability³². Unless ownership and accountability are put in place, success is less likely to be achieved on a sustainable basis. Thus, developing system³³ and enhancing implementation capacity and capability for scaling up/out of already existing full package technologies need to be a quick win action in start-kick off an agricultural transformation in Oromia. In mobilizing³⁴ stakeholders for this purpose, ensure full engagement and commitment of:

³² Note: For any rural development program to be successful, active participation and ownership by village communities is crucial. In the case of Ethiopia, community ownership and participation is largely lacking due to the mainly top-down approach followed by the government. Even the leaders in the recent village level networks comprising developmental groups lack the trust of the group members, which can be easily resolved through empowerment and deep awareness creation activities.

³³ Note: For instance, within 10 years after doi moi Vietnam had transitioned from a country facing chronic food deficiency to being the 2nd largest rice exporter in the world and a leading agricultural product supplier in world markets for coffee, pepper, cashew and seafood

³⁴ Note: We need to learn from the republic of Korea's Saemul (New Village) Undong (movement) often referred to as the SU movement is a classic example of community-driven development (CDD) based on specific institutional principles and community participation.

- policymakers for committed leadership, public funding and creating an enabling environment³⁵ for agricultural transformation, which goes beyond the agricultural sector and involving transport, road, trade, finance/credit, electrification, telecommunication, import, and export policy
- Institutional support, such as credit and market.³⁶ Building the output market, which is linked with the functioning commodity value chain serves as a pull for farmers to adopt productivity-enhancing technologies such as improved quality seed, fertilizers, crop protection measures, and best agricultural practices; also motivated to follow extension services. A recent study highlights that credit, insurance, and information are the most barriers to agricultural technology adoption in developing countries³⁷.
- extension services³⁸, such as capacity building, and communications
- Knowledge and innovation institutes – research organizations and universities
- Seed producers, agricultural equipment manufacturers, and agricultural input importers and agricultural product exporters
- Input and output marketing entities, which requires professionalization of farmer cooperatives, unions, and federations
- Agri-processors, agro-industries and agribusiness development
- Producers (smallholder farmers through their unions/federations, commercial farmers)
- Development partners, NGOs, and community development organizations to support the scaling up initiatives by being aligned with regional, zonal, district, and village level specific activities.

There is a need to measure the effectiveness of AR4D and adoption of agricultural technologies. Research evaluations have increasingly focused on identifying a causal relationship between agricultural research and outcomes. Tools are needed to monitor and evaluate effectiveness to reduce the risk of decision making; provide accountability to

³⁵ Lack of access to credit, risk, information, land, labor, input/output markets constraints that can act as barriers to the adoption of existing productivity-enhancing technologies

³⁶ Access to finance, communication and market for input and output can increase farmer wide scale adoption of agricultural technologies

³⁷ Magruder, J.R. (2018). Magruder, An Assessment of Experimental Evidence on Agricultural Technology Adoption in Developing Countries. *Annual Review of Resource Economics*, 10:299-316.

³⁸ Note: Learn possibility of private extension service from Uganda, Chile, Denmark and The Netherlands

governments and funding agencies by demonstrating that their investments had impacts; enable implementers to identify problems, and flexibly adjust activities and readjust goals in real-time. A successful agricultural transformation requires some basics to be in place, such as transportation and other kinds of infrastructure, stable business and economic conditions, and trained business and scientific talent.

Conclusion

This paper analyzed the need for agricultural transformation in Oromia, the opportunities and challenges to do so, and the role of agricultural research for development in agricultural transformation. It further analyzed the capacity and capability of Oromia Agricultural Research Institute to deliver demand-driven agricultural technologies own its own as well as in partnership with other sister research institutes like EIAR and universities. The analysis showed that the IQQO has serious limitations in terms of human resource capacity, research infrastructure and facility, logistics, and operation budget, justifying for the need to substantially increase in public investment and strengthening the partnership. Based on the situational analysis made and gaps identified strategic goals are set and strategic actions have been identified. The actions need to be further refined and fine-tuned through subsequent stakeholders' discussions at various levels and then followed by the ramification of each of the actions into an operational plan with targets and budget.

CHAPTER II: STATUS, CHALLENGES AND INTERVENTION STRATEGIES FOR AGRICULTURAL INPUT TRANSFORMATION IN OROMIA REGIONAL STATE, ETHIOPIA

2.1 INTRODUCTION

Although agriculture is the dominant sector of the Oromia region, crop productivity remains at a very low level largely because of the low level of input utilization. Agricultural inputs (improved seed, fertilizer, pesticides, breeds and semen, drugs, and vaccines and feeds) play major roles in the transformation of subsistence mode of agriculture into the market-oriented production system and thereby improve its contribution to the national economy at large. The use of these inputs in Ethiopia is very low compared to most African countries. Regardless of being a high agenda of the government for decades, Ethiopia is among the few countries in the world that use a small amount of these major inputs. For instance, less than 20% of agricultural land is covered by quality seed and the average chemical fertilizer use is only about 26 kg/ha (World Bank, 2014). The use of improved cattle breed is also less than 2% while AI coverage at the national level is below 20%. The low use of these inputs is reflected in the low productivity of the agricultural sector. It is not uncommon also to see excess stock of these inputs in the country portraying inefficiency at the operational system particularly due to promotion and timely distribution.

Several subtle and intricate factors are accountable for the low levels of supply and use of agricultural inputs in the country in general and Oromia region in particular. While the supply of these inputs to farmers is made available primarily with high involvement of the government, agriculture commonly fails to get the policy attention it deserves beyond lip service. Some of the inputs like fertilizer and seed are considered as political commodities and thus have to be managed and distributed under the close supervision of the government. There is high variability across the agricultural sub-sectors (field crops, horticulture, and livestock) in terms of production and distribution of major inputs. To a large extent, the livestock is constrained by a shortage of improved breed, feed, and health services.

The performance of inputs such as seed, fertilizer, pesticides, etc. in the country in general and Oromia region, in particular, is far below the desired level, negatively influencing crop productivity. Major factors for low performance of the seed sector, for example, both at regional and national levels are primarily the failure of ownership to implement the endorsed strategies and legal frameworks at all government structures because of poor commitment and absence of strong monitoring and evaluation system. Besides, lack of role

differentiation, accountability, and capacity across institutions as well as poor business and investment environment, are major features of the seed industry (MoA, 2019). There are unresolved policy and legal frameworks relating to variety release, plant variety protection, seed production and certification, marketing, import, and export via sub-continental harmonization. As a result, the seed industry development remains stagnant lacking competitiveness, apart from an increase in the volume of seed production over the years.

A low proportion (Only 30 to 40%) of smallholder farmers use fertilizer in Ethiopia (IFPRI, 20012). The average rate of use per hectare, as indicated above, is as low as 26kg compared to their counterparts in Asia who consume 209 kg/ha on average. This resulted in a severe soil nutrient depletion, the rate of which exceeds 60 kg/ha (Wanzala and Groot, 2013). On the other hand, there have been high carry-over stocks of fertilizer both at national and regional levels. Several reasons are responsible for the low rate of fertilizer use including; inaccurate demand assessment, inefficient procurement system, a thin network of agro-dealers, lack of technical knowledge in appropriate fertilizers, lack of access to finance all along the value chain which prohibit the purchases of sufficient quantities to capture economies of scale, and high transport costs due to inadequate ports, rail and road networks. These factors result in high costs, putting fertilizer beyond the reach of most farmers.

The use of synthetic organic pesticides to control major insect pests, fungal disease, pathogens, and weeds has become a widespread practice both in the smallholder and commercial agriculture in the country. There are several registered herbicides, insecticides, and fungicides currently in use in the country targeting different economic pests. Nevertheless, there has been misuse and also abuse of pesticides by smallholder farmers due to low levels of knowledge, appropriate skills on pesticide handling such as knowledge on safe storage, calibration, and spray, usage of protective devices, etc. The emergence of resistant pests to pesticides is happening in the country. The causes for resistance development include increasing lack of alternative pesticides to manage economic pests and under/overuse of available pesticides, presence of contraband pesticides, presence of poorly informed, trained and skilled pesticide users, and also the escalating price of a new generation of pesticide. Moreover, lack of corporate-thinking and suppliers bias towards high profit than responding to growers demand such as the failure to supply new generation seed dressing pesticides has been a challenge. All these have allowed illegal pesticide trade to proliferate and become a threat to both the growers and consumers indicating the pesticide input system transformation.

Various services and inputs supplied to the livestock industry both at the national and regional levels include; animal genetic feeds and forages, veterinary drugs and vaccines, machinery and utensils as well as knowledge. However, the current supply of these services and inputs are inadequate compared with the amount needed to transform this subsector. The components and manner of provision of inputs and services to livestock producers vary from place to place, depending on proximity and connectivity to provision centers, and in context to the existing production system and absence or presence of service providers. Hence, the realization of the transformation of the livestock sub-sector calls for renewed attention to fostering environmentally friendly livestock system development, strengthened technological innovations, and heavy investment on the adequate production, multiplication, and efficient delivery of the required inputs.

The Bureau of Agriculture and Livestock in Oromia Regional Government initiated an agricultural transformation in the region. A core team established to work on this task identified nine major focus areas as drivers of agricultural transformation: These are institutional and enabling environment, technology generation service, agricultural extension service, agricultural inputs, irrigation, agricultural mechanization, soil, and natural resources management, rural finance, and production sector. It also formed an advisory working group for each of these focus areas. The input advisory group involving 11 professionals from different institutions (Annex- X) in the country was identified accordingly and given the task of developing an input sector transformation document. Four input parts were covered in this document. Part one addresses issues relating to seed and part two discusses fertilizer while parts three and four examine pesticides and livestock inputs, respectively.

The purpose of the document is, therefore, to review and consolidate current status and identify major challenges in these inputs components and suggest strategic solutions for implementing the agricultural transformation process in the National Regional State of Oromia.

2.2 SEED SECTOR TRANSFORMATION

2.2.1 Introduction

The seed is an indispensable input in crop production and the use of quality seeds of improved varieties contributes up to 50% in yield increment per ha (MoA, 2019). It also triggers the use of other accompanying agricultural inputs like fertilizers and pesticides. The success of the green revolution in Asian countries is mainly attributed to a combination of

factors such as the availability of high yielding varieties, access to other inputs, investments in infrastructure (e.g. irrigation schemes), favorable output markets and enabling policy environment (Gebisa, 2013; MoA, 2019).

The performance of the seed sector in Ethiopia in general and that of the Oromia region in specific is far below the desired level, negatively influencing crop productivity (Seyoum, et al., 2011; ISSD, 2011). If the agricultural intensification is to sustain, the performance of the seed system needs to be considerably improved. There are policy and legal frameworks in terms of variety release, plant variety protection, seed production and certification, marketing, import and export, and sub-continental harmonization. Major factors for low performance of the seed sector both at regional and national levels are primarily the failure of ownership to implement the endorsed strategies and legal frameworks at all government structures because of poor commitment. Besides, lack of role differentiation, accountability, and capacity across institutions as well as poor business and investment environment in the sector, are major features of the Ethiopian seed sector (MoA, 2019). As a result, the seed sector development remains stagnant lacking competitiveness, apart from an increase in the volume of seed production.

Therefore, the purpose of this document is to review and consolidate the current status and major challenges gathered together from previous initiatives and suggest strategic solutions for implementation to transform the seed sector in the Oromia national regional state. Chapter two describes on the definition and recognition of seed, seed quality, and seed science under traditional and modern agriculture; a series of processes involved in seed system development; categories of classes of seed; the seed system value chain; major activities of seed production agencies; Ethiopian seed system; and finally the public and private roles in seed system development. Chapter three emphasizes on the concept of seed transformation. Chapter four describes on how to transform the seed sector in the region indicating the goal, vision, present situation, challenges, reasons, international experiences and key lessons, goal and strategies for interventions under each of the six building blocks for seed sector transformation envisaged, i.e., production system, service provision, market development, revenue generation and reinvestment, regulation and management, and sector coordination. Chapter five indicates the way forward while chapter six shows the reference list.

2.2.2 Seed and Seed System Development

Seed in this document carries the definition of seed given in the Ethiopian Seed Proclamation (No. 782/2013) that seed means true botanical seed, bulbs, tubers, cuttings, rhizomes, roots, seedlings or any other plant propagating material intended for planting. Seed system development can be viewed as a dynamic process of matching the supply to the changing demand for seeds (ISSD, 2011). The seed is a source of planting material that has come through research investment and has added value matched by performance. It is a technology channel through which genetic improvements in yield, nutrition, agronomic traits, fungicide and insecticide seed coatings, and biotech (input and output) traits are amended as individuals or stacks (Taye *et al.*, 2018). In other words, there should be a distinction between what we call a seed and grain. “Seed” is an entity with known genetic and physiological attributes, and produced under most optimal conditions. These attributes are “Distinctiveness, Uniformity, and Integrity”. “Grain”, on the other hand, is a product harvested from Seed. A major educational effort is needed to produce the seed and thus, has taken too long to get this distinction established in developing countries in Africa. Thus, the goal of developing seed and seed system development is to provide high-quality seed of products with high and stable performance in quantities and at times required by growers. Crop improvement and seed supply are farmer-based activities that are evolved into distinct breeding and seed production activities (Gebisa, 2013). The seed is a great vehicle of change and it is considered as a driver for agricultural transformation. It all starts with a seed, though other inputs and better management practices are also needed.

2.2.2.1 Seed and Seed Systems in Traditional vs Modern Agriculture

In traditional agriculture, farms are largely independent; grain harvested from crop fields used as “seed”, there is limited scope for crop improvement and limited incentive for better management options. On the other hand, in modern agriculture, agricultural scientists develop improved varieties and hybrids that are high in yield, tolerant to pests and diseases, and have better quality traits. The seed is purchased as inputs with fertilizers and insecticides. The higher crop performance as a result of the use of these inputs gives farmers the incentive to use better management practices. Seeds are produced by privately owned farms and thus the seed is catered for “Business” as input. In developing countries, on the other hand, the seed is regarded as a “Public Service” effort.

There is always a lack of recognition especially in traditional farming existing in developing countries concerning seed quality, seed systems, and seed science. Seed quality

is the most underappreciated input in traditional farming. Seed systems are also unappreciated among the least developing countries institutions. By its very definition, seed science is the sound technical process around seed production, seed conditioning, seed certification, seed quality control; as well as the management of seed operations, which are also underappreciated. Gebisa (2013) indicated that the value of seed is not recognized in developing countries. When the value of seed is recognized by farmers and agents of change, a necessary impetus for technology generation & adoption is catalyzed. When it is recognized by policymakers & decision-makers, then conditions for agricultural transformation are facilitated (See Figure 3). It is only then the seed can be conducted as a profitable business operation that renders invaluable service.

Taye *et al.* (2018) described a series of processes involved in seed system development. These are a breeding program for a steady flow of improved products; a testing scheme to identify appropriate products; parent seed or foundation seed production; seed production capability to produce large quantities; seed quality evaluation and control; facilities for cleaning, treating, packaging and storage; an outlet network for making seed available at the local level; and a feedback mechanism to assess product performance. In other terms, seed business has got unique features that make it different from other production schemes. Firstly, it requires an inflexible time lag-preplanning years in advance from breeder to basic to certified seed production. Secondly, it requires technical tasks, such as timely planting, detasseling, rouging, isolation distance; nicking, etc. This means that activities need to be done regardless of circumstances-no second chances. Thirdly, appearance cannot be used as an indicator of quality. When a farmer buys seed he can't tell if the producer has done a professional job during production. Thus, certification and labeling laws help in ensuring good quality. Fourthly, proper handling is needed to preserve quality since the viability of seed revolves around its moisture content.

In modern agriculture, public sector roles are supporting research, seed standards regulation, variety release/registration, seed quality evaluation, and seed certification. The private sector, however, is engaged in seed multiplication of various seed class (breeder, pre-basic, basic and certified), seed processing (dry, clean, grade, treat), product introduction, promotion, distribution, customer service, and farmer uptake. In, traditional agriculture, however, private sector engagement is very low or does not exist. Thus, the seed and seed system is highly supported by public institutions. Therefore, seed production and distribution in an evolving modern seed industry should make a paradigm shift. The

key issue in transforming the modern seed industry is developing competence, competition, and incentives with public resources. Figure 6 shows a schematic representation of the evolution of a seed delivery mechanism in a country (Gebisa, 2013).

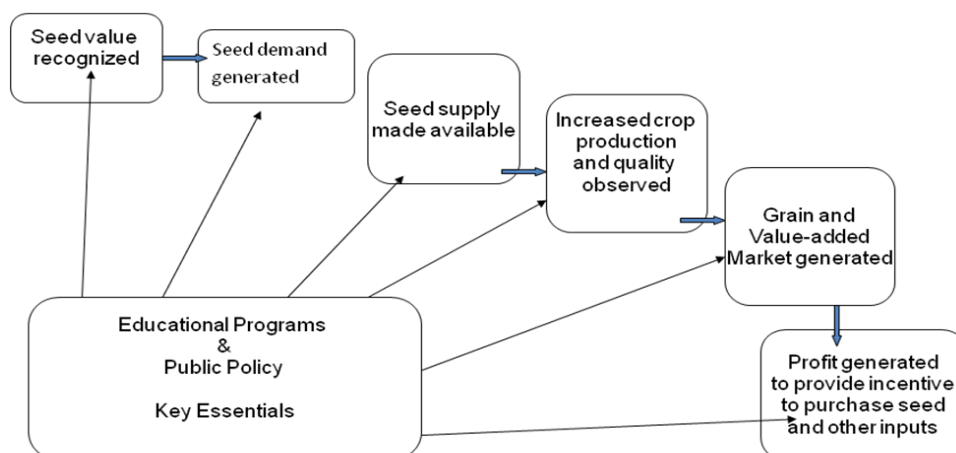


Figure 6 Schematic representation of the evolution of a seed delivery mechanism in a country (After Gebisa, 2013)

2.2.2.2 Seed System Value Chain

According to Taye *et al.* (2018) the seed system value chain has got five categories: seed breeding or research, seed multiplication, seed processing and storage, seed marketing and distribution, and finally the end-users. These functions operate in a coordinated and sequential manner. Seed breeding or research develops a variety of superior qualities. Seed production (division or agency) is responsible for careful and controlled production of good quality seed of officially released varieties of public or private agencies; seed quality control is responsible for assessment and control as well as operationalizing of field and laboratory-based quality control procedures including isolation, rouging, contaminants, germination, etc.; Seed certification: the regulatory arm of quality control with official authority to declare seeds of acceptable quality through legal certification; and seed marketing is responsible for assessing seed demand projections and managing to advertise, and seed sales and distribution for the seed agency. Large firms have the resources to perform all of the activities indicated earlier, while smaller firms may choose to specialize in selected aspects such as marketing and distribution. The end-users, farmers, buy seed and produce grains for sale to consumers.

The major activities of a seed production agency are field selection, optimizing seed setting, roguing, artificial emasculation, harvesting, seed drying, seed conditioning, seed quality control, seed storage, and seed marketing. Field selection is where seed-fields are selected based on the distance away from contaminants, soil fertility and quality, water source or rainfall amount, good management, and potential yield is expected. Optimization of seed set means ensuring available pollen vectors, wind and wind direction patterns, and implementation of male and female row: rations (for hybrid production). Rogue of seed field includes timely roguing of potential contaminants before pollen shedding starts. Rogue needs to be repeated to be effective. In producing hybrids, some method of removing the male flower from female rows is needed. The removal needs to be 100% complete, as it takes only a small error to have a great negative effect on hybrid seed production. During the harvesting of a seed production field, the operation needs to be carried out with suitable equipment at the proper temperature in clean containers or space. Gentle handling is required to avoid physical harm to seed. After harvesting, seed drying must be conducted if the seed is harvested below optimal moisture. Drying should be made at optimal temperature soon after harvest to prevent loss of germination and vigor (Taye et al., 2018).

Seed conditioning and pre-cleaning upgrade seed to improve its planting value. These include: cleaning (remove the trash, broken seed, inert matter and another crop/weed seed, separating based on seed physical characteristics (size, shape, weight), and treatment with chemicals (fungicide, insecticides, germination boosters, etc.), bagging, labeling and blending. Genetic purity should be the same or similar from the first batch to the last batch of seed packaged for the year. Seed quality testing involves management for purity that starts with plant inspection in the field, seed inspection in the laboratory, germination test, weed seed frequency, foreign (inert) matter admixtures. Thereafter, the seed must be stored in the proper condition. Poor storage puts all previous effort to waste. Hence, the seed must be kept under optimal temperature and humidity, in facilities that maintain high germination. Long term storage reduces the germination of most crops drastically.

Seed marketing is often handled by a separate department. Basic elements of market management include product quality, distribution system, price structure assuring a reasonable return, promotional activities that create demand, providing background information on the product, and customer support. Educational and promotional activities

must be jointly targeted during seed production by using as many different media and forums as available.

2.2.2.3 Classes of Seed and Share of Responsibilities in Seed Production

Based on the Ethiopian context, there are five categories of classes of seeds. These are breeder, pre-basic, basic, certified, and the recently adopted seed class called quality declared seed. Breeder seed is a nuclear seed that is always produced and maintained by the plant breeder who developed the cultivar or variety. The pre-basic seed is produced from breeder seed and maintained by a reputable research center or public seed enterprises. Basic seed, sometimes equates to foundation seed is produced from pre-basic seed by research centers, public seed enterprises, and private farms. Foundation seed can also be produced from prior year foundation seed, if available. Certified seed is produced only from basic seed, this is the seed sold to the farmer to produce “grain” sold as a commodity. Quality declared seed is produced by farmers or farm unions from prior year certified seed (Taye *et al.*, 2018).

Table 10 Share of responsibilities in seed production and distribution in an evolving modern seed industry in Ethiopia (After Gebisa 2013)

Classes of Seed	Who produces seed?	
	Short-term	Long-term
Breeder seed	Public breeder	Public and private breeder
Pre-basic seed	Public breeder	Public and private breeder
Basic seed	Public and parastatal	Private
Certified seed	Communal, public, parastatal, and private	Private
Quality declared seed	Private, parastatal, farmer unions and cooperatives	-

2.2.2.4 Seed System in Oromia

Several organizations, individuals, and institutions are involved in the seed system in Oromia that performs different functions in the seed value chain. Farmers obtain their seeds through three broad but intergraded seed systems, i.e., formal, informal, and intermediary. While the informal system is not regulated and is a major seed supplier, the formal is regulated by different policies but contributes a relatively small amount (MoA, 2019). The

informal seed system includes seeds that farmers saved, exchange, gift, barter or buy from a local market. The formal system is largely public driven across the seed value chain, from breeding to seed distribution. This includes seeds produced by public institutions, private companies, and by a mix of national and private companies. The intermediary system shares some features of the formal and informal systems, i.e., community-based seed producers and Local seed businesses developed as groups or individual entrepreneurs. Variety development and release have been primarily the role and responsibility of the government, as a result of which more than 85% of the released varieties are public owned. All public (OSE and ESE) and domestic private seed producers use varieties developed by public research institutes without paying royalty fees or having exclusive use right (MoA & ATA, 2017).

Seed multiplication by public enterprises is also made both using their farm and on out-grower schemes based on a contractual agreement with private farms as well as clustering the smallholder farms. Production is, however, largely supply-driven, even for the small scale domestic private seed producers who are currently selling their seed directly (MoA, 2018a). Given the subsistence nature of agriculture in Ethiopia, seed production also geared towards meeting the need for subsistence agriculture and not well linked with the current government strategies (Agricultural Commercialization Cluster and agro-industrial parks) for agricultural commercialization. Moreover, since seed production is largely through out-growers, the production system remains traditional and less mechanized. Besides, management of out-growers scheme with smallholders is challenging in terms of maintaining seed quality, trust, and price determination relative to grain price and recovery rate from out-growers is often very low (ISSD, 2016).

EGS is mainly produced by research institutes (federal and regional), public seed enterprises (ESE, OSE), and to a lesser extent by private seed producers. There is no clarity on the roles and responsibilities in the production and supply of EGS, resulting in shortage or excess supply, in terms of availability and accessibility. Moreover, EGS production is not well aligned with certified seed production because of ineffective planning and low market orientation of EGS production by the public research institutes, resulting in a mismatch between demand and supply. As such, certified seed production is not dictating EGS production. Very recently, attempts are being made among producers both at regional and federal levels for joint planning and role differentiation for EGS production and supply.

Seed production is dominated by few varieties and the rates of varietal change as well as seed replacement are low. Of the 1198 varieties released (MoA, 2019) only the seed of about

10% varieties (mainly wheat and maize) are commercially produced. With few exceptions, the capacity of seed producers is generally low in Ethiopia. There is a risk that on the one hand, they cannot supply enough seed to farmers, and on the other hand, they cannot withstand shocks that may arise from any direction (market, production, competition, and globalization).

The barriers to accessing seeds are weak production and quality assurance and poor extension of information and knowledge for the uptake of new technologies. To increase production and quality assurance, one has to ensure certification (methodology for ensuring that varieties are true to type), field inspection, testing seed samples for quality concerning physical purity, germination/ vigor, health, and genetic purity/ true to type.

2.2.2.5 Demand and Supply of Improved Seed in Oromia Region

OBOANR employs DAs at *kebele* level to collect individual farmers' seed needs and report to *district* Agriculture offices. This information is aggregated into the *district*, Zonal, and regional and national demand statistics. The result is a rough estimate of the types and quantities of seed that farmers want to purchase the following year in each *kebele*. This target is loosely apportioned to the various producers (i.e. ESE, OSE, Private seed producers, unions, etc.). At the end of the cycle, the government allocates supply proportionally through the cooperatives based on the original demand, without considering shifts in demand due to changes in rainfall patterns and market situation.

However, in many years, seed supply is well below demand, either because of variation in the original estimates or due to supply bottlenecks. For example, referring to OSE seed supply, the largest seed producer in Oromia, there is a big gap between seed demand by OBOANR and supply by OSE in many crops and there is no supply for some crops at all. Seed demand and supply during 2017/18 is only 52% (Table 11). During the growing season, seed carries over amounts to 11.5 million qt that costs the government huge money to dispose of the treated seeds. The amount of seed supplied by private seed producers, cooperatives, and unions in Oromia during 2017/18 doesn't exceed 14,163qt (Table 12). Moreover, private seed producers mainly depend on hybrid maize which is cost-effective for them.

According to CSA data during the 2017/18 crop season, 4,797,159 ha of land is covered by cereals in Oromia. Compared to the total cereal crop cover, only 13% is covered by improved seed in the region. The coverage of improved seeds for pulses and oilseeds were 0.8% and 1.6% of the total pulse and oilseed land cover, respectively. This implies that the

majority of smallholder farmers do not use improved seed. Seed supply shortage creates incentives for brokers to inflate their demand, and for black market sales and corruption. Hence, Oromia regional Government should aspire to targets that can take into account both demand and supply with sufficient flexibility to accommodate shifts in rainfall patterns and planting time.

Table 11 Seed demand, supply and carry over (million qt) for major crops by OSE during 2016/17 and 2017/18 cropping seasons

n o	Crop	Seed demand for 2016/17	Seed Supply for 2016/17	Carryove r	Seed demand for 2017/18	Supplied by OSE	Carryove r
1	Maize	163455	27133.34	1428	135784.83 8	43059.5	1866.5
2	Wheat	237833	374267	19698	209124.75 5	172048.5	23000.66
3	Barley	49642	47324.51	2491	43948.1	19743.25	1665.6
4	Tef	21600	51	3	14707.605	128.43	226.13
5	Fababean	6617	17778	935	7929.7	1400.5	111.5
6	Pea	2184	0	0	2336.55	0	0
7	H/bean	15748	41	2	12524.41	257.25	49.25
8	Chickpea	8914	0	0	17961.5	0	0
9	Lentil	4742	0	0	4518.5	0	0
10	Linseed	1807	912	48	1274.5	445.62	2.02
11	Rape seed	187	0	0	280	335.54	62.63
12	Sorghum	1394	1585	83	2055.03	1244.7	60
13	F/Millet	606	159	8	67.97	69.06	145.09
14	Rice	181	0	0	48.91	0	0

1							
5	Sesame	325	19	1	16	0	0
1							
6	Soybean	6	1920	102	48.9	935.1	406
1							
7	G/nut	192	0	0	8.5	0	0
1							
8	Onion	0	24	0	0	0	0
1							
9	Pepper	0	15	0	0	0	0
2							
0	Niger	68	0		28	0	0
Total		515,501. 0	471,228. 9	24,799.0	452,663.7	239,667. 5	27,595.4

Table 12 Amount of seed produced by private seed producers in the Oromia region

Crop	Seed supplied (qt)
Maize – hybrid	6781.6
Soybean	30
Tef	5827.5
Chickpea	1148
Wheat – bread	25.75
Lentil	350.1
Total	14,163.00

2.2.3 Transforming the Seed Sector in Oromia

2.2.3.1 Overall Goal

The overall goal of the seed sector in the region is to meet efficient and well-regulated seed production with quality standards, transparent and inclusive governance, which provides farmers with the certified seed of improved varieties of key crops in sufficient quantity and

quality at the required place and time with affordable price through multiple production and marketing channels, while maintaining the biodiversity of the country.

2.2.3.2 Vision

The vision in the seed sector is to have effective availability and accessibility of quality seed; competitive at both domestic and international markets; transparent and inclusive governance system; innovative and responsive; enabling regulatory environment; sustainable and; contribution to the improvement of farmers' livelihood.

2.2.3.3 Concept of Seed Sector Transformation

Previously efforts were made to support the value chains. While the value chain approach has resulted in 'islands of success' the approach could not create 'seas of change' as there are many obstacles with the underlying root causes for poor performance that could hinder the change (MoA, 2019). Sector transformation demands more than just sustaining an increase in production and productivity; it requires a fundamental shift in agricultural practices and re-orienting smallholder farmers to commercial and sustainable production. To realize this, seed sector transformation is pivotal. Thus, sector transformation requires a holistic approach beyond interventions in the individual value chain to proactively create sector structures and mechanisms that support more sustainable change. The sector transformation concept highlights the need to develop a shared vision of the desired performance of a sector as a whole. Before making a holistic approach to transform the seed sector, it is important to look into its building blocks. There are six building blocks as indicated below in figure 7 (MoA, 2019). The first three building blocks refer to the transformation of the production base (production, services, and marketing). The other three building blocks refer to the governance of a sector (revenue generation, regulation, and coordination).

In a similar line, Djamen (2016) argued that future public policies and investments can effectively contribute to the sustainable development of the seed sector only if they are directed mainly towards the following six areas: (i) Implementing more coherent seed policies [= regulation block]; (ii) Improving the governance of seed sector [=coordination block]; (iii) Strengthening seed demand and supply [=marketing]; (iv) improving the performance and responsiveness of the research - development scheme [=production + service block]; (v) Strengthening actors capacities and facilitating the involvement of youth

and women [=production + service); and (vi) Establishing appropriate and sustainable funding mechanisms [=revenue generation block). Thus, it is the accumulation of strategic outcomes of these six critical areas that will lead to the improvement of the accessibility and use of certified seeds to meet demand in the region.

There have been different efforts to improve the performance of the Oromia seed sector, which need to be consolidated and pulled into the appropriate building blocks and reshaped in such a way that the different strategies would concertedly contribute to the transformation of the seed sector. Status, challenges, goals, and strategies for each transformation block are presented in the following sections.

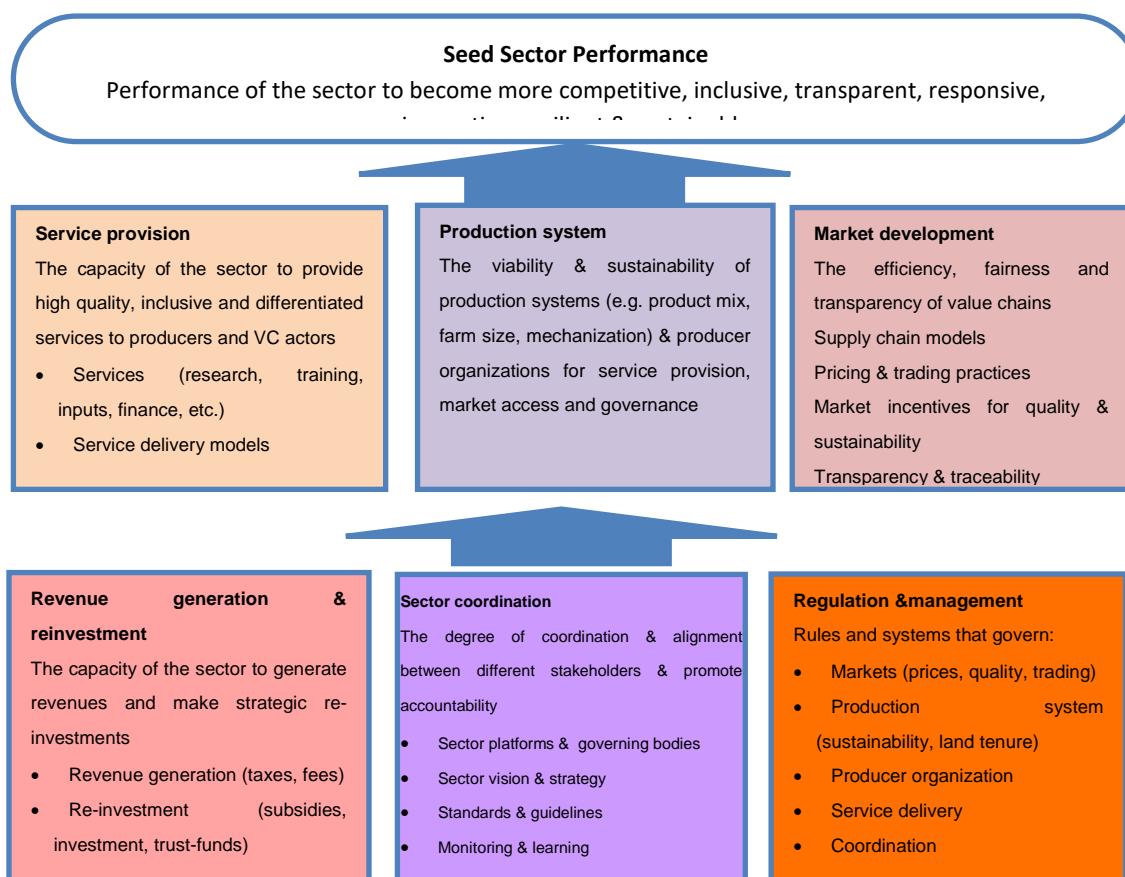


Figure 7 A framework for sector transformation and its building blocks after MoA (2019)

2.2.3.3.1 Transforming the Production System

There are some efforts already underway towards improving the seed production system. The government has created a fertile ground in partnership with CGIAR centers for variety

development. There is also technical capacity building in the research institutes. The government has been providing land on lease basis, tax exemption (duty-free import of farm machinery and tax holidays on income tax) upon obtaining a license for seed business. Moreover, the government has allowed access to public varieties (EGS) for seed producers, without paying a royalty fee. Besides, the government encourages the out-grower scheme for seed producers through training of out-growers, technical support in clustering fields, and providing agronomic advice to farmers in seed production. The government in collaboration with development partners also equipped some research centers and public seed enterprises with irrigation facilities, farm machinery, seed lab infrastructure, and facilities.

Despite all these efforts, quality seed production remains a challenge to seed sector development both at regional and federal levels (MoA & ATA, 2017; MoA, 2018b). Some of the reasons as to why it is not possible to transform the production system are discussed in Table 13 below:

Table 13 Challenges to quality seed production system in Oromia regional state

No.	Challenges	Reasons and justification as to why the challenges occur
1	Limited availability of EGS (breeder, pre-basic and basic seeds) across crops and varieties that occurs due to lack of commitment and lack of planned promotion of varieties.	<ul style="list-style-type: none"> • Failure to put in practice a coordination system that governs the quality of EGS production and accountability as per the mandate given by different legal frameworks. The proposed solution that was designed to bring an accountable system (contract-based production) is delayed for years due to a lack of commitment to the MoA and OBoA to enforce the agreement. • Lack of planned promotion of available and newly released public varieties as an option to existing well-adopted varieties through PPP in addressing the diverse agro-ecology of the country to increase variety choices. The sluggish promotion resulted in promising varieties of unnoticed and unutilized for a long period. For instance, the BH hybrid maize series of BH546 and 447 (MoA, 2019). • There is a slow rate of variety replacement which means that the rate at which both new cross-pollinated and self-

		<p>pollinated crop varieties are being developed and released following the release of existing varieties in the national/regional research system is generally considered slow compared with other neighboring African countries denying seed companies and farmers fast and increased access to better genotypes.</p>
2	Failure to determine effective annual demand and supply	<ul style="list-style-type: none"> • Seed companies in the country plan their annual seed production without knowing how much seed is required in the market for a particular year. MoA/BoA makes an attempt to estimate reported demands via request data collection from kebeles through districts, Zones and then regions that have never been used correctly and effectively for guiding the exact national seed demands by crop species and varieties • Absence of effort geared towards mobilizing all stakeholders into seed demand assessment: Domestic seed companies depend entirely on-demand assessment of the extension system and no regional/national effort is underway to develop a system that ensures the involvement of every company towards building an effective system for mutual benefit, • The persistent problem of seed leftover: While annual national/regional supply of certified seeds consistently lags far behind demand, there is paradoxically a huge amount of seed left-over annually with many companies due to multiplication of non-demanded varieties as a consequence of the absence of market information, promotion, timely distribution, and proper production and marketing plans. • Under-developed agro-dealer system: Direct Seed Marketing (DSM) that has been under a pilot scheme in the country for some time now appears to be a favored means of seed distribution by all stakeholders in the seed production and marketing chains. Nevertheless, the capacity of agro-

		dealers in terms of the provision of appropriate seed storage, keeping accurate sales records of the various companies, rendering unbiased and equal service to the public and/or private companies, and furnishing adequate financial capital to purchase seeds and distributing to farmers is limited.
3	Lack of market-driven seed production system	<ul style="list-style-type: none"> • Failure of Government to consider seed as a marketable commodity and lack of trust in private producers due to unethical behavior of few domestic private producers and their low capacity to respond to market demand. • There is high Government fear on a monopoly of the seed sector in the future, particularly by foreign companies. Thus, the seed is generally over-politicized and remained under the grip of the government. As a result, there is a high dependency on local producers on public support.
4	Inefficient out-growers management system	<ul style="list-style-type: none"> • Failure to select trustworthy farmers due to the influence of the <i>District</i> office of agriculture and at the same time the dependency of the seed companies on the public structure to select and manage out-growers. • There is also an undeniable weakness of seed companies to supervise the seed production fields to maintain quality, in addition to their weakness to collect the seed for processing and marketing in time (ISSD, 2016). This is because of the symbiotic relation between seed producers and the office of agriculture, manifested in the form of rent-seeking practices. • There is a lack of access to finance and purchase harvested seed on time by the seed producers, particularly when produced by the out-grower schemes. The small domestic private producers do not get credit to purchase raw seed, since there is neither credit system tailored for seed production, nor the government gives guarantee as they do for the unions and state-owned seed enterprises. Although there is no legal ground that fixed the current raw seed price (commonly 15% above the grain price), and this is

		negatively affecting seed recovery from out-growers (ISSD, 2016), seed companies are reluctant to change the system. Moreover, the production contract lacks trust and legal basis, limiting the enforcement in case of a dispute.
5	Limited capacity for seed production	<ul style="list-style-type: none"> • Lack of full-fledged investment by the regional and federal governments to sustainably and timely fulfill the infrastructure and facilities required to produce sufficient and planned amount of quality seed; • Government failure to recognize private seed producers as key role players in developing the seed sector, and thus support them to strengthen their capacity for production and processing and; • Failure to change the mindset of local administration to understand and own the responsibility of protecting the investments in the seed business, as producers are losing resources to produce the required quantity of seed. For instance, failure to secure land or farms for research, public and private seed producers by district, city, and regional state administrations, is limiting the capacity of producers.
6	Non-policy challenges of the private sector	<ul style="list-style-type: none"> • Poor entrepreneurship of local seed company owners: Owners and managers of these companies invariably lack capacity and enthusiasm to employ strategic management tools to take their seed business from subsistence to a higher performance level. • Limited organizational structure: Most companies, irrespective of their size and number of years of existence in the seed business operate with rudimentary farm structures including human resource management and development. • Poor accounting and financial management system: Many companies operate with a sub-standard financial management system regardless of expectations from the tax authority requiring the use of a standard accounting system. This could undermine both payable taxes to the government

		<p>and transparent financial transaction operations among share-holders.</p> <ul style="list-style-type: none"> • Reduced capacity for penetration in the seed market: Existing private seed companies appear to be satisfied with their current low position in the market share of the country/region and lack the drive to excel in availing better quality and higher volume of seed than their present performance. • The low effort of the domestic private sector to develop varieties of its own: These companies entirely rely on public EGS for the production of certified seed which, coupled with other factors, limits their capacity to increase annual seed volumes. • Local domestic private seed companies are under the indirect influence of public price-setting- public enterprises set the annual price of hybrid maize seed and the private companies fall under the influence of this move since both produce the same varieties and compete in the same market,
7	Limited commercialization and adoption of released varieties	<ul style="list-style-type: none"> • Local companies do not have exclusive user rights of public varieties. Plant variety protection policy has not yet been implemented since its first enactment in 2006. This is because the government lacks the commitment to implement the policy. • Plant breeding in Ethiopia is part of public service and there is no internal motivation to be competent and release outstanding varieties and niche varieties for different uses (food and nutrition security, agro-industrial input, and export). Moreover, there is low investment in developing modern breeding capacity and capability to enhance the development of outstanding varieties that are demand-driven. Thus, of more than a thousand varieties released by the public research system, only about 10% are under formal seed production (MoA & ATA, 2017).

Key lessons from other countries on the seed production system

The increased number of seed companies in many developing countries in Asia, Africa, and Latin America and consequently increased volume of seed production and supply has followed increased public investment in research for development and infrastructure as well as creating enabling policy environment, with full commitment for the implementation of policies and regulatory frameworks (MoA, 2019).

Goals and Strategies

Based on national and international experiences, goals are set and strategies are developed to enhance the seed production system in the region as indicated in Table 14 below.

Table 14 Goals and strategies to curb the challenges in the quality seed production system in Oromia regional state

Goals	Strategies
	Short-term
<ul style="list-style-type: none"> • Efficiency and effectiveness of seed production enhanced • Well-functioning production system with multiple operators in the seed production targeting increasing involvement of the private sector is ensured. • Increased seed production of crop varieties having less commercial interest from state and 	<ul style="list-style-type: none"> • Engage multiple producers in the seed production business • Attract more private seed producers through an incentive scheme including partial privatization of existing public seed enterprise • Define procedures by which international seed companies invest in Ethiopia to attract foreign direct investment (FDI) • Encourage and support Ethiopian professionals to enter into the business of seed production and variety development • Promote small scale forage seed producers in mixed agriculture, agro-pastoral and pastoral areas • Implement Government subsidy for the production of seeds of strategic crops, which are not profitable for producers, such as seeds of grain legumes • Production of EGS through: <ul style="list-style-type: none"> ○ Designing and implementing directive for the

<p>private seed producers is ensured.</p> <ul style="list-style-type: none"> • Variety development and EGS production by all capable seed producers enhanced • An efficient and reliable seed production system is ensured 	<p>exclusive user right for public varieties, and transfer the responsibility of producing EGS to companies.</p> <ul style="list-style-type: none"> ○ Making a variety of owners undertake regular variety maintenance ○ Incentivize workforce in variety development and seed maintenance ○ Enforce demand and contractual based EGS production system • Ensure access to land for seed production <ul style="list-style-type: none"> ○ Strengthen out-grower scheme including licensing out-growers ○ Recognize the use of the out-grower scheme for investment in the seed sector ○ Enforce direct engagement of the seed producer using out-grower (without the involvement of District Office of Agriculture). ○ Provide an incentive for investment in the seed sector through full public capital investment (for example irrigated land with full facility). The flower model can be applied for seed. <p>Long-term</p> <ul style="list-style-type: none"> • Support variety development through: <ul style="list-style-type: none"> ○ Increase in public investment in research to develop outstanding varieties ○ Support state-owned and private seed producers to develop varieties
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2.2.3.3.2 Transforming the Marketing Development

Seed marketing in Ethiopia and other developing countries is largely directed by the government (Benson *et al.*, 2014). It was in 2011 that a new option of marketing called Direct Seed Marketing (DSM) was introduced at the pilot level (MoA, 2019). The pilot was found successful and gradually scaled up to 228 Districts in 2018 (ATA, 2018). Thus,

currently, there are two major seed marketing channels in the country. With the centralized distribution system, seed demand is collected by the office of agriculture and used for allocating produced seed but doesn't ensure production planning of seed. The seed will be distributed through cooperatives. With DSM, companies sell their seed through agents or own shops, to farmers in the designated districts. In 2018 about 60% of the seed is marketed at the national level through DSM in a proportionally fewer districts, while the remaining 40% was distributed through the conventional systems in the four major regions, in disproportionately more districts.

Seed prices set by state seed producers indirectly influence the seed selling price. The four state-owned companies decide the price of all crops and this is communicated to the regional states. All of the domestic private seed producers use the same varieties and thus price decided by state companies govern the price at which private producers sell their seed. Being the major seed producers, the public seed enterprises are the price makers, but the fact that the government is endorsing the suggested price makes things complicated, reducing competition in price-setting among the seed producers. Such price fixing also influences the price of raw seed and thus, the volume of seed recovery.

Changing the seed marketing system is about trust and this may take time. DSM has been piloted and has achieved commendable results over the last eight years. There is a good understanding of the concept of seed marketing in Ethiopia compared to 2010. The directive for seed marketing has been just approved in the last week of December 2018. Identifying the challenges of DSM and standardizing across the regions as well as limited seed production by seed companies, limited the uptake of DSM as a strategy. Particularly the volume of seed being produced by the domestic small private producers is limiting the expansion of DSM to a larger extent (MoA, 2019).

Direct seed marketing mainly focused on certain potential areas and limited crops; largely for hybrid maize. There is a narrow product portfolio that does not address the diverse agro-ecology and diversity of crop varieties in the country. This is because, there are limited varieties that suit to these diverse and 'marginal' areas, and there is poor agricultural extension service and thus lack of awareness of varieties and low seed demand. Though research and extension system needs to focus on high potential areas, the 'marginal' areas ought to get the due emphasis they deserve, including agro-pastoral areas. Moreover, limited information exists on what seed is available and accessible to address some of these areas. This is mainly because the Ministry and Bureaus of Agriculture use rudimentary data

management system, which can't be easily accessed by seed actors to make available the seed to the needy areas. Seed promotion is also weak since companies are all using public varieties and no one is interested to invest in promotion. It is not also uncommon to see companies not selling their seed because of delay in processing, which is partly related to lack of access to land for construction, finance, and electric power.

The agro-dealer system is not developed in the region leaving all marketing risks to the producing companies, if not to the government. From the government side, there is no interest to develop agro-dealers. On the other side, the Prevalence of a fake seed remains of high concern in the seed market, and legal frames for the protection of such an unscrupulous act shall be strengthened and given high accord.

Centralized seed distribution will continue to be one of the channels for seed dissemination. Regional Bureaus of Agriculture continues to estimate seed demand and allocate for the unions/cooperative, increasing the inefficiency of the system. Although seed demand is not met, paradoxically, more seeds still left unsold in the stores of unions and cooperatives, partly because they do own it, both physically and psychologically. Inefficiency persists mainly because the bureau of agriculture is reluctant to leave some of the operations to the value chain operators (cooperatives).

Key lessons from other countries on the seed marketing system

Unlike in Ethiopia, seed marketing and distribution (including promotion) is done directly by the seed companies using their own sales personnel and agro-dealers and stockiest. Engagement of seed companies in seed marketing, active involvement of a large number of agro-dealers is creating farmers' access to quality seeds of improved and preferred varieties on time and close to their farm gate. Market-orientation is the driving force for seed marketing and distribution to grow steadily. The motive to have more market share prompts seed promotion, diversification of the crop-variety portfolio, product development, and seeking a new market. Market-orientation also increases the quality of products and services to develop and maintain trust and reputation, thereby reducing customer complaints. Continuous feedback collection on the need of farmers and requirements of market (consumers, processors) help in demand estimation and product development. Market-orientation coupled with the absence of market monopoly through involving a large number of companies and products would help stabilize price and/or even reduction.

Goals and Strategies

Based on national and international experiences, the following goals are set and strategies are developed to make the seed marketing efficient and effective (Table 15).

Table 15 Goals and strategies to curb the challenges in seed marketing and distribution system in Oromia regional state

Goals	Strategies
	Short-term
<ul style="list-style-type: none"> • Efficient, market governed and multiple seed marketing and distribution channels established • Investment in marketing capacity (technical and infrastructural) is enhanced • The country entered the international seed market 	<ul style="list-style-type: none"> • Expand DSM to cover more geographical areas and all crops through: <ul style="list-style-type: none"> – Engagement of agents/agro-dealers to penetrate rural areas and actively participate in seed marketing, including collecting demand data, with full accountability for maintaining quality and trust – Support of agents/agro-dealers in establishing seed marketing infrastructure – Engagement of seed producers actively in seed promotion – Engagement of seed companies promote small seed packs as deemed necessary to address farmers having small land holdings • Support suppliers to open market outlets in marginal areas • Seed prices should be set based on market demand taking into account the cost of seed production. At the same time, farmers should be subsidized if necessary. • Increase the demand for quality seed through developing commodity value chain through alignment of seed business with the recent public initiatives (Agricultural Commercialization Clusters, Agro-processing industry parks).
	Mid-term
	<ul style="list-style-type: none"> • Promote international seed trade (import/export) through:

	<ul style="list-style-type: none"> – Finalizing seed trade harmonization with the regional market to produce seeds of varieties that is adaptable in Common Market for Eastern and Southern Africa (COMESA) countries, including Ethiopia – Finalizing the directive on import of foreign-registered varieties for local production and export purpose to exploit the potential of producing high-value crop seed – Operationalization of strategic seed reserve system to ensure sustainable seed market (to be used both for domestic and export) – Use of Ethiopian embassies/missions to promote regional seed sector and attract foreign direct investment (FDI)
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2.2.3.3.3 Transforming the Service Provision

For seed production and marketing, most important services include variety release and registration, seed field inspection, and quality assurance as well as finance. In terms of quality assurance, the system has been established since the early 2000s. It is structured at both regional and national levels, where the four regions have 14 laboratories, although the laboratories have limited capacity. Regional coordinating structures have been established in Amhara and SNNPR some years back and this year in Oromia. Seed quality is still an issue both at regional and national levels (ISSD, 2017), though some progress has been made since the early 2010s. Training on technical capacity development as well as the process of harmonizing across the regions is underway by different projects. Quality control was mainly limited to certified seed production in the past, but the service has now extended to EGS production in the research centers. A central laboratory is now a member of ISTA through project support, which is important to have access to information and support.

The existing regional laboratories are not regulating the seed sector as expected. Though the regional laboratories lack logistics (vehicle), infrastructure, and testing facilities, the regional government is reluctant to fully strengthen the laboratories. Regardless of the capacity limitation of the public quality assurance system and the growing demand for the services, there is no attempt made to introduce private quality assurance service. Moreover,

to reduce the burden from the regulatory system, there was no attempt from the government to accredit seed companies with dependable potential (ATA, 2017).

There is a variety release committee that is responsible for evaluation and release of varieties, whose members are predominantly from research and no representation from private and civic organizations/associations (like seed association, agro-processors, and trade associations). Most of these varieties are from public research institutes with few from the private producers (MoA, 2019). National performance trials for the candidate varieties from both public and private are managed by the public research system. There is always complain from private horticultural seed companies that they are not getting adequate service, both in terms of several varieties accepted for the trials and how the trial is managed, which is particularly serious for vegetable varieties. Moreover, how the payment for variety performance trials is decided is not transparent, although there is a policy in place.

The current variety release and registration system lack independence and impartiality; hence, there is a conflict of interest as the trials are managed by the research system, which also releases their varieties. In other words, the neutrality and inclusiveness of the variety release and registration system is in doubt (World Bank Group, 2015, 2016). The Ministry, which is responsible to manage the process according to the existing seed law, only serves as a secretary (MoA, 2017). The existing directorate for plant variety release, protection, and seed quality is supposed to be promoted to authority level to effectively manage and coordinate the seed certification and variety release and registration process. However, the government has not endorsed the proposed structure for the establishment of the proposed authority.

Although Oromia regional state avail credit for unions and state-owned companies, this service does not extend to the private sector (MoA, 2019). Similarly, insurance is important for agriculture including seed, but the service is not developed for agriculture in general and the seed in particular. Like any other agricultural venture, seed production is a risky undertaking, subject to vagaries of climatic (e.g. drought, flood), biotic (e.g. diseases and insect pests), and human (e.g. war, civil conflict, fire, theft) factors. Hence, there is a strong need for putting in place crop insurance for seed producers.

Key lessons from other countries on a service provision system

Countries with developed seed industry such as Brazil, Egypt, India, Kenya, Uganda, Vietnam, and Zambia do provide efficient services to the seed industry concerning variety

registration and release; seed quality testing and certification (field inspection, seed sampling, seed testing, certification, and labeling); licensing seed producers and private seed inspectors; having seed laboratories, some of which are ISTA accredited seed laboratories; and plant varieties protection services. Some of the countries are members of ISTA and OECD; have ISTA accredited seed labs, giving the confidence to undertake international seed trade. Therefore, Efficient, transparent, and accountable service provision is one of the requirements for the development of vibrant seed industry. Being a member of ISTA and OECD as well as having seed laboratories accredited by ISTA is necessary for a country to engage in the foreign seed trade, esp. export trade (MoA, 2019).

Goals and Strategies

Based on national and international experiences, the following goals are set and strategies are developed to make the regional seed sector service efficient and transparent (see Table 16).

Table 16 Goals and strategies to curb the challenges in seed service provision system in the Oromia region

Goals	Strategies
	Short-term
<ul style="list-style-type: none"> • Neutrality and inclusiveness of variety release and protection system is ensured • Reliable quality assurance across the whole seed value chain ensured • Tailored credit and insurance schemes are developed and operationalized 	<ul style="list-style-type: none"> • Modernize seed sector service deliveries through: <ul style="list-style-type: none"> – Establishing a database and an ICT based information exchange and service delivery – Including seed marketing in input voucher systems (including seed aid) – Outsourcing field inspection service to private business service providers – Accreditation of potential seed companies for own seed quality assurance – Accreditation of private seed quality assurance agencies. • Develop seed tailored schemes to enable seed business investment through: <ul style="list-style-type: none"> – Credit including machinery leasing to enhance seed business

	<ul style="list-style-type: none"> – Crop insurance schemes for seed business – Promotion of agricultural service providers including farm machinery, processing, and crop protection services • Immediate investment in regulatory capacity through: <ul style="list-style-type: none"> – Investment to enhance transport, laboratory facility, and human resources capacity in the region – Implementing and collaborating in the upgrading of the regional and national seed laboratories to obtain ISTA accreditation and ensure sustainable membership
	Mid-term
	<ul style="list-style-type: none"> • Establish regional seed regulatory authority through <ul style="list-style-type: none"> – Contribution and support to finalize the regulation that was submitted to the prime minister office on the establishment of regulatory authority. – Ensuring a variety release and protection system is handled by the authority

2.2.3.3.4 Transforming Seed Sector Regulation and Management

Different policy and legal frameworks (seed law, PBR law, seed regulation, quality assurance service fee, and directives, certificate of competence (CoC), quality declared seed (QDS), tracking rejected seed) are in place for the smooth functioning of the seed sector. The policy and legal frameworks are also being implemented, though not adequately and fully done. Their wide implementation is still under question, partly due to lack of awareness (i.e. not clearly knowing what the goals and priorities of the seed sector), low level of commitment and accountability as well as limited capacity to translate policy and legal frameworks into action. Ethiopia is using seed sampling procedures and testing rules of the International Seed Testing Association (ISTA) and Organization for Economic Cooperation and Development (OECD)'s seed scheme rules and regulations for seed certification as well as the four-generation seed classes (breeder, pre-basic, basic and certified seed). However, Ethiopia only becomes a member of ISTA and not yet a member

of OECD; also none of the seed laboratories are ISTA accredited (MoA, 2019). The membership of ISTA is obtained through the support of development partners paying the membership fee. Being a member of ISTA and OECD as well as having ISTA accredited seed laboratory are among the requirement for Ethiopia to enter into international seed trade. Another requirement for involvement in seed trade is seed trade harmonization. Though Ethiopia signed a regional agreement on COMESA seed trade regulation, it has not yet endorsed an implementation plan for seed trade harmonization. If Ethiopia is to become a member of the World Trade Organization, it also needs to apply article 3 (b) of agreement on Trade-Related Intellectual Property Right. The Ministry, regional bureaus including Oromia region, and development partners have been working to create awareness on existing legal frameworks, for seed producers, technical experts, legal officers, etc. There have been efforts to identify gaps regarding policies and regulations (MoA, 2019).

As an opportunity, two public (Ethiopian Seed Enterprise and Oromia Seed Enterprise) seed enterprises, two multinational hybrid maize seed producers (Pioneer and Sidsco) and eight small and medium private seed companies (Amuri High Yielding Varieties and Agri. Products, Anno Agro Industry PLC, Gadisa Gobena Commercial Farm, Hadiya Enterprise PLC, Homa Seed PLC, Nono Agri-Development, Tadese Gena Farm and Zi-Anderta) and quite several primary cooperatives and unions, as well as NGOs, operate in Oromia. These different sources offer diverse opportunities for seed sources and access for farmers in the region. If the current unconducive seed production enabling environment prevailing in the region is abated, these sources of improved seeds of varying crop varieties have a lot to offer in supporting the needed transformation of the agricultural sector.

The existence of several policy documents meant for supporting the development of a vibrant seed sector in the country also adds positively to the potential resources this region could tap into to develop its seed sector. These include:

- The first Ethiopian seed policy that was formulated in 1992, and served as the basis for different laws and regulations decreed thereafter addressing the various components relating to the seed issues. This seed policy focused on plant genetic resource conservation, crop variety development, testing and release, seed production and supply, seed import and export, and reserve seed stocking. The seed policy was followed by Proclamation No. 56/1993 for the establishment of the National Seed Industry Agency and then by Seed Regulation No. 16/1997, which was later replaced by Seed Proclamation No. 206/2000. The seed proclamation of 2000 covers genetic

resource conservation and development; variety development, testing, and release; seed production, distribution and marketing; participation of farmers, public and private seed enterprises in the seed industry; agricultural extension and input; seed import and export; the organization of the Seed Industry Agency; seed legislation; and quarantine and seed databases (ISSD AFRICA, 2012).

- The Establishment of the Oromia Regional Public Seed Enterprise by the Regional State
- A Seed System Development Strategy (five-year working strategy document) prepared by ATA and MoA (MoA and ATA, 2017) to guide domestic and international partners in targeting their investments and efforts towards addressing systemic bottlenecks to bring about holistic transformation, rather than piece-meal activities within the seed system. It has been indicated in this document that there is a national seed regulatory system consisting of quality standards and seed related legal frameworks at the federal level with implementation taking place mainly at the regional level. The role of the federal system is to ensure operational consistency across regions.
- Supportive national policy acts:
 - Decreeing of a Revised National Seed Proclamation No. 782/2013, governing the definition of seed terms; variety development, release and registration procedures; seed production and distribution mechanisms; quality control and assurance methods, provision of certification of competence for seed business; and other miscellaneous provisions related to seed issues in its six parts.
 - This seed policy also encourages alternative sources for local seed production by farmer seed producer's cooperatives or associations to fill the gap and expand quality seed supply. Recognition and introduction of a Quality Declared Seed (QDS) scheme and development of standards for 35 priority food, feed, and horticultural crops (Zewudie and Abebe, 2016) is stepping forward in increasing access to seeds.
 - The Biosafety and PBR Laws currently undergoing the processes of reviewing and revision in the country, unlike an earlier policy of total prohibition, Open up a new window of opportunity not only for the introduction, testing and release of biotech crops but also enhances the protection of domestic and foreign plant varieties and encourages more participation of the private sector investment in the seed sector

Challenges

Irrespective of the existence of the above-indicated policies, regulations, and guideline, the seed industry in general and the private sector in particular of the country, inclusive of the Oromia region, has been restrained by numerous general policy (Teshome and Dawit 2012; ESA, 2018) related challenges that could be categorized under the following groups as indicated by ESA assessment studies:

- Poor enabling environment: Inadequate market system, inadequate support of the government to the private sector, lack of investment incentives, inadequate policy implementation, and enforcement at all levels and inadequate access to publicly owned varieties of EGS are the primary bottlenecks under this category. The assessment identified the lack of a clear policy direction on the role of the private sector in the development of the seed industry of this country.
- Institutional & administrative bottlenecks: major institutional and administrative challenges are identified as inadequate government support (federal and regional), inadequate public and private partnership and networking, limited financial resources, lack of awareness of existing new varieties, and lack of modern equipment and poor road infrastructure facilities.
- Production and quality control: The main challenges include poor quality of source seed, inadequate availability of EGS, lack of fertile and quality land with irrigation, limited skill on seed production, weak quality assurance service in seed production, and inadequate capacity of seed quality laboratories (Staff, logistics and facilities and equipment).
- Seed marketing and distribution: Absence of alternative and more efficient marketing systems, lack of seed price set by market factors, limited resource capacity and inadequate effort to make effective demand assessment by stakeholders,
- Capacity limitations: The private sector has limited knowledge and skills in seed business planning, marketing, brand development, managerial, technical, and operational capacity, and limited equipment and financial resources.

Key lessons from other countries on seed regulation and management

Countries with a well-performing seed industry have developed and judiciously implemented the seed policy and seed regulatory frameworks to the extent that it is enabling seed business both by domestic and international private seed companies. The countries are also known to periodically revise their seed regulatory frameworks to fit with market

demands like harmonization of seed regulations to promote seed trade internationally. In many countries (e.g. Vietnam, South Africa, Kenya, India, South Korea, Canada) that have adopted PVP, the number of protected varieties increased as a result of increased direct foreign investment and incentivized private seed sector development (MoA, 2019). Consequently:

- Yield has increased (rice, maize and sweet potato in Vietnam; cut flower in Kenya, cabbage in Republic of South Korea; maize and wheat in China; fruit trees in South Africa and potato in Canada)
- Seed trade (both domestic and foreign trade) has significantly increased productivity
- Direct foreign investment increased, contributing also for employment and technology transfer

Seed policy and Strategy Recommendation

Based on national and international experiences, the following goals, policies, and strategies are developed to make the seed sector in the region well regulated (see Table 17)

Table 17 Goals and strategies to curb the challenges in seed regulation and management system in the Oromia region

Goals	Policies	Strategies
		Short-term

<ul style="list-style-type: none"> • Competitive seed market and pluralistic seed sector model is developed • Harmonized seed trade to meet COMESA standards and international schemes 	<ul style="list-style-type: none"> • Develop an effective seed and seedling production and supply system that involves both the public and private sectors. • Develop and support an effective system for production and supply of High-quality seeds of selected crops to satisfy the Regional Seed Demand. • Ensure a sustained supply of those seeds of selected crops and create effective linkages among all the actors of the seed sector in the region. • Encourage the informal sector seed producers to compensate and fill the gap for non-priority crop seeds. 	<ul style="list-style-type: none"> • Approve & effectively implement seed policy, seed law, seed related regulations, directives, guidelines and procedures by <ul style="list-style-type: none"> – Finalizing and implement the seed policy – Developing regulations and directives for Plant Breeders' Rights (PBR) – Endorsing pending draft directives (import of foreign-registered varieties for export purpose, administration of public varieties) – Implementing effectively in-country seed quarantine procedures – Revoking regulation that requires land (Van Mele, 2011) for investment in the seed business • Develop and periodically update legal frameworks to ensure sustainability, accountability, and transparency of the seed sector actors by: <ul style="list-style-type: none"> – Developing effective legal frameworks for contractual-based seed production – Developing emergency and seed aid distribution modality to minimize its effect on seed sector development – Developing a legal framework and implementation modality for maintaining seed reserve • Engage in international seed related
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	<ul style="list-style-type: none"> Strengthen the regional seed quality standard regulatory body and demolish any barriers that limit the free seed trade in the Region. 	<p>schemes through</p> <ul style="list-style-type: none"> ISTA membership and accreditation <ul style="list-style-type: none"> the Ministry need to budget for an annual fee; OECD membership Implementing COMESA seed trade harmonization regulation and its implementation plan <ul style="list-style-type: none"> Create an enabling environment in the region for the dynamic participation of private both local and multinational seed companies as well as public enterprises and community and farmer groups to promote the regional seed system. Create a conducive policy environment and responsive seed supply through variety of improvement and extension. Build Regional seed data system, create regional capability on trained manpower and physical seed related facilities. (storage facility warehouses cleaning machines and retail shops) Designate a regional agency to support, advise and control of the seed actors as well as the consumers in the region. Regulate the contract based seed multiplication mechanisms in the region to make sure that all actors responsibly comply with the legal contract agreements in the Region. Encourage private seed producers to access land for seed multiplication in the Region.
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2.2.3.3.5 Transforming the Seed Sector Revenue Generation and Re-Investment

The seed sector is becoming a high revenue-generating sector in the country. As the sector grows, the contribution of the sector to revenue generation continues to increase. Currently, the whole value of the transaction, just taking the value of the certified seed, from the sector exceeds 3 billion ETB. There are also seed companies as well as research institutes that generate revenues from sales of EGS. The public institutions engaged in service provisions are also exercising the generation of revenues. For instance, the research system has been collecting revenues from national performance trials for varieties from private companies. Regulations are also in place to collect service fees that are provided by regulatory authorities. The seed certification authorities have started collecting service fees from the field inspection and laboratory testing. There is great potential for revenue generations from royalty fees and licensing of public varieties. As the contribution to government taxation (land lease fee and income tax), the sector is playing a vital role. Moreover, the sector is creating job opportunities for citizens. But the total national revenue generated compared to international seed market value, which is about 46 billion USD, is very much below the potential it ought to be for Ethiopia. The sector is still not playing a significant role in the seed export market, though there are potentials to engage in seed export, which entails the implementation of PVP and harmonization of seed trade. In 2016, the value of vegetable seed import is about 7 million USD. However, there is a potential to produce vegetable seed in Ethiopia both for import substitution and export, given the diverse agro-ecology and proximity to the international market, and companies are sitting on the fence waiting for a conducive policy environment. In particular, this calls for the endorsement of the directive for import of unregistered varieties for the export only, and efficient phytosanitary service. There is an opportunity for private plant breeding and seed company development in Ethiopia in the future, which could generate a substantial amount of revenue as it is the case in other countries like Uganda, Zambia, South Africa, and Zimbabwe.

Though there is no supportive directive that facilitates the export of seed, the government is providing seed import permits for foreign registered varieties for re-export purposes. The government has been working towards seed sector development, and always indicates that seed is a priority agenda. However, it is not envisioning the contribution of the sector in terms of revenue generation. The seed is mainly considered as agricultural input to ensure food security, but not as a commodity both for import and export market.

Key lessons from other countries on revenue generation and re-investment

Working capital and long term financing to the seed sector are required to meet seasonal production costs as well as capital investment needs for research and development, warehousing, processing machinery, vehicles, irrigation structure, and other farm equipment. But, like any other sector in agriculture, the seed sector is extremely overlooked by financial institutions (Jessop, et al., 2012; ISSD Africa, 2017). Even then the seed sector could generate revenue and finance the sector in different forms such as through domestic and export marketing of seed; revenue from the services that service provider is providing, which includes fees for variety testing, inspection, licensing; royalty from making use of plant variety protection and royalty fees from public varieties by providing exclusive right use for seed companies; own saving and re-investment by seed companies; grants provided to seed companies and governments by foundations and development programs; loans from finance institutions (through collateral & loan guarantee), value chain financing as well as from seed trade (World Bank, 1995; ISSD Africa, 2017; MoA, 2019).

Based on national and international experiences, the following goals and strategies are developed to make the seed sector for generating revenue and re-investment (see Table 18)

Table 18 Goals and strategies to curb the challenges on revenue generation and re-investment in the Oromia region

Goals	Strategies
	Short-term
<ul style="list-style-type: none"> The seed sector becomes a revenue-generating industry, including foreign currency for the country. The sector become a self-financing industry for investment (human resource development, infrastructure, and related inputs such as seed treatment chemicals, seed inoculants like rhizobium for grain 	<ul style="list-style-type: none"> Expand revenue-generating schemes for institutions engaged in the seed sector by initiating and supporting institutions (agricultural research system, ESA/OSA, and regulatory authorities) to expand their income generation scheme and allow re-investing. Public funding for investment to stimulate seed business through: <ul style="list-style-type: none"> Investment (incentive, logistics, and infrastructure, facilities) in the seed sector targeting increased foreign currency generation. Select a few outstanding companies for such

legumes, fertilizers/bio-fertilizers)	<p>privilege.</p> <ul style="list-style-type: none"> – Investment in infrastructure (irrigation, power, ICT, strategic storage facilities), logistics and packaging to enhance seed trade both at the domestic and export market • Design an end-user contribution to fund the sector (breeding and seed production) by: <ul style="list-style-type: none"> – Strengthening linkage between end-users' industries (agro-processors such as millers, bakeries, pastry, breweries, textiles) and the seed value chain so that the industries also contribute to the seed sector development, such as variety development – Developing MoU between the seed sector actors and industries for selected commodities to promote public-private partnerships (PPP).
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2.2.3.3.6 Transforming the Seed Sector Coordination

The Ministry of Agriculture and Regional Bureaus of Agriculture are responsible to guide and coordinate the seed sector at their respective levels. Within the Ministry, the activities of the seed sector are under two state ministers and three directorates. Similarly, in the regions, seed issues are dealt with by different directorates and offices. As such, all do their specific task, with weak coordination, alignment, and integration. The national seed sector in general and that of regional in specific is at early growth stage (AGRA, 2013), and is not responding effectively to the local demand, let alone to compete in the international market. It needs strategic guidance, not only to supply quality seed to the domestic market, but also to compete in the international market and generate foreign currency. However, no one is responsible to give strategic guidance to take the sector from the current low level of performance to an advanced level. In other words, an entity that has a clear role and responsibility to guide the overall seed sector development is virtually missing both at the regional and national levels.

In the absence of a clear organizational structure that guides and coordinates the seed sector (MoA, 2017d), currently, ad hoc teams are organized to coordinate and guide the sector. For instance, regional seed core teams (each in Amhara, Oromia, SNNPR, and Oromia),

composed of major stakeholders of the seed sector, were organized in mid-2010 and since then have been guiding the seed sector in the respective regions. Similarly, seed units at both regional and federal levels were organized in 2017 (drawn from different organizations), to facilitate the process of establishing a formal structure within the Ministry and the regional bureaus of agriculture. Also, the National Seed Advisory Group (NSAG) was organized in 2017 and reorganized in 2018 to provide effective advice to the Ministry. Over and above, a national seed platform was established on 21 December 2017, to set strategic directions that would need due attention of policy and decision-makers to take farther the seed sector development.

All the above efforts are ad hoc, as they are implemented by teams from different organizations, which could cease to exist at any time. They are not legally and structurally responsible and accountable to coordinate and lead the sector and also lack commitment and sustainability at large. They rather tend to make suggestions and recommendations, and they do not have the legal power to enforce the suggestions and recommendations as well as any initiative whatsoever. Thus, they cannot be the official/legal governance structure of the seed sector and they also lack legitimacy to call upon pertinent stakeholders to take up any task, that otherwise could be important to address existing or emerging challenges in the seed sector. Certainly, seed sector governance is lacking in Ethiopia since 2004, when the National Seed Industry Agency was abolished for reason not clear enough to most actors in the seed sector. There has been discussion since 2008 to reinstitute the seed sector governance structure, but there has not been a political will from the Ministry to accept the idea of reinstating the seed sector governance structure.

Key lessons from other countries on seed sector coordination

Several countries like Egypt, Ghana, Nigeria, Uganda, Bangladesh, and Nepal have set up seed coordination bodies (MoA, 2019). Many of the countries with advanced seed industries have a well-coordinated and well-regulated seed system. The entities (council, board, or agency) leading the seed coordination are all accountable/report to the ministry of agriculture. Thus, for the Oromia region to have a vibrant seed sector, it is completely important to set up and make operational an entity to coordinate the seed sector both at the federal and regional levels. Regardless of the naming (board, council, agency, or authority), the seed coordination entity has the following roles and functions:

- Provide overall coordination and oversight the performance and development of the seed sector

- Design improved management systems and procedures relating to the administration of seed activity
- Responsible to lead, guide and monitor the reform/up-dating of the seed sector
- Analyze and formulate programs or revise, policies and actions regarding the seed industry development (research on issues relating to seed testing, registration, release, production, marketing, distribution, certification, quality control, supply and use of the seed, seed import and seed export and coordination and management as well as financing); and accordingly, advise the ministry
- Develop policies that stimulate the development of the seed sector and encourage companies to carry out research, production, processing, and marketing of seeds in the country, subject to the approval of the ministry/government
- Ensure the consistent implementation and monitoring of activities laid out in the seed policy and seed regulatory frameworks
- Define clearly the roles and responsibilities of actors and stakeholders to ensure harmonious operation, create synergy and reduce duplication of efforts and optimize resource use, with the required commitment and accountability
- Foster a better understanding between public and private interests and activities to facilitate cooperation and complementarities
- Advise the national research system on the changing pattern of seed demand and farmer's needs (i.e., based on market, climatic and biotic factors) so to help the development of farmer preferred varieties

From experiences of several countries indicated above, seed sector governance oversees the implementation of different policies, propose policy ideas for the development of the seed sector, coordinate activities of different actors, and define the roles and responsibilities of actors. The improvement of the governance of the seed sector is necessary to enable the various actors to fully play their specific roles and to have appropriate elements to manage the demand and the supply in a coordinated way. In this context, the role of each stakeholder in the seed sector must be clearly defined to better establish responsibilities, reduce duplication of efforts, and create synergies in interventions. Functional dialogue spaces at the national and regional levels are needed, particularly for consultation, identification of innovative needs, and coherence of interventions as well as the elaboration of responses to challenges of the seed sector. Improved communication around legislative and regulatory frameworks is necessary to facilitate ownership and compliance by stakeholders. It is

important that resources (human, material, infrastructure, and facility) and autonomy of services in charge of enforcing seed regulations be improved to reduce their vulnerability and improve their efficiency.

Based on national and international experiences, the following goals are set and strategies are developed to coordinate, align, and integrate the seed sector (see Table 19).

Table 19 Goals and strategies to curb the challenges on revenue generation and re-investment in the Oromia region

Goals	Strategies (Short-term)
<ul style="list-style-type: none"> • All seed issues are coordinated by one designated governing body at the regional level, which is well-staffed with competent, effective & accountable leadership. • Stakeholders' inclusiveness, transparency, and governance ensured • Respective mandates, roles, and responsibilities of actors in the sector in the region are clearly defined and delineated; each well-functioning to ensure accountability 	<ul style="list-style-type: none"> • Establish seed governance structure and corresponding entity at the regional level, mandated for seed sector leadership and coordination by: <ul style="list-style-type: none"> • Reviewing and analyze the performance of existing coordinating systems and present to the regional dialogue in the presence of pertinent stakeholders/actors from regional states • Establish an agency at regional as well as zonal coordinating structures and ensure their linkages, integration, and alignment

2.2.4 The Way Forward

This document presented the existing scenario in seed production in seed production, major challenges, and key strategic interventions for each of the six sector transformation blocks to transform the seed sector of Oromia toward effectiveness and competitiveness. The adoption of seed sector innovations is crucial for agricultural economic growth as well as economic development. To help immediate implementation and achieve the intended vision, we suggest the following action points to be considered:

1. Official approval of the document to guide seed sector interventions
2. Prioritize and implement accordingly the key strategic interventions for each block

3. Allocate the necessary resources (human, infrastructure and facility, capital and operational budget, and logistics)
4. Set up effective monitoring, evaluation and learning systems for swift adjustment of measures

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2.3 FERTILIZER SECTOR TRANSFORMATION

2.3.1 Introduction

Fertilizer is a critical input (Zerfu & Larson, 2010), an increase in the efficient use of fertilizer has great potential to increase crop yields and improve land productivity (Barbier, 2000). According to Beaman, *et al.* (2013) fertilizer is credited with increasing global yields of food crops by 40–60% and no region has been able to boost agricultural growth without increasing its use (Duflo, *et al.* 2011). Recognizing this, the Government introduces and promotes chemical fertilizer effective utilization to compensate for the loss of fertile soil to ensure the increment of agricultural production and productivity and improve the livelihoods of the rural community. However, the fertilizer use rate in Ethiopia is very low among smallholder farmers while the annual nutrient depletion rate is very high. Only 30 to 40 percent of Ethiopian smallholder farmers use fertilizer (IFPRI, 20012). Farmers in the country use on average 26kg of fertilizer per hectare (Wold Bank, 2014), compared to their counterparts in Asia who consume on average 209 kg/ha. The result is severe soil nutrient depletion; the rates of soil nutrient depletion exceed 60 kg/ha (Wanzala and Groot, 2013). On the other hand, there have been high carry-over stocks of fertilizer nationally.

This low rate of usage fertilizer use in Ethiopia is due to several constraints. Matsumoto and Yamano (2009) summarized these constraints pointing to two groups. The first group is the market-based constraints, which suggest that farmers do not use fertilizer because of a relatively high fertilizer to crop price ratio. The second group, the non-market-based constraints, emphasizes farmers' lack of knowledge about fertilizer as well as land degradation, which lowers the returns to fertilizer application. In the Ethiopian case, although non-market constraints play a role, Dercon and Christiaensen (2011) clearly showed that the crucial point is market constraints. They demonstrated that over time the fertilizer-to-output price ratio has increased substantially. Additionally, inaccurate demand, inefficient fertilizer procurement system, a thin network of agro-dealers, lack of access to finance all along the value chain which prohibits the purchases of sufficient quantities to capture economies of scale and high transport costs due to inadequate ports, rail and road networks. These factors result in high costs, putting fertilizer beyond the reach of most farmers. Lack of favorable and harmonized fertilizer policy and regulatory environment and quality control is highly contributed to the low rate of fertilizer use, particularly at the regional level.

The approach for the development of the document includes map the existing context of the fertilizer subsector, identify and analyze key constraints and group identified bottlenecks into priority areas and finally develop an intervention strategy to transform the fertilizer subsector in the region. Different diagnostic studies and strategy materials on the fertilizer sector were reviewed to map the existing scenarios and analyze the constraints. In addition, data on fertilizer import and used by regions were collected from the MoA (Ministry of Agriculture) and analyzed. Based on the analysis, the key problem was identified and grouped into priority areas. A long list of interventions was identified for each priority area. The interventions were further shortlisted to smaller numbers through two layers of prioritization, as indicated in Figure 8 below. Finally, interventions strategy designed to address these groups of priority areas based on international best practices that can be tailored to the Ethiopian context.

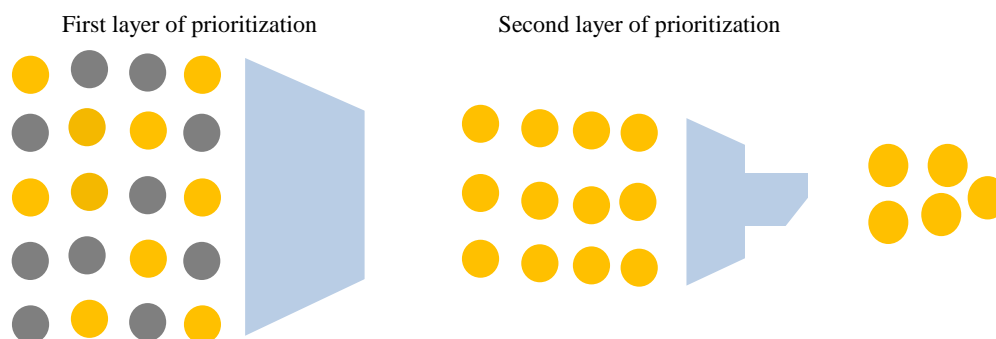


Figure 8: Intervention areas identified through two layers prioritization

2.3.2 The Ethiopian Fertilizer Policy Contexts and Its Institutional Framework

Since 1992, there have been several policy shifts that shaped and re-shaped fertilizer supply in Ethiopia. These policy shifts can be grouped into three phases: (i) complete government control (1966-1992), (ii) Partial liberalization (1992-2002), which allowed a few private companies and regional state-run agencies to enter the market and (iii) Back to centrally control supply chain (2002 –to Present Back to central controlled supply chain). Competing against a state-run enterprise for a limited market demand became difficult which led these private firms to exit in the market.

Through the new marketing system introduced in 1992 as part of its overall market liberalization policies, the transitional government articulated its desire to end government monopolies. However, private sector entry into the fertilizer sub-sector in Ethiopia was slow in the early years of liberalization. Only one private company, Ethiopian Amalgamated

Limited, actively participated in fertilizer imports and distribution until 1996. Subsequently, three additional companies entered the market and actively tried to develop their fertilizer marketing channels. In 1996 regional government companies, mostly affiliated to the ruling party, began fertilizer business. Among such companies to enter was Dinsho in Oromia, owned by Oromia regional government. By 1998, the holding companies of all four major grain-producing regions were importing and distributing fertilizers alongside AISE and four private fertilizer companies. However, this state of competition in fertilizer supply between government, private, and regional holding companies was short-lived. The share of the market for private firms decreased from 30 percent in 1996 to less than 10 percent by 2001 and then to zero in 2002. As the share of private companies diminished, regional state-run agencies took over, but these were also replaced with cooperatives as EABC became the sole importer (Gebrerufael, 2015).

As illustrated in the table, fertilizer is centrally procured through the EABC while Private sector participation in the importation and the procurement, and supply of fertilizer is almost no-existent and thus, the current fertilizer procurement and tendering system effectively exclude private sector importers, unions and federations from the process. This lack of competition leads to late arrivals of fertilizer, due to the administrative requirements of procurement and transportation as well as higher fertilizer delivery costs to farmers. As a consequence, the high-cost fertilizer limits its use by farmers and the late delivery makes use of a costly input less effective and reduces farmer's demand for fertilizer.

As one of the efforts to increase crop production and productivity through enhancing and expanding national fertilizer utilization, the country has developed fertilizer proclamation no 137/1998 and facilitated its implementation. Also, the first fertilizer policy was drafted in 1993, but not endorsed by councils of ministers due to different reasons. Ethiopia's fertilizer proclamation has recently been revised and fertilizer policy also developed. Both documents were submitted to the federal general attorney for final input for approval. The new fertilizer policy explicitly addresses several emerging trends in the fertilizer sector that include the introduction of new types of fertilizers (relaxing restrictions on types of fertilizers to be imported), expansion of local fertilizer production capacity, and the development of soil resource information maps that include the fertility atlas of agricultural land which are likely to spur efficient fertilizer utilization and demand. The new policy also addresses the need for increased involvement of the domestic and international private sector, cooperatives and unions, and other actors in the import, production, distribution, and retailing of fertilizers.

The Oromia regional state is expected to review and conceptualizer fertilizer policy and proclamation based on its regional context.

Many Government Ministries administer different aspects of fertilizer regulations/legislation. These include Ministry of Agriculture and Regional Bureau of Agriculture (RBOA) which play the central role of a national fertilizer regulatory authority with responsibility for registration, production, importation, distribution, and use of fertilizers and the Ministry of Transport which has interests in the transportation of fertilizer; Ministry of Trade and Industry, which has interests in aspects of importation and distribution including setting and enforcing standards, issuance of trade licenses; Custom Authority and the Maritime Affairs Authority. In addition to these ministries, other statutory bodies also handle different aspects of fertilizer regulation. These quasi-government institutions include; the Ethiopian Agricultural Business Corporation (EABC), Agricultural Transformation Agency (ATA), The Commercial Bank of Ethiopia, Ethiopian quality and standard Agency (ESA), Ethiopian Conformity Assessment Enterprise (ECAE), federal Cooperative Agency (FCA) and Regional Cooperative Promotion Agency (RCPA).

Table 20 Fertilizer policy and market evolution in Ethiopia

	1960 – 1992 (Centrally controlled supply chain)	1993 – 2002 (Partial liberalization with the private sector)	2002 – Present (Back to centrally controlled supply chain)
Evolution of Fertilizer Markets	<ul style="list-style-type: none"> • Importation of fertilizer Started in the 1960s by “freedom for hunger Project” • Before 1992, AISCO was the sole importer subsidized fertilizer market network. • The Ethiopian 	<ul style="list-style-type: none"> • 1993: Government decided to include private sectors • 1996: Two private companies together imports 38.1% of the total supply • 1996 – 1997: Three additional regional holding companies involved in fertilizer supply chain 	<ul style="list-style-type: none"> • Public & regional holding companies actively took part in the supply chain • 2005 to 2008: Cooperative union were provided with a credit to import and distribute fertilizer

	Amalgamated Limited was the only private company actively participated in fertilizer marketing during this period	<ul style="list-style-type: none"> • 1996 to 2002: because of various reasons private companies rolled out of the system • 2008: Due to inflation & BoP challenges gov't again decides to make the procurement & distribution central • AISCO renamed as EABC and is now the sole importer, distributor
Evolution of Fertilizer Policy framework and institutions	<ul style="list-style-type: none"> • 1993 a draft of fertilizer policy developed • 1994 fertilizer industry agency established with proclamation number 106/1994 • 1998 fertilizer proclamation endorsed with proclamation no. 137/1991 • In 2002 the fertilizer industry agency demolished with proclamation number 288/2002 and input authority established 	<ul style="list-style-type: none"> • In 2003 input authority demolished the role and responsibility of the authority transferred to the ministry of agriculture proclamation number (320/2003) • In 2006 Ethiopia fertilizer strategy document developed
Procurement	<ul style="list-style-type: none"> • Centrally procured through AISCO • AISE, private comp. and regional holding companies participate in the procurement 	<ul style="list-style-type: none"> • Start of 2008: Centrally Procured through EABC

Key challenges	<ul style="list-style-type: none"> • Inefficient and expensive marketing control of AISCO • Gov't subsidies to cover its large administrative cost 	<ul style="list-style-type: none"> • Indirect support of regional gov't to holding companies made it difficult for the private sector to compete • Decreased market demand and unsuccessful retail practices led to a lower supply of fertilizers 	<ul style="list-style-type: none"> • Shortage of Forex • Inefficient demand assessment • Port congestion
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2.3.3 Mapping the Existing Fertilizer Supply Chain

The chemical fertilizer demand and supply value chains in Ethiopia go through enormous steps and involves several actors who plan the yearly total demand of chemical fertilizer of the country, bid in the international market, execute import, fertilizer marketing/pricing, and distribution as indicated in figure 9 below.

	Demand Assessment	Procurement	Distribution	Pricing and fertilizer sale
Process Involved	<ul style="list-style-type: none"> • Development Agents collect demand from farmers, which is subsequently aggregated at Woreda, zone and • Regional level Regions submit their demand to MoA which compiles a national estimate 	<ul style="list-style-type: none"> • EABC receives demand from MoA • EABC conducts bidding & awards procurement order to winner • Supplier ships fertilizer to Djibouti port • Fertilizers inspected, packaged at port and dispatched for 	<ul style="list-style-type: none"> • EABC arranges trucks to deliver the fertilizers to central warehouse • Unions transport from central warehouse to primary cooperatives • Primary cooperatives distribute to SMHF 	<ul style="list-style-type: none"> • EABC and MoA determine price at central warehouse • BoA and Unions add margins • Primary cooperatives sell fertilizers to farmers
Involved Parties	RBOA, RCPA & MoA	EABC & MOA	EABC, MOA, RBOA, RCPA, ETA, Federations, Union, primary coops.	EABC, MOA, RBOA, RCPA, Federations, Union, primary coops.
Total time	~3 months	~3 to 4 months	~9 months	Variable
% of supply chain costs		80 - 85%	10 – 15%	< 1%

Figure 9 Parties and process involved in Fertilizer Supply Chain

2.3.3.1 Fertilizer Demand Assessment of the Region

Demand assessment is a critical part of the supply chain, if not done properly will lead to underserving the farmer and carryover in the supply chain. Capturing the demand as close to the actual consumption is vital to avoid inaccurate demand estimates and keep fertilizer carry over to a minimum. Conducting demand assessment requires getting the right information such as soil fertility study and carryover data estimates to forecast accurate demand estimates. The annual regional demand and import planning begin with an assessment of the fertilizer demand of each farmer for the next production year. These estimates begin at the *kebele* level by development agents and then aggregated to the *district*, zonal, regional, and national levels (Figure 10). This process is coordinated and aggregated nationally by the MoA. Once the fertilizer estimates have been determined by MoA, the EABC places tenders on the international market for the supply of fertilizer.

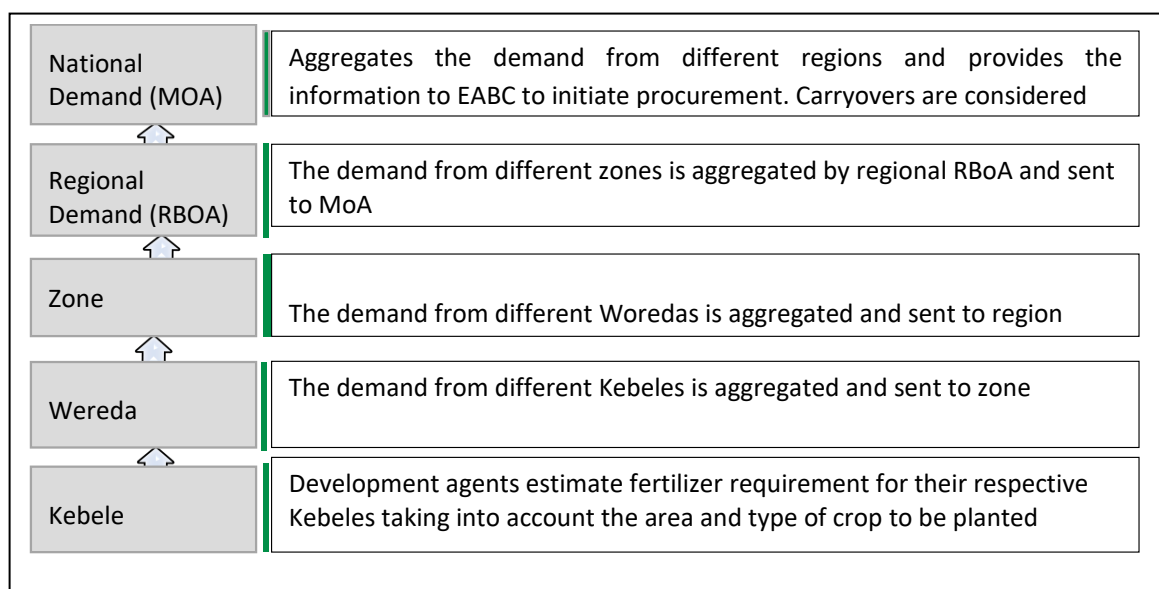


Figure 10 Steps of fertilizer demand estimation in Ethiopia

Source: Author, Adopted from IFDC, 2015, based on current information collected from MOA

Starting the demand assessment is early (in May/June) does not fully capture the amount of fertilizer in stock (carryover data). Furthermore, the current process doesn't consider future

circumstances such as weather, international fertilizer prices, market conditions, and farmers' buying capacity. It takes 3 months starting from kebele deliver to district, Zone, region, and finally to reach the national level. The process has the potential for mistakes being made both overestimation and under-estimation depending on the priorities of a region and the incentives related to fertilizer procurement and distribution for officials involved in the process. There are often large variations between demand and supply. Unlike the other regions, the Oromia region gives significant weight to the GTP target, which in turn puts more emphasis on the production of cereals and, hence, the use of fertilizer (DSA, 2006). Consequently, the leftover stock from the Meher season in Oromia reached historical highs in recent years.

2.3.3.2 Fertilizer Import and Distribution System in Oromia

Once the fertilizer estimates have been determined by the region as described above (Figure 10), the EABC places tenders on the international market for the supply of fertilizer. Once imported fertilizer arrives at Djibouti port, EABC ships the consignment to their central warehouses and informs the cooperative unions to get their supplies. The cooperative unions determine where to store the fertilizer depending on their available storage capacity. EABC contracted transporters to send the fertilizer directly from the Djibouti port to the warehouses of the cooperative unions. In the region, priority in fertilizer distribution is given to areas where the cropping seasons start earlier and also to zones which will be difficult to reach once the rain has started. After fertilizer has been transferred to the cooperative unions' warehouses, it is in turn distributed to the primary cooperatives, where farmers have direct access to the fertilizer for cash purchase or, in some cases, obtained on a credit basis. The Commercial Bank of Ethiopia (CBE) guarantees credit for EABC through issuing letters of credit (LoC) on behalf of EABC to procure the fertilizer and makes payments to the international supplier. The bank also provides credit to cooperative unions by the credit guarantee of the Oromia regional government which set fertilizer prices and margins for the unions and the primary cooperatives. Figure 11 illustrates the import and distribution process considering the flow of the product.

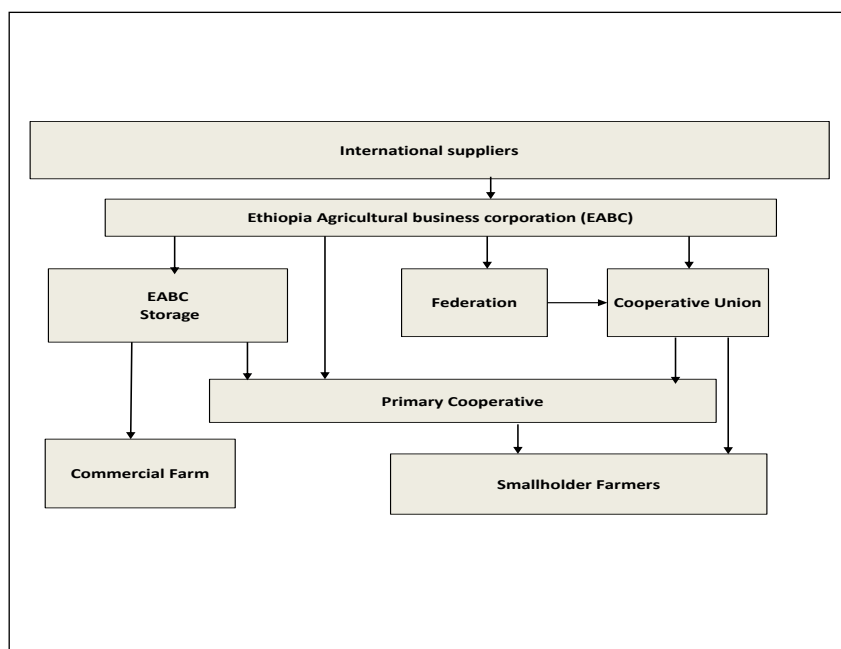


Figure 11 Fertilizer Distribution System in Oromia, considering product flow

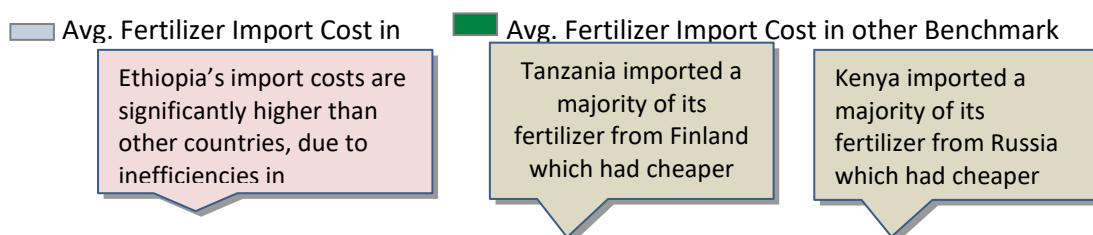
Fertilizer distribution in the region usually delays because of many reasons. The main causes for the delays are challenges around planning and coordination, lack of storage space, and skilled labor to manage these warehouses, congestion of the union's warehouse due to urea arriving earlier than the sales period and shortage of trucks for transportation. Thus, enhancing the distribution process is vital to improve the system's throughput and also to deliver fertilizer at the right time at an optimal cost.

Moreover, since 2008, the execution of the fertilizer importation process has been carried out exclusively by EABC. The logic for giving monopoly power to EABC is to take advantage of economies of scale – importing in bulk gives the buyer more bargaining power to negotiate lower prices. In 2011, Oromia cooperative unions together with several regional cooperative unions requested the federal government to allow them to import fertilizer through the formation of the regional federation of cooperative unions, with coordination from the Ministry of Agriculture. The ministry, however, decided that fertilizer importation should be undertaken by a single agent instead of three or more cooperative union federations. With the expectation of bulk purchases that take advantage of economies of scale in procurement and shipping to lower farm-gate prices. As a result, EABC again was designated as the sole importer of fertilizer on behalf of the cooperative unions.

2.3.3.3 Fertilizer Price

The high price of fertilizer relative to the resource-poor smallholder farmers has long been a national concern in the country. Though fertilizer price in Ethiopia is low relative to other neighboring countries (Rashid *et al.*, 2013), it has steadily been increasing in the past years. The price increment might be attributed to the international fertilizer market and ocean freight, poor institutional and infrastructure development where transport cost alone contributes to about 64 to 80 percent of the price differential between the landed cost at Djibouti Port and the farm gate price (Rashid *et al.*, 2013); and the long-chain and multiple profit margins and administration costs.

Ethiopia's import costs are significantly higher than in other countries, due to inefficiencies in procurement and also due to current expensive suppliers. The study conducted by IFPRI 2012 revealed that comparing AISE's currently named EABC procurement prices and world market prices at contract dates shows that for the two procurement periods prices given to the AISE were slightly higher than prices on world markets for both DAP and urea. Weighting prices with quantities imported gives an average of 13 USD/MT paid by the AISE above world market prices at contract dates, which is equivalent to about 2% of the weighted world price at the time of contract. Considering world market prices at delivery dates, the results show that the AISE paid substantially higher rates than world market prices. Weighting prices with quantities imported gives an average of 66.7 USD/MT paid by the AISE above world market prices at delivery dates, being equivalent to about 14% of the weighted world price at delivery time. As can be seen from figure 12 the fertilizer import price for Ethiopia for the year 2014 was 12466 ETB/MT whereas the import price for Tanzania and Kenya for the same year was 9839.40 ETB/MT and 10327 ETB/MT, respectively.



	Ethiop	[105] Tanzan	Keny
Total Fertilizer Imported	783,384 MT	308,120 MT	494,097 MT

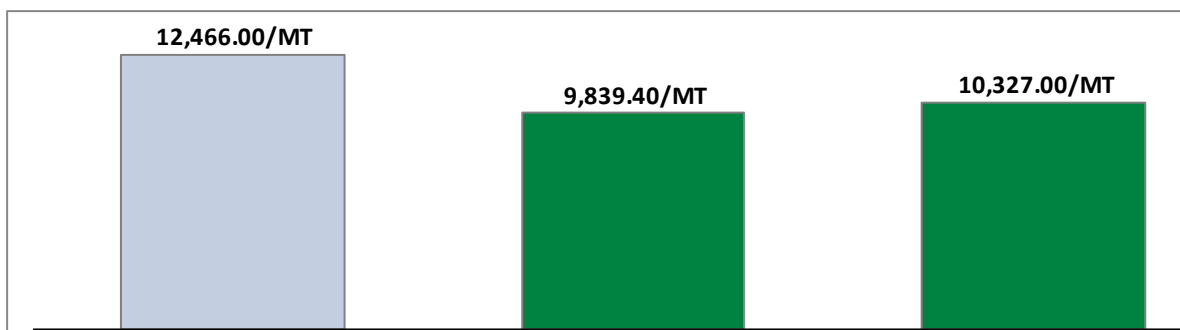


Figure 12 Comparison of Ethiopia's 2014 avg. fertilizer import cost, with benchmark countries in ETB/MT

Source: fertilizer supply chain enhancement analysis, ATA analysis result

At the country level, a national government can do very little to influence ocean freight fees, but it can directly influence domestic transaction costs through improvements in infrastructure, institutions, and policy environment; and Ethiopia has done relatively well in reducing domestic marketing costs.

2.3.3.4 Fertilizer Consumption

According to the historical data of fertilizer consumption compiled from MOA, over the last 10 years, total fertilizer consumption has increased by more than 170 percent; from less than 404,756mt in 2008 to almost 1127111mt in 2018. The fertilizer consumption rate was on average increased by 11 percent every year between 2008 and 2018 see figure 13. Fertilizer consumption levels vary across the country with Oromia, Amhara, Tigray, and SNNPR regions. Oromia and Amhara region consume 36 % and 37% of the total fertilizer consumption, respectively. This shows that both regions shared an average of 73% of the total fertilizer consumption of the country from 2012 to 2018 (figure 14). Also, the growth rate of the regional consumption varies across the regions as shown in figure 14 Oromia and Amhara regions consumption has been growing on average by 8% and 12%, respectively.

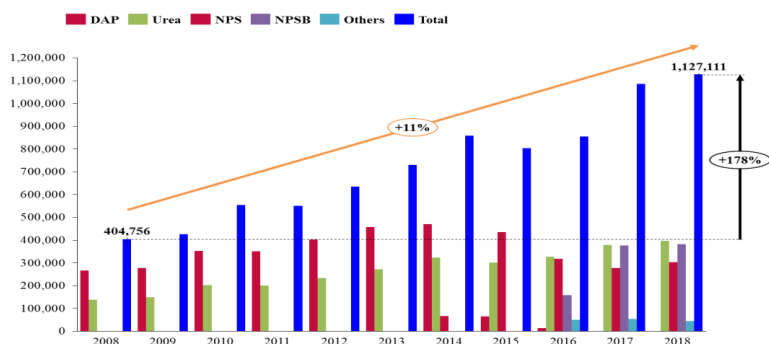


Figure 13 Trend of Fertilizer consumption in Ethiopia

Source: compiled by Author based on the Data sources from MOA

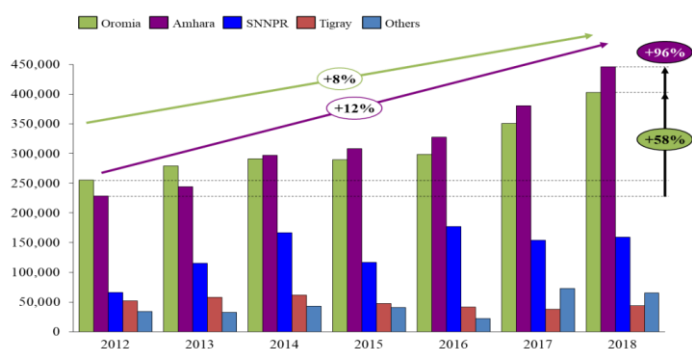


Figure 14 Trend of Fertilizer consumption by regions from 2012 to 2018

Source: compiled by Author based on the Data sources from MOA

Most of the fertilizer consumed in the Oromia Region is used on cereal crops (89 percent), 4 percent on pulses, 5 percent vegetables, and Root crops, 1 percent oil seeds, and 1percent other temporary crops (Figure 15). From total fertilizer use in cereals, maize receives the highest share with almost 33 percent of fertilizer use, followed by wheat (23 percent), teff (31 percent), barley (6 percent), sorghum (3 percent) and figure millet (3 percent) (CSA, 2017).

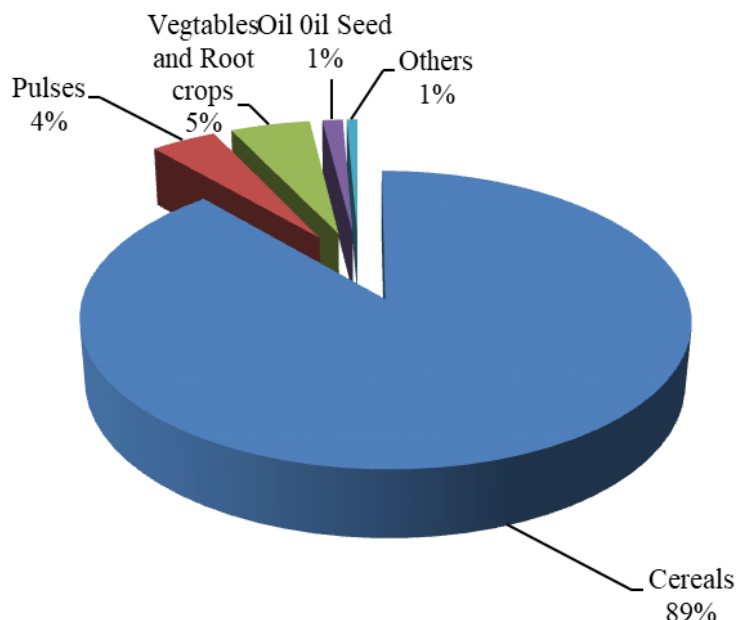


Figure 15 Average fertilizer use on main grains in Oromia, CSA 2017/2018

The recent introduction of new types of fertilizers such as NPS and micronutrients has shown greater potential in improving overall soil fertility and management and hence it is a good opportunity for smallholder farmers to improve the productivity of their crops. However, the fertilizer consumption and intensification fluctuated considerably and intensification has only recently resumed a steady upward trend. While consumption of fertilizer has tripled in the past decade, it is still far behind other African and fast-developing countries of the world. The national average fertilizer consumption of the country remains at 26 kg/ha, in contrast to a 91 kg/ha world average, 67 kg/ha in Morocco, 152kg/ha in Thailand and 175kg/ha in Brazil, 565 kg/ha in china and 663kg/ha in Egypt, as indicated in figure 16 (Wold Bank, 2014).

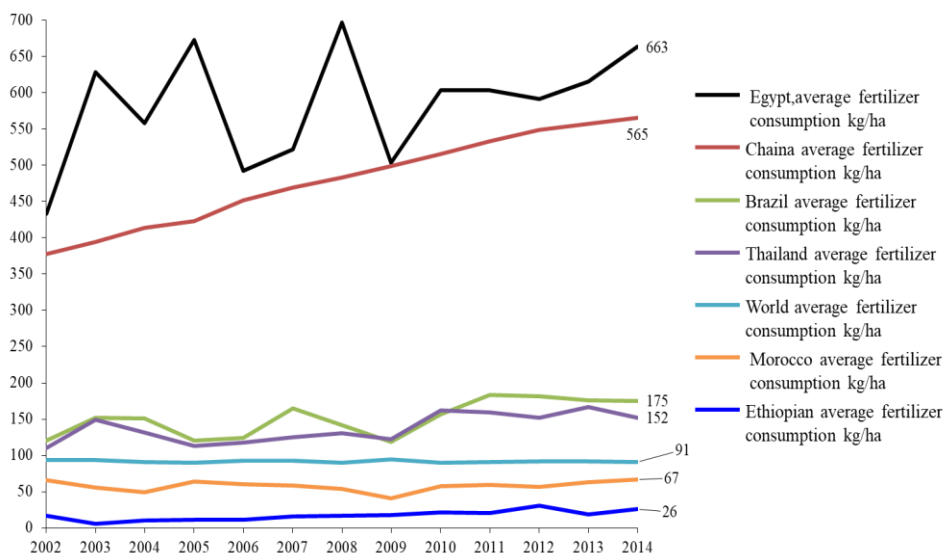


Figure 16: Cooperation of countries average fertilizer consumption kg/ha

Source: compiled by Author based on the Data sources of World Bank, 2014

2.3.3.5 The Farm Inputs Subsidy Program

About two-thirds of the countries in SSA have fertilizer subsidy programs and approximately 40 percent of the fertilizer consumed is subsidized. Expenditure on subsidies runs into billions of dollars each year and, on average, subsidies account for 30 percent of national agriculture budgets (Wanzala and Groot, 2013). The motivation behind subsidies cited by governments takes different forms: introduction of improved technologies to farmers, who will then be incentivized by good returns to purchase their fertilizers; and encouragement of fertilizer use to raise production nationally and end food insecurity. These subsidies range from non-targeted/universal with complete government control of all aspects of the subsidy program to targeted programs with importation and distribution exclusively carried out by the private sector. Input vouchers are the most commonly used mechanism to deliver

The fertilizer subsidy policy in Ethiopia was also an important part of the country's agricultural development strategy to increase agricultural productivity, achieve food security, and reduce poverty. The fertilizer subsidy, not exceeding 25 percent of the unsubsidized price, was introduced in 1993 following the period 1985-1993 that AISCO had controlled the fertilizer sector. It was aimed at offsetting the effect of currency devaluation in the fertilizer markets. In 1994, the Ethiopian government also introduced a 100 percent

credit services at below-market interest rates for smallholders to purchase fertilizer. Then, cooperatives started to sell fertilizers in cash or credit while the government credit is being scaled down.

However, in 1997, the government removed fertilizer subsidy, associated with the removal of constraints and impositions on peasants and restricted access to agricultural credit except on unfavorable terms. This policy action coupled with privatization measures were the two most difficult political decisions made during the mid-1990s, to address the prioritization and scrutiny of sectoral expenditures (World Bank, 1997b). The government justified the removal of fertilizer subsidy through the intent to take measures to reduce marketing costs than providing direct subsidies. A series of such measures included adjusting port fees, cutting the time required for fertilizer clearance, road development, cuts on fuel costs, and uncertainties during the distribution of fertilizers. These measures, however, were not fully implemented and small-scale farmers were less encouraged to fertilizer use.

2.3.4 Domestic Fertilizer Production Initiatives

Ethiopia has initiated four fertilizer production projects in the Afar region, the Oromia region, Dire Dawa, and the blending plant in the four regions. The four blending initiatives should allow Ethiopia to produce the primary soil nutrients for plants that will blend fertilizer tailored to soil/crop needs and thus close the import gap. They may even allow exports of fertilizer, or at least its constituents. Investment in fertilizer production in Ethiopia by Allana, ICL, Yaara, OCP, and the government may be sufficiently profitable to make the lower world price and construction may continue regardless, particularly to feed the domestic market, where domestic production of feedstock for the mixing plants has a greater comparative advantage (World Bank, 2013).

Afar Region Dallol Potash Project: Allana Potash plans to extract and export muriate of potash (MOP or potassium chloride, KCl), estimated reserves in April 2013 were 438 million tons of raw materials, yielding 1.0 million tons of MOP annually for 30 years. In addition, other companies such as ICL are Yara also engaged in the potash production process, in line with the total production could exceed 2 million ton annually.

Oromia Region: NPS and urea: Fertilizer-production plants using lignite coal energy from Yayo district in Illubabor zone of Oromia region. A feasibility study found that the Yayo area had deposits of around 100 million tons of coal. These deposits have the potential to produce 300,000 tons of urea and 250,000 tons of DAP or NPS annually for decades.

Dire Dawa Fertilizer complex: an integrated fertilizer production plant to be built in Dire Dawa with jointly by Morocco company call OCP and the Ethiopian government. In the first phase, the megaproject will be able to produce 2.5 million tons/year of fertilizer by 2022. This will make Ethiopia self-sufficient in fertilizer, with export potential. With full capacity by 2025, the project will produce 3.8 million tons/year of fertilizer to support the growth of local demand.

Fertilizer Blending Plants: Ministry of Agriculture (MOA) in collaboration with Agricultural Transformation Agency (ATA) have supported the establishment of five fertilizer blending plants in four major regions i.e tow for Oromia and one for each of the remaining three regions including Amhara, Tigray and SNNPR regions. As indicated in table 21 the five Blending plants established have ~450,000 MT per year with full operational capacity. Besides, twelve sites were identified for the establishment of seventeen new fertilizer blending plants to increase local production and availability of fertilizer.

Table 21 Fertilizer production potential and initiatives

s/no	Source	Production capacity
1	Dire Dawa Fertilizer complex	<ul style="list-style-type: none"> • Moroccan phosphate group OCP partnered with Ethiopia to construct Fertilizer complex • In the second phase expected to produce 2.5 million tons of fertilizer in its first phase by 2022
2	Illubabor – Yayu NPS and urea	<ul style="list-style-type: none"> • The coal has the potential to produce 300,000 tons of urea and 250,000 tones of Dap or NPS
3	Blending Plants	<ul style="list-style-type: none"> • Five Blending plants have 450,000 MT per year with a full operational capacity • There is a plan to establish 12 new additional fertilizer blending plants with local and international public-private partnership
4	Afar Region: Dallol- Potash Project	<ul style="list-style-type: none"> • ICL and Allana potash reported estimated reserves 3.2 billion tons of potash was discovered which could be mined for 50 years

2.3.5 Constraint Analysis

Several constraints impinge on the fertilizer sub-sector in the country. Among these constraints, the key bottlenecks include weak demand assessment, inefficient procurement modality, limited access to financial resource and service, inefficient fertilizer distribution, inefficient market information systems, lack of integrated fertilizer logistics management system, weak of fertilizer quality control systems and lack of stable and conducive fertilizer policy and regulatory environment, etc. These key challenges grouped by fertilizer supply chain components (figure 17) and are discussed in detail below.

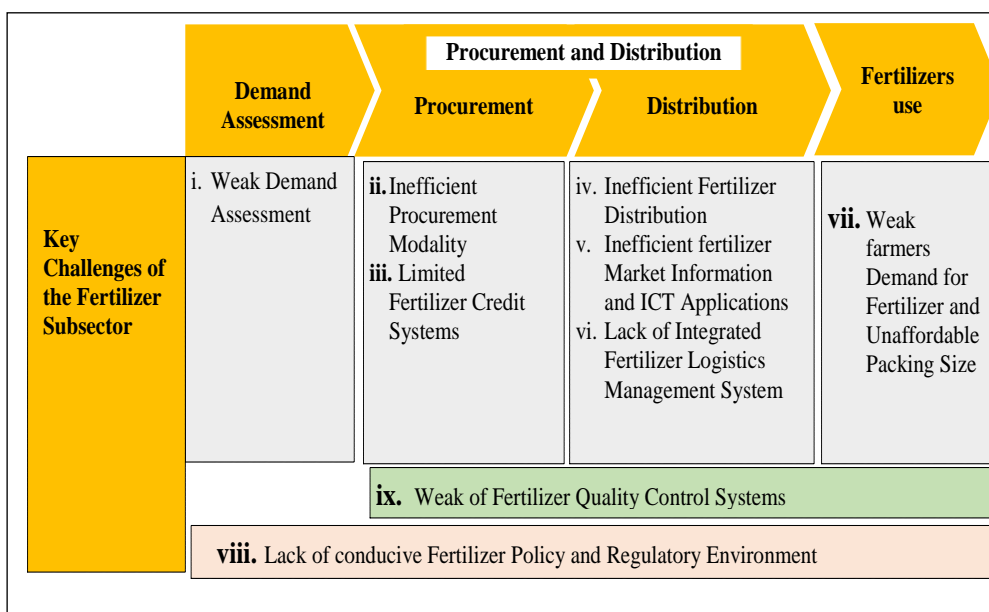


Figure 17 Key constraints of Fertilizer sub-sector by Supply Chain components

Source: Compiled by the author

I. Weak Demand Assessment

Fertilizer demand assessment, a critical part of the supply chain, if not done properly will lead to underserving the farmer and carryover in the supply chain. Inaccurate and incomplete forecasting, and lengthy demand assessment process; the demand estimation of fertilizer is constrained by unreliable, manipulated at different levels, takes a long period (up to 3 months), mismatching soil fertility map, poor coordination among the actors and lack of means of back stressing. Furthermore, the current demand process doesn't consider future circumstances such as weather, international fertilizer prices, market conditions, and farmers' buying capacity. Non-considerations of these factors lead to a build-up of carryover

from year to year, in the supply chain. Thus, there is a need to solve this bottleneck through designing and implementing effective fertilizer demand forecasting tools.

II. Inefficient procurement process

The procurement process contributes to the highest percentage of cost in the final fertilizer price. The Existing procurement process (bid process) is less flexible & less favorable to fertilizer procurement. It exhibits many critical challenges which include taking longer bidding processes, limits payment flexibility to deal with foreign exchange scarcity, and creates additional indirect cost, a limited number of the importer concerning a large amount of fertilizer imported and weak linkage to the international market. Furthermore, inadequate technical specification and consideration during procurement leading to low-quality fertilizer purchases.

III. Limited Fertilizer Credit Systems

The fertilizer business is inherently very capital intensive, as it requires huge financial investments for importing, transporting, and distribution. Moreover, it is too expensive to smallholder to buy a sufficient amount of fertilizer. Lack of access to credit continues to be one of the main constraints faced by small-scale farmers, fertilizer importers, unions, and primary cooperatives. In the country, many poor households may find fertilizer use is profitable but lack the cash to buy fertilizer. Access to finance is a key limitation for all those in the supply chain – importers, distributors, and farmers. Both high-interest rates and limited bank guarantees make it difficult to access to the banking system. Due to the high risk in agricultural operations, commercial banks are unconvinced of lending funds for this activity.

IV. Inefficient fertilizer distribution systems

Limited distributional channel; farmers can only access fertilizer through the primary cooperative in their kebele, which gives them limited options - especially when fertilizer is unavailable or not at the appropriate level of quality. Furthermore, the fertilizer market deals with high transaction costs in marketing and distribution to geographically dispersed smallholder farmers. Weak coordination of fertilizer value chain actors and supporters is also another key challenge of fertilizer distribution. Moreover, a vibrant agro-dealer network would ensure the timely availability of fertilizers and information to a wide range of farmers in rural areas. Existing agro-dealers do not have adequate capacity and management skills for handling fertilizers. Furthermore, the agro-dealers should be able to provide information leading to the proper use of fertilizers.

V. Inefficient Fertilizer Market Information and ICT Applications

The skills, knowledge, and information needed to make fertilizer markets efficient are inadequate at all levels of the marketing chain; the importer does not have adequate knowledge about the conditions prevailing in the fertilizer markets; wholesalers and retailers lack the necessary skills for enterprise management and business. Thus, farmers and input providers are not able to make informed decisions on what fertilizer to buy and where to find it. Furthermore, establishing an information system and promoting ICT applications on fertilizer production and distribution will help to document the scanty fertilizer production and marketing statistics and information to form a foundation of a database; set up an active data collection center to specifically collect, analyze and disseminate fertilizer production and marketing-related information and statistics. It will encourage both the public and private sectors in the industry to conduct market research in the rural areas and international arenas.

VI. Lack of Integrated Fertilizer Logistics Management system

As the scale of fertilizer operations grows significantly, the quantity and quality of warehousing will become more important, as will efficient logistics to manage storage efficiently. Having an efficient and integrated fertilizer logistic implies that the right type of fertilizer reaches the farmer, at the right time and place with an appropriate cost. However, the lack of warehousing as a major possible constraint in logistic management. Also, absence of a satellite tracking system for trucks, weak fertilizer inventory management system, a deficit of trucking services Djibouti port during the peak period, lack of developing an ICT system to inform logistics for imports of fertilizer, and inefficiencies around planning and coordination are critical constraints in fertilizer logistics Management system. Furthermore, the World Bank's annual assessment of national logistics performance expressed as the logistics performance index (LPI), Out of 155 countries, Ethiopia ranks 141th in by its logistics capacity.

Therefore, Warehousing and bagging at rail junctions and other key logistical nodes will be important to reduce logistical costs. More generally, particularly in the context of geographic shifts and significant changes of scale in the fertilizer sector over the next few years, it would be prudent to make more use of rented warehousing, at least initially, rather than investing in fixed plant that may turn out to be inefficiently located or conceived on the wrong scale. Where possible, operators will want to avoid warehousing altogether at

transshipment nodes and will value-efficient transfers from rail to road and vice versa, without recourse to interim storage. They will also want to avoid bagging, if possible, preferring to transport in bulk, if possible.

VII. Weak Farmers Demand for Fertilizer and Unaffordable Packing Size

Farmers' demand for fertilizers is extremely weak, as it is essentially constrained by inadequate incentives and a lack of financial capacity to invest in fertilizer. In addition, farmers' purchasing power is extremely weak. Adding to this is a dearth of access to credit for the acquisition of fertilizer because farmers' knowledge of lending institutions and loan application procedures is inadequate; the agricultural sector is often considered insolvent and is seen as a high-risk sector. Furthermore, unaffordability of the current packing size and Limit subsidies to targeted or "smart" fertilizer subsidies for poor farmers' particularly for poor and marginal men and women farmers

Besides, even when farmers have enough income to purchase fertilizer, it might not be available at all or insufficient quantity and good quality at the opportune time. As a result, the current fertilizer application rate in Ethiopia is among the lowest in Africa. Average fertilizer use intensity amount to a mere 26 kilograms per hectare compared to the world and Asia Average of 91 and 148 kilograms per hectare, respectively. Therefore, it is critical that the fertilizer subsector would be improved to promote the accessibility, affordability, use of quality fertilizer and introduces incentive structure in the use of fertilizer by the farmers for achieving the objective of production and food security.

Key learnings from African countries on stimulating the farmer's demand, increase access, affordability, and use of fertilizer

VIII. Weak Fertilizer Quality Control Systems

The national fertilizer policy and law explicitly state the need to regulate the quality of

<p>Case Study 1: Nigeria, West and Central Africa, and Zimbabwe successfully established market network, increased access to fertilizer, fertilizer use rate and yield by supplying fertilizer in small package</p>		
<p>Nigeria Main Focus: Increase affordability and availability of high quality fertilizer through small packages size <ul style="list-style-type: none"> Educate farmers in on farming techniques and proper fertilizer application Introduce: Fertilizer Bag Size distributed – 1 & 10 Kg packs Result <ul style="list-style-type: none"> Stimulated commercial supply of over 5K metric tons of fertilizer in small packs to 1.7M farmers Established a transformed market system in which the distribution network reached 25 states (out of 36) across Nigeria </p>	<p>West and Central Africa Main Focus: Improve availability of privately distributed fertilizer Introduce: provide several different pack sizes for sale as low as 1kg and up to 25kg Result <ul style="list-style-type: none"> Fertilizer use rates increased from 7.41 kg/ha (baseline) to 11.45 kg/ha. The proportion of farmers using fertilizer increased from 21% to 68%. Created easy access through proxy input shops, average distance to input shop was reduced from 13 km to 6 km. </p>	<p>Zimbabwe Main Focus: Increase affordability and availability of high quality fertilizer through small packages size Introduce: provide different pack sizes for sale – 5 kg, 10 kg and 25kg bag sizes. Result <ul style="list-style-type: none"> Grain yields were increased by 30–50% on more than 95% of the plots. 40% of the small bag buyer never purchased fertilizer before </p>
<p>Key Leanings</p> <ul style="list-style-type: none"> Distributing small fertilizer bags , besides meeting farmer's small fertilizer demand, can also be used to educate farmers and increase adoption of fertilizer use The introduction of small fertilizer bags suits the pro-poor demands and capacities and will contribute to increase the national fertilizer utilization rate The speed of adoption of fertilizer by small farmers confirms that it is a profitable business for the suppliers But the market should be studied very well to beat the competition from informal open fertilizer markets. 		

fertilizer imported and produced locally, but the existing institutional framework operating

<p>Case Study 2: Implementation of fertilizer marketing policies has affected the private sectors' response, the costs borne by marketing actors, and fertilizer consumption.</p>	
<p>Reforms From 1974 to 1984, the Government of Kenya (GOK) provided a fertilizer importation monopoly to one firm, the Kenya Farmers Association (KFA). The monopoly position of KFA was later viewed as an impediment to the development of the fertilizer market. In addition, the GOK increasingly recognized that its controlled pricing structure did not ensure adequate margins for retailers to supply the relatively distant rural areas. While the controlled pricing structure was designed to improve farmers' access to fertilizer, it had the opposite effect in the more remote areas. These concerns led the GOK to reform its fertilizer marketing system.</p> <ul style="list-style-type: none"> During the rest of the 1980s, the GOK tried to encourage other firms to enter the market albeit under very tight controls. The GOK determined which firms were allowed to operate, through licensing requirements and the allocation of foreign exchange 	
<p>Outcome</p> <ul style="list-style-type: none"> Small-scale farmers relied exclusively on the private sector and cooperatives for fertilizer. By 1996, 12 major importers, 500 wholesalers, and roughly 5,000 retailers were able to distributing fertilizer in the country By 2000 and 2001 the number of retailers rose to between 7,000 and 8,000. Some of the largest importers were cooperatives and estate firms supplying their members, most of whom were small-scale farmers participating in tea, coffee, and sugarcane out grower schemes. There has been an impressive private sector response to fertilizer market reform and that the market is generally competitive, particularly at the retail level Since the introduction of fertilizer market reform in the early 1990s, the marketing margins have declined substantially During the 1990-95 period, mean domestic marketing costs were \$262 per ton, in contrast to \$206 per ton between 1996- 2000, a 24% decline. 	
<p>Challenge; Smallholders' access to inputs on credit is restricted primarily to those participating in integrated cash crop programs.</p>	
<p>Key Learnings</p> <ul style="list-style-type: none"> Market reform encourages private sector to engage in fertilizer market and improve the competitive of fertilizer market, particularly at the import and retail level and facilitate the transformation of the fertilizer subsector. An introduction of fertilizer market reform can decrease marketing margins marketing costs 	

within public service has not been able to deal with quality problems adequately. The capacity to enforce fertilizer regulation for improved fertilizer quality along the supply chain is weak. There is a lack of laboratories where fertilizer quality tests can be conducted to check if they meet specific quality requirements and the few existing laboratory facilities and human capacity are inadequate to conduct fertilizer quality tests and inspection. There is thus a need to intervene in upgrading public sector laboratories as well as promote the creation of private labs for testing fertilizer quality and to build human capacity in conducting fertilizer tests at retailing points. Moreover, there is a limited number of qualified inspectors to conduct random checks of fertilizer quality along the supply chain. There is a need to train more fertilizer inspectors to equip and empower them in their role of fertilizer quality regulatory and management who can carry out random inspection of production units, warehouses, wholesale and retail traders.

IX. Lack of Conducive Fertilizer Policy and Regulatory Environment

The longstanding (outdated) fertilizer policy draft (1986/93) and proclamation (no.1991/1998) are largely unimplemented and lose enforcement. Various changes outside of the official policy and regulatory frameworks have taken place in the fertilizer sub-sector. Currently, the country has developed a new fertilizer policy and revised the law but is awaiting promulgation. Though the regions are expected to adopt the policy and proclamations per their real context, the initiative of many regions including the Oromia region to do this is found to be weak. The other key challenges include enforcement of the policy frameworks and weak awareness of the fertilizer value chain actor about the legal frameworks and weak.

Furthermore, fertilizer is centrally procured through the EABC while private sector participation in the importation and the procurement and supply of fertilizer is almost non-existent and thus the current fertilizer procurement and tendering system effectively excludes private sector importers, unions and federations from the process. This lack of competition leads to late arrivals of fertilizer, due to the administrative requirements of procurement and transportation as well as higher fertilizer delivery costs to farmers.

Table 22 Short, Medium and Long Term Priority Actions and Intervention Strategy

Priority Action	Objective	Intervention Strategies
Enhance the	Improve the accuracy of	Short- term

<p>efficiency of fertilizer demand assessment</p>	<p>demand assessment in order to get a close estimation to actual farmers' demand, at the right time and appropriate cost</p>	<p>1. Introduce new scientific fertilizer demand assessment model</p> <ul style="list-style-type: none"> • Develop effective fertilizer demand forecasting model. • Validate the fertilizer demand forecasting model. • Pilot the demand assessment model parallel to the conventional fertilizer demand assessment process. • Establish Regional, Zonal and woreda level fertilizer demand forecasting team. • Provide intensive training for the demand assessment team on the implementation of the model. <p>2. Enhance the efficiency of the existing fertilizer demand assessment process</p> <ul style="list-style-type: none"> • Develop regional fertilizer demand assessment directive with clear roles, responsibility and accountability • Strengthen the capacity of producers and demand collectors • Prepare an annual fertilizer demand assessment and supply plan
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Improve fertilizer procurement process	Establish procurement model and strengthen the capacity of private sectors to progressively transfer fertilizer procurement deliver fertilizers in the right quantity, quality and time, and in a cost-effective manner.	Short- term
		<ul style="list-style-type: none"> • Renegotiate the provision to import fertilizer by the region and Introduce fertilizer procurement model that is more flexible, favorable to buyer • Renegotiate the provision to import fertilizer by the region • Collect international fertilizer price information • Contract a multiple-year framework agreement for flexibility in payment period • Tender with selected manufacturers and traders for flexibility in competitive price and credit facility • Schedule a multiple delivery period to ease port congestion, transportation and delivery to warehouses • Establish a Revolving Fund for fertilizer importers

		Medium-term
		<ul style="list-style-type: none"> • Promote multiple fertilizer importers through strengthening their capacity to progressively transfer fertilizer procurement and distribution functions from the public to the private sector. • Develop, validate and disseminate a strategic plan for the progressive withdrawal of the government from procurement • Built the capacity of federations and private sector • Develop an efficient linkages with international fertilizer market • Progressively transfer fertilizer procurement functions to the private sector and federations • Organize the fertilizer importers to cooperate and collaborate with other importers • Improve Fertilizer Credit Systems for international procurement and distribution • Induce banking sector reforms to tailor lending terms and conditions to the needs of farmers and traders. • Establish a Revolving Fund for fertilizer importers • Facilitate access of importers to the Agricultural Guarantee Fund • Promote competition among banks

		<p>through dissemination of information on lending terms and conditions</p> <ul style="list-style-type: none"> • Scale up and institutionalize the IVS system in all Anas
<p>Enhance the efficiency and effectiveness of fertilizers and distribution system.</p>	<p>Strengthen the fertilizer distribution system in the region through promoting multiple fertilizer distribution channels and marketing information systems</p>	<p>Short-term</p>
		<p>1. Promote multiple channels of fertilizer distribution mechanism through strengthening and engaging private sector in fertilizer supply and distribution system</p> <ul style="list-style-type: none"> • Develop, validate and disseminate a strategic plan for the progressive withdrawal of the Government from distribution activities • Develop a coordinated and comprehensive technical training program for the private sector • Develop fertilizer supply and distribution guidelines/directives which support private sector • Progressively transfer fertilizer procurement functions to the private sector and union federation

		Medium-term
		<p>2. Develop fertilizer marketing information systems through timely provision of relevant information and statistics, and promote ICT applications</p> <ul style="list-style-type: none"> • Set up an active data collection center to specifically collect, analyze and disseminate fertilizer production and marketing related information and statistics • Sensitize the farming community, traders etc on availability and use of fertilizer production and marketing statistics and information • Publish in the print media to aid dissemination of information and enhance competition in the market. • Ensure that information and statistics is made available to all players in the fertilizer sub sector to enable them to make informed decisions. • Develop and maintain Information and Communication Technology (ICT) databases of fertilizer dealers, fertilizer distribution at regional and zonal levels (nodes) to monitor and forecast aggregated demand
		<p>3. Design and implement efficient logistics management system including warehousing, transport coordination, and expansion of ports for fertilizer supply and distribution.</p>

		<ul style="list-style-type: none">• Plan and implement a rail-based and bulk transport fertilizer to optimize option for importing• Improve logistics, particularly through web-based ICT systems in preparation for multimodal interaction of maritime rail and road shipment• Develop warehouse management, logistics integration and coordination strategy• Facilitate facility location and network design, transportation and vehicle routing• Develop and implement a monitoring, evaluation and learning framework that continuously generates data on fertilizer use and draws the lessons learnt• Establish regional fertilizer inventory controlling system that tracks stocks and flows of fertilizer and unused warehouse space.
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		Long – term
		4. Establish dry bulk fertilizer storage and operational centers <ul style="list-style-type: none"> • Facilitate feasibility study and identify appropriate centers for the establishment of Dry Bulk fertilizer storage and operational centers • Facilitate developing standard and designing of the Dry Bulk fertilizer storage and operational centers • Facilities facilitate the constriction of investment include silo, constricting warehouse • Facilitate installation of bagging machine and bulk transport facilitate • Create linkage mechanisms between the dry Bulk fertilizer storage and operational centers, central, local warehouses.
Enhance the production and availability of fertilizer.	Improve the availability and accessibility of fertilizers	Long - term 1. Establish new fertilizer blending facilities and operationalize the existing ones to expand access to new blended fertilizer, in accordance with specific soil requirement as per soil mapping information to promote self-sufficiency in fertilizer production. <ul style="list-style-type: none"> <input type="checkbox"/> Diagnosis and develop viable business model that would best fit to fertilizer blending <input type="checkbox"/> Update feasibility study, identify and decide on the location and size of blending plants <input type="checkbox"/> Establishing new fertilizer blending plants

		<p>in deferent production corners, in accordance with specific soil requirement as per soil mapping information</p> <ul style="list-style-type: none"> □ Strengthen quality control standards, laboratory, installation and capacity building. □ Operationalize existing fertilizer blending facilities and provide facility support for fertilizer blending union, especially packing material, parts and accessories for fertilizer blending and packing machinery and maintenance <p>2. Establish fertilizer manufacturing complex to enhance fertilizer production</p> <ul style="list-style-type: none"> • Conduct feasibility study which include environmental impact analysis, identification of appropriate raw materials, marketing and location of the fertilizer complex • establish public and private partnership corporate for joint establishment of fertilizer complex • mobilizer resources for the establishment of the fertilizer complex • facilitate procurement of all the required facilities and human resource development for the factory • Facilitate the establishment of the fertilizer manufacturing complex
Stimulate the farmers	Enhance fertilizer consumption among	Short – term

<p>demand, increase access, affordability and use of fertilizer</p>	<p>smallholder farmers through increasing the accessibility, affordability, profitability, and strengthen the capacity of SHF farmers in safe use of fertilizer</p>	<p>1. Pilot and scale up fertilizer small packs model to increase the accessibility and affordability of fertilizer to smallholder farmers.</p> <ul style="list-style-type: none"> • Develop appropriate fertilizer small bag model and assess to identify the type, cost and size preferred by SHFs. • Build the capacity for the regional and zonal office of agriculture, cooperatives, promotion agro dealers, development agents and target groups. • Develop appropriate labeling of small bags and link the unions to the source of small bags. • Facilitate purchase of packing machines for the selected pilot unions
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		Medium-term
		<p>1. Design and implement targeted subsidies, smart subsidies, and vouchers programs.</p> <p>2. Strengthen capacity of smallholder farmers and actors both public and private sectors</p> <ul style="list-style-type: none"> • Develop crop and region-specific technology packages through participatory approach • Create awareness of the value and change mind-sets about the integrated use and effects of organic and inorganic fertilizer • Build farmers capacity to use and access fertilizer • Establish multiple fertilizer selling points close to farmers • Calculate the profitability of fertilizer use by region and crop and disseminate results to farmers • <input type="checkbox"/> Establish demonstration sites, Design and disseminate factual information related to fertilizer use using promotional tools
Improve Fertilizer Quality Control Systems	Establish and strengthen fertilizer quality control systems, standards and formulation laboratory	Medium-term

		<p>2. Ensure quality control, laboratory, standards of fertilizer supply</p> <ul style="list-style-type: none"> • Design fertilizer quality control mechanisms • Equip regional fertilizer quality testing laboratory with facilities and logistic. • Establish a clearly defined regulatory body under the Agricultural input regulatory Authority to monitor and enforce standards. • Building the capacity of fertilizer inspectors and fertilizer analysts in testing fertilizer samples and enforcing quality control mechanisms at regional borders and in rural markets. • Enforce truth-in-labeling
<p>Create conducive Fertilizer Policy and Regulatory Environment</p>	<p>Develop and strengthen enabling policy, regulatory, and favorable environments for fertilizer market development</p>	<p>Medium-term</p>
		<p>1. Establish and enforce legal and regulatory frameworks for fertilizers</p> <ul style="list-style-type: none"> • Develop region fertilizer policy, proclamation and directives. • Enact and enforce • fertilizer law and regulatory system including registration of businesses and products; licensing requirements; labeling requirements; inspection fee; definition of violations; system of penalties. • Initiate the registration of all fertilizers

		<p>imported in the country and distributed in the region</p> <ul style="list-style-type: none"> • Strengthen the capacity of the regional regulatory body in testing fertilizer samples and enforcing quality control mechanisms at national borders and in rural markets. • Establish customs in several strategic delivery points.
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2.3.6 Implementation Strategies and Priority Action

The approach for implementing the strategy, including priority area, objectives, and key activities, are provided in the matrices below. The implementation strategy grouped in to short and medium-term, and long term interventions. The detailed priority actions and implementation strategies are explained in the table below.

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2.4 PESTICIDE SECTOR TRANSFORMATION

2.4.1 Introduction

2.4.1.1 History of Pest Management

The pest problem is as old as agriculture itself, which began about 10,000 years ago in the fertile crescent of Mesopotamia. In the history of crop production, farmed crops have been suffering from pests and diseases causing a large loss in yield with the ever-present possibility of famine. Even today with advances in agricultural sciences losses due to pests range from 10-90%, with an average of 35 to 40%, for all potential food and fiber crops. In general, globally, the efforts to manage pests stretch into antiquity for instance sulfur was a common fumigant during the Hellenistic period (323-31 BC) and it is still a tool commonly listed in modern pest management resources; oil sprays were used toward of certain insect pests, a practice still commonly used in pest management; plant-derived insecticides were common during the golden age of Greece (500-300 BC); Chinese cultivated natural predators in pest control (304 AD); the ancient Greeks developed the first sticky traps using animal-derived grease to sequester flies, fleas, and bedbugs and Hellenists began to develop structures that could exclude rodents from granaries, etc.

2.4.1.2 History of Synthetic Organic Pesticides

At the dawn of the 20th century, the quiet discovery of two chemicals, termed “2, 4-D” (the 1940s) and “DDT” (1930s), fundamentally changed pest management. Between World Wars I and II, large-scale production practices coupled with major developments in synthetic chemistry revolutionized the pesticide industry. In the 1940s and 1950s, soil fumigants were found to effectively suppress soil-borne, parasitic nematodes, and fungi. New insecticides, herbicides, fungicides, and nematicides were introduced almost annually through the 1950s and 1960s. During the same period, granular pesticide formulations were developed, which led to large expansions of pesticide usage on the major field crops.

By the 1960s, some very important new families of chemicals were discovered as herbicides (e.g., triazines, acetanilides, and dinitroanilines). In the 1970s, the synthetic pyrethroids came on to replace much of the insecticide chemistry developed before that. During the 1980s, imidazolinone and sulfonylurea herbicides came on to dramatically lower application rates for weed control. Synthetic pesticides quickly became the favored means of crop protection and dramatically eclipsed other approaches to pest management because of the

following reasons: highly effective and predictable at reducing pest populations, produced rapid and easily observed mortality of the pest, flexible enough to meet diverse agronomic and ecological conditions, and inexpensive treatments compared to the crop damage that would be otherwise sustained.

2.4.2 Situation Analyses on Pesticides Input To Agriculture in Ethiopia

2.4.2.1 Pesticide use history in Ethiopia

According to available and limited early information sources (USDA, 1958, Crowe and Shitaye, 1970 and Tsedeke Abate, 1985), in Ethiopia, synthetic organic pesticides have been in use both commercial and small scale farms across the country probably since the beginning of the 1960s. The government-owned commercial farms in the 1970s, 80s and early 1990s used to be the biggest users of pesticides. The heavy use of pesticides in the commercial farms was ascribed to the lack of effective alternative methods of control such as cultural practices and varietal resistance (Tsedeke Abate, 1985).

In general, however, pesticide use has been on the increase and it is expected to continue growing because the demand for herbicides, insecticides and fungicides are getting higher due to increased level of awareness of smallholder farmers on the importance of pesticides to increase production and productivity in small scale agriculture, expanding irrigation schemes all across the country, expanding large scale farms, which have been growing different commercial and industrial crops, the shortage of labor during the peak period of crop growth. This development is taking place without having any environmental impact assessment of pesticides, which is due to the lack of officially published regulation and guidelines to assess pesticide impact on human health and the environment.

2.4.2.2 Pesticides use by smallholders in Ethiopia

The use of synthetic organic pesticides to control major insect pests, pathogens, and weeds have become a widespread practice both in the smallholder and commercial agriculture. The use of herbicides has become widespread practice and most farmers depend on it to grow major cereal crops including wheat, barley, maize, and tef. In general, the use of herbicides to control annual weeds has been on the increase since the introduction of 2, 4-D into the country. 2, 4-D, and other phenoxy herbicides like MCPA were commonly used to control broadleaved weed species; Puma Super and Cladinofopropargyl for the control of grass weeds; and Palas for control of both broadleaved and grasses.

The application of synthetic organic pesticides has also become quite a common practice in control of fungal diseases and insect pests on different crops being grown in all the districts across the country and there are several registered insecticides and fungicides that are being applied on the different crops by targeting different economic pests. The application has been particularly more common in irrigated crops like in vegetable products such as onion, cabbage, and tomatoes and also in cash crop production, such as cotton, sesame, and sugarcane.

The following tables show the utilization of synthetic organic pesticides by smallholder farmers. The rates of synthetic organic pesticide application per hectare have been very variable for the different pesticides groups, but the frequency of application per season on the vegetables and cotton were very high (Annex I)

Improper use of pesticides by smallholder farmers: The significant proportions of insecticides and fungicides imported every year are applied in the rift valley of Ethiopia, which extends between Afar in the North and South Omo in SNNPR, the eastern Ogden plains and the western lowlands that extend between Humera in the North and South Omo in SNNPR whereas most imported herbicides are used in the high altitudes, which are the major cereal production areas in the country. In all these areas farmers are engaged in the production of different cash crops. Since the lowland areas are hot spots for migratory and regular economic pests, the farmers have been utilizing a significant amount of insecticides to grow cotton, different vegetables, fruit species, and sesame.

The case of the central rift valley in Oromia: In the central rift valley the use of pesticides is widespread and farmers invest substantial money to repeatedly apply on the major vegetable crops grown in the valley. Table 23 shows that up to 32, 28, and 29 rounds of spray are applied on tomato, onion, and cabbage, respectively, in one cropping season. Besides farmers apply up to 4X at harvest, which does not contribute to the protection of the crops from economic pests. This is unnecessary action by farmers who think spraying the harvest will attract buyers. This clearly shows the lack of knowledge on maximum residue limit by farmers hence affecting all the actors involved in the vegetable market chain unknowingly. The lack of knowledge on maximum residue limits and time needed before fresh produce can be harvested for the market is a huge gap and needs to be addressed.

Table 23 Mean number of synthetic organic pesticide application frequency per cropping period at peasants' association level on the three major vegetable crops in Oromia

	Mean number of spray-on
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Location	Tomato at harvest	Tomato total	Onion total	Cabbage total
Kobolito	4a	24.5bc	15.2bc	NC
Wonji	2.8ab	19.9cd	17.6bc ^b	28.8a
Buta Degaga	1.1b	20.3cd	19.1b	NC
Kechachule	1.7b	19.9cd	12.8bcd	NC
Bekele Gerisa	2.7ab	31.9a	27.9a	NC
Gudeno	NC	NC	9.1d ^a	7.8b ^c
Abene Germama	3.2ab	27.6ab	15.4bc	15.4b ^e
Weyo Gebreal	3.0ab	25.6bc	17.7bc	NC
Dodicha	2.9ab	13.8d	11.5cd	9.7b ^d

^a n= 4; ^b n=7; ^c n=5; ^d n=6; ^e n= 8, NC= Not calculated

Source: Unpublished data Lidet Sitotaw, 2011

The uncontrolled use of pesticides in the rift valley, farmers have reported a significant reduction in the efficacy of several synthetic organic pesticides including endosulfan, malathion, lambda-cyhalothrin, and copper-based fungicides (Table 24).

Table 24 Percentage of farmers in the central rift valley who reported ineffectiveness of synthetic pesticides against insect pests and leaf diseases in vegetable crops

Synthetic organic pesticide	Percentage of farmers complained ineffectiveness*		
	Tomato (n=200)	Onion (n=188)	Cabbage (n=94)
Profenofos (Selecron)	6	15	17
Endosulfan	41	47	29
Lambda-cyhalothrin (Karate)	35	17	50
Malation	10	0	0
Copper hydroxide (fixed copper)	26	15	18
Mancozeb	6	3	0
Mefnoxam (metalazyl + mancozeb)	5	0	0

*Data summarized from farmers interviewed in 9 kebeles in the central rift valley

Source: Unpublished data Lidet Sitotaw, 2011

2.4.2.3 Pesticides use by commercial farmers viz. smallholders in Ethiopia

Currently, the commercial farms that included both open field and protected farms, have been using pesticides safely whereas smallholder farms have not been respecting the rules of

safe use of pesticides that include buying from authentic/known sources, transporting and keeping safely until use, most smallholder farmers do not use protective clothing while mixing and applying pesticides; they often store the pesticides and leftovers in their dwellings, give little care when mixing and filling into the sprayers, they apply at will then by following recommendations put on labels. Moreover, the application frequency in smallholder farms is very high and in some cases, it could go as high as 20 times per cropping season for vegetable crops like an onion; both for fungicides and insecticides, whereas large scale commercial farms, apply 1-2 times per cropping season on same crops (Bayeh 2012). Whereas in cotton wherein the use of insecticides is very common, the frequency of application targeting different chewing and sucking pests has reached 9-12 times per season (Bayeh 2011 and Bayeh and Miesso, 2013). Several reasons have been given why there has been misuse and also abuse of pesticides by smallholder farmers and include low levels of knowledge, appropriate skills on pesticide handling such as knowledge on safe storage, calibration, and spray, usage of protective devices; management of empty containers, pesticide residue viz. safe harvesting time.

2.4.2.4 Accumulation of obsolete pesticides in Ethiopia

There has been an accumulation of obsolete pesticides even after the country cleared a significant amount of obsolete pesticides accumulated since the 1960s, which included 1500 tons (including 200 active ingredients) disposed of during 2000-2003 at a cost of about US\$ 4.44 million. Another 1000 tons of obsolete pesticides stock was disposed of at a total cost of US\$ 8,135,500 (Israel and Dalvie, 2009). Nevertheless, there is a new accumulation of obsolete pesticides in the country including DDT and Endosulfan. The accumulation is mainly in government institutions, i.e., MoA and MoH.

2.4.2.5 Synthetic organic pesticide registration and regulation in Ethiopia

The Pesticide Registration and Control Special Decree No. 20/1990 was issued on September 1, 1990, was replaced by Pesticide Registration and Control Proclamation No. 674 /2010. According to the revised Decree, no pesticide shall be registered unless the efficacy, safety, and quality are tested under field or laboratory conditions and approved by the Ministry of Agriculture. Moreover, no person may formulate, manufacture, import, pack, re-pack, label, sell, distribute, store or use a pesticide not registered by the Ministry or contrary to the conditions of its registration.

2.4.2.6 Step-by-Step pesticide registration procedure in Ethiopia

2.4.2.6.1 Processing applications

Application is required for registration of a new active ingredient, the active ingredient and/or the formulation is not identical to that of a registered product, for registration transfer or to make amendments to the existing registration. There is a well-detailed guideline the MoA put together to guide applicants for pesticide registration and require material safety data sheets. Pesticide registration requires research on the efficacy of the pesticide proposed for registration.

The pretest documents or dossiers needed for the new active ingredient (technical grade) include designation, physical and chemical properties, toxicology, ecotoxicology, behavior in the environment, and residues in the plant whereas formulated product dossier include physical and chemical properties of the formulated product, and on toxicology. All products submitted for registration need information on emergency measures in cases of accidental exposure or poisoning, emergency procedures in case of fire/spillage, use, minimum label requirements, country-specific requirements, and content of a label.

2.4.2.6.2 Pesticide efficacy evaluation/verification

The responsibility to generate pesticide efficacy data has been given to the national agricultural research system including higher learning institutions. The procedure includes testing on a target pest, compiling data, and generating a report, which is submitted to the MoA for evaluation and possible registration of the product. The approved pesticides after registered are imported by the registrant. Based on the legal framework, the MoA has been regularly conducting the registration and control import of pesticides to the country. However, the pesticide registration process is very weak, slow, and complicated hence has been delaying pesticide registration, allowing the registration of generic products in big numbers, besides there, has not been the proper implementation of the law to regulate pesticides at the different stages before they reached farmers.

Table 25 Pesticides registered in Ethiopia by different registrants in 2017 and 2018

Pesticide group	Registered pesticides*		No. of registrants**	
	2017	2018	2017	2018
Insecticides	149	177	36	41
Herbicides	112	131	24	30

Fungicides	109	133	25	29
Rodenticides	3	4	3	4
Avicides	10	1	7	1
Miticides		10		6
Nematicides		1		1

*Pesticides by trade name not by active ingredient

**Total number of registrants in 2017 and 2018 were 59 and 62, respectively

Although there are more than 60 registered pesticide importers, it is only 41 of them have imported mainly second-generation pesticides in 2018 for distribution to smallholder farmers. The distributed insecticides are organochlorine (Endosulfan), organophosphate (Malathion), synthetic pyrethroids (Hilrat, Lamdex, and Karate) as insecticides; propiconazole, tebuconazole, metalaxyl + mancozeb as fungicides; 2,4 D for broad-leaved weeds and Palas for both grass and broadleaf weeds.

2.4.2.7 Sources of pesticides in local markets across the country

The sources of pesticides in the market are diverse and include legal pesticide dealers, government (for the control of migrant pests), donations from different NGOs for food security, and illegal sources (contraband). The volume of pesticides imported through illegal routes has never been documented but is expected to be a substantial amount.

Although there has been a significant increase in the import and use of pesticides in the country, the total amount of pesticides imported is still very low when compared with other countries. This argument is still a valid one because, considering the total area put under crop production every year such as about 14 million hectares in 2013 (CSA, 2013), the amount of pesticide the country imported was far way below many countries. The world ranking of countries with the value of imported pesticides put Ethiopia as 52nd in the world and in 2012 it imported USD 53,134,000.00 worth of pesticides ([www.mongabay.com/commodities/data/category/4-resources/19-pesticides+trade/1357-pesticides/62-import+value+\(1000+\)\\$](http://www.mongabay.com/commodities/data/category/4-resources/19-pesticides+trade/1357-pesticides/62-import+value+(1000+)$), acc. on Sep 2, 2014). The total area put under crop production has increased to about 15.3million hectares in 2017/18 (CSA, 2018), yet the amount of pesticide the country has been importing is very low. Bulk imported pesticides in seven years are summarized in table 26 and as shown in the table there is no clear trend in the annually procured however the bulk of the pesticides imported are herbicides followed by insecticides.

Table 26 Bulk imported amount of pesticides in lt/kg between 2011 & 2016 (MoA, unpublished data 2017)

Year	Fungicides	Insecticides	Herbicides	Unnamed pesticides	Total per year
2010	651,900	3,146,800	387,300	25,400	4,213,410
2011	396,537	402,456	957,762	23,724	1,782,490
2012	363,520	843,024	1,723,830	46020	2,978,406
2013	192,805	1,077,699	3,609,477	62,122	4,944,116
2014	166,992	407,389	802,887	150,884	1,530,166
2015	79,184	205,250	779,297	46,937	1,112,683
2016	49,482	500,005	1,260,233	306,728	2,118,464
Over six years	1,900,420	6,582,623	9,520,786	661,815	18,665,644

2.4.2.8 Synthetic organic pesticide use in Ethiopia with safety

Globally, awareness about the dangers of pesticides was not widely known until Rachel Carson wrote her now-famous book ‘Silent Spring’ in 1962 (Carson, 1962). In this book, she described how pesticides can kill an organism directly or indirectly through an organism eating another one that has been poisoned. Until this time how pesticides are stored in animals and then concentrated through the food chain was not widely understood. Some of the effects of pesticides she noted included that they: kill valuable insects, kill ‘friendly’ animals, poison the soil, change ordinary pests into super pests, harm the climate, poison our food, and stay in the food chain.

Since the alarm bell on the side effects of pesticides was rang by Carson in 1962, the world has started looking into the safety aspect of the use of pesticides. This movement has helped the establishment of rules and regulations on the use of pesticides. Because of the tightened rules related to minimizing pesticide-related risks on humans, non-target organisms, and the environment at large, the rate and cost of discovering effective yet environmentally benign pesticides have become very difficult. As described earlier, currently, the time required to get a newly developed pesticide registered is nine years with a cost of US\$ 140 million. Since the new generation of pesticides is environmentally friendly then their benefit cannot be underestimated (34).

In the Ethiopian context, all these negative impacts of pesticides are very apparent and have been occurring regularly. The synthetic organic pesticides in use in Ethiopia are still the early generation except for organochlorines, which are banned. Because of this, the side effects of pesticides on human health and the overall environment have been substantial. And are being aggravated by the low level of understanding most farmers have on the health and environment impacts of pesticides, because of this, pesticide misuse and abuse are common occurrences. For instance, Tadesse and Asferachew (2008) reported that in Ziwaye and Arsi Negele in the central rift valley of Ethiopia 84.4% of the farmers rely on farming as the sole source of livelihood and 94.3% of interviewed farmers have been using pesticides as one of the different agricultural inputs they regularly use. However, the protective equipment utilization in the area was almost non-existent; alongside which 31% of the respondents claimed illness after spraying pesticide and 14.2% indicated the occurrence within the family of pesticide-related health problems.

The above authors also reported that about 50% of the respondents said that they use empty pesticide containers for water/food storage and about 7% of them indicated that they sell empty containers to others for similar use. About 31% of respondents store pesticides anywhere in their house and about 6% of them store pesticides even in the kitchen. Thus farmers in the surveyed areas have a low level of awareness about environmental and health hazards of pesticides.

Although awareness creation could help solve some of the problems associated with the failure to make safe use of pesticides, training that has been given to the farmers on pesticide-related issues have been very minimal. Moreover, farmers do not seem to have been concerned about the effect of pesticides on non-target organisms and the environment at large.

2.4.3 Benefits of Pesticides in Crop Production

Pesticides can be useful tools that provide significant benefits to society providing that they are used safely and responsibly. But, using pesticides incorrectly can put people and the environment at risk. If one uses a pesticide when it is not needed, he/she will be wasting money and increasing the possibility of pests becoming resistant. In some cases, one might also damage the treated area. A pest, weed or disease being present does not justify taking action against it. For these reasons, one should take care when deciding whether or not to use a pesticide (<http://pesticides.iupac.org/>, accessed on June 25, 2013) however, totally it is impossible to avoid the use of pesticides.

The international pesticide market and regulatory profiled by worldwide crop chemicals (19) showed that the pesticide industry is expected to reach an estimated US\$ 68.5 billion in 2017, with an annual growth of 5.55% over the next five years. Growth will be higher in the developing countries of South America and Asia. This shows that pesticide utilization will continue to be part of future agriculture. Therefore considering also the benefits of the use of pesticides, particularly, the new generation ones are very important (34).

In general crop protection products contribute to the production of a stable and predictable supply of high quality, affordable food. Crop protection technology, which includes all pesticides, herbicides, insecticides, fungicides, as well as biotechnology products helps control the thousands of weed species, harmful insects, and numerous plant diseases that afflict crops. Pesticides are vital to sustainable development in many countries in the developing world. Without crop protection and pest control technologies, food production would decline, many fruits and vegetables would be in short supply, and the price of food would rise. Moreover, the production of important fiber crops, such as cotton, would decrease as farmers would lose their harvests and livelihoods to crop pests and diseases. The major benefits of pesticides and their role in food production include the following:

- Increase food production – Crop protection technologies allow U.S. producers to increase crop yields and efficiency of food production processes. Up to 40 percent of the world's potential crop production is already lost annually because of the effects of weeds, pests, and diseases. These crop losses would be doubled if existing pesticide uses were abandoned.
- Decrease the cost of food – Because the use of pesticides improves crop yields, crop protection technologies also impact the cost of food. Without crop protection chemicals, food production would decline, many fruits and vegetables would be in short supply and prices would rise. Helping to keep food prices in check for the consumer is another large benefit of pesticides.
- Consumer benefits – Pesticides allow consumers to consume a high-quality product that is free of insect blemishes and insect contamination. Crop protection chemicals that reduce and, in some cases, eliminate, insect damage allows the consumer to purchase high-quality produce free of insect fragments.

2.4.4 Modality of Pesticide Import, Storage, and Marketing in Ethiopia

Most of the pesticides consumed in Ethiopia are imported mainly as formulated products except what is imported by the Adami Tulu pesticide formulation plant, which imports active ingredients of different insecticides and fungicides and produces formulated products. In 2018 there were 62 registered pesticide importers in Ethiopia, but only 41, 30, and 29 imported insecticides, fungicides, and herbicides, respectively.

2.4.4.1 Pesticide import modalities

Pesticide import in the country is made in the following ways:

1. Chemical agents representing multinational companies: The registrants (Multinational Companies) give the registered products to their local agents or representatives for import. These local agents are responsible for the marketing of the products locally. The agents have developed long time relations with multinational companies and thereby the products they are entitled to are hardly possible for the other importer to import and deal with.
2. Companies that are dealing with generic products: These are companies that are importing different types of generic products as registered from generic source manufacturers and formulating companies. Importation of such products by those who have pesticide import license is possible after a consent letter for the importation of the product is submitted to the ministry and requires opening an LC in the name of the applicant,
3. Commission based importation: The companies which are working through this system do not have products registered in their name or have registration of the product with high demand in the market. However, they do have an import license that would enable them to import various products. They import through the consent letter and the payment of commission to the registrant of the product. In this case, LC is opened in the name of the product owner/registrant.

2.4.4.2 Pesticide storage at country level

Pesticide storage is absent at the ports of entry and the customs authority does not have stores designated for transiently storing imported pesticides. The importers do have stores whereas local distributors though it is mandatory for them to have stores, often store pesticides in inappropriate storage facilities. Moreover, there are numerous pesticide

retailers across the country but their storage facilities are difficult to characterize and often are not appropriate.

2.4.4.3 Pesticide marketing in Ethiopia

Pesticide marketing involves the ministry of trade, agriculture, and the ministry of health. The registered pesticides are imported by different registered pesticide importing private and government companies then being sold to local certified pesticide dealers/distributors across the country. The local dealers include company agents, cooperatives unions, government, Agricultural Input Suppliers like EGAA PLC, retailers. The retailers are numerous and are more close to farmers. The pesticide marketing involves packaging for distribution and redistribution. By and large, pesticides are imported packed in low volume/quantity for direct distribution by local dealers. There has not been legal backing for the monitoring of packages of pesticides. Because of this quality compromise has been a common practice. For instance, there has been repacking of pesticides by local retailers.

The conventional pesticide marketing in Ethiopia is not in favor of the small scale farmers. These can be explained by the long distribution chain except in a few and recent cases. There are so many actors between the end-user and the importers adding no value to the imported product but only cost at each step. When products are distributed through such a channel and are arriving at the end user's either it is costly so that it is beyond the buying capacity of the farmers or it might be adulterated, expired, or not on the proper manner to be used by farming communities. At the end of the day, the farmers are forced to pay all unnecessary costs incurred on each step. Due to this situation, the farmers either refrain from using or use at low concentrations than recommended to cover their farmland. This results in pesticide resistance development, lower efficiency of the products, and then lower productivity and production and consequently in the poor livelihood of the farming communities. The demanded products are not fully imported, supplied, and made available in a timely manner at the required volume. The shortage is always evident in the country's pesticide input supply system.

2.4.4.4 Pesticide safety measures and handling in Ethiopia

Currently, the commercial farms that included both open field and protected farms, have been using pesticides following the steps needed to follow in the safe use of pesticides, but the small scale farms have not been respecting the rules of safe use of pesticides described earlier.

AS also described earlier in this document most small scale farmers do not use protective clothing; they often store the pesticides and leftovers in their dwelling areas, give little care when mixing and filling into the sprayers, they apply at will then by following instructions/recommendations put on labels. The application frequency in small scale farms could go as high as 20 times per cropping season for vegetable crops; both for fungicides and insecticides whereas large scale commercial farms apply 1-2 times per cropping season on the same crops.

It is worthwhile to mention here some of the reasons why small scale farmers are not following safety procedures/requirements. Safety materials are not made available to farmers due to loss of interest in importing companies as the materials are taxed similarly to clothing materials. When taxed, the items get costly to the farming communities. This has limited the interest and initiation of importers to import safety ensuring equipment.

2.4.5 Situation Analyses of Pesticide Input Supply in Oromia

2.4.5.1 Pesticide supplying institutions in Oromia

Union Federations: The demand is generated and collected from different districts through the agriculture office and the Agriculture bureau compiles and then some amount is provided to Union Federation for importation and supply. Then the Union federation negotiates with local agents of multinational companies or generic pesticide registrants for getting consent letter for importation and then upon receipt of consent letter opens international LC, purchases and distributes to the unions and primary cooperatives that in turn distribute to the farmers as per the demand of each district. The amount allocated may be the amount that might satisfy the demand or it could be less than the demand. Moreover, it could be supplied within the time required or out of time for the application based on the situation.

Private chemical importers/agents: The Agriculture bureau also notify or provides some amount of the region's demand to the different chemical importers. Based on this demand and their assessment the agents import and distribute to the different retailers located in different zones of the region. The conventional retail shops are characterized by a long chain of supply; hold also unregistered products; may also keep expired and adulterated pesticides. Most of the pesticide retail shops provide technical support to buying farmers and often post non-technical persons to provide the service.

Government enterprise/AISCO/: Some products are imported on the base of commission negotiating and entering an agreement with registrants of pesticides and then distributed to different zones of the region following the established distribution channel. Compared to others, this supply channel is less efficient at the current time.

EGAA Agricultural Input Suppliers (private): This is the newly established private firm of professionals. The company imports and provides products to different Farm Service Centres that are established by the support of ATA and USAID at different locations in the region and the country. In this case, the importer directly reaches the Farm Service Centres/ FSCs/ which in turn avail the products to farmers. In addition to this, the farmers at the reach of FSCs are assisted by technical persons serving at each FSC. Here, the supply is direct, price is defined and technical assistance is rendered to farmers.

2.4.5.2 Pesticide supplied and distributed for users in Oromia

The pesticide supply chain in Oromia involves, in the order of involvement, retailers, farmers' Union Federation, government agricultural input supply system, the Farm Service Centers, and pesticide company representative. The union federations have a significant contribution to the supply of pesticides in the region. Aside from these suppliers, there are smuggled, counterfeit and adulterated pesticides that have been infiltrating the market. Moreover, some registered pesticide suppliers are also suspected to import low-quality products than respecting the dossiers they submitted for registration. This is taking place because there has not been an authority within the region to regulate the different agrochemical inputs including pesticides for their quality. Until very recently, the regulatory body was the extension directorate of the region's Bureau of agriculture through the crop protection case team and plant health clinics.

In Oromia, during the 2018 crop season, a total of 2.2 million liters of pesticides was planned to be procured through all channels, however, about 1.5 million liters were supplied, out of which only 1.35 million liters were distributed to users across the region (table 27). The demand for 2019 is also significantly higher than what was possible to procure in 2018 (Annex II).

Table 27 Pesticides planned, supplied and distributed for 2018 crop season through the private importers

	Plan	Supplied	Distributed	Supplied vs plan (%)	Distributed vs supply (%)
Herbicides	1491529	1018912	957118	68	94
Fungicides	461447	275165	235919	60	86
Insecticides	226574	178121	155709	79	87
Total	2179550	1472198	1348746	68	92

2.4.6 Pesticides Applied on Different Economic Pests in Oromia

There are four generations of insecticides: 1st generation that include inorganics such as mercury, lead and arsenic, and botanicals; 2nd generation include organochlorine, organophosphate, carbamates, synthetic pyrethroids, and neonicotinoids and others; 3rd generation include insect pheromones, insect growth regulators, chitin synthesis inhibitors, juvenile hormones, and microbial insecticide such as *Bacillus thuringensis*. The new generation of pesticides include mainly bio-pesticides, which are derived from animals, plants, and other natural materials such as fungi, bacteria, algae, viruses, nematodes, and protozoa. The latest generation pesticides, however, are not available in the local market. They are allowed only for use by flower growers and commercial horticultural farms who import them without tax. The pesticides that have been in common use are described in the table below.

Table 28 Pesticides in common use to control multiple pests on multiple crops in Oromia 2018

Pesticide name	No. of crop species	Number of pests	Efficacy range	Application frequency
Endosulfan	9	6	2-3	1-3X
Λ-cyhalothrin	12	11	1-2	1-5X
Malathion	7	5	1-3	1-5X
Mancozeb	5	5	1-3	1-6X
Ridomil	4	5	1-3	2-6X

Propiconazole	6	8	1-3	1-4X
Nativo	5	7	1-2	1-3X
Natura	5	8	1-3	1-3X
Rexido	5	7	1-2	1-3X

2.4.6.1 Pesticide packaging in Oromia

Most of the pesticides are packaged as one litter. Especially the union's federation mainly provide pesticides with one litter size containers. Pack size is improving from time to time. Currently, importers have started importing the products with affordable pack size. There are some instances that the products are packed at 500ml, 250ml, and 100 ml, based on their rate of application. This has to be encouraged as the farm size of our smallholders is small and requires a low amount of pesticides to apply at a time by way of this no pesticides will remain at the hands of farmers who often store leftover pesticides in their dwellings. Big pack sizes expose the farmers to different problems such as exposure to the pesticide, incur an unnecessary cost, and apply to control household pests, and also inappropriate handling that may even lead to accidental death.

2.4.6.2 Pesticide storage in Oromia

It is observed that pesticides imported through the unions federation and EGAA PLC are kept in appropriate stores in isolated areas and comparatively better managed as compared with other retailers where the storage system is often unfit for keeping pesticides for longer periods. Looking at pesticide stores at retails offices dictates a lack of uniformity as well as standards to come into agrochemical business. The shops are so narrow, in most cases, and don't allow the shop keeper to move in the shop safely to give the required service. The shelves are not to their standards and the products are shelved one on the top of the other. Liquid formulations are not separated in the proper manner from dust and other formulation types. The products that are known as highly toxic like Aluminium phosphide are not well labeled and separated from others.

2.4.7 Critical Problems Identified to Affect the Pesticide Supply Chain in Oromia

Assessment of pesticide Supply chain in Oromia: Key challenges across the pesticide value chain is illustrated in figure 18 below:

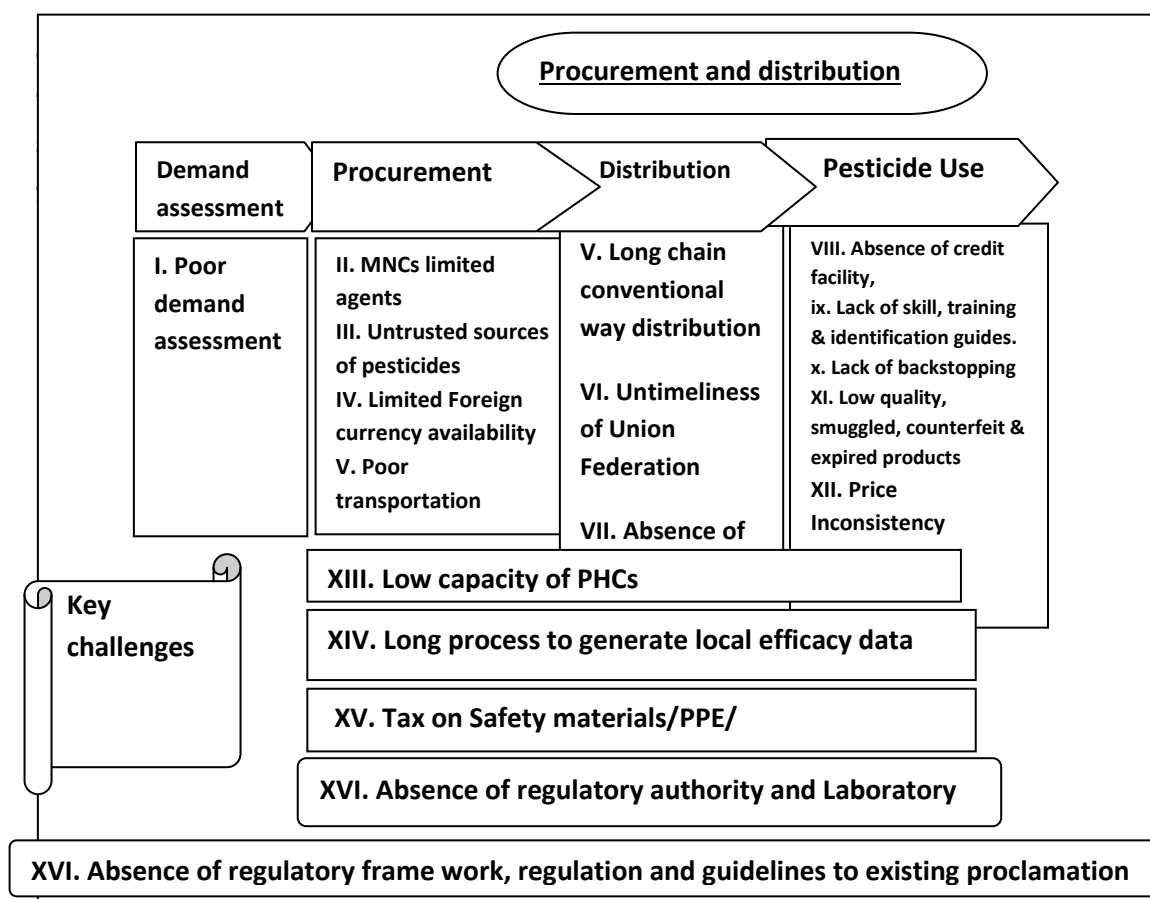


Figure 18 Key challenges of pesticide across the value chain

- The shortage of foreign exchange has been a major challenge to the import of agricultural inputs and their availability to the farming communities in time. This had resulted in a shortage of inputs in the market and allowed price hike. Citing mainly shortage of foreign exchange made available to them, importers are not willing to sell their stocks, thus forcing smallholder farmers to buy pesticides at an inflated price. For instance, in July 2018, the price of Ridomil was between ETB 240 & 800, Lambda Cyhalothrin is between ETB 325 & 500 and for 2, 4 D is between ETB 75 & 115. Due to also the presence of many pesticide trade names registered, it has become difficult for users to tell the product they are using is genuine. These have been complicating the pesticide supply chain.
- Complicated transportation facilities operating in the country including Oromia. Ethiopian Shipping and logistics enterprise having only a few vessels in the only

transport provider for importers. In areas where the vessel of the enterprise is not reaching, an importer must get permission from the enterprise to use other transporters, which may have sufficient vessels. However, the contracted agents or transport facility providers work on their schedule and do not pick the consignment on time or hold the consignments at sea for long period hence creating delays in the delivery of the inputs in time.

- Absence of laboratory capacity to confirm matching bulk imported pesticides with a registered dossier of the same pesticides: There is repeated complaints from pesticide users that the efficacy of some imported pesticides has been very poor. Nevertheless, there is no single laboratory to test whether the active ingredient contained in the formulated product being imported is to its standard or not.
- Domination of second-generation insecticides in the market, low-quality, and cheaper pesticides dominate the pesticide market in Oromia, which is further complicated by the presence of unregistered pesticides from flower farms that have been infiltrating the pesticide market unlawfully. There is an apparent knowledge gap on the side of smallholder farmers regarding pesticides, their safety, and ways of handling, hence, incline to use easily available and cheaper pesticides, which they can identify only with the trade names.
- Domination of the pesticide market by Union Federation and supply delay: Farmers Unions complain that farmers' Union federations are controlling the pesticide purchase process. Products supplied through Union Federation are not made available in a timely manner to end-users due to the long process to assess demand, compile the needs and open a letter of credit (LC), and delivering the product to farmer's cooperative unions for distribution to users. Because of this reason, farmers are not getting the pesticide they demand on time. This has resulted in a huge quantity of unsold pesticides and may expire and contribute to the buildup of obsolete pesticides.
- Monopolistic behavior of the agents of multinational companies: Most agents of the multinational companies are characterized by either importing low volume of their registered pesticides or import products selectively based on their plan, regardless of the current nationwide demand for their products. Even after import, the products are distributed to a defined group that may work for a price hike. Besides, this model of supply is not allowing the participation of third party importers to import the same products for distribution.

- Taxation on safety ensuring equipment at import: It is known that Personnel Protective Equipment (PPE) is taxed during importation similar to clothing articles. This has discouraged importing PPEs by importers and when imported their price has not been affordable to smallholder farmers. This has forced farmers to apply pesticides without wearing personal safety equipment compromising their health and environment.
- Absence of credit facility to farmers: It is understood that farmers experience a shortage of money during pick period in the cropping season to purchase required inputs and apply. In most cases, they either would not buy the inputs or apply at quantity lower than what is recommended. This has been resulting in poor efficiency of pesticides, development of resistant strains/biotypes pests, and lower productivity of the crops. Therefore, as per the experience gained from some European countries such as in Georgia where the organized microfinance institutions need to work with farm service centers and make credit available to farmers by connecting with the credit facility of banks.
- The poor capacity of smallholders in handling pesticides: Apparent absence of the skill required on pesticide acquisition, transporting, handling, storage, and application. The overlooking of the need to train applicators and their possible certification: Currently the application of pesticides are made by unskilled laborers or by farmers. This has resulted in the inappropriate application, contamination of the applicators, and the environment.
- Limited technical backstopping from the public and private actors: As discussed before, issues to pesticide handling and management is not simple. It is dealing with toxic substances. If not handled and managed carefully, results in consequences of damage to human and animal health and the environment.
- Availability in the local market of illegally procured pesticides: Availability of counterfeit, smuggled, and/or expired pesticides in the local markets is affecting the pesticide trade. As elaborated before, there is the infiltration of some products from flower farms to the local market or retails shops, smuggled pesticides cross the borders at different corners of the country. In general smuggled, adulterated, substandard, and expired pesticides are present on the shelves of retailers in different areas across the region and are sold to farming communities easily.
- Weak enforcement of the pesticide law: In general, the regulatory part of the pesticide legal framework is either not existing, inactive, or didn't get the support that it deserves

from concerned authorities in the country including the Oromia Bureau of agriculture to properly regulate pesticides in the region. Because there are repeated complaints coming from district, zone, and regional plant protection experts within the region that they could not enforce the set pesticide management rules due to lack of pesticide regulation and guidelines.

- Long pesticide verification for registration in the country/region: This mandate is given, by law, to research system and /or higher learning institutions which themselves are busy on their primary activities and do not give due to emphases for pesticide verification. Because of this, there is a long delay in the registration of pesticides in the country, which also affects Oromia. Experience in other countries shows that the efficacy data generation for candidate products submitted for registration is outsourced for qualified technical professionals.
- Absence of pesticide repacking companies: To date, there are no repacking companies that are operating in the country and have not been permitted by law. It is not clear why the existing law is not allowing repacking business. This may help the farmer as it allows for delivering pesticides in smaller packs by importing in big containers of different capacities such as 1000, 500, 200 liters/kg. This helps reduce import prices and maximize the meager foreign exchange, thus the government, farmers as well as pesticide importers benefit from the bulk import and repacking.
- Absence of sufficient pesticide formulating companies in the country: It is worthy to mention here that only one formulating company is existing in operation to give service to an estimated 15million of farming communities of the country and 5 million of whom are in Oromia regional state. Despite this, the company did not develop its capacity.

Conclusion Based On the Situation Analyses

The emergence of resistant pests to pesticides is happening in the country. For instance, diamondback moth to lambda-cyhalothrin, bollworm in cotton to endosulfan, aphids to dimethoate, and onion thrips to profenophos are some of the suspected pesticide resistances reported in the country.

The causes for resistance development include increasing lack of alternative pesticides to manage economic pests and under/over the use of available pesticides, presence of contraband pesticides, presence of poorly informed, trained and skilled pesticide users, and also the escalating price of a new generation of pesticide.

Moreover, lack of corporate-thinking and suppliers bias towards high profit than responding to growers demand such as the failure to supply new generation pesticides including seed dressing pesticides has been a challenge.

All these have allowed illegal pesticide trade to proliferate and become a serious threat to legal pesticide marketing, farmers, and consumers. Oromia region is one of the critical regions that have been utilizing pesticides in an increasing amount. Thus the pesticide input system needs to be transformed to make it responsive to the current and future needs of the region.

The availability of the right type in better quality and at the required amount is governed by several factors including changing the weak registration and post-registration system, by placing the laboratory needed to allow registration of quality products (e.g. pesticide formulation analyses laboratory is absent), effective pesticide demand assessment and improper regulation. Thus the MoA is forced to perform weak inspection allowing poor quality pesticide access to the pesticide market.

The lack of coordination in all the actors in pesticide trade is affected proper use of the otherwise very small amount of pesticide the country affords to supply. Resolving the very poor interaction among various stakeholders in the pesticide trade including national and regional regulatory bodies and governmental organizations such as the plant health regulatory directorate (PHRD), which has not re-establish itself as an effective agency to address the pest management problem.

The storage and distribution of pesticides require to be improved following the standards approved by the regulatory authority of the MoA and ATA (reference). This, therefore, calls for the application of standards approved by the regulatory authority of the Ministry of Agriculture/ MoA/ and Agricultural Transformation Agency /ATA/ in collaboration with Cultivating New Frontier in Agriculture /CNFA/. Linking this to capacity building on pesticide management by training farmers, development agents, experts and pesticide dealers on the proper management of pesticides is crucial.

The pesticide supply can significantly be improved by increasing the capacity of the lone pesticide formulating plant and also establishing new ones. Moreover, importing pesticides in bigger containers and repacking locally will also improve the supply. Thus the region should opt for the establishment of pesticide packing factories.

The pesticides supplied to the local market should also be utilized with consideration for the use of alternative pest control methods and the promotion of IPM as an approach to reduce the use, health, and environmental impacts of pesticides.

Table 29 Identified critical problems, strategic options, and the specific activities to better address the pesticide input supply system in Oromia

Critical problem	Strategic option	Specific activities
Shortage of foreign exchange	Give priority to the import of pesticides	<ol style="list-style-type: none"> 1. Make a critical inventory of needs 2. Assign regional body to compile the demands 3. Give priority for new generation pesticides
Complicated transportation facilities	Allow the multimodal system of transportation and also capacitate the existing enterprise	<ol style="list-style-type: none"> 1. Lobby for lifting for the restriction 2. Identify reliable alternative transporters 3. Agree with the identified transporter
Absence of laboratory capacity to confirm the quality of imported pesticides	Put in place pesticide analytical laboratories Exploit available analytical laboratories	<ol style="list-style-type: none"> 1. Work for the buildup of the national laboratory 2. Put up a regional laboratory 3. Capacitate the available analytical laboratories
Domination of the pesticide market by second-generation pesticides	Revise the pesticide law and develop regulation and guideline	<ol style="list-style-type: none"> 1. Discourage the importation of second-generation pesticides, 2. Strengthen the pesticide regulation 3. Strengthen pesticide traders capacity
Domination of the pesticide market by Union Federation resulting in a delay of pesticide supply and monopolistic behavior of the agents of Multinational companies	Reshape the pesticide marketing system	<ol style="list-style-type: none"> 1. Encourage free market 2. Allow only qualified professionals to engage in the pesticide market 3. Systematize the retail market
Taxation on safety ensuring equipment at import	Constantly aware decision-makers	<ol style="list-style-type: none"> 1. Communicate the problem to concerned government bodies 2. propose for the lifting of taxes on PPE 3. Define the specifications for PPE 4. Designate suppliers based on competitiveness
Absence of credit facility to farmers to use pesticides	Establish a system that is responsive to the financial needs of smallholder farmers	<ol style="list-style-type: none"> 1. Establish credit facility at points of sales of inputs to smallholder farmers 2. Encourage microfinance institutions to take the lead of rendering credit at FSCs.
The poor capacity of smallholders in handling pesticides and the limited technical backstopping from the public and private actors on pesticide management	Develop a reach-out program to farmers in pesticide management	<ol style="list-style-type: none"> 1. Identify skill and knowledge gaps 2. Develop a curriculum on pesticide management 3. Arrange regular training for farmers 4. Distribute made-simple pest identification guide

Critical problem	Strategic option	Specific activities
		<ol style="list-style-type: none"> 5. Distribute guideline for pesticide handling 6. Train and certify pesticide dealers, handlers and applicators 7. Organize radio and television programs on pesticides
Availability in the local market of illegally procured pesticides due to weak enforcement of the pesticide law	Work for the enforcement of pesticide law and develop regulation and guideline	<ol style="list-style-type: none"> 1. Establish and strength regulatory authority 2. Insist on the MoA to develop regulation and guidelines 3. Establish and capacitate pesticide laboratory, 4. Strengthen legally operating companies such as FSCs and establish them further where required
A long process on pesticide verification for registration in the country/region	Revise the procedure and implement	<ol style="list-style-type: none"> 1. Identify institutions capable of verifying pesticides for registration 2. Provide time-bound assignment 3. Put in place an independent monitoring group 4. Review the results with support from the expert group
Absence of pesticide repacking companies	Create a system to allow pesticide repacking locally	<ol style="list-style-type: none"> 1. Discuss the issue with MoA 2. Check in the proclamation for the provision of repacking permit 3. Identify companies that can repack pesticides 4. Establish a regulatory system to check for the quality of the repacks
Absence of sufficient pesticide formulating companies in the country	Work to convenience decision-makers	<ol style="list-style-type: none"> 1. Capacitate the existing formulating company 2. Establish new share pesticide formulating companies
Lack of focus for alternative pest management approaches	Promote integrated pest management (IPM)	<ol style="list-style-type: none"> 1. Promote IPM through the farmer's field school 2. Promote the use of botanicals 3. Promote a new generation of pesticides and bio-pesticides 4. Train farmers on the significance of area-wide pest management for reducing pesticide use

2.4.8 Transforming the Pesticide Input Supply System in Oromia

2.4.8.1 Institutionalizing the process

The pesticide input registration, import/formulation, distribution, and supply to the farmers are supported by the pesticide proclamation of 2010. This, however, is not properly implemented due to the absence of regulation and guidelines to implement it. This is

complicated in general by the poorly implemented pest management support service strategy (PMSS), which was developed and effected since 2016.

The PMSS system in the national regions across the country is currently non-responsive to the needs of farmers due to the downsized manpower in crop protection structures and its consideration as one service in crops packages to be delivered by the extension directorate, the lower budget allocated for the service and critical shortage of transport and laboratory facilities and the disincentive to the experts in plant protection due to lack of attention to their career development.

The requirements put for pesticide supplying registrants include professional relevance to pesticide management, owning appropriate storage facilities, and capacity to deliver to local distributors. The most critical part of this delivery process is having a competent institutional setup that helps regulate the movement and delivery of pesticides to smallholder farmers. This requires not only putting in place an institute to handle the process of pesticide inputs supply and delivery but also the manpower needed to handle the process properly and according to the national law.

Having in place a competent institute helps to regulate pesticides from import to final retail outlets and at the farm level. The significance of farmers' service centers /FSCs/ in properly implementing the pesticide input regulation at the farm level needs to be checked and systematized. Moreover, a mechanism to prevent the use of unregistered pesticides from unknown sources should be prevented.

2.4.8.2 Monitor the pesticide input supply chain in Oromia

The regional government of Oromia should coordinate with the federal MoA to put in place the required institution and the manpower required to take to the ground level the pesticide law and work for its full implementation in the region. This implementation is mainly regulation of the pesticide supply chain operating in the region. This can be affected by addressing the problems that have been constraining the pesticide supply chain and are described earlier. The actors at the regional level should include the following:

- a) Qualified pesticide experts should be recruited and capacitated to regulate pesticides distribution in the region,
- b) Pesticide regulators/inspectors who can regularly evaluate the competence of traders engaged in the pesticide supply chain. The regulators/inspectors should be well-trained pesticide monitors who can enforce the pesticide law of the country. Therefore, the region should fasten the process of assigning the needed regulators and work for the

development of the regulation and guideline to effect the successful implementation of the national pesticide law.

- c) Trained development agents who can use established database on the registered pesticides, the companies that are registered to import and distribute pesticides, data on where and how much and where their pesticide stocks are distributed, recording data on pesticides that may be found ineffective for back-tracing to locate their origin.
- d) Aware development agents who can use effective mechanisms devised to block the distribution and use of illegally procured pesticides and promote the use of only registered ones. Build the capacity of district crop protection experts pesticide regulators/inspectors, development agents and smallholder farmers on pesticides selection for use on different target pests, handling, use, and management

2.4.8.3 Promote new generation pesticides use in Oromia

As described in the analyses above the pesticides that are in wide use in the region are from the second generation and were introduced before the 1980s (Table 28). They are characterized by ineffectiveness and multiple side effects on human health and the environment. Some examples on this regard are described below:

- a) The rampant use of Endosulfan on many target insects including aphids, bollworm, stalk borer, plusia worm, and onion thrips is an important area of concern. This pesticide belongs to the organochlorine class, which is persistent in the environment and all insecticides in this class including Endosulfan have been banned from use. Its use on crops like tomato, which is directly consumed as a fresh vegetable is most worrying.
- b) The widespread use of Mancozeb, Ridomil (Mancozeb+Metalaxyl), and Propiconazole on different fungal diseases infecting different crop species with the repeated application as high as 20X in onion has been recorded.
- c) Synthetic pyrethroids- Lamdacyhalothrin group (Karate, Lambdex, and Hilrat), which are nonselective and because of their flashing effect kill both the target pests and the beneficial and the harmless insects present in sprayed areas are in common use. Their repeated use has been helping the selection of synthetic pyrethroid-resistant insect pest populations.
- d) There are situations when some pesticides are applied even though they were not giving effective control of the targeted pests; these are the insecticide Malathion and the fungicide Mancozeb.

Above all what is described above, the rates of application of the different pesticides on different target pests are quite similar. Moreover, the frequency of application is often limited to onetime, which may not be sufficient especially for the fungicides being used on diseases like the late blight of potato that gives no chance if left unchecked after one spray. These all indicate the level of mismanagement of pesticides taking place under the small scale farming system in Ethiopia.

Considering all these drawbacks reported in the country promoting the new generation pesticides described earlier is important. The region, therefore, should work proactively to promote the 3rd generation pesticides and the bio-pesticides that are taking over the global pesticide market and are by far much safer than the second generation pesticides and compatible with IPM.

Table 30 Pesticides that are in wider use to control crop pests in Ethiopia

Pesticide name	Category	Time of introduction to the market
2,4 D	Herbicide	1942
Malathion	Insecticide	1950
Endosulfan	Insecticide	1954
Carbaryl	Insecticide	1958
Atrazine	Herbicide	1958
Mancozeb	Fungicide	1962
Lambda-cyhalothrin	Insecticide	1977
Ridomil gold	Fungicide	1979
Propiconazole (Tilt)	Fungicide	1979

2.4.8.4 Promote integrated pest management

To promote IPM, it is essential to enhance first the infrastructure of the Plant Protection System in the country including awareness creation, required number of trained staff/farmers, necessary material and equipment, phytosanitary control and pesticides management systems, reviewed and updated national plant protection related legislation, enhanced research and extension program, necessary documents, communication and information exchange system, and marketing policy.

Based on the analysis of the general situation of the plant protection system in Ethiopia and to establish an IPM strategy in the country, especially for smallholder farmers, it is highly necessary to cover the following basic needs:

- i. Reinforcement of the national policy/decision on plant protection
- ii. Review/update the national plant protection legislation according to the IPPC standards,

- iii. Establish a National Working Group to develop and follow up national technical IPM programs,
- iv. Enhancement of the infrastructure of the concerned technical services and research Institutions,
- v. Training the human resource of the technical services and research Institutions,
- vi. Extension/education/awareness-training of farmers through farmers field school (FFS),
- vii. Enhancement of pest information communication systems,
- viii. Development of the local industry/market to provide the necessary material and equipment, for the implementation of the IPM strategy,
- ix. Development of the local and external markets for the acceptance/ propagation of IPM products, based on justifiable certificates, according to IAPSC and IPPC standards.
- x. Reinforcement of national, regional and international collaborations in pest management,

2.4.9 Risks and Assumptions

Table 31 Risk matrix for pest management and pesticide use in Oromia

Risk	Impact	Probability	Mitigation
Uncontrolled or unregulated pesticide use prevail across the country	Poor pesticide management system rules over the region	Very high	<ul style="list-style-type: none"> • Enforce the pesticide law • Develop the missing pesticide regulation and guidelines • Create wider awareness on the pesticide law, regulations and guidelines
The PMSS strategy not fully owned by the region	Uncoordinated and emergency response based tactical pest control continue to be the norm	Very high	<ul style="list-style-type: none"> • Circulate the PMSS strategy document • Wider awareness creation • Provision of technical training on pesticide management
Threat from economic pests continue to be a threat to smallholder farmers	Infestation and economic damage by pests increases	Very high	<ul style="list-style-type: none"> • Recruit capable experts • Aggressively train junior experts • Boost the material capacity of the service providers • Strengthening pest surveillance, survey, and monitoring • Train farmers regularly on how to manage economic pests • Establish an efficient pest information exchange network Ethiopia • Deliver effective control technologies
Effective	Infestation and	Very high	<ul style="list-style-type: none"> • Enforce the pesticide law

Risk	Impact	Probability	Mitigation
pesticides not delivered	economic damage by pests increases		<ul style="list-style-type: none"> • Regulate the quality of imported pesticides • Train farmers on the safe use of recommended and registered pesticides • Fast delivery of procured pesticides ensured
Failing to promote IPM in all farming systems and agro-ecologies	Dependency on the use of pesticides will continue	Very high	<ul style="list-style-type: none"> • Train experts on IPM and its means of promotion • Produce IPM implementation guidelines for the economic pests affecting crop production in the country • Create wider awareness in decision-makers, development workers, farmers, and others • Mobilize smallholder farmers across the country to adopt IPM

2.4.10 Appendix Tables

Appendix Table 1 Efficacy of synthetic organic pesticides in some selected places in Afar, Amhara, Oromia, Tigray and SNNP regions

Crop species	Target pest	Pesticide in use	Rate	Efficacy [†]
Cabbage	Aphids	Malathion	1-2l/ha	2/3
		Lambda-cyhalothrin	0.5-1l/ha	2
		Profenophos	1l/ha	2
Onion	Onion rust	Mancozeb	3kg/ha	1
		Mancozeb + Metalaxyl	1-2kg/ha	1
	Onion thrips	Chlorpyrifos	1l/ha	1
		Profenophos	0.5-2l/ha	1
		Lambda-cyhalothrin	1l/ha	1
		Endosulfan	2l/ha	2
Tomato	Early & late blight	Mancozeb	3kg/ha	1
		Mancozeb + Metalaxyl	1-2kg/ha	1/3
	Bollworm	Endosulfan	1-2l/ha	3
		Malathion	1l/ha	3
		Profenophos	1l/ha	1
		Bayleton	0.5kg/ha	2
Cotton	Chewing insects	Endosulfan	3l/ha	3 (5X)
	Sucking insects	Carbosulfan	3l/ha	1 (2X)

([†]1=very good, 2=Good, 3=Fair and 4=Poor efficacy)

Source: Unpublished data, Bayeh Mulatu, 2011 & 2013

Annex II: Different pesticides applied on different economic pests during 2018 cropping season

Crop species	Target pests	Pesticide name	Efficacy range	Application frequency
Chickpea, faba bean, Grasspea, Head cabbage, Lentil, Maize, Onion, Tef, Tomato	ABW, Aphids, FAW, Onion thrips, RTW, Tuta absoluta	Endosulfan	2-3	1-3x
Barley, Cabbage, Field pea, Head cabbage, Maize	Shootfly, Aphid, Stalk borer	Hilrat	1-2	1-2x
Barley, Chickpea, faba bean, Field pea, Head cabbage, Maize, Onion, Tef, Tomato	Shootfly, Aphid, ABW, Cutworm, DBM, FAW, Stalk borer, Onion thrips, RTW, Tuta absoluta	Karate	1-2	1-5x
Field pea, Lentil, Onion	ABW, Aphid, Onion thrips	Lamdex	1-2	2-5x
Faba bean, Field pea, Head cabbage, Lentil, Maize, Sorghum, Tef	ABW, Aphid, FAW, Stalk borer, Shootfly	Malathion	1-3	1-5x
Faba bean, Garlic, Onion, Potato, Tomato	Chocolate spot, Garlic Rust, Late blight, Potato blights	Mancozeb	1-3	1-6x
Barley, Emmer wheat, Garlic, Onion, Wheat	Barley Rust, Scald, net blotch, Wheat rusts, Garlic Rust, Powdery mildew,	Nativo	1-2	1-3x

	Wheat rusts, Yellow rust			
Barley, Emmer wheat, Garlic, Potato, Wheat	Rust, Scald, Net blotch, Wheat rusts, Garlic Rust, Late blight, Wheat rusts, Yellow rust	Natura	1-3	1-3x
Barley, Emmer wheat, Garlic, Potato, Wheat	Barley Rust, Scald, Net blotch, Wheat rusts, garlic Rust, Late blight, Wheat rusts	Rexido	1-2	1-3x
Faba bean, Lentil, Onion, Potato	Chocolate spot, Faba bean gall, Lentil Rust, Onion Rust, Late blight	Ridomil	1-3	2-6x
Barley, Emmer wheat, Faba bean, Garlic, Potato, Wheat	Barley Rust, Scald Net blotch, and rust, Wheat rusts, faba bean rust, garlic rust, Late blight, Wheat rusts, Yellow rust	Tilt	1-3	1-4x

Pesticide demand for 2019 cropping season in Oromia

The region has no data on the amount distributed based on the different supply categories. For this crop season, about 2.66 million lit and 50,000 kg of different pesticides were estimated to be required and the demand amount was communicated to the different suppliers as indicated in the tables below.

Appendix Table 2 Pesticides to be imported and supplied by Unions Federation, 2019

Pesticide group	Products	Unit of measurement	Amount
Herbicides	2-4 D	Lit	675000
	Pallas	Lit	90000
	Primagram	Lit	30000
	Axial 50% EC	Lit	25000
	Galant super	Lit	11000
	Atilantis	Lit	50000
	Glaxmax	Lit	20000
Insecticides	Actalic 2%	Kg	20000
	Karate	Lit	30000
Fungicides	Tilt 250EC	Lit	85000
	Ridomil	Kg	30000
	Nativo	Lit	60000
	Natura	Lit	60000
	Rex Duo	Lit	30000

Appendix Table 3 Pesticides expected to be imported and supplied by private chemical importers, 2019

Pesticide group	Product	Unit	Amount
Herbicides	2-4 D	Lit	556661
	Topic	Lit	88451

Pesticide group	Product	Unit	Amount
	Pallas	Lit	200000
	Ralon super	Lit	1826
	Granstar	Lit	26733
	Top harvest	Lit	11407
	Terminater	Lit	3280
	Glyweed	Lit	575
	Stellar	Lit	4258
	Lasoatrazin	Lit	350
	Glyphosate	Lit	1442
Insecticides	Actalic 2%	Kg	30000
	Cymbush	Lit	10932
	High way	Lit	12095
	Pyrinex 48%EC	Lit	3531
	Alderine	Lit	1063
	Dursban 48%EC	Lit	24756
	Malathion 50%EC	Lit	42749
	Deltamethrin 2.5%EC	Lit	550
	Roger	Lit	93
	Lamdex	Lit	2307
	Endosulfan	Lit	25564
	Diazinon	Lit	41617
	Carbaryl	Lit	829
	Confidence	Lit	1046
	Sevien 85% wp	Kg	2332
	Helerat 48%EC	Lit	16101
Fungicides	Tilt 250EC	Lit	59053
	Bayleton	Lit	10571
	Mancozeb 12%	Lit	67026
	Natura	Lit	34267
	Rex Duo	Lit	121548
	Penncozeb 75	Lit	522
	Agromax	Lit	44248

2.5. LIVESTOCK INPUTS SECTOR TRANSFORMATION

2.5.1 Introduction

The livestock sector is one of the fastest-growing segments of the agricultural economy, particularly in the developing world. Despite the rapid structural change in parts of the sector, smallholders still dominate the system in many developing countries. In Ethiopia, livestock production is mainly of smallholder farming systems with an animal having multipurpose use and accounts for approximately 47.69% of the total agricultural gross domestic product (GDP) and 23.8% of national foreign currency earnings (IGAD, 2013). Livestock production is an integral component of the whole agricultural activities and is complementary to each other. It provides income, quality food, fuel, draught power, building material, and fertilizer, thus contributing to household livelihood, food security, and nutrition at large where crop production, on the other hand, provides the feed base for the livestock.

Oromia National Regional State is one of the regions that endowed with diverse livestock genetic resources in the country. According to CSA (2018), the livestock population of the region accounts for more than 40% of the livestock population in the country. This is attributed to its diverse agro-ecological settings for livestock production, socio-economic and socio-cultural connection of Oromo people with livestock rearing. However, the majority of the livestock population of the region is dominated by indigenous livestock breeds characterized by low productivity leading to an increasingly unmet demand for food of animal origin. This steady demand for food of animal origin attributed to various drivers such as rapid population explosion in urban centers, economic growth, changing diet preference towards value-added foods of animal origin. Though the figures vary from literature to literature FAO, (2018) reported that per capita consumption of milk is still limited at 19 kg per year in Ethiopia, which is much lower than East African (40kg) and the global average (100kg). Likewise, the per capita consumption of meat and egg is estimated at 8 and 0.6 kg, respectively).

With the current status and subsistence mode of livestock production, level of productivity, marketing system, policy environments, research, and development interfaces in the livestock subsector, it is inconceivable to satisfy the ever-growing demand for animal source foods. Booming demand for food derived from animals necessitates either exponential increases in livestock number or use of major technological innovations, the use of more

productive animals, and intensive use of inputs that enhance productivity per unit animal. However, the exponential increase in the number of livestock populations has negative impacts on ecosystems and natural resource bases. As experienced in the developed world, this surging demand needs to be met by commercialized livestock production and the use of tailored inputs that enhance livestock productivity.

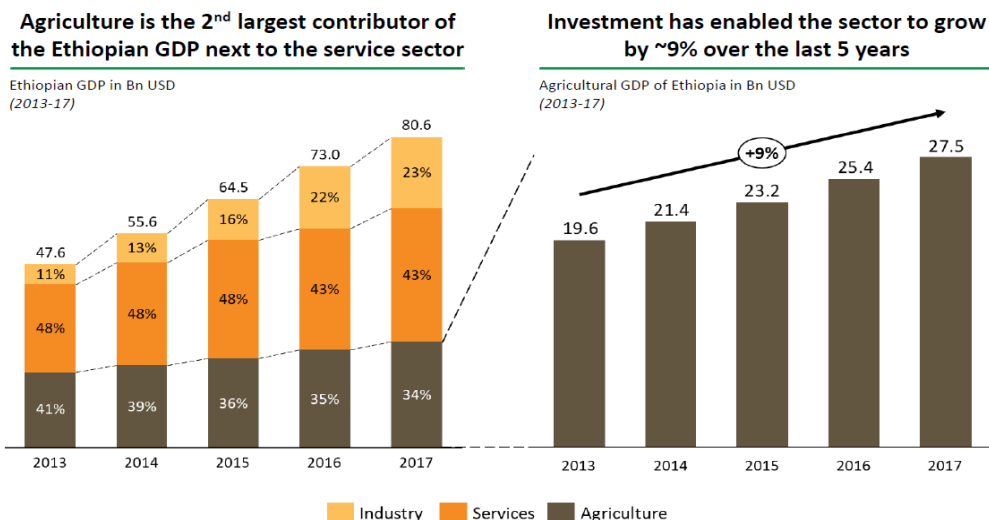
The input supply both in terms of quantity and quality plays a central role in the transformation of subsistence mode of livestock production into market-oriented production. The major livestock inputs are animal genetics, feeds and nutrition, veterinary drugs, and vaccines. However, these inputs are inadequate as compared to inputs needed to transform the subsector. The components and manner of provision of inputs and services to livestock producers vary from place to place depending on proximity to service centers and contexts of the existing production system. This calls for renewed attention to environmentally friendly livestock and livestock system development, technological innovations, and appropriate investment on livestock production inputs.

2.5.2 The Need for Livestock Inputs Transformation in Oromia

The analysis of the agricultural sector conducted by the Agricultural Transformation Agency (ATA, 2019) reveals that agriculture has been consistently contributing 35-40% to the Ethiopian GDP and has grown by 9% annually over the last five years (Fig.19). Yet, its contribution is higher than the industrial sector to the national economy. Of the agricultural sector, livestock is considered as one of the next growth drivers in Ethiopia. The analysis also indicated that livestock is a major contributor to the agriculture sector. Nevertheless, it remained underdeveloped.

The present contribution of livestock to the national economy (Fig 20) is far less than its potential. Among other factors, livestock production inputs are the major factors affecting livestock production and productivity and thereby reducing their potential to the national economy. Currently, producers/farmers, bureau of livestock and fisheries, primary cooperatives and unions, and private input suppliers are the main actors of input supply. With the current traditional way of livestock production, it is unthinkable to narrow down demand-supply variance for food and income generation from animal production. This requires a “deep dive” to transform the subsector (Fig. 21). Identification and ranking of the constraints that impede the flow and effectiveness of livestock inputs value chain have paramount importance to improve their delivery systems and thereby improve livestock

productivity. Accordingly, the status and intervention strategies for the main livestock inputs viz., breed/genetics, feeds, drugs, and vaccines are discussed below.



Source: Ethiopia's Progress Towards Eradicating Poverty, UNDP Ethiopia, 2018; Data Worldbank.org/country/Ethiopia, World Bank, 2018; Human Development Reports – UNDP, 2018

Figure 19 Contribution of Agriculture to Ethiopian Gross Domestic Product (GDP)

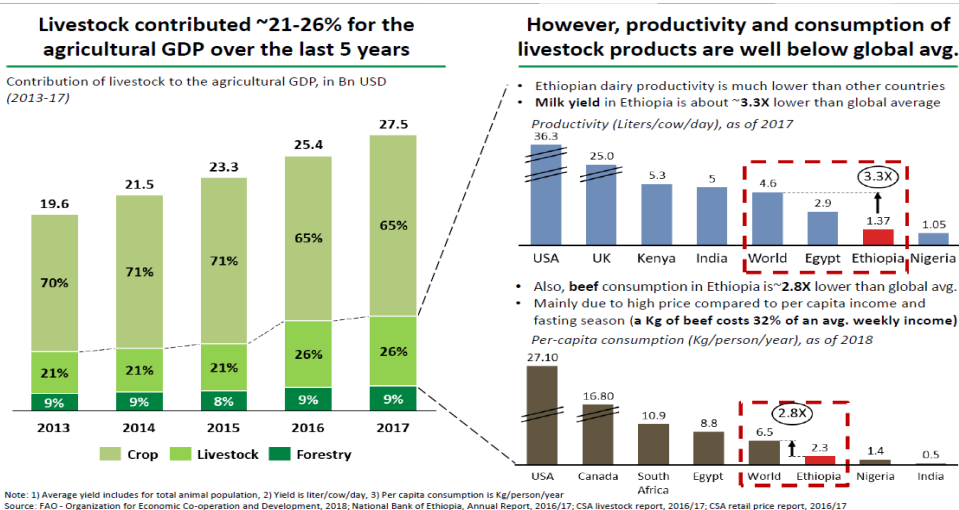


Figure 20 Contribution of Livestock to the Ethiopian Agricultural Sector

Deep Dive: Red meat

Ethiopia is 6th placed from the globe in terms of livestock population

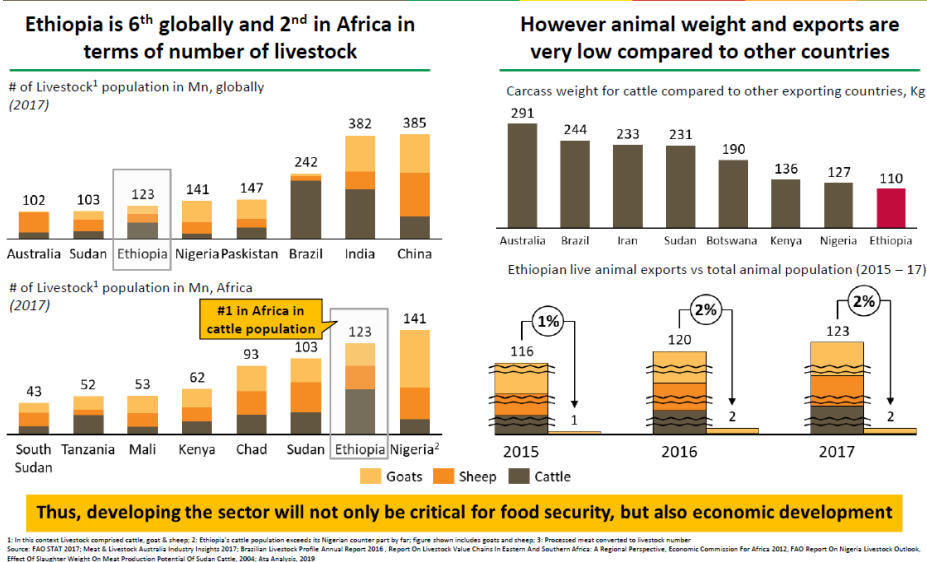


Figure 21 Meat productivity and consumption of Ethiopian livestock subsector as compared to other countries

2.5.3 Improved Breeds

Four livestock species are prioritized for the livestock transformation. These include cattle, small ruminants, poultry, and camel.

2.5.3.1 Cattle Breed

According to the Livestock Master Plan (LMP, 2016), cattle were found to be the dominant species in 70-90% of the livestock producing households in Ethiopia. They dominate smallholder income generation and milk/meat production in all production zones. Moreover, cattle were found to account for about 72% of the meat and 77% of the milk produced annually at the national level. Cattle thus play a dominant role in producing smallholder income and in meeting domestic milk and meat consumption requirements.

Furthermore, based on potential returns per Ethiopian Birr invested (Internal Rate of Return) in available technologies (genetic, feed, and health), results show that investing to improve cattle productivity has high potential in all the production zones to reduce poverty, to contribute to national income growth, to meet future domestic consumption requirements, and to also increase meat and milk exports and foreign exchange earnings.

2.5.3.1.1 Past Cattle Genetic Improvement Efforts

Cattle breed improvement in Ethiopia has focused on crossbreeding of the local stock with exotic breeds. To this effect, different initiatives have been made to promote crossbreeding schemes through the establishment of the National Artificial Insemination Centre (NAIC) and the establishment of cattle breed improvement and multiplication centers with the major aim to distribute improved animals to smallholders.

There used to be government-operated cattle multiplication and improvement centers/ranches in various locations dedicated to supplying smallholder dairy farmers with crossbred dairy heifers. These centers also have an element of conserving identified cattle breeds/populations in their environment. For instance, Didu Tiyura Borana breed improvement and multiplication center, Gobe, Abernosa, Horro Guduru ranches are worthy to mention. But some of these ranches have been privatized and no longer had supply subsidized crossbred heifers. This resulted in scarcity and increased prices of improved breeds in the region and the country at large. As a result, crossbreeding local cows with exotic breeds through AI and the purchase of unknown pedigree heifers and cows are the only sources to get improved breed. However, the AI service delivery system is reported to be inefficient, constrained by a shortage of AI technicians and inputs like semen and liquid nitrogen supplies. Moreover, low involvement of the private sector in AI provision, lack of recording scheme, lack of selection criteria for bulls, lack of pedigree information to technicians and dairy farmers, limitation of activity to few cattle breeds are contributing to the low performance of the sub-sector. Concerning the effectiveness of AI service, the overall average conception rate to the first service was as low as 16.1%, with significant variations between regions: 21.8% in Addis Ababa; 19.2% in Oromia; 17.7% in SNNPR; 16.3% in Amhara and only 3.7% in Tigray (Azage *et al.*, 2010).

In general, the major problems associated with the breed as input include limited capacity and/or lack of government ranches and multiplication centers for the supply of improved animals, inefficient and ineffective AI services, distribution of improved breeds or technologies in isolation from other associated inputs and services, weak follow-up and extension services and limitation on some improved genetic resource distribution. Hence, alternative options have to be explored to have an effective and efficient improved breed improvement and supply system. One such system is to utilize the indigenous potential breeds through an open nucleus development scheme.

2.5.3.1.2 Open Nucleus Breeding Scheme

Oromia is gifted with some of the globally well-known cattle breeds with well-recognized product qualities. Borana, Horro, Kereyu, and Arsi cattle breeds are among the cattle of Oromia known for their premium quality meat, milk, and hides. In particular, Boran cattle breed, which is said to be “God Gift to cattlemen” is among the globally recognized cattle breeds that originated in the region (Fig. 22). This indigenous breed is found in the lowland pastoral areas of the region, predominantly in the Borana, Guji, and west Guji administrative zones. The breed, which has dual merits for both meat and milk, is a well-adapted breed to arid and semi-arid environments with less variability in its performances under various environmental stresses. Therefore, the livestock transformation agenda in Oromia shall target Boran cattle breed for transforming the beef industry to improve the livelihood of pastoral communities in the region. The key action in transforming the beef industry would be setting up and designing the appropriate and sound genetic improvement program of Boran cattle breed.



Figure 22 Boran cattle breed under rangeland conditions

The open nucleus breeding scheme is proposed to improve and transform the genetics of Boran cattle breed at Dida Tiyura Cattle Ranch and pastoralist herds in Borana zone (Fig. 23). Bondoc and Smith (1993) recommended the establishment of a two-tier open nucleus breeding scheme to maximize genetic improvement, reduce the inbreeding rate, and total cost of recording in the participating herds. Recoding of newborn calves is highly essential in the participating herds and gradually be introduced as part of the extension program of the scheme. Indeed, identification and traceability of Boran cattle breed are mandatory to create disease-free zones and compete in the booming beef industry. The nucleus at Dida Tiyura Cattle ranch can be opened to an introduction from the participating community herds or closed completely to importation from outside where Boran cattle breed has been genetically

improved. Major challenges and intervention strategies to transform the beef industry in the region are indicated in Table 23.

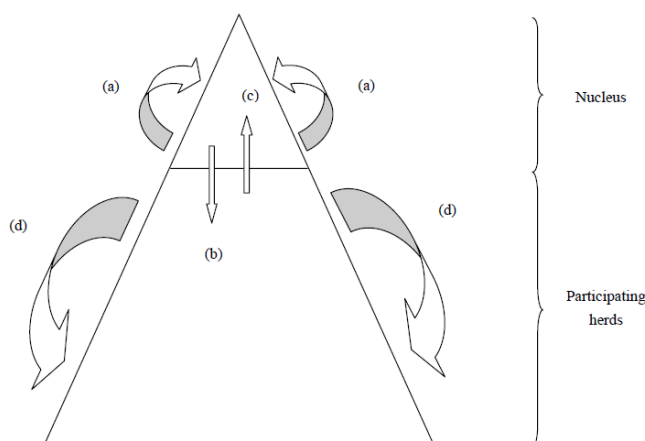


Figure 23 Representation of an open nucleus breeding scheme for Boran cattle breed

The nucleus is the tier that generates genetic gain and bull selection in the main activity (a); there is the movement of bulls from the nucleus to sire progeny in the field population (b); there is the introduction of dams born in the participating herds into the nucleus (c) and there is little selection in the participating herds (d). It is to be noted that the cattle breeding scheme developed for Boran cattle breed applies for other prominent cattle in Oromia. However, the currently operating Dida Tiyyura Cattle Breeding and Conservation Ranch is constrained by major basic facilities and inputs to undertake its mandates/the proposed breeding program which necessitates due attention of the region to strengthen the center.

Even though modern dairy development in Ethiopia dated back to early 1950', milk production and productivity of the dairy herd is still low. For instance, more than 98% of the herd is indigenous cattle with an average milk yield of 1.37lt per day resulting in a lower per capita milk consumption rate of about 19 liter which is far below the FAO recommended standards. Due to a seasonal lack of animal feed and fasting periods, large fluctuations occur in demand and supply of milk.

Apart from genetics, dairy development is hampered by various factors like weak extension and advisory services, inadequate input supply, financial constraints, and poor veterinary services. Therefore, the development of viable strategies for dairy transformation is warranted. Though attempts have been made nationally, customized strategies have not been

vigilantly extracted from the Livestock master plan (LMP) for regional interventions. Therefore, customized dairy development interventions are needed for the region because the region has a relative strategic location, favorable climates, availability of inputs and services; high demand, and market access for dairy products that attract investors and development partners in and around major towns and cities.

Table 32 Major challenges and intervention strategies to transform the beef industry in the region

No	Challenges	Intervention options
1	Lack of improved breeds for meat production	Breed improvement through selection and crossbreeding
2	Poor linkage with the pastoral and agro-pastoral communities	Establish functional community ranches in strategic areas and create a strong linkage with pastoral communities to improve Borana cattle breed in the region
3	Absence of delineated Disease free-zone targeting the export market	Delineate and establish disease free-zone targeting the export market
4	Lack of livestock marketing system and facilities	Establish reliable and sustainable livestock marketing facilities
5	Lack of standard abattoir, cooling and standard transport facilities for meat	Construct standard slaughterhouse and associated facilities
6	Absence of livestock insurance for animals lost during prolonged drought and	Establish an insurance system for pastoralists

2.5.3.2 Small ruminants

Small ruminants are among the selected livestock species targeted for transformation. They contribute about 46% of the national meat consumption and 58% of skin production. They are also one of the top priority species currently used as export commodities for red meat. Therefore, to comprehend the livestock transformation agenda of the region and the country at large, small ruminants are key intervention areas for transformation.

The primary aim of a small ruminant breed improvement program is to increase the production of mutton and goat meat, which commands a premium price on both the domestic and export markets. Apart from the limited experiences of Farm Africa in crossbreeding of local goats with exotic dairy goats for improved milk production in the Hararghe highlands and the SNNPR, there has been no organized goat improvement program. The major limitations in the sheep improvement program in the region are the absence of comprehensive local sheep improvement programs, inadequate information on

meat, milk production, reproduction, housing, feeding, disease control methods, and poor marketing system.

The traditional production objective of small ruminants needs to change to introduce a market-oriented commercial system. Sheep and goat meat export mainly focused on lowland breeds. However, due to the increasing demand for Ethiopian meat in general in selected export markets in the Middle East more highland sheep and goats are being slaughtered for export mainly to fill gaps in supply necessary to meet demand. This suggests a high potential for increasing the export of meat from highland sheep and goats.

Taking into account the growing demand of sheep and goat meat in the country (both domestic and in export market) the small ruminant sector needs to be commercialized by involving the private investment and partnerships with the public sector. Create a conducive environment to promote private actors to invest in the sector is a prerequisite of the commercialization process. Vibrant farmer organizations to support the production, processing and marketing of small ruminants are crucial. The government and other investors should equip smallholder producers with technology knowledge credit and market linkages through farmer-based organizations in a public-private-producer-partnership mode (Indian experience Melinda Gates in collaboration with ILRI 2016). Institutional strengthening through farmers' organizations privatizing buck production promoting commercial sheep and goat farms, promoting entrepreneurs for fodder production, encouraging private animal health care service providers, etc.). *The challenges* and intervention strategies in this sector are indicated in Table 33 below.

Table 33. Challenges and intervention strategies in small ruminant transformation in Oromia

Challenges	Intervention strategies
<ul style="list-style-type: none"> • Low productivity of animals 	<ul style="list-style-type: none"> • Increasing access to improved genotype through <ul style="list-style-type: none"> ◦ Re-enforcing and scaling up of CBBP ◦ Encouraging private and Government-owned sire multiplication and distribution ranches
<ul style="list-style-type: none"> • Lack of quality and safety standards for sheep and goats export 	<ul style="list-style-type: none"> • Improve the capacities of actors to respond to norms for quality (safety product) for the local and export market <ul style="list-style-type: none"> ◦ Improve capacities for diseases control and certification ◦ Improve traceability ◦ Improve standards for quarantine system ◦ Upgrade quality of abattoirs (ante and post mortem inspection system) ◦ Alliances between actors to implement the above components both for live animal and meat export
<ul style="list-style-type: none"> • Low involvement of the private sector in the small ruminant 	<ul style="list-style-type: none"> • Encourage private-owned sire multiplication and distribution ranches

improvement	
<ul style="list-style-type: none"> • shortage of veterinary services and drug supply 	<ul style="list-style-type: none"> • Improving small ruminant health services and vet. inputs through <ul style="list-style-type: none"> ○ Engaging the private sector ○ Capacity building through training ○ Forging public-private partnership ○ Development of a business model for a revolving fund to support veterinary service and drug providers
<ul style="list-style-type: none"> • Lack of access to credit 	<ul style="list-style-type: none"> • Arranging credit services for smallholder sheep and goat producers
<ul style="list-style-type: none"> • Lack of accessible marketing structures 	<ul style="list-style-type: none"> • Improving transport and market infrastructure along the small ruminant value chains • Building alliance between actors through <ul style="list-style-type: none"> ○ Organization of producers, traders, and exporters, slaughter abattoirs ○ Organizing youths and women
<ul style="list-style-type: none"> • Lack of adequate incentive for the quality of live animals and meat 	<ul style="list-style-type: none"> • Establishing quality based payment for live animal and meat
<ul style="list-style-type: none"> • Informal cross border trade 	<ul style="list-style-type: none"> • Developing a workable regional regulatory system
<ul style="list-style-type: none"> • Limited access to market information 	<ul style="list-style-type: none"> • Making use of available media to update the marketing information
<ul style="list-style-type: none"> • Lack of legally binding agreement between suppliers and export abattoirs and the varying price paid by the abattoir 	<ul style="list-style-type: none"> • Developing and enforcing legal frameworks that bind the two parties • Developing pricing policy and implementing the same for all abattoir

2.5.3.3 Camels

Camels (*Camelus dromedaries* and *Camelus bactrianus*) have demonstrated their high adaptation to the most rigorous environments since their domestication. They are mainly found in the arid and semi-arid regions and lowlands of Eastern African countries namely, Somalia, Sudan, Ethiopia, Kenya, and Djibouti (FAO, 2011). The Ethiopian camel is found in Somali, Afar, Oromia, Amhara, and some parts of Tigray regions where the majority of people are pastoralists and Agro- pastoralists. Oromia is endowed with large camel populations.

They thrive and produce better than other livestock species under harsh environmental conditions in Ethiopia is estimated to be more than 4.5 million (LMP, 2014). The one-humped camel dromedary (*Camelus dromedarius*) is found in the pastoral and agro-pastoral areas of Ethiopia.

The rationale for considering camels as priority livestock species

- Camel production makes a significant contribution to the national economy of Ethiopia
- Camel production is on the rise due to their inherent adaptation to climate change

- Contributing greater share to regional and country GDP. For instance, Ethiopia's live camel trade value in 2010 G.C. was close to 61 million USD which is greater than the annual export values of other animals combined (Aklilu and Catley, 2011).
- Becoming major sources of meat. For instance, camel meat annually produced in Ethiopia is 74 thousand tons valued at 3614 million (LMP, 2014).
- Produce three times more daily milk than cattle. The annual camel milk production in Ethiopia is estimated to be 247,100 Metric tons (FAOSTAT, 2010).
- Demand for camel milk is on the rise in Ethiopia.
- Increasing medicinal importance of camel milk
 - Camel milk possesses anti-oxidative factors such as vitamin C, lactoferrin, and components of health-related effects (insulin).
 - Treat chronic liver problems like jaundice, edema, and swelling of the belly
 - Raw camel milk contains insulin-like proteins that can bypass the stomach and be absorbed intact
 - Nutritive Value of Camel Meat-the low level of the cholesterol content of the fat than other meat animals (Al-Ani, 2004; Dawood and Alkanhal, 1995).
 - This is an important factor in reducing the risk of cardiovascular diseases which are related to saturated fat consumption (Giese, 1992).
 - Reduces blood sugar and used to treat diabetes (Zagorski *et al.*, 1998)

The major challenges and intervention strategies are indicated in Table 34 below.

Table 34 Major Challenges and Strategic interventions to improve camel production

No	Major challenges	Intervention strategies
1	Poor linkage among research, development institutions and private sector working on camel genetic improvement and breeding activities	Oromia Agricultural Research Institute (Yabello Center) should take a leading role in coordinating camel research activities and information generation
2	Poor coordination and integration of camel research and development program in the country (Research, Universities, MoA, CGIAR, NGO's,)	Oromia Agricultural Research Institute (Yabello Center) should take a leading role in coordinating camel research activities and information generation
3	No or poor market access for camel milk and meat	Attract investors to establish milk processing facilities in pastoral and agro-pastoral areas
4	Lack of quality standards for camel breed technologies across the production system	Conduct a study and set quality standards for camel derived foods products (meat and milk)
5	Absence of slaughtering facilities for camel meat	Establish satellite slaughtering facilities in pastoral areas

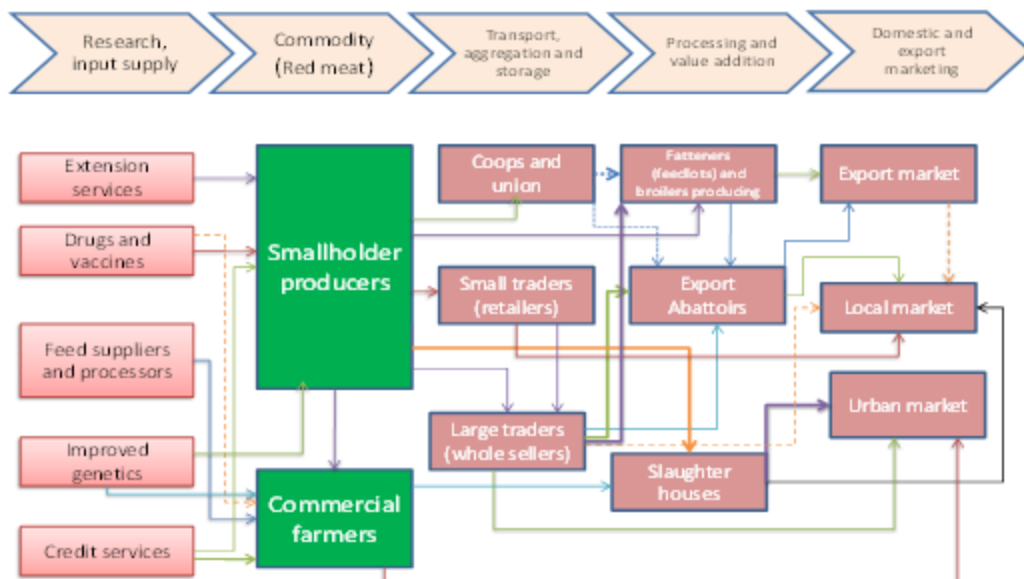


Figure 24 Red meat value chain that involves cattle, camels and small ruminants

2.5.3.4 Chicken breed

Chicken is one of the priority commodities targeted to transform the livestock sub-sector in Ethiopia. In the Ethiopian Livestock Master Plan, greater attention has been given to transform both traditional backyard family poultry and vastly expand specialized commercial-scale broiler and layers units to reduce the environmental impact of ruminant livestock. Poultry is increasing the share of chicken meat consumption believed to help close the total national meat production-consumption gap and achieve the CRGE targets of increasing the share of chicken meat consumption from the current 5% to 30% by 2030 by substituting red meat that comes from larger high green gas-emitting animals (LMS, 2015). Oromia National Regional State has only four chicken multiplication and distribution centers whose mandate is to receive day-old chicks, rear for 3 months, and distribute to farmers at about 2.5-3 months of age. However, the maximum annual capacity of each center is not greater than 72,000 making the overall annual distribution close to 300,000. As compared to the annual demand for chicken, the supply is quite far below the demand. Moreover, all the centers are not operating at full capacity. This resulted in the high price of poultry meat and egg in Oromia and Ethiopia at large. Chicken is said to be "a rich man food" in Ethiopia while it is considered as "poor man" globally. Indeed, our religion and cultural barriers and food habit are the major barriers to poultry development in Ethiopia. To

transform poultry production in Ethiopia in general and Oromia in particular, a new intervention strategy is required to enhance the capacities of existing chicken multiplication and distribution centers as well as establish new ones in a strategic location.

Challenges of the chicken production:

- Absence of private chicken multiplication and distribution centers in Oromia;
- Absence of appropriate breeds for various production systems
- Absence of chicken processing and packaging facilities
- The slow transition from traditional chicken food preparation to simple and easy to use system
- Socio-cultural, socio-economic and religious barriers that deter consumption of chicken food

Table 35 Additional multiplication centers, generators, and vehicle required by zone/clusters in the region

No	Zones/cluster	No. Required	Site	No. of Generator	Vehicle
1	Jimma	1	Jimma	1	1
2	East Shoa	1	Bulbula	1	1
3	Bale	1	Bule Hora	1	1
4	Borana				
5	West Guji				
6	East Guji				

Table 36 Annual potential of existing chicken multiplication and distribution centers in Oromia

No	Zone	Annual Capacity
1	North Shoa (Fiche)	208,000
2	East Wollega (Nekemt)	208,000
3	West Shoa (Ambo)	208,000
4	East Hararghe (Adelle)	208,000
	Total	832,000

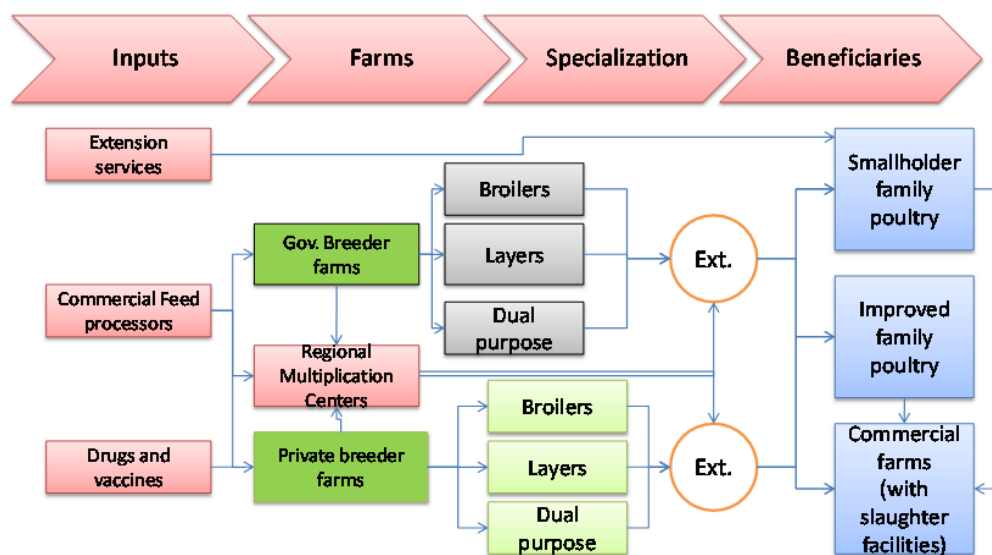


Figure 25 Conceptualized framework for chicken transformation

2.5.3.5 Dairy breed

A study conducted by Nathaniel et al (2014) indicated that Ethiopia has a global share of 2.86% in terms of livestock population, ranked 8th in the world that is almost equivalent to the livestock population in the entire USA that has a global share of 2.83% ranked 9th next to Ethiopia. However, production and productivity are very low and Ethiopia is not self-sufficient in milk. There is unmet demand for dairy products in urban and village town markets that lead the country to spend foreign currency every year to import dairy products; for instance in 2012, the country spent USD14.4 million. The country has also the export market potential for dairy products. In 2011 for instance, the country exported dairy products value USD 3.3 million, while imported dairy products value USD10.6 million for the same year. So far no work has been done by the public or by donor-supported projects to export dairy products. The plan has been to satisfy the domestic market to be self-sufficient in dairy products and still need long distance to travel to achieve this.

Per capita, milk consumption in Ethiopia decreased from 26 liters in the mid-1980s to 16 liters in 2001 and rose to 19 and 20 liters in 2009 and 2010, respectively. Reports on the per capita milk consumption are inconsistent across different kinds of literature in Ethiopia. In 2014, Nathnael et al. (2014) reported that per capita milk consumption was estimated to be 18.87 liters, which is extremely low in comparison to Africa and the world average. In 2016,

taking into account domestic milk produced and milk imported in various forms, Kefena et al. (2016) reported that per capita milk consumption reached 44 liters. In either case, there is no comprehensive report that indicates actual per capita milk consumption in Ethiopia. In either case, milk is one of the most expensive and rarely available food items not consumed by all people in Ethiopia.

Milk is also a cash crop for smallholder farmers. There are three milk production systems in Ethiopia, urban, peri-urban, and rural production systems. Considering all three, cow milk production was estimated at 869 million liters in 1992 and consistently increased to 1,100 million liters in 2000 and 3,300 million liters in 2011. This figure rose to more than 5 billion liters in recent years. These increases come largely from an increased number of cows not an increase in productivity. Milk production enhancement inputs and services are limited in Ethiopia (Reference required)

Related with the past dairy development projects and establishment ranches that multiply and distribute crossbred dairy heifers, Oromia is one of the centers of focus for dairy development in Ethiopia. For instance, the establishment of former Chilalo Agricultural Development Units in 1968 and various ranches such as Gobe, Abernosa, and Horro in various locations in the region played key roles in the multiplication and distribution of crossbred dairy heifers in the region. Moreover, Oromia was the epicenter and focus of Smallholder Dairy Development Projects (SDDP) that distribute crossbred dairy heifers to smallholder farmers in the country. Consequently, currently, more than 50% of the dairy farms and smallholder dairy producers that keep improved dairy are located in Oromia, particularly in the Addis Ababa milk shed. Thus, a proper dairy cattle transformation plan in Oromia implies a transformational change in the country at large.

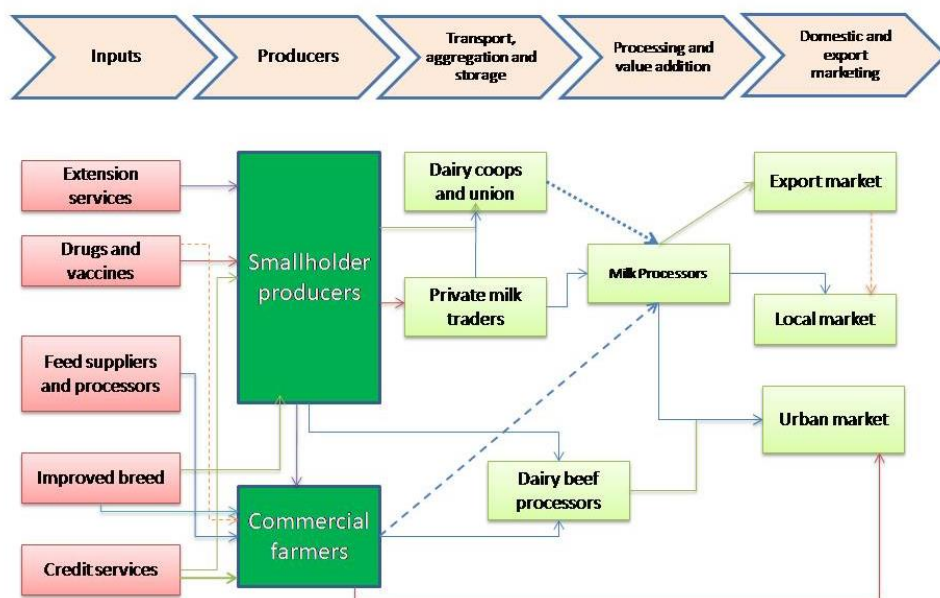


Figure 26 Conceptualized framework for dairy transformation

2.5.4 Other Critical Inputs for Livestock Transformation

2.5.4.1 Semen and Liquid Nitrogen Supply

Liquid nitrogen is one of the critical inputs required in artificial insemination and livestock genetic improvement programs. Currently, Oromia Regional State has 7 liquid nitrogen plants in various agro-ecologies with the capacity range of 150 to 280 liters (Table 37) of liquid nitrogen per day. However, most of the machines are not functioning at full capacity due to long year services and availability of spare parts as needed. One of the key challenges is that there is only one agent that supplies liquid nitrogen plants and spare parts for the country. In a nutshell, the quality and efficiency of liquid nitrogen plants and its supply process are some of the major challenges that the country is facing at the moment.

There is a big mismatch between the current supply and demand for liquid nitrogen. Therefore, additional liquid nitrogen plants are required to produce a sufficient amount of liquid N₂ at scale in Oromia (Table 38). The conceptualized framework for dairy transformation is indicated in Fig 27 while the major challenges and suggested interventions needed to transform the dairy subsector are indicated in Table 39.

Table 37 Location and status of Liquid nitrogen plants in various agro-ecologies

				Produced
--	--	--	--	----------

No	Zone	Status	Full Capacity (Liters/day)	(Liters/day)
1	North Shoa (Fiche)	Not working at full capacity	150	0
2	West Hararghe (Hirna)	Working	150	150
3	East Wollega (Nekemt)	Not working	150	0
4	West Arsi (Shashemane)	Working	180	120
5	East Wollega (Nekemt)	Not working	150	0
6	Jima	Working	280	260
7	Guji	New	150	0
	Daily capacity		1050	530
	Annual production capacity			1060

Table 38 Additional liquid nitrogen plants required by clusters in the region

No	Zones/cluster	No. Required	Site	No. of Generator	Vehicle	Liquid N2 container
1	West Shoa	1	Ambo	1	1	15
2	Southwest					15
3	Qellem Wollega	1	Guliso	1	1	10
4	West Wollega					10
5	Iluubabor	1	Bedele	1	1	10
6	Buno Bedele					10
7	East Hararghe	1	Haramaya	1	1	15
8	Bale	1	Robe	1	1	10
9	Borana	1	Yabello	1	1	10
10	West Guji					10
	Total					115
		6		6	6	

Table 39 Major Challenges and suggested interventions to transform the dairy subsector

Challenges	Intervention strategies
<ul style="list-style-type: none"> • Shortage of breed multiplication centers/Ranches • Shortage of improved breed • The high price of improved breed • Shortage of AI technicians • The inefficiency of AI service • Shortage of LN2 & semen • Lack of trained personnel in maintaining LN2 plant • Weak extension services in distributing improved breeds • Major milk sheds in Oromia is not well delineated 	<ul style="list-style-type: none"> • Establishing improved breed multiplication centers at strategic locations • Establishing community-based bull service stations in strategic locations • Increasing supply of improved local and exotic genotypes through private and community-based animal genetic improvement programs • Strengthening AI & mass synchronization service provisions • Use of sexed semen to increase the production of improved dairy heifers • Encouraging private investment in improved heifer production • Organizing and supporting youth and women in improved heifer production • Reducing calf mortality through intensive management • Capacity building for producers and technical staff • Strengthening herd performance recording and registration systems • Training new AI technicians • Training new farmers as community artificial inseminators • Improving the efficiency of AI technician through continuous refreshment training for AI technician and community AI technician • Encouraging private AI Service providers • Strengthening the existing semen and liquid nitrogen processing centers • Establishing new semen production and LN2 processing plant • Providing LN2 transporting vehicles (installed LN2 tanker on the truck) • Training experts on LN2 plant maintenance • Provision of AI kits and logistics (Motor bicycle, LN2 containers, consumable gloves, AI gun, etc.) • Strengthening the existing extension services in all aspects of breed supply • Strategic delineation of major milk sheds in Oromia region

2.5.4.2 Animal feeds

Feed, both in terms of quantity and quality, is one of the critically important livestock production inputs that decide the production and productivity of the livestock industry in Ethiopia. cursory reviews show that feed contributes about 70 percent of the cost of livestock production input. This indicates that the economic feasibility of animal agriculture is mainly depending on the quantity and quality of the available feeds. The feed is a point of convergence and a critical commodity for which all livestock species compete for, and it is a major pillar towards ensuring economic, social and environmental goals of livestock production (Makkar, 2016). Feed resources can be classified as natural pasture, crop

residues, improved forage, and agro-industrial by-products of which the first contributes the largest share (Alemayehu Mengistu et al., 2017).

Currently, with the rapid increase in human population and increasing demand for food, grazing lands are steadily shrinking by being converted to arable lands, and are restricted to areas that have little value. Productivity estimates also vary probably due to variation in time and ecological change, rainfall, soil type, and cropping intensity. Therefore, it is time to develop alternative options to ensure feed sufficiency for livestock subsector in Oromia.

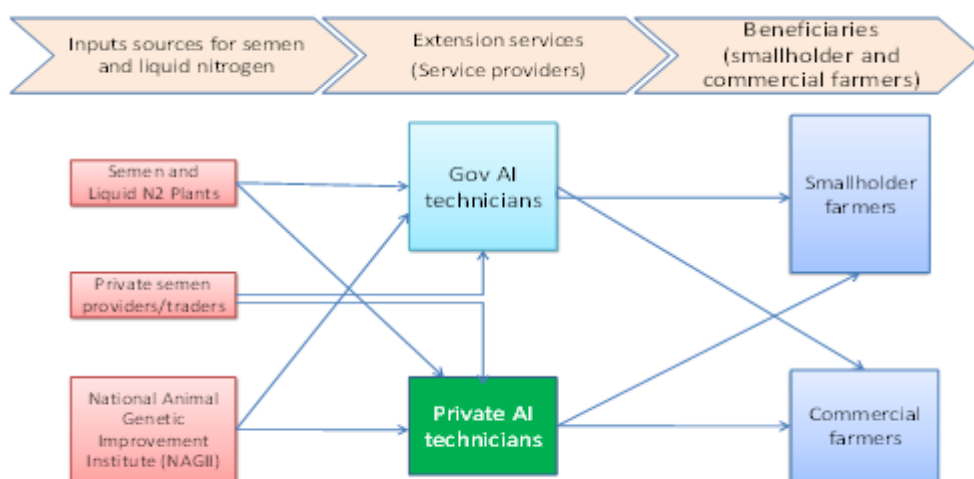


Figure 27 Conceptualized framework for dairy transformation

2.5.4.2.1 Current Status of the Commercial Feed Sub-Sector

Currently, a total of 81 enterprises are operating in the Ethiopian commercial feed sub-sector which are grouped under 5 major categories (Table 40). The dominant enterprises are feed processing plants owned by private companies and farmers unions engaged in the production of compound feed followed by importers or manufacturers of supplements (premixes, feed additives, etc.) and feed processing machinery/equipment and suppliers of forage seeds (FAO, 2018).

A total of 32 privately owned feed processing plants are currently operational in Ethiopia out of which 12 are located in the Oromia region with a contribution of 37 percent. Nationwide, there are a total of 28 farmers' unions engaged in commercial feed sector out of which six (6) are found in the Oromia region (FAO, 2018).

Table 40 Industry structure and regional distribution of enterprises engaged in the feed industry

Region	Number of enterprises in each category					Total Enterprises
	Feed processing plant	Farmers union	Supplement Importers/ manufacturers	Feed processing Machinery/ equipment	Forage seeds	
A. Ababa	10	1	10	4	1	26
Oromia	12	6	4	1	0	23
Amhara	4	7	0	0	0	11
SNNPRs	4	6	1	0	0	11
Tigray	2	8	0	0	0	10
Total	32	28	15	5	1	81

Source: FAO (2018)

There are about 12 enterprises engaged in the importation of supplements (premises, additives, and vitamins) while 3 enterprises are engaged in the manufacturing of supplements, making a total of 15 enterprises that engaged in the supply of feed supplements. In terms of the geographical distribution of enterprises that engaged in importation or manufacturing of supplements, most of them are in Addis Ababa (ten enterprises) followed by Oromia (four enterprises) and SNNPR (one enterprise) states.

Domestic production of feed supplements is currently limited to mineral supplements and effective microbes and delivery of premises depend on imports. Major categories of premises include premises for egg production (rearing premix, starter premix, and layer premix), broiler premix (broiler starter, broiler grower, and finisher) and ruminant premix which contains vitamins, trace element, minerals, and other additives. Currently, there are 5 enterprises engaged in importation or manufacturing feed processing machinery or equipment and they are all located in Addis Ababa. Commercial forage seed production is currently limited to one enterprise located in Addis Ababa (FAO, 2018).

2.5.4.2.2 Feed types

Improved forage seed system

Azage et al. (2010) indicated that several projects we're involved in forage seed and development in both crop-livestock, pastoral and agro-pastoral systems in Ethiopia. These include the Forth National Livestock Development Project (FNLDP), The Smallholder Dairy Development Project (SDDP), and the National Livestock Development Project (NLDP). Activities in these projects included improvements in natural pastures, crop residue

use feed conservation practices, and the introduction of improved forages using different strategies.

The introduction of improved forage was facilitated through these projects used government nurseries for multiplication and seed production. However, the success of these projects in developing a market-oriented livestock production system that responds to the adoption of feed technologies remains to be determined. Moreover, the private sector is not attracted to improved forage seed production due to underdeveloped marketing systems.

Cursory reviews, however, indicate that driven by a steady reduction in grazing lands and increased commercialization of livestock subsector and recurrent drought, there observed an increasing trend in a request for improved forage seeds, production, and utilization improved forage crops (Figure 28). Moreover, though data is not available, the involvement of the private sector is on the rise.



Figure 28 Improved forage seeds production

Compound feeds

Compound feed production and intensification of animal agriculture are key processes that ought to go hand-in-hand towards transforming animal agriculture. Although market-led economy and commercialization of animal agriculture have opened new avenues to achieve this Goal, an increase in demand for compound feeds has not yet reached the desired level. Thus, most of the feed processing plants are operating below capacity.

Imports of premixes, minerals, and vitamins

Among various inputs, premixes, minerals, and vitamins are critical in supporting the desired level of animal productivity. However, they are currently imported from abroad using hard currency and their prices are very high.

Key challenges in the commercial feed industry

The commercial feed sector in Ethiopia is currently facing several challenges. Key challenges are discussed below:

1. The high price of feed ingredients and compound feeds

Seasonality, shortage, and very high prices of feed ingredients are key challenges for sustainable and affordable delivery of compound feeds. During the last five years, prices of feed ingredients and compound feeds have increased by an average of 52 and 82 percent, respectively, leading to low demand for compound feeds. This situation has even led to the closing of some of the commercial farms (dairy and beef), essentially due to low return on the investment (Seyoum *et al.*, 2018).

2. Un-fair taxation policy on feed ingredients and compound feeds

Commercial feed sub-sector and livestock production, in general, has long been suffering from unfair taxation. On ruminant feeds, 15 percent value-added tax (VAT) is charged on feed ingredients and compound feeds leading to double taxation for feed ingredients and formula/compound feeds. On poultry feeds, since most of the feed supplements especially the premixes are imported from abroad, the government has taken positive measures recently in removing VAT on poultry feed ingredients and formula feeds.

3. Feed safety and quality

Ensuring feed safety and quality is recently one of the key challenges in the commercial feed sector. It is also of high importance for the livestock producers and consumers of animal source foods. Among feed safety issues, the recent detection of high aflatoxin levels in oilseed cakes and compound feeds has raised serious concerns in ensuring the desired quality and safety of feed along the food value chain. Additionally, the need for maintaining the desired level of nutritional and quality standards of feed ingredients and compound feeds is also a challenge for commercial feed producers, the regulatory body, and livestock producers. Lack of confidence of livestock owners on the quality of compound feed is also one of the reasons for not using such feeds.

4. Research and extension support for the commercial feed sector

Technical services (research and extension) in promoting the commercial feed sector (use of alternative feeds for compound feeds; use of innovative approaches in import substitution via local production of feed supplements; research, extension, and infrastructure development support in forage seed and feed processing machinery; on-farm testing and promotion of compound feeds, and technical support for feed safety and quality regulation) are very weak or non-existent.

5. Feed quality and safety analytical service

Most private and farmers union feed processing plants are currently facing serious challenges in analytical services mainly because of high cost and inadequate service delivery. There are no well-equipped and accredited labs to the satisfaction of the commercial feed sector. To date, only one commercial lab that undertakes a modest number of analyses is available (Seyoum et al., 2018). Labs in the public institutions have limitations in capacity and mode of service delivery to support the commercial feed sector.

In nutshell, feed scarcity in terms of both quantity and quality has remained to be the main limiting factor hampering the productivity of the Ethiopian livestock sector. The provision of adequate feed supply is essential to ensure economically viable and environmentally friendly livestock production. This requires complementing the traditionally available low-quality feed resources with other alternative feed resources and improved utilization. Various technologies in feed resources have been generated during the last five decades of research. However, the generated technologies largely remained untapped. Possible reasons for low adoption of improved feed technologies include lack of adequate demonstrations on comparative advantages of the technologies, lack of inputs such as forage seeds, the overall low attention given to feed development by the extension service, and the consequent low public awareness. Figure 29 shows the conceptualized framework for forage seed transformation while Table 41 shows the major challenges and strategies for intervention.

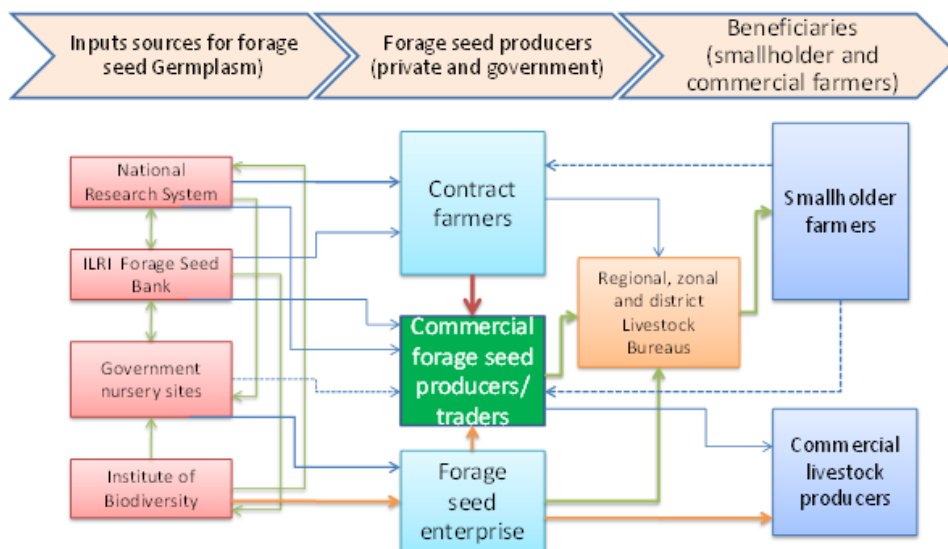


Figure 29 Conceptualized framework for forage seed transformation

Table 41 Major challenges and intervention strategies in animal feed

Challenges	Intervention strategies
<ul style="list-style-type: none"> • Less interest by the private sector in the development of improved forage seed • No land-use policy or if available, lack of commitment to implement approved policies • No or few contract farmers engaged in supplying improved forage seed to forage, seed collectors, • Quantities and qualities of basic seed generated by research centers are insufficient to meet rising demand • The poor linkage between research institutes and private investors engaged in improved forage seed multiplication • No land is dedicated for the multiplication and distribution of improved forage seeds • Imbalance of land use for crop and livestock production • Shortage of animal feed • Poor quality & safety of feed 	<ul style="list-style-type: none"> • Allocating adequate land and subsidize private sector interested in improved forage seed investment • Law enforcement on appropriate land use for both foods forage crops/grazing land • Establishing contract farming strategy to farmers interested in the production of improved forage seeds • Improving the capacities of research centers involved in basic seed production • Creating a close collaborative partnership between federal and regional research institutions and private improved forage seed multipliers • Allocating adequate land for the multiplication and distribution of improved forage seeds • Enforcing land use policy • Establishing feed processing plants at strategic locations • Strengthening the existing feed processing plants • Organizing and capacitating youth and women as animal feed suppliers • Establishing primary cooperatives on feed supply & strengthening the existing primary dairy cooperatives to supply feeds to their members • Establishing improved forage seed producers cooperatives • Enhancing improved forage production at farmers level • Enhancing research and extension system on forage development • Improving the utilization of crop residues through different treatment options

<ul style="list-style-type: none"> • Adulteration of feeds • Lack of feed quality control • High price feed • Shortage of forage seeds • Inaccessibility • Seasonal availability of fodders • Un-fair taxation on animal feeds • Under the capacity operation of feed processing plants • Degradation of the pasture lands • Low digestibility and low protein content of crop residues • Limited introduction of forage crops due to crop dominated farming 	<ul style="list-style-type: none"> • Capacity development (training, sharing best practices) on forage production, conservation, and utilization • Enforcing traditional community rules that provide an opportunity in the management of the grazing and other land resources. • Promoting practices to zero-grazings and controlled grazing and encourage people to see their animals in economic terms (market value) rather than social prestige • Improving pasture productivity, management, and utilization through pasture rehabilitation using promising forages • Promoting different feed conservation & utilization technologies (hay Bailer, feed choppers, feed Moyers, molders, etc.) • Updating feed quality and safety standards • Deployment of animal feeds standards and labeling, • Enforcing feed quality control system • Developing low-cost feeding troughs and promoting their use to decrease feed wastage. • Map out areas along the main rivers that are suitable for the production of improved forage crops, and support communities in planting and managing upgraded fodder production (alfalfa, Sudan grass, Rhodes grass, etc.).
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2.5.4.3 Drugs and vaccines

In general, animal health inputs and services in Ethiopia include:

- Preventive services and vaccinations
- Education/extension including public health education
- Regulatory services to control the occurrence of new diseases
- Clinical services which include diagnosis and treatment of sick animals
- Supply of livestock drugs
- Meat inspection services at abattoirs.
- Public health concerning zoonotic and food-borne disease control, hygiene, food, etc.

In Ethiopia, the government is the major animal health service provider. There is also limited involvement of the private sector and NGOs in the provision of drugs and animal health services. A few years back, there have been attempts to promote privatized veterinary services, but has not effectively materialized. Due to the nature and variability of the livestock production systems in Ethiopia, some animal health services have public good characteristics. The widespread nature of killer diseases, limitations inaccessibility, cross-border animal movement, and drug supplies, lack of adequate infrastructure, and the presence of incomplete markets contribute to market failure in the provision of animal health services. This situation is not different from many African countries (deHaan, and Bekure,

1991; Smith, 2001). In Ethiopia, public sector involvement and support has often been associated with disease surveillance, eradication campaigns, vaccine production, drug and vaccine quality control, quarantine, and food hygiene and inspection measures. Eradication and control programs of killer diseases call for national and international efforts, and surveillance and control measures often require national coverage including remote and inaccessible areas. However, the public sector has been limited by a lack of adequate resources to deliver the services. Shortage of manpower (quantity and quality), lack of transport, availability of drugs and other supplies, poor information, communication and reporting systems, and limited finances are some of the reasons frequently raised by the professionals in the field. The major complaint and dissatisfaction of livestock keepers is the unavailability of professionals, lack of communication, unavailability or shortage of drugs, poor diagnostics capability, and lack of confidence in the quality of the service Table 42. Shows major challenges and intervention strategies of drugs and vaccines.

Public or private service provisions could include diagnostic services, vaccination, vector control, and treatment. However, private sector animal health service provision is limited in Ethiopia due to several factors. These include lack of capital, the willingness of livestock keepers to pay, affordability of drugs and services, poor accessibility, high transportation costs, alternative cheap supplies of drugs from illegal markets, NGO and public sector provision of drugs and services at subsidized rates, and isolated herds.

Other public health services such as zoonotic and food-borne disease control, hygiene, food, and feed safety, and environmental control are often very weak and at best are limited to major urban centers. Farmers tend not to report risk factors on the farm due to deterrent costs of treatments or scare of some serious zoonotic diseases such as brucellosis or tuberculosis that may result in the slaughtering of animals without compensation. Furthermore, given the poor communication and transport system, and lack of appreciation of timely information, reporting could be costly, ineffective, and inadequate. In urban areas, meat inspection is undertaken in abattoirs and is the responsibility of the Ministry of Agriculture and Rural Development. However, the administrative responsibility is Public Health Department or Municipality. In Ethiopia, it is also common to slaughter for home-consumption, without undergoing any inspection.

In commercial farming such as large dairy farms and intensive poultry production systems, extension and (veterinary) public health services are more likely to be delivered privately without extensive public intervention. Smallholder dairy producers often form cooperatives

and often provide farm inputs and animal health services. For example, the Ada'a dairy

Challenges	Intervention strategies
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cooperative in Debre Zeit provides animal health and milk quality control services.

Table 42 Major challenges and intervention strategies of drug and vaccines

<ul style="list-style-type: none"> • Inadequacy of drugs • Inconsistent supply of drugs • The high price of drugs • Inaccessibility & Unavailability of drugs • Poor quality • Illegal trade/smuggling 	<ul style="list-style-type: none"> • Improving veterinary drugs & supplies in types, quality, and quantity • Encouraging & supporting the establishment of private animal vet drugs • Allocating adequate funds for drugs and supplies • Strengthening, capacitating and regulating revolving funds to enhance the service delivery system • Establishing veterinary clinics & health posts in strategic locations • Equipping the existing vet. clinics & health posts with critical equipment and kits for dairy herd health management • Improving dairy herd health management through capacitating animal health professionals • Improving vet. extension services • Providing regular calendar based vaccine & vaccination service for major diseases • Improving dairy farm hygiene standard & bio-security through skill training of farmers and extension agents • Strengthening and enhancing, monitoring, surveillance and laboratory diagnosis of major diseases of livestock • Enhancing dairy herd health services through engaging major dairy processors • Providing logistics and transportation services (Motor Bicycles, fuel, perdiem, etc.) • Strengthening the regulatory system to control illegal trade
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CHAPTER III: IRRIGATION

3.1 INTRODUCTION

Like many other regions in Ethiopia, agriculture in Oromia is mainly rainfed. Implicitly, the rainfed system is the major food crop producer which is the sector highly threatened by unpredictable rainfall patterns and aggravated by the lack of solid mitigation measures. This means also agriculture in the region in a shortfall to sustainably feed the burgeoning population and satisfy the raw material demands by emerging agro-industries.

Cognizant with this, the regional government is striving to expand irrigation with its resources as well as through externally funded projects such as Agricultural Growth Program (AGP). However, due to competing investment needs from the other sectors and limited revenue, the resource allocated to the sector is inadequate to address these challenges. Cost recovery from the investment is yet to be developed and built into the system. Therefore, the meager public resources can be invested in a few irrigation infrastructures taking decades to make irrigated agriculture operational. Besides, most of the schemes that are already commissioned are sub-optimally functioning due to varying technical and socio-economic constraints. Therefore, the envisaged benefits are not fully realized.

Expansion of irrigated agriculture and agro-industrial developments are complementary. Given the high level of investment needs, irrigation is more profitable if focused on high-value crops such as fruits and vegetables. However, by their very nature, these crops are perishable and need to be either consumed fresh or preserved/processed. The bulky nature of the crops and the care they need pose a daunting challenge to their transportation. Implicitly while supplying year-round raw material to agro-industries, the irrigation sector can be benefited from better access to the market. As a corollary to this, farmers may also get better advisory services from the agro-processing sector such as through contract farming or out-growers' models. Such complementarity, if well managed, may accelerate also the expansion of irrigated agriculture, which is currently low in contrast to the potential of the region.

The question is how we can improve the diversity, quantity, and quality of irrigation commodities to meet the standard of agro-industries and enhance the two sectors complementarity. Irrigation also ensures the year-round supply of agricultural products

throughout the year resulting in reduced food demand-supply gaps and food grain import, saving scarce foreign currency.

Among the areas that need immediate intervention might be closing yield gaps on exiting irrigation schemes and optimizing benefits from the products. Increasing water use efficiency, enhancing operation and maintenance systems, improving market linkages, institutional services delivery, and implementation of a value chain approach is among the areas of interventions that might lead to a better performance of the irrigation systems. As part of the transition between the short and long term planning horizon, efforts to expand irrigation should take into account the socio-political equity and environmental sustainability.

Below are clusters of tasks to be undertaken to address some of the outstanding issues and contribute to the regional irrigation transformation effort:

3.2 EXPLORING THE RESOURCES BASE AND DEVELOPMENT PRIORITIES

3.2.1 Overall understanding of the planning process

In undertaking irrigation development planning, understanding the overall development trajectory of the government, the potential of the resources base, public demand, regional, and national political ambition are among the starting points. Accordingly, the following key points are proposed to guide the team in i) understanding the resources base; ii) exploring regional and national demand; iii) National and Regional governments policy directions; iv) propose the short term and long-term development priorities and directions. While the short term (~3 years) can be thorough and built on existing initiatives, the medium (5 years) and long-term (10 years) plans and strategies will be laid out as road maps. A transition period overlapping between short- and long-term plans will be a critical planning horizon to synthesize lessons from the subsequent segments of the planning and implementation efforts, including in terms of expectation and resources base in the region and the irrigation development pathways.

3.2.2 Tasks for situation analysis (Understanding the existing internal and external environment)

- Review Government (Federal and Regional) policy directions, priorities, strategic plans including food, nutritional and job security and regional development goals
- Critically review regional land and water resources base with its spatial distribution (by basin, zone and agroecology/development zone as appropriate)
- Explore, in-depth, the current level of irrigation development (by scale, technology type by spatial distribution)?
- Review ongoing and planned irrigation projects for the next three years and explicitly indicate ongoing projects that are likely to be completed in this planning year and these that potentially might rollover?
- Review the overall status of the irrigation system performance (e.g. yield gaps, water allocation, water productivity, institutional, general operation, and maintenance)?
- Critically assess ecologically threatened and economically hot and bright spot areas in the region. This may involve areas live rift valley where irrigation intensity is high and environmental degradation and conflict over water use are major concerns and areas vulnerable to drought.
- Sketch out the raw material input demand from the planned and existing agro-industry in the region/nationally and assess the level of raw material input requirements
- Identify critical issues in value chain development for commodities related to irrigation
- Summarize lessons and implementation capacity (financial, human and physical resources and based on self-evaluation during GTP I and II) and what worked well and what did not during GTP I and GTP II and what is envisaged
- Identify and prioritize prevailing and emerging threats

3.3 PRIORITIZING AND PLANNING

3.3.1 Critical indicators for priority setting

Given the background and situation analysis under the section above evaluate the priority of proposed intervention across the planning horizon in terms of i) overall economic benefit; ii)

Job/employment generation; iii) mitigating vulnerability to climate change and system shocks; iv) socio-political equity; v) resources demand implementation; vi) ecosystem sensitivity. Through consultation with regional key stakeholders, the weightage for each indicator can be set.

3.3.2 Short-term priorities

In filtering the immediate and short-term priority one may need to look at the work at hand and these that will potentially be rolled over to next year; short- and long-term plans of the regional and federal government. To understand these and prioritize key tasks under this planning horizon the following points are proposed as a guiding list and must be confirmed by experts and decision-makers in the regional state.

The interventions to enhance the delivery of irrigation infrastructure and increase the efficiency of its utilization to achieve the desired goal of increased production, economic benefits, and sustainable agroecosystem can be viewed at pre-commissioning, which involves all the actions that are needed to have the infrastructure in place, and the post-commissioning, which is related to all the activities that are necessary to ensure the proper functioning of the system and maximize the benefits from the system.

Pre-commissioning

- Develop and prioritize implementation for ongoing/ pending irrigation projects
- Identify priorities for hotspot and bright spots (development zones) -areas that must be prioritized (because of the political decision or/and can be achieved with simple/ smaller investment/ those that addresses inequalities/ vulnerabilities, those that can be a model to establish a standard of operation and investment in small scale irrigation) and those that can benefit a greater number of farmers?
- Provide strategic direction as to how the private sector participate in the irrigation water supply (ground, micro dams, river diversions- involving production and delivery) and other service provisions
- Propose incentive mechanisms for the private sectors to engage and explore other countries experiences in this regard
- Given the national initiatives to engage youth in irrigation development, adopt and contextualize the national level programs and direction to the regional situations
- Identify accountability gaps across levels and the incentive mechanisms to enable accountability
- Identify and develop a system to address the priority capacity development needs

- Post-commissioning – the focus in the short term is to revitalize and the benefits from existing systems
- Identify critical issues impeding full-scale functioning of schemes and devise a systematic approach to address them
- Propose a mechanism to address gaps in value chain nodes (service provision, including tailored extension; input supply, on-farm production, processing and marketing, and role of youth)?
- Suggest mechanisms to strike balances of food, nutritional security and agroindustry targeted raw material production
- Identify modality to enable/initiate cost recovery and water pricing?
- Suggest strategic directions and priorities for out-growers/contract farming modality mainly concerning agro-industry
- Define capacity building/motivation needs across scale (DA, SMS? managers)

3.3.3 Medium and long term

- Identify transition period activities between immediate and short term and the medium and long term planning horizons
- High-level resources assessment (including mapping of groundwater)
- Identify and study new irrigation schemes
- Develop a mechanism and incentive to promote pressurized irrigation
- Identify a mechanism for private sector involvement in groundwater development and marketing system (youth can be organized in areas where there are resources)

3.4 POLICY GAPS AND IMPLEMENTATION STRATEGIES

- How the production in irrigated agriculture is effectively linked to market
- Given the land policy, how private companies can invest in irrigated agriculture
- Multiple-use of water
- Cost recovery and targeted subsidy

CHAPTER IV: AGRICULTURAL MECHANIZATION STATUS, CHALLENGES, OPPORTUNITIES AND INTERVENTIONS

4.1 INTRODUCTION

Geographically, Oromia is the largest region in Ethiopia with a total land size of 286,612 km². According to the 2011 census report, the population is estimated to be 35 million with an average growth rate of 2.4% per annual. As in other developing regions, the regional economy depends predominantly on agriculture and about 82% of the populations are rural dwellers while the remaining 18% is in urban.

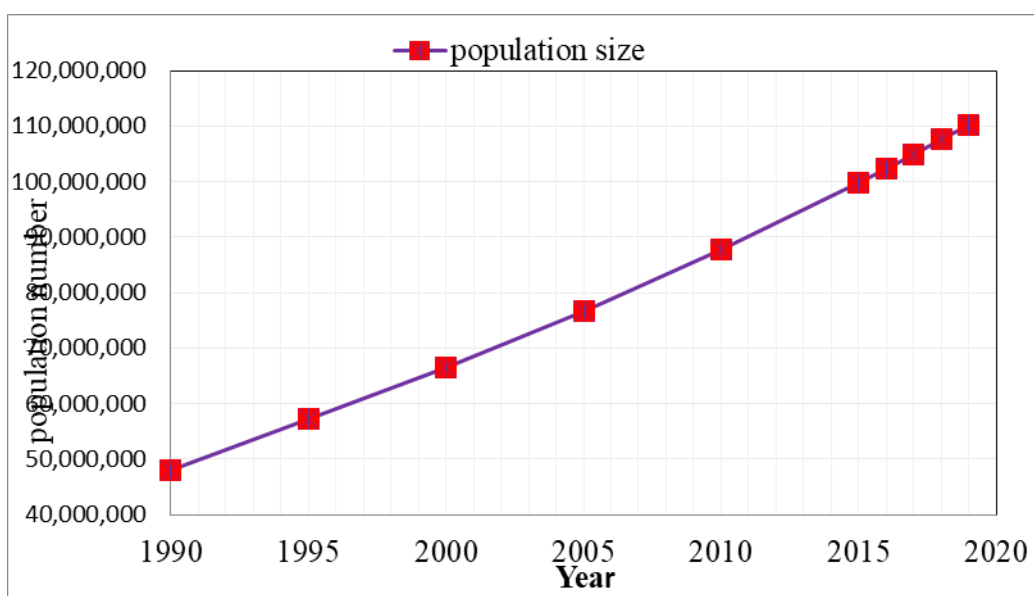


Figure 30 National Population growth (World Bank, 2019)

The State of Oromia sprawls over the largest part of the country and at present consists of 20 administrative zones and 290 districts and 6,447 kebeles as shown in Table 43. Of the 20 zones, Bale and Borena account for 45.7% of the State's total area but only about 14% of the state's population. The Council of the State of Oromia is the highest body of its administration.

Table 43 Number of existing zones, districts & kebeles in the region

Zones	Districts	Kebeles
20	290	6,447

Agriculture is the largest sector and backbone of the economy in Oromia as well as in our country. The region's economy predominantly depends on agriculture. The region has also great potential to agriculture because of its vast area of fertile land, diverse climate, generally adequate rainfall, and large labor pool. Despite this potential, however, Oromia as well as national agriculture for many decades remained undeveloped. This is due to quite a lot of factors. The largest shares were the low level of mechanization inputs and the low level of technologies. The shortage of farm power has been identified as one of the limiting factors in increasing crop production (FAO, 2001 & 2006). The greatest source of farm power was mainly human and animal since dated back to 2000 BC (FAO, 2007).

Oromia agriculture which had been driven by traditional farming systems is characterized by low productivity. This has made it difficult to attain food self-sufficiency in the country (Azertegn & Kassa, 2008). Therefore, introducing agricultural mechanization in the region is crucial to transform the existing agriculture. The improvement of agriculture is then paramount in poverty reduction as an action that increases agricultural production that will ensure the availability of agro-output to supply raw material to agro-industry, access to food, improve farm income and thus reduce poverty.

4.1.1 Why mechanization: fact review

According to the United Nations projection, in 2040, the world population will be over 9 billion. In the coming two decades, 50% more food, 45% more energy, and 30% more water will be needed in the world. With the same circumstance, in Ethiopia, as well as Oromia the population is increasing at an alarming rate. According to World Bank (2012), by the year 2030, the population will be 117 million. The majority of the population is exiting the Oromia region. In the existing situation, the region is characterized by a high growth rate of population, low productivity of food crops due to low modernization of agriculture, and high food scarcity. Hence, mechanization is a must to produce more and feed the upcoming population.

4.1.1.1 Increase labor productivity

Traditional farming resulted in low labor productivity. An increase in labor productivity means that there is a release of labor for other sectors of the economy. The same labor force could cover a large area. Here the connotation of the long impact of mechanization is, to decrease in agricultural labor force & to decrease the labor force per hectare (relative sense). In the case of mechanization, small labors can do many jobs. Hence, the cost of production

decreases. When excess labor force would be there created as a result of mechanization, industry or other labor force seeking sectors would get sufficient manpower.

4.1.1.2 Increase land productivity

Mechanization is a complementary input. This is to mean producing more from the existing land. Mechanization technology (machinery) increases productivity by enabling the farming community to produce a good quality of work, increase the production of crops output by improving soil water infiltration and air movement in the soil, timeliness of operation, good cropping intensity and faster turnaround, reduction of crop losses, & increase in the cultivated area.

4.1.1.3 Rural exodus, the rising cost of labors and drought animals

The good progress of 10 years economic development plan which started in late 1990 allowed Oromia to achieve promising economic growth, which triggered rapid industrial development and urbanization. As a result, the labor demand in the industries and associated sectors abruptly increased resulting in an inflow of rural laborers into the urban. The outflow of the rural labor forces naturally brought a reduction in quality as well as a number of rural labor forces. Seeking better jobs, facilities, and infrastructure cause youth to flow to urban which has been resulted in a declining rural population. Ultimately, wages for rural laborers were raised. Therefore, during the busy farming seasons, even with higher wages, manpower for farming was difficult to secure. On top of this, rising service costs and purchasing price of oxen for the farming community in an existing situation enforce us to seek mechanization. The increasing cost of draught animal feed and forage, shelter, and cowboy.

4.1.1.4 Reduces drudgery of the rural traditional Farming

Farming community had been working in hard, and harsh, conditions. They produce a crop produced by such a condition to feed themselves and supply to the urban population. Young generations do not want to engage with boring traditional farming rather prefer to migrate to overseas & inflow to urban as aforementioned. Mechanization modernizes existing farming, makes the life of rural communities pleasant and attractive. This makes the region demanding mechanization.

4.1.1.5 General Factors that affect agriculture in the region

These are the things that hinder the success of Ethiopian agriculture, particularly in the Oromia region. They constitute a bottleneck to it are as follows: a rapid decline in soil

productivity under intensive use; accelerated soil wastage through erosion (wind & water) and desertification; absence of local sources of soil amendments or nutrients & soil acidity; unbalance between crop water requirement and natural precipitation needing irrigation facilities; large numbers of preferred food crops as a result of zonal preferences; absence of sustained policies and basic adaptive research for the improvement of local crops; livestock and processes; declining work-force on the farm due to drift of labor from rural to urban areas, disease, old age, and absentee farmers; long trend usage of traditional farming systems and less attention to modern farming systems; shortage of skilled labor who can operate and maintain farm machinery; lack of local fabrication and maintenance facilities for appropriate capacity energy-saving production, processing, and handling equipment.

In addition to the above facts, inadequate stock of scientific knowledge of soils, crops, livestock, the environment, food preservation, conservation, and combination; heavy burden of diseases, pest, flood during heavy rain and drought; preponderance of cultural and religious diversity are also factors that affect agriculture.

4.1.2 Vision

- To see transformed, modernized, prosperous, and food self-sufficient Oromia region in Ethiopia through farm mechanization.

4.1.3 Mission

- using mechanization technology transforming the exiting agriculture to get better production per unit hectare and change the livelihood of our farming community,
- To produce sufficient production for household consumption, and agricultural product processing industries.
- To release the Oromia region's farmers from heavy and tiresome traditional farming practices through the introduction and promotion of modern farming systems.

4.1.4 Objective

- To access the existing conditions of the Oromia region small holder's agriculture.
- To assess farm mechanization status of small and medium-size farm holders to transform traditional farming systems of the region to modern & mechanized farming systems to increase production and productivity of agriculture.

- To change the livelihood of our farmers through the introduction of appropriate mechanization technology.
- To recommend appropriate mechanization policy direction to national & regional policymakers and suggest short medium, and long term cost-effective mechanization options for the region to implement mechanization.

4.2 CURRENT STATUS OF AGRICULTURAL MECHANIZATION IN OROMIA REGION

4.2.1 Status of Crop Production

The main crops in the region include maize, teff, wheat, barley, peas, bean, and various types of oilseeds. Among these crops, cereals take the largest share in the region. Of the existing cereals crops which have been producing include maize, wheat, Tef, and sorghum and barely can be ordered in their highest to lowest production rank in the region. Maize is a specialized cereal crop in western (Wellaga, & Illubabor) and eastern (Hararge) and central (Arsi, East Shoa) parts of Oromia. Wheat and Barely are socialized crops in Arsi & Bale parts of Oromia. Tef is a prominent crop in the most central parts of Oromia. Next to cereals, root crops like potatoes are widely produced crops in the region. Coffee and chat are the main cash (commercial) crops which are widely produced in the western and eastern Oromia. Oromia accounts for 51.2% of the crop production, 45.1% of the area under temporary crops.

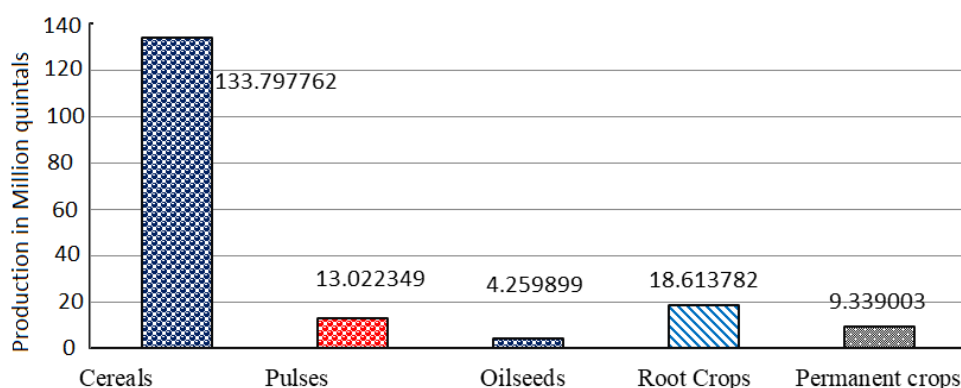


Figure 31 Oromia Region 2017/18 crop production

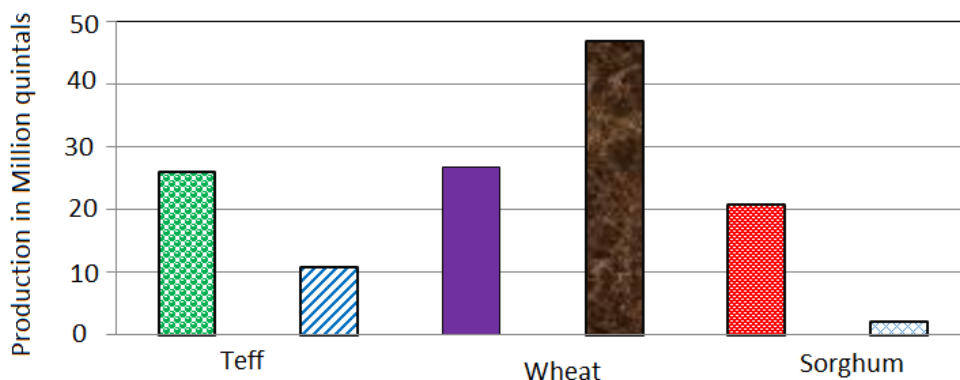


Figure 32 Cereal crop production in the Oromia region. source: CSA, 2017/18

Despite the big and promising potential, agriculture in Oromia is characterized by very low productivity and the average grain yield for main cereal crops is less than 1 ton per hectare. Mostly farm power is draft oxen and human muscle in the land preparation, planting, and post-harvest operations, for main cereal crops, which is the main cause of low productivity.

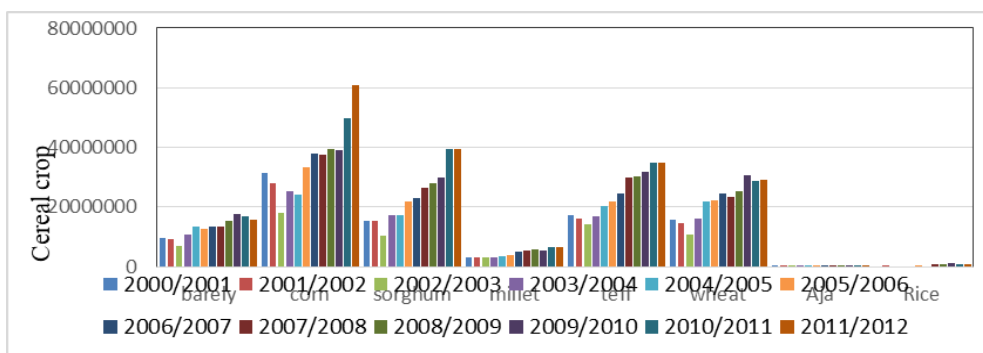


Figure 33 Ten years of cereal crops production data

Food shortage in the region as well as in the country is increasing. The low productivity in agricultural production has made it difficult to attain food self-sufficiency for the country. As some data shows (Figures 34, 35 & 36) the county had been importing cereals for both household consumption and food industries from overseas countries. However, the region has the potential of being producing cereal crops. To provide the solution to the low productivity of agriculture is to improve the traditional farming practices (Azerfegn and kassa, 2008).

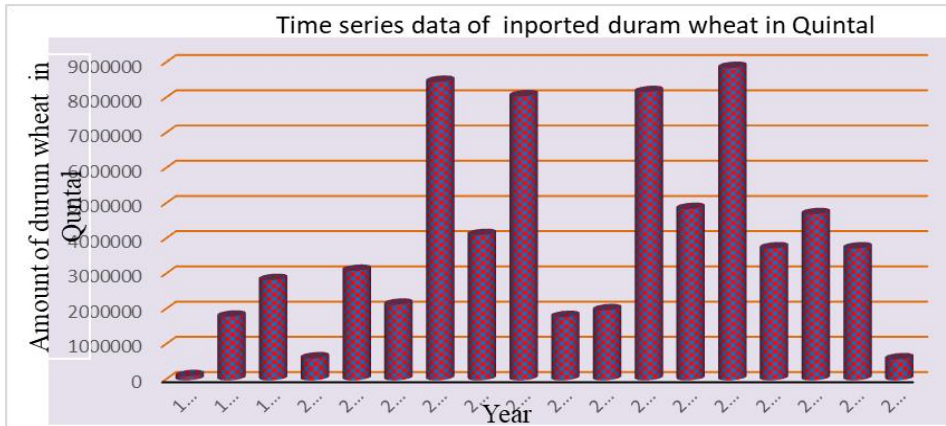


Figure 34 Fifteen years' data of imported wheat

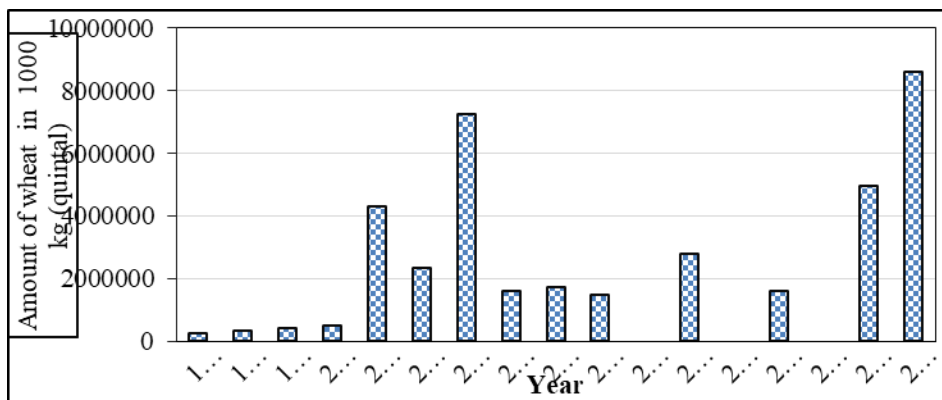


Figure 35 Imported common wheat

4.2.2 National Agricultural imports projected to keep growing

According to official Ethiopian trade statistics, imports of agricultural products have grown from just over \$1 billion in 2010 to nearly \$1.8 billion in 2015. Similarly, over this same period, imports by volume increased from 1.9 million to 3 million metric tons.

As the country's economy continues to steam ahead and as the population grows from its current level of nearly 100 million inhabitants, imports of agricultural products are expected to continue growing as demand outpaces local production capacity. This anticipated growth, however, will be moderated somewhat due to anticipated increases in local agricultural production and the private sectors' difficulty in accessing sufficient amounts of foreign exchange.

The country's foreign exchange reserves were recently estimated at less than two months of import coverage, below the IMF recommended a minimum of three months. Therefore, if

Ethiopia is to meet the expected increase in demand for certain agricultural imports, it will need to, among other things, increase its exports (e.g. agriculture and floriculture products, textiles and apparel, leather and leather products, and electricity, etc.).

4.2.3. Agricultural imports growing, especially wheat, sugar, and palm oil:

Similar to the economic development trends of other countries, as Ethiopian consumers' incomes have grown, the demand for cooking oil, sugar, livestock protein (e.g. meat, milk, and eggs), wheat-based products (e.g. pasta, cookies, and biscuits), and convenience foods are gradually increasing.

Of these products, palm oil, sugar, and sweeteners, and wheat were the three largest agriculture imports by value in 2015. From 2010-2015, imports of palm oil doubled to nearly \$425 million, wheat imports (Figure 36) climbed 20 percent to a little more than \$360 million, while imports of sugar and sweeteners grew 65 percent to almost \$180 million. It should be noted that the Government of Ethiopia (GoE) intends to increase local production of wheat and sugar to reduce and eventually eliminate imports of these products. However, given local demand requirements and existing capacity constraints, post expects imports of these (and other) products to continue for the foreseeable future.

Besides, imports of rice, prepared foods, distilled spirits, pasta, and vegetable oil, among others showed significant growth as consumers' diets are gradually beginning to change. For example, over the six years from 2010-15, rice imports increased six-fold to almost \$158 million, prepared food imports quadrupled to \$126 million, distilled spirit imports doubled to almost \$20 million, pasta imports increased sevenfold to \$38 million.

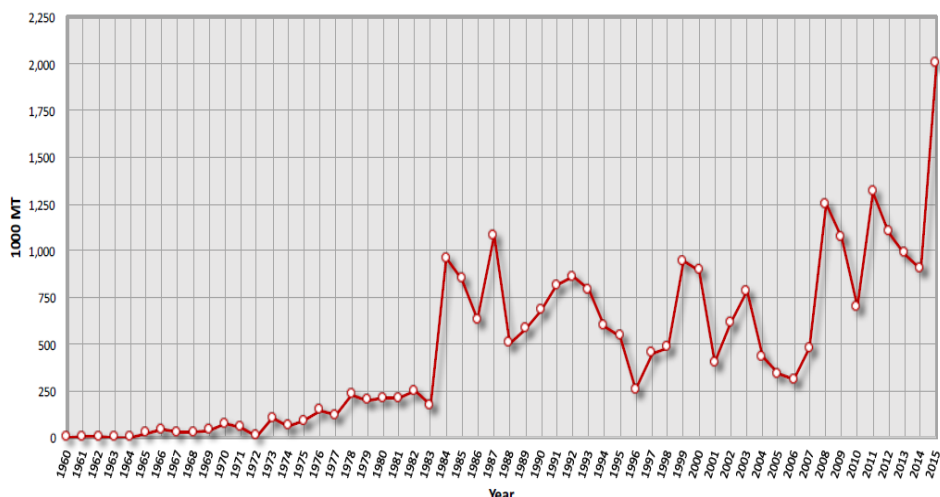


Figure 36 Total Imported wheat data from 1960-2015

Source: Data United States Department of Agriculture

4.2.4 Status of Natural Resource: land, water, and energy

There are 28,661,200 million hectares of land in Oromia. 18, 8 million hectares of which is suitable for agriculture. The total cultivable landmass is 8.42%, the land occupied by forest is 8.5, land occupied by grass and the man-made forest is 59.7% and the land occupied by marsh, water, stony, urban, and others is 2.9%. 13.6 million hectares of which is currently under production. According to Ethiopian CSA & World Bank (2013/14) agriculture contributes about 40.2% for the country's gross domestic product (GDP) and it also accounts for 80% of total employment. Crop agriculture accounts for about 29% of GDP followed by livestock for 12% and the forest at 4% of which Oromia took a lion share.

The crater lakes Green Lake (true to its name), are found in this region. They have immense potential for recreation and fishery development.

Oromia region has abundant water resource potential with about 58 billion m³. The highest rainfall (2400mm/annum) prevailing in the country is found in Oromiya. The region has 8 major river basins, about 68 major rivers and 688 tributaries that drain into the Indian Ocean, Blue Nile, and Inland drainage systems/lakes region. Awash, Wabe-Shebele, Genale, Gibe, Baro, Dedessa, Guder, etc. are major rivers in the region. River Awash, which is the longest river inside Ethiopia, is a source of great agro-industrial, hydroelectric power, and irrigation.

Table 44 Major river basins area, their discharge and irrigation potentials

Rivers	Basin area in Km ²	Mean annual volume of 10 ⁹ m ³	Potential gross irrigable area (ha)	Groundwater potential x 10 ⁹ m ³
Awash	112696	4.6	205400	0.14
Abay (Blue Nile)	204000	52.62	1001550	1.8
Baro-Akobo	75912	11.81	600000	0.13
Rift valley lakes	52739	5.63	139300	0.1
Omo-Gibe	79000	17.96	86520	0.1
Genale-Dawa	17104	5.88	423300	0.03
Wabi Sheble	202697	3.16	204000	0.04
Total	744148	101.66	2660070	2.34 x10 ⁹

Source: Country- Wide Resource Master Plan (1998).

Note: Data is extracted for Oromia Region only.

The Region has 12 major lakes like Wonchi, Bishoftu, Kuriftu, Bishoftu-Gudo, Hora-Kilole, Horsa Arsedi, and the rift-valley lakes Ziway, Abiyata, Abaya, Shala, Beseka, and Langano which cover an area of 3135km². They are immense potential for recreation, irrigation, and fishery development.

The average annual rainfall of the region varies from 400mm in parts of Borena in Southern Oromiya to over 2400mm in parts of Ilubabor Zone or over its western highlands. As it is shown in figure 37, the agroecology of the region is suitable for crop production unless for some parts of the region.

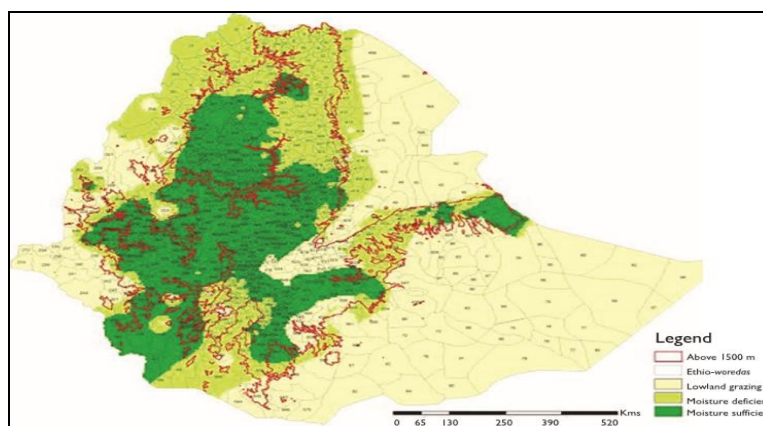


Figure 37 Agroecology of the county

The Region has an estimated potentially irrigable land of about 1.7 million hectares. Despite all these resources, Oromiya's Agriculture is rain-fed and subsistence. Hence, using all these

opportunities & potential of surface water and groundwater at hand, the region should be able to harness and utilize it by using mechanization technologies and facilities to produce sufficient crops for those arid and dry land/rainwater shortage/ parts of the region. It could be also possible to produce crops using irrigation mechanization technologies alongside Awash River for pastoralist areas of the region particularly East Shoa and Arsi Dodota. Similarly, dryland parts of West Arsi like Arsi Nagelle districts have also a potential of rivers and lakes (Shalla, Langano, and Abijata) to be mechanized by irrigation technologies.

4.2.5 Status of Agricultural Soil in the Region

Oromia region has a huge land resource, which is suitable for crop production. Most of the lands are cultivated land. These lands have been produced an ample amount of specialized and diversified crops. To produce much from it, farming communities had been using fertilizers as agricultural inputs. Farmlands are cultivated several times without any gap/ fallowing it, hence topsoil intended to lose its fertility. The amount of nitrogen and nutrients gradually declines from time to time. As data shows in Figure 38. soil acidities in the region are also increasing from time to time. Particularly in western and central Oromia strong and moderate acidities were manifested.

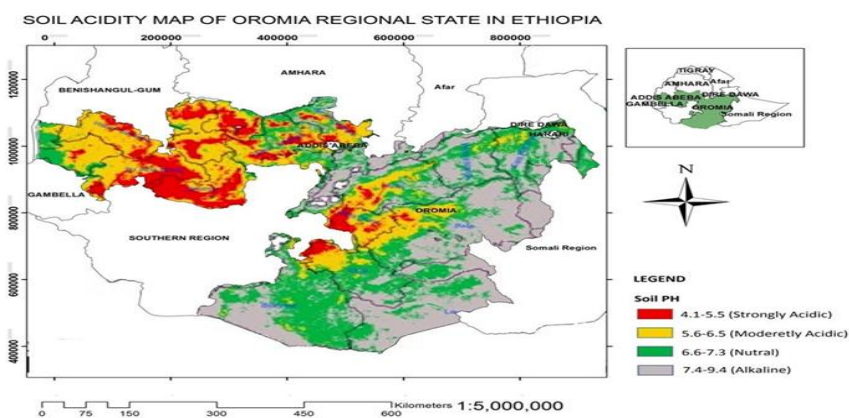


Figure 38 Soil acidity map of Oromia region

Soil conservation technologies in the region seem to be weak. To tackle this problem, lime spreading mechanization technologies usage in the region should be adopted and applied to retain the fertility of the soil. Using proper mechanization inputs like crop production

technologies, selected seeds, and fertilizer by itself doesn't make the land to produce much yield unless great attention and proper soil care are given.

4.2.6 Status of Livestock Production

Oromia is one of the renowned regions in animal production. Pastoralists and agro-pastoralist areas of Oromia such as Borana, Bale to the border of Somali, Arsi high land areas, East Shoa's Fantale district, some parts of Hararge, north Shoa Salele plane and Horo Guduru Wollaga are among livestock production parts of the region. Equines and cattle are nominal in the region. As data in figure 39 shows donkey and cattle are widely produced equines and bovine in the region which is followed by horse and sheep respectively. Equines are used for different purposes in rural communities. In most rural communities of Oromia region equines in particular donkey had been using for transporting goods and agricultural products from field to storage areas, from storage areas to market place. While cattle particularly oxen are used for draught animals to provide food, their hides are also used for industrial input for leather production. Sheep, Goats, poultry, pigs, and bees are potential livestock resources for the region.

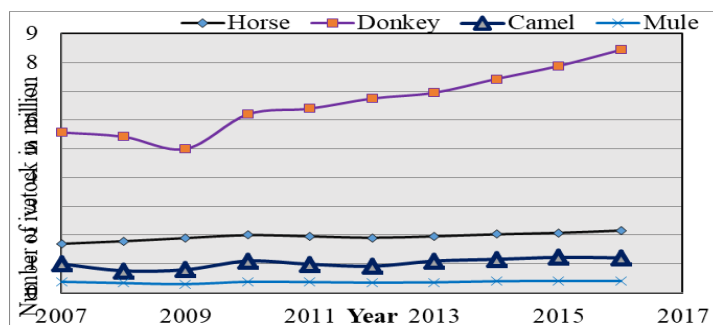


Figure 39 Ten years of time-series data of livestock (equines) of Oromia region (Zelege, 2017)

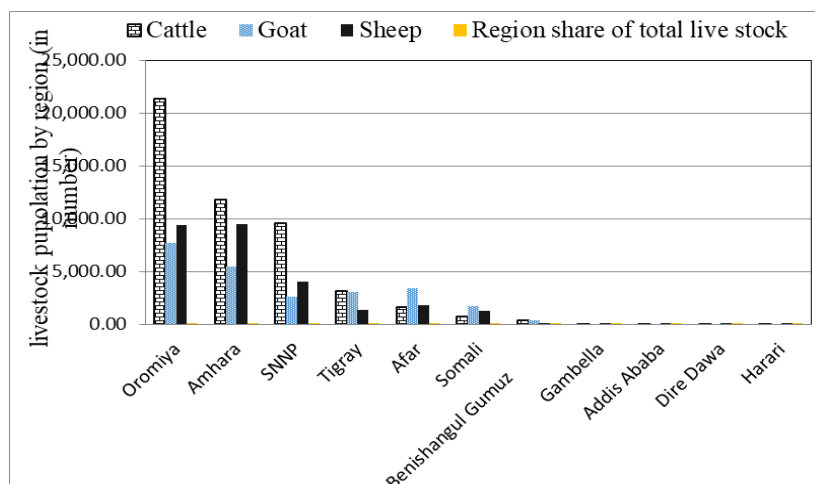


Figure 40 Livestock population by regional & city administration

The livestock subsector is also already a major contributor to the overall economy of the Oromia region. Furthermore, the country's geographic location offers substantial opportunities for exportation, thus earning foreign exchange from livestock products, especially of red meat to the Gulf and within Africa, as well as leather, honey, and other livestock products to Europe (ILRI, 2017). The livestock sector can also be a major contributor to poverty reduction by improving the livelihoods of rural people.

Agriculture is not only crop production but also animal production. Agricultural mechanization, modernization, and transformation of agriculture don't limit crop but also applicable for animal production. Mechanizing animal production means that modernizing the ways of breeding/ Genetic resources, farm steady structure, feeding systems and nutrition, animal health, product processing, and getting better yield and quality products from them. Transforming the existing production systems and animal products that we can see in figure 41 from traditional to mechanized one is crucial for the Oromia region to increase the live style /livelihood of the farmers. Besides, increases the efficiency and productivity of animal products can only be possible when we mechanize and transform production systems.

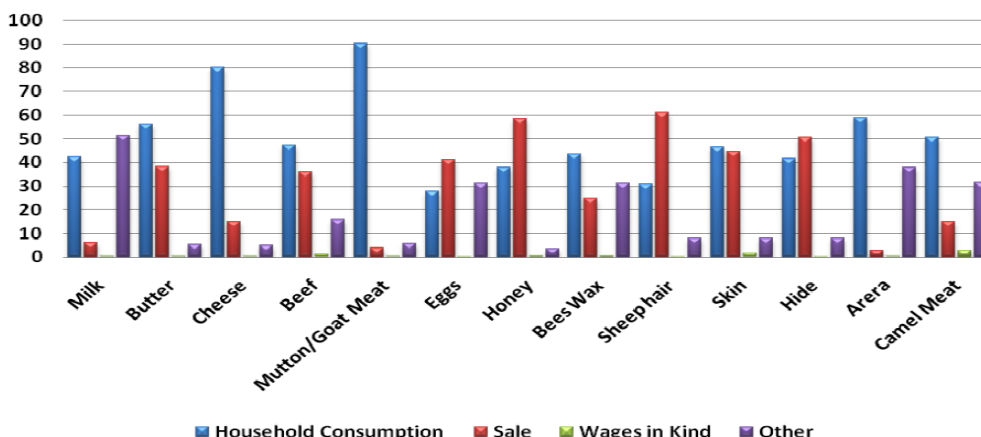


Figure 41 Percentage of livestock product utilization (CSA, 2015/6)

4.2.7 Status of mechanization facilities and infrastructures

To transform national as well as Oromia's regional agriculture, transforming rural facilities and infrastructure is crucial. Rural access roads to the farming communities are highly important for the mobility of farm machinery to mechanize the existing traditional agriculture. Supplying farm machinery to the farming communities has no meaning if there is no access to the road. With this understanding, our county has designed and constructed rural access road. Oromia has also benefited more or less from this project. Even though we lack tangible data which shows rural access roads of the region, from those few roads contracted by URAP project many of rural communities have been benefitted from it by transporting their agricultural products to the vicinity market, taking their patient to the hospital, getting access to transport services, getting access to farm machinery and many more. However, many parts of the region require rural access roads. Unless the region facilitates it, a dream of mechanizing regional agriculture remains unrealistic.

In line with this, the Shortage of energy supply to the rural communities is a chronic problem. In the current situation, far distant fuel stations from the rural areas made a service of farm machinery expensive than the regular ones. Lack of rural electrification and better facilities affected agricultural transformation. Due to the lack of better facilities in the rural area youngsters are migrating (rural exodus) to urban seeking better job, facilities, and life (Figure 42). Unless we tried to keep them in place by facilitating rural infrastructure and facilities aged and unproductive laborers will be remaining in the farming which would be a great failure for the countries as well as the region. Great attention is required by the regional government to solve the existing condition of rural infrastructure.

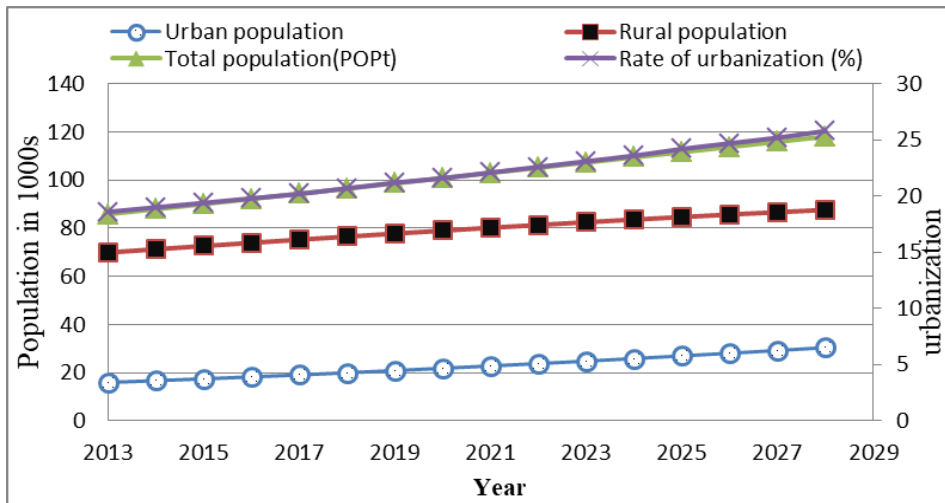


Figure 42 population growth projection & rate of urbanization

Source: CSA (2013) population projections for Ethiopia (2007–2037)

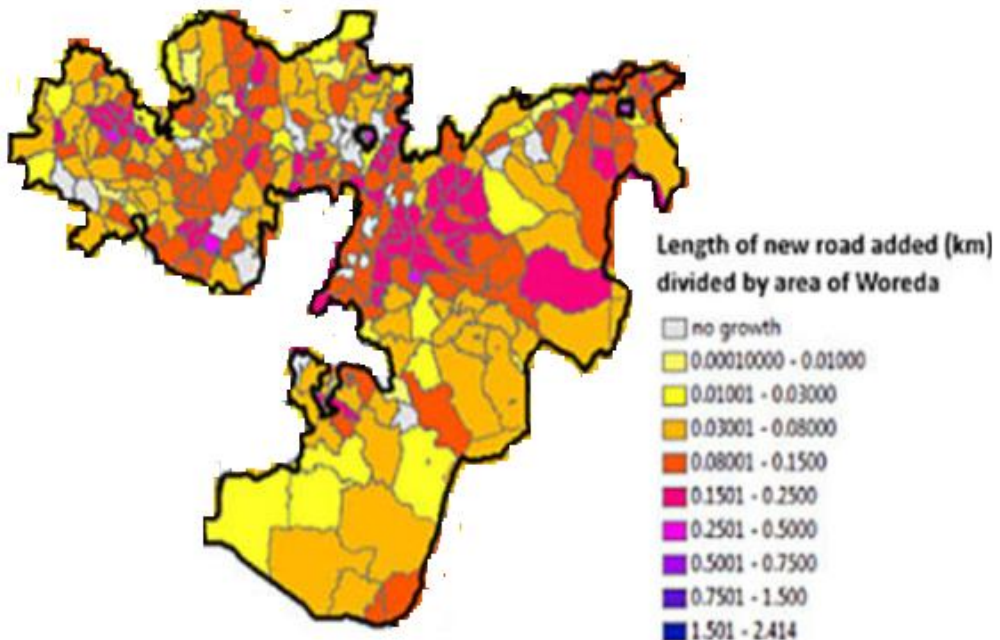


Figure 43 Rural Road data (map)

4.2.8 Status of agricultural Mechanization Training centers

Oromia region has about 5 agricultural-based technical, vocational, education training centers (Table 45). Most of the centers have been providing training on agricultural extension in particular on plant science, animal science, natural resource, and finance and cooperative. None of these ATVETs existing in and owned by the Oromia region provide training on agricultural machinery and mechanization except two (Alagae and Agarfa) federal ministry of Agriculture owned ATVETs.

To assist farmers, recommend farmers on how to use and which type of farm machinery to be used for specific agroecology and terrain conditions, ATVET trainers must have knowledge and skill of mechanization and farm machinery. In existing condition, those graduates of the aforementioned ATEVTs owned by the Oromia region doesn't have such an understanding. For this specific field and profession, the region has to establish at least three mechanization training center at the regional level from which highly on importance of mechanization, pre and post-harvest mechanization technology usage, crop-specific mechanization technologies, terrain specific mechanization technologies, soil specific mechanization technologies, etc. to increase production and productivity of agriculture of the region. Unless the region intended to train professionally with the aforementioned field transforming or modernizing the existing agriculture would not be possible with only animal science, plant science, and natural resource professional who are working as extension workers in farming communities.

Table 45 Number of TVET in the region including Agri based one

No	Agricultural TVET College	Location (Zone)	Availability Of Agri. Mechanization Dept.	Owner
1	Bako	West Shoa, Bako Tibe	No	Oromia region
2	Agarfa	Bale, Agarfa	Yes	Ministry of Agriculture
3	Holeta	West shoa, Holeta	No	Oromia region
4	Dambi Dollo	Kelem Wollega, Dambidollo	No	Oromia region
5	Chiro	West Harargee, Chiro	No	Oromia region
6	Kombolcha	East Hararge, Kombolcha	No	Oromia region
7	Alage	East Shoa, Alage	Yes	Ministry of agriculture
8	Ardayeta	West Arsi, Asasaa	No	Ministry of agriculture

As well known, the landmass of the Oromia region is wide. Schooling and educating all farmers in the region is unaffordable. Apart from ATVET, existing farm machinery as well as newly produced/ arrived mechanization technologies demonstration centers for farmers is highly important. Establishing at least one farmer's training center at the district level enables them to have known how of machinery.

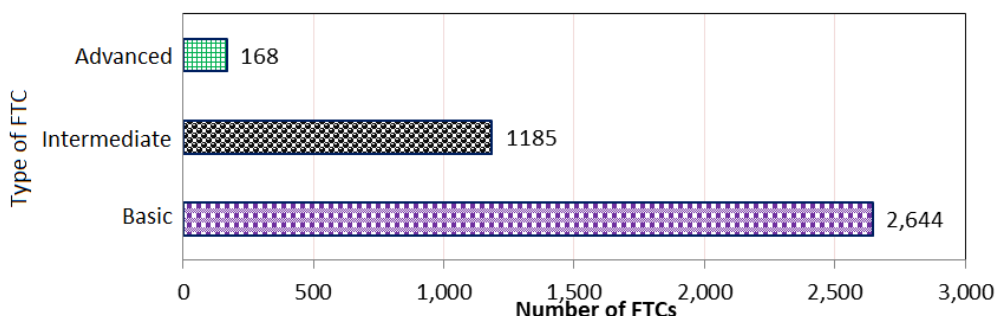


Figure 44 Existing FTC in the Region

In the current condition, we could find quite a lot of FTC (Figure 44) in the Oromia region. However, we can't find a single FTC which provide training for farmers on how farm machinery to be used for their farm operation.

4.2.9 Status of Agricultural Mechanization Technologies in the Region

According to the World Bank (2003), in Ethiopia, about 14 million oxen were routinely used for cultivation. Among these oxen majority of them were found in the Oromia region. The country has been using these draft oxen since dated back 2000 BC (FAO, 2007). In general, the majority of small farm holders have been cultivating their lands manually except some parts of wheat-growing regions of Arsi and Bale high lands (CIMMYT, 2014). This is a clear indication that the country's agriculture is characterized by its low level of mechanization which can't soundly gear towards technological advancement. But in other nations, increasing the advent of mechanized farm equipment dramatically increased agricultural productivity over the past hundred years. For example, in 1900, 40% of the USA population worked to feed the county. Today it is only 2% by mechanized farming (Fawccet *et al.*, 2007).

One of the keys to success in food production in Asia and Latin America has been farm mechanization but in contrast, the use of tractors in sub-Saharan Africa has declined over the

past 40 years and compared with another world region, their use in sub-Saharan African today is very limited. Tractor use over the same period in Asia has increased tenfold. For example, mechanization levels of the Philippine and Japan were 0.15 kW/ha and 2.25 kW/ha respectively in 1968, while in 2005, the values were raised to 1.02 kW/ha and above 7 kW/ha respectively. Similarly, since 1997, other Asian countries like Korea, China, India, and Bangladesh, farm powers required were 3.08 kW/ha, 2.91 kW/ha, 0.75 kW/ha, and 1.17 kW/ha respectively (AGMACHIN, 1998 & Soni and Ou, 2010). In 2009, the number of tractors, power tillers, and combine harvesters in Korea were 258,662, 714,537, and 79,561 respectively (Kim, 2013). Total arable land was 10 million hectares during this time (Kim, 2011). Based on these facts, mechanization levels for the tractor, power tiller, and combine harvester were 25.6, 71.5, and 7.9 respectively. But in Ethiopia, where the Oromia region has been used farm machinery for crop production, currently, this power is 0.1KW/ha which is incredibly by far less than Bangladesh's fifteen years back power level.

Farm equipment utilization is observed less due to less attention of the government to promote farm equipment and lack of mechanization policy. As CSA (2014) data shows, the number of farm equipment is very few in the country. According to the data shown in Figure 45 & Figure 46 below, the ratio of farm machine to the 1,000 hectares is 0.5 for tractors and 0.1 for combine harvesters by the year of 2014. Attention to small farm holders utilizing farm power is more likely less due to the aforementioned facts. They have less insight into and knowledge about the benefit of farm equipment and its effect on crop production in all aspects in the Oromia region as well as in the country.

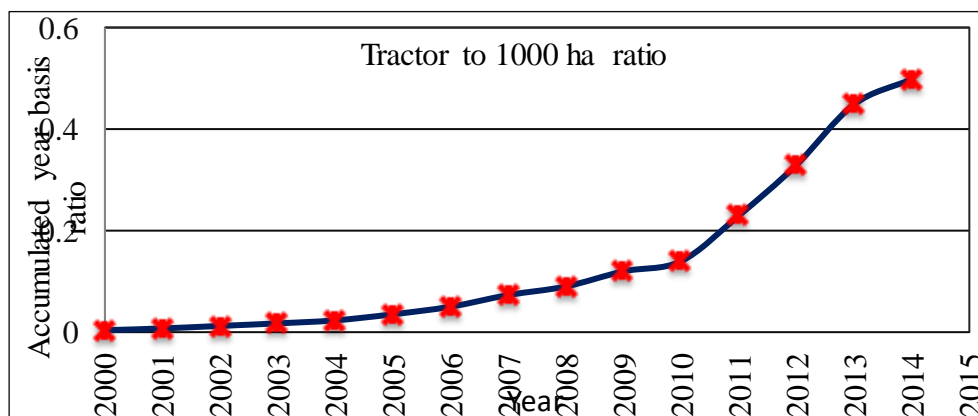


Figure 45 The ratio of farm machine to the 1000 ha

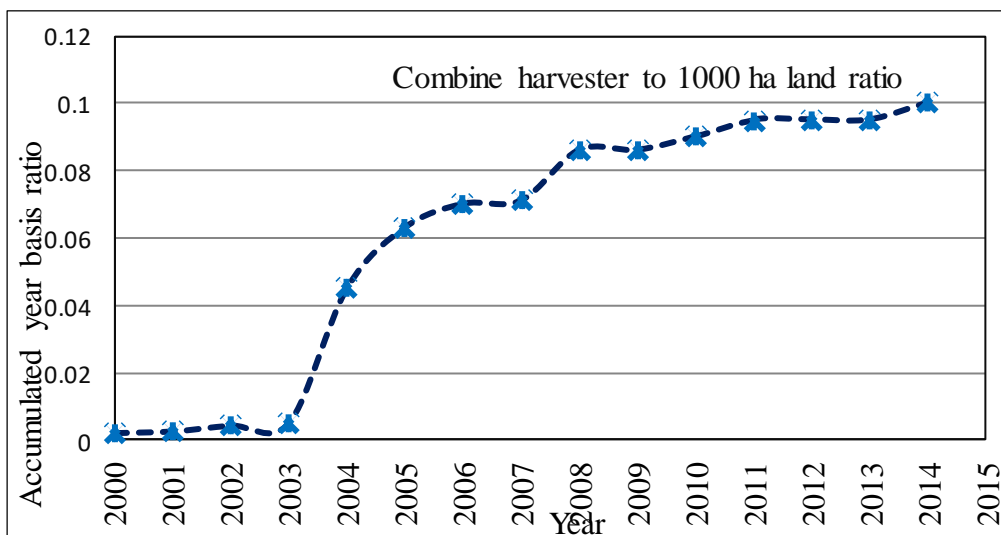


Figure 46 Combine harvester to 1000 ha land ratio

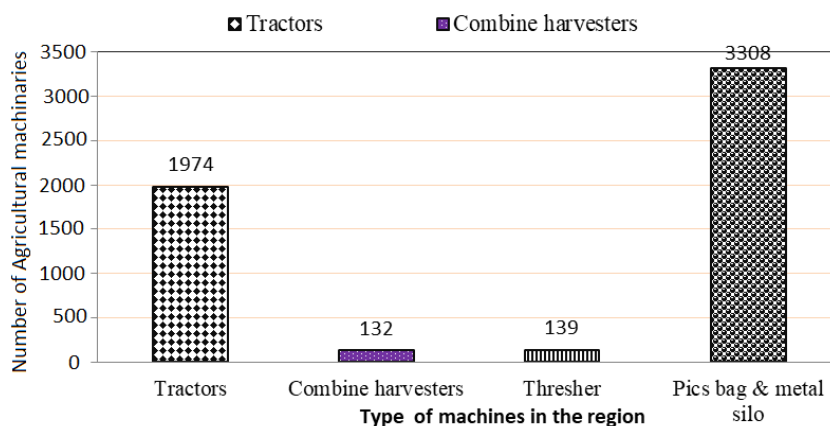


Figure 47 Current status of Mechanization technologies in Oromia region

As figure 47 shows, currently about 2000 tractors, above 100 combine harvesters and threshers and more than 3000 pics bag and metal silos are found in the region. Storage technologies are being introduced to farming communities than the rest of the technologies. The number of farm tractors are very limited in the region. The dependency of drought animal technology is still very high. However, there is significant usage of farm machinery

in the Oromia region as compared to another region of Ethiopia (Table 46). This condition should be changed to transform regional agriculture to mechanization.

Table 46 Households using agricultural machinery, percent

Region	Farmers no.	For any operation	For plowing	For harvesting	For threshing
Tigray	603	9.1	8.3	0.5	0.7
Amhara	1656	7.4	5.7	1.6	0.1
Oromia	2111	11.5	4.1	7.1	5.6
SNNP	1599	7.7	6.2	1.6	0.0
Full sample	5969	9.1	5.5	3.4	2.1

Source: IFPRI 2016 Guush Berhane *et.al.* Agricultural Mechanization in Ethiopia:

Evidence from 2015 Feed the Future survey

4.3 DEVELOPMENT OF AGRICULTURAL MECHANIZATION IN OROMIA REGION

4.3.1 Agricultural Mechanization Pre Dargue Regime

During the Pre Dargue, agricultural mechanization development was started during the late 1950s and early 1960s. These development strategies were paying much attention to supporting medium to large scale capital intensive private farms mainly producing cereals like wheat (Cohen, 1987). One of the strategies designed was to develop and test agricultural technologies using agricultural development units established at different locations and promote these technologies using extension systems. With support from the Swedish International Development Agency (SIDA), the first development units that came to existence in the 1960s was the Chilalo Agricultural Development Unit (CADU). In addition to improved seed and chemical fertilizer use, CADU was also demonstrating agricultural mechanization use. In addition, the government also designed an extension system under the Minimum Package Program (MPP) that mainly focused on enhancing smallholder farmers' access to a package of improved technologies in the regions of CADU.

In the 1970s, the Emperor's government developed policies that provide large-scale private commercial farms the privileges to import duty-free farm machinery and parts, access to credit, and foreign exchange for buying such equipment with government-subsidized loans at 7%, and fuel tax waivers (Cohen, 1987). According to Cohen (1987), such a huge support to private farms increased profit margins of mechanized cereal production and several land-owners around the Chilalo wheat-based system evicted smallholder tenants using draft

animal power and traditional maresha. However, this didn't last as long as the revolution took place in 1974 and largely private.

4.3.2 Agricultural Mechanization during the Dargue Regime

When the Dergue came to power, there was a handful of private farms with a better level of mechanization in place. Due to the socialist ideology, the government appropriated private farms with all their properties and put them under state farm. The government kept supporting the state farm by supplying them with better machinery. These state farms are Lole, Tamela, Garadella, Sinana Dinsho, Gofer, Serofta, Ardayeta, Adelle, Shallo, Wollaega, etc. To maintain the level of agricultural mechanization in large state farms and make them sustainable, under the technical and economic collaboration agreement with the then Union of Soviet Socialist Republic (USSR), the Dergue government established the current Adama Agricultural Machinery Industry and the former Nazareth Tractor Assembling Plant in 1984. The plant was assembling SKD (Semi-Knocked Down) and CBU (Complete Build Up) tractors imported from socialist countries including USSR. The tractors and their implements assembled at NTAP (Nazareth Tractor Assembling Factory) were sold to state farms and donated to prominent smallholder producer's cooperatives established in cereal-based systems. Due to poor management and lack of know-how in machinery operation and maintenance, machinery provided to the producers' cooperatives didn't last long and all cooperatives were abolished starting the mixed-economy proclamation in 1990 and ended with the over-thought of the Dergue government.

During the later years of its rule, the Dergue government proclaimed a mixed economy that allows the private sector to own capitals worth more than 500,000 ETB (by then equivalent to 250,000 USD). Though Dergue ruled only for one year after this proclamation (1990), it was a good initiative to encourage business people to go for large scale mechanized farms.

Except transferring land from the feudal system to the tillers on the use-right basis, no attention was given to the development of farm implements and farm power smallholder farmers were using in crop production. In terms of agricultural mechanization, like the preceding government, the Dergue government was also favoring capital-intensive and large-scale state farms (Belete *et al.*, 1991).

4.3.3 Agricultural Mechanization during Post Dergue regime and current scenario

During the current government, the agricultural sector has got better attention and emphasis. The sector has got a recognition that the overall economic growth in the country depends on the performance of this sector. Accordingly, several agricultural development strategies and plans have been formulated and implemented. As the major contribution of agriculture comes from smallholder farmers, the government put a clear agricultural development strategy focusing on enhancing technology generation and use by smallholder farmers to close the productivity gap in major crops. However, smallholder agricultural mechanization hasn't got equal attention to other yield improving inputs/technologies like improved seeds and fertilizers.

In 1992, the tractor assembling plant established during the preceding government was renamed as Adama Agricultural Machinery Industry (AAMI). In 2010, it was transferred to the Metals and Engineering Corporation (METEC) that manages many sister industries. AAMI assembles and manufactures tractors, water pumps, and various agricultural combines and products. Products from this corporation are used by government, farm unions, and state-owned enterprises for agricultural, water irrigation, construction, and transportation-related projects. AAMI also trains tractor operators and tractor-pulled implements.

In 2004, under regulation No. 97/2004, the Council of Ministers issued a regulation for the establishment of Agricultural Mechanization Service Enterprise (AMSE). The Enterprise was established with an initial capital of 20.5 Million Birr with multiple objectives to render agricultural mechanization services on a rental basis, provide maintenance services on a rental basis, sale farm implements and spare parts manufactured domestically or imported, provide transportation services to farm produce and farm inputs, introduce the utilization of modern farm implements by being the transmission belt of modern agricultural technology, provide training and consultation service on a better and effective utilization of farm machinery in consideration.

In addition to the government-owned AMSE, there are also private companies importing agricultural machinery (combine harvesters, large and small tractors, farm implements, etc.) and providing rental services to smallholder farmers, particularly in wheat-based Arsi and Bale highlands. Recently, one big company established by Public-Private Partnership (PPP), Kenya Agricultural Equipment manufacturing, and General Trading PLC (KAEMGTPLC) which is located at Shashemene come to function since late 2017 to transform exiting

traditional farming and as job creation strategy for the youths in the region. The company has imported SKD and CBU tractors from prominent John Deere agricultural machinery manufacturing company and have produced and delivered to farming communities more than 70 tractors within one year period.

As compare to the aforementioned two regimes, current conditions seem to be better. Many mechanization technologies, particularly for cereals production such as row crop planters, threshers, shellers, dehallers, and storage units (pit bags, and metal silos) are emerging despite the dynamics is low.

Generally, agriculture mechanization technology in the region is relatively better than the rest of the regions but it is still backward. The technologies are limited to Arsi-Bale wheat belt where almost all (>95%) of the country's combine harvesters exist. There is also a tractor plowing service in the area. This was the only place where mechanization is taking place in the region widely. There are very good experiences to look for further scaling out in the rest of the region. Another good practice is on threshing of cereals using a portable small engine thresher in the Arsi Negele-Shashemene belt where threshing services are widely given. Even though the mechanization system is currently working in those areas, it does not mean that the services are very adequate to the farmers at affordable prices at the required time. There need to be a lot of work to be done in the area of quality of work and service delivery.

4.4 MAJOR INTERVENTION PRIORITY AREAS

As far as mechanization is concerned, there are critical intervention areas that need to be considered.

1. Mechanization needs a system approach, not a piecemeal approach where the technology only cannot give a solution for a specific problem. For instance, a tractor is a technology that can do versatile jobs with enormous capacity. If there is no trained operator, no spare part, no mechanic, the tractor, will eventually have no use. Thus, mechanization needs a careful approach.
2. Oromia region has the potential to use the available facilities such as research institutes, universities to acquire at least shelved technologies apart from the training and skill providing.
3. There is also institutional potential to utilize the available ATVETs in the region for further capacity building.

Considering the above facts, the Oromia region should focus on three areas to transform the sector.

- Crop production
- Livestock production
- Apiculture

Crop production focus should be given for maize, teff, sorghum, wheat, and barley according to production and special emphasis needs to be given to the imported crop such as wheat and export crops such as coffee and beans. Root crops such as sweet potatoes, taro, garlic, and potato need also mechanization interventions in the region.

The crop production tasks that need intervention are:

4.4.1 Crop production mechanization technology

1. Land preparation technology
2. Seeding technology
3. Soil acidity reduction and fertility-enhancing technologies (lime spreading and fertilizer applicators)
4. Crop protection technology
5. Irrigation technology
6. Harvesting technology (including root crops such as potatoes and sweet potatoes etc.)
7. Threshing and shelling technology
8. Storage technology for post-harvest loss intervention
9. Transporting technology
10. Post-harvest processing technology

In livestock production, dairy, meat, and poultry production need to be given priority. The region also has water sources suitable for fishery production. Special focus in the sector is for apiculture for honey export.

4.4.2 Livestock production mechanization technologies

1. Baling technology
2. Animal feed processing technologies (feed pelleting etc.)
3. Milking technology
4. Milk processing technology
5. Meat processing technology

6. Poultry production technologies (hatchery, feeding and housing technologies)
7. Apiculture technologies (beehive, honey extractor)
8. Fishery technologies (net, fish feeding, pelleting technologies, fish drying, and smoking technologies)

Moisture conservation for sustainable intensification needs to be part and parcel of the production systems in the region. Dryland technologies should be explored to mitigate the moisture deficit and improve the drought-prone areas in the western Hararege and some parts of Wollega. Such areas need conservation agriculture and moisture conservation.

4.4.3 Dryland production mechanization technologies

1. Conservation agriculture technologies (reduced tillage such as ripping technologies, zero tillage implements)
2. Moisture conservation technologies (such as tie-ridges)
3. Water lifting technologies for irrigation (pumps including solar and engine)

The application of mechanization technologies is not a one-fits-for-all approach. In the region, the land size ranges as low as 0.5ha to more than 10 hectares and hence the approaches are different. For instance, in hilly/upland places, tractor technologies may not be used because of the unsuitability of the terrain for tractors.

4.4.4 Proposed Mechanization technology vs land size

1. Small scale farming

Most of the Oromia region's farmers are small scale, farm holders. These farmers are not able to owe large size farm machines. Large-sized farm machines are expensive which the small farm holders can't afford. Hence appropriate technologies for these farmers are crucial. Appropriate technologies that are applicable for small farms are dependent upon crop variety and type, agroecology, and topography of the lands. Generally, mechanization technology for small scale farming is a technology that is selected and recommended by mechanization engineers. Most of the technologies can be produced at local mechanization/ agricultural engineering research centers, micro-enterprises, and local artisans. Apart from these, imported technologies for crop production are like walky tractors, rotavetors, threshers, etc are also applicable for small farming.

2. Medium-scale farming

Technologies that are used for small scale farming can also be used for medium size farming. These technologies can be adjusted and sized for medium scale farming. Hence,

small farm holders are believed to owe these technologies based upon their income. Technologies that can be used for large scale farming can also be used for medium-scale farming. But, the farmers can owe it for themselves. However, model farmers and privates can provide services for medium scale farm holders.

3. Large scale farming

In Oromia, large scale farms are a farm which exists on hand of private and enterprises like Oromia Seed Enterprises. Private and state farms have been exercising mechanization technologies for their farms at the mechanized and semi-mechanized level. However modern (state of the art technologies), efficient and loss reduction technologies should be applied for these farms to increase production and productivity.

4.4.5 Where to find appropriate mechanization technologies?

Mechanization seems very difficult for small plots in most of the agricultural sector literate's mind. This was not true, we can examine the cases of Asian countries where the land size for rice fields is less than 0.3 ha to be plowed using tractors, harvested using combines and other technologies. To use mechanization technologies, a country should not necessarily have larger land sizes. The most appropriate to define this is that we need to use appropriate mechanization technologies rather than modifying the existing landholding for bigger machines which comes later after certain development stages where the rural dynamics changes, the role of the agrarian population reduced to a minimum and fragmented lands are consolidated to bigger sizes. This will eventually change the mechanization types and the machine sizes that are necessary for mechanization.

For example, we do not need bigger maize combines currently, we have efficient maize shellers that are available in research centers even by far much efficient than imported shellers. Therefore, we will exploit the available technologies in Ethiopia. Research centers, universities, and development partners. Thus, we will look for technologies in

- Research and Development (R&D) level in the research centers (federal and regional, universities) and
- Importing technologies, testing and certifying for suitability

4.4.6 Demonstration of appropriate technologies for the farming community

Mechanization technology demonstrations need different kinds of approaches. Experiences in Ethiopia tell us that a mechanization technology demonstration is a systematic approach where the involvement of different stakeholders. For instance, Arsi-Bale wheat belt

mechanization is the result of the then established state farms by the then government together with the hiring services offered by the state farm machinery operators. It was not done by the government agricultural offices for intentional demonstration instead of done by the operators to get money from hiring but it was helping the neighboring farmers to use and adopt technologies and realize their benefits. It was also one of the successful places in the country where mechanization is booming. Thus, the ordinary technology demonstration approaches may not work as mechanization involves high capital investment where regional governments cannot handle by themselves.

This calls a need for the engagement of private service providers together with the government state farms and maintenance centers. Joint hosting of annual agricultural machinery trade-fares and exhibitions will also enlighten the farming community to see the opportunities and be familiar with the technologies.

- Strengthen the federal, regional, zonal and district level mechanization experts and development agents
- Establishing training and demonstration centers at the regional level or zonal level (short term, long term, and medium-term). Training needs to focus on the following pillars:
 1. Training service for machinery operators
 2. Training mechanics and repair crew
 3. Training how to handle machinery
 4. Certifying machinery driving licenses

4.4.7 Mechanization facilities & Infrastructure

One of the drivers of mechanization is the availability of infrastructure. Agricultural machinery needs roads to move to a farm and from the farms, fuel stations nearby the localities, repair and maintenance shops, mobile garage, and spare parts shops. Such kinds of interventions involve high capital investment in the sector and hiring a rural educated youth to reduce the unemployed youth as jobs are created in the different segments of the sector. Therefore, the following infrastructure should be facilitated in the Oromia region to boost mechanization.

- Rural access roads to the farming community to facilitate mobility of farm machinery and transportation of agricultural output

- Equipping special fuel stations for farm machinery at the district level to make access for fuel for every season
- Equipping repair and maintenance shops along with highly skilled agro mechanics for farm machinery/ as part of job creation for rural educated unemployed youth
- Avail mobile garage which reaches to failed machinery at farm site during critical or peak seasons. In this case, highly skilled technicians who can fix machines' problems should be required.
- Spare part supply shops should be organized at zonal capitals and districts to make access to spare parts for farm machinery owners.

4.4.8 Accessibility of high-cost farm machinery community

There are several strategic options to make farm machinery accessible farming community. Hence we can use the following option to facilitate agricultural mechanization in Oromia.

Option 1. Organizing farmers to have machinery through joint ownership/ joint use of farm machinery/: One of the important objectives of agricultural mechanization is the improvement of agricultural productivity. To improve agricultural productivity, it is needed to reduce the expenses by using agricultural machinery efficiently. To reduce the operating cost of agricultural machinery, they should be used as close as possible to the arable land area under a burden to reduce the fixed cost of the agricultural machinery per area.

To this option development of joint use organizations for agricultural machinery. under this condition, the government should organize farmers based on their financial capacity and provide machinery so that they use machines they owe far their farms. They can also serve neighboring farmer when their machine is free from operation to make benefit from it.

Option 2. Organizing youngsters in the group and providing machinery as a means of job creation strategy. There is the best experience in the region that the government organizes youngsters and providing them tractors from Kenya Agricultural Equipment Manufacturing and General trading PLC with financial support from Oromia saving and credit share company. Hence, this experience should be continued to make tractors and other farm machinery accessible for the farmer

Option 3. Capacitating cooperatives in the region: To make farm machinery accessible to farmers Strengthening cooperative/ unions is very important. Most of the

cooperative in Oromia has experience of serving farmers to the vicinity with the minimum service costs. Such service Provision would help low-income farmers. Hence, the government capacitates them to make the best option for farmers.

Option 4. Capacitating private service provision: private machinery owners have provided services for farmers. However, service cost had been a critical problem because of an abnormally increasing service cost. Hence, the government needs to regulate or control the aforementioned costs so that this option would be a very important farming community.

Option 5. Establishing service provision institution: Service providers can be established by the government under the control of the regional bureau of agriculture and rural development. In this case, the government provides subsidy, technical, and strategic support to this institution to help the farming community.

Option 6: Lease of agricultural machinery

4.4.9 Policy environment

The Agricultural Development Lead Industrialization (ADLI) policy which states that labor and land are the main and abundant factors of production in Ethiopia and that their effective use should generate rapid and sustainable development. This was clearly stated in the Economic Development Strategy of Ethiopia in 1994. Rural Development Policy and Strategy (RDPS) document states that adoption of labor-intensive strategy: Within the framework of the strategies enunciated above, accelerated and sustainable growth in Ethiopia can be brought about by utilizing labor-intensive rather than capital-intensive production processes. This is more for the agricultural sector than in the other sectors. An important mechanism that enables to introduction of labor-intensive strategies and helps to employ modern agricultural inputs and practices is the adoption of new agricultural technologies and the training of the agricultural labor force with effective skills. Thus the RDPS also ignored the importance of mechanization and lacks the support that needed to be given for the sector.

Currently, however, the need for increased production and productivity, decreasing postharvest loss and production cost, the dynamism of population growth, the rural-urban migration which resulted in the stress of labor supply, the expansion of education where there are more than sixty universities and thousands of TVETs in the country, the backward

farming operation which is unattractive to the younger generation, the rise of rural wage rate and climate change are the driving forces for the ultimate deployment of mechanization with a specific policy support framework. Other countries' experience also shows us that the strategy unless backed by a specific climate-smart policy framework, its implementation will not be effective to address the sector's planned interventions. Thus, the following activities need to be implemented by the bureau of agriculture in Oromia region, there needs to be also organizational structure in the regional mechanization development directorate together with other key stakeholders. Concerning the importance of these activities, it has been observed that the implementation of the strategy was hindered by various factors and there is also a need to update the strategy mainly to widen its scope of implementation indicate the role of the stakeholders involved in the implementation of the strategy.

1. Preparation of 'Regional Agricultural Mechanization Policy'
2. Preparation of Regional Agricultural Mechanization Strategy which can be extracted from the National Agricultural Mechanization Strategy
3. Preparation of regional mechanization promotion enactments

Agricultural mechanization development in Oromia also suffering from lack of adequate institutional set-up, human capacity, weak partnerships between the regional and federal level mechanization offices, ATVETs, and FTC's. Addressing these challenges should be the major intervention area of the regional government given developing agricultural mechanization in the country. Thus the following activities were crafted to be conducted by the Oromia region mechanization development directorate together with other key stakeholders.

Notwithstanding the intensification of agriculture to be targeted in the subsequent development programs, utilization of mechanized power was so limited in the country and the region. Much emphasis has been set towards the inputs of fertilizers and improved seeds. The role of mechanical power is not overlooked at all, rather a deliberate policy direction that could overcome unintended consequences to come. For policymakers in Ethiopia especially in the region, the displacement of the rural labor force remained the main concern as one of the unfavorable outcomes from the expansion of mechanization. Hence, from then onwards, the policy environment needs government attention for the mechanization system to be effective.

4.5 CHALLENGES OF AGRICULTURAL MECHANIZATION IN THE REGION

The following challenges were observed:

4.5.1 Policy environment

- Lack of mechanization policy and strategy
- Lack of tax exemption for agricultural machinery
- Lack of subsidy, and incentive package such as importing small hp engines with lower cost, etc
- lack of loan facility for farmers to owe farm machines
- lack of agricultural bank in the region as well as at the national level
- Lack of mechanization promotion enactments

4.5.2 Institutional and academics

- Lack of Agricultural mechanization institutional set-up/structure from region to zonal and districts
- Shortage of trained professionals in agricultural mechanization and engineering,
- lack of appropriate curriculum and department for agricultural mechanization/engineering in the universities
- Lack of education and training for agricultural mechanization. Agricultural Engineering and agro mechanics
- Lack of training centers and ATVET for farm machinery operators and mechanics at the regional level
- Inadequate and inefficient agricultural mechanization research and development center in the region.
- Lack of testing and inspection facilities at the regional and national level for agricultural equipment
- Weak partnerships b/n the regional and federal level mechanization offices, ATVETs, and FTC's.

4.5.3 Technical and management

- limited aftersales services for tractors, combine harvesters and other farm machines

- Low quality. substandard of some brands of imported farm machines
- shortage of well-skilled aeromechanics and operators in the region
- Improper handling of farm machines
- limited know-how, awareness, and usage of farm machines
- The problem of a selection of farm machinery based on agroecology, soil type & landscape

4.5.4 Delivery and commitment

- Most of the type, we can't find agricultural engineers on the position of the agricultural institution. Another professional is not able to talk and promote agricultural mechanization due to lack of know-how. They can talk more about other agricultural mechanization inputs while they fail to do so for farm machines because of limited awareness and attention about engineering equipment. Besides government commitment to promoting mechanization to increase agricultural production and productivity in the region was so weak. However, the current scenario seems to be promising.

4.6 Opportunities in the region

To transform the agriculture Oromia region has quite a lot of opportunities. These are ample amount of natural resource like cultivable land, sufficient ground and surface water potential, adequate rainfall, suitable agroecology for agriculture, educated youths to drive mechanization, high demand and interest to use farm machinery, high potential of tractors sales and earning revenue, increasing of regional government commitment to mechanize agriculture, promising decision to make farm machinery free from tax and others can be taken as opportunities in the region to mechanize and transform regional agriculture.

4.7 Interventions

Interventions	Theme components/activities	Short term 3Years (2012-2015 E.C)	Medium-term 6Years (2016-2019 E.C)	Long term 10Years (2020-2024 E.C)
			Goals, where to reach	
		SMART goals, with what new approaches, tools, progressive volumes, etc. at each phase that attribute for the changed output/outcome		
		a	a+b (show only b list)	a +b +c (only show c list, a & b are obvious)

4.7 Interventions

Interventions	Theme components/activities	Short term 3Years (2012-2015 E.C)	Medium-term 6Years (2016-2019 E.C)	Long term 10Years (2020-2024 E.C)
			Goals, where to reach	
		SMART goals, with what new approaches, tools, progressive volumes, etc. at each phase that attribute for the changed output/outcome		
		a	a+b (show only b list)	a +b +c (only show c list, a & b are obvious)
Organizational intervention	Reorganization of mechanization development structure in the region at different levels, ATVETs, FTCs (District to Kebele)	<ul style="list-style-type: none"> District & Kebele level capacity enhanced (agricultural engineers/ mechanization specialists recruited at all levels) Establishing mechanization department in ATVET colleges available in the region (Bako, Holeta, Demidolo, Chiro, Kombolcha) in the context of developing human resource in agro-mechanics & agricultural machinery operators Enhancing advanced FTC's in agricultural mechanization 	<ul style="list-style-type: none"> At least one pilot mechanization service center established at the central part of the region (wheat belt) Upgrading the ATVET's infrastructural & human capacity Upgrading advanced FTC's to act as one of the agricultural mechanization schools for the farmers, operators & agro-mechanics 	<ul style="list-style-type: none"> At least two centers with the full-fledged capacity to test and evaluated agricultural machinery established Upgrading the ATVETs into Agricultural University
	<ul style="list-style-type: none"> Facilitation of access to financing options for mechanization (orientation of banks in the region for agricultural 	<ul style="list-style-type: none"> At least two banks engage in the loan & credit facilitation for agricultural machinery 	At least one dedicated agricultural bank established to serve the agricultural sector especially the mechanization sector (machinery loan, purchase, etc.)	

4.7 Interventions

Intervention	Theme components/activities	Short term 3Years (2012-2015 E.C)	Medium-term 6Years (2016-2019 E.C)	Long term 10Years (2020-2024 E.C)
			Goals, where to reach	
		SMART goals, with what new approaches, tools, progressive volumes, etc. at each phase that attribute for the changed output/outcome		
		a	a+b (show only b list)	a +b +c (only show c list, a & b are obvious)
	inputs such as machinery, seeds, etc.)			
Pre-harvest interventions	Specialization of crops & livestock production (Selection of Districts for specialization)	<ul style="list-style-type: none"> Target crops for large scale production and export crops for cash in each district identified 	Mechanization interventions taken based on the target crops & livestock identified	
	Enhancement of soil fertility for acidic soils & vertisols in the region	<ul style="list-style-type: none"> Introduction of technologies (lime spreaders, fertilizer applicators, etc.) to improve the soil fertility in highly affected acidic soils in the pilot sites (Southwest & western Oromia) Introduction of technologies (BBM) in selected pilot sites 	Scaling out of the best technologies for the rest of the acid affected areas.	

4.7 Interventions

Interventions	Theme components/activities	Short term 3Years (2012-2015 E.C)	Medium-term 6Years (2016-2019 E.C)	Long term 10Years (2020-2024 E.C)
			Goals, where to reach	
		SMART goals, with what new approaches, tools, progressive volumes, etc. at each phase that attribute for the changed output/outcome		
		a	a+b (show only b list)	a +b +c (only show c list, a & b are obvious)
Pre-harvest interventions	Selection & categorization of Districts for moisture stress and development of water sources for supplementary irrigation, the introduction of water & soil enhancement technologies (Conservation agriculture & water harvesting technologies, shallow ground well developments, etc.)	<ul style="list-style-type: none"> All districts categorized and mapped based on the water source availability Pilot sites selected and adaptation measures taken such as irrigation technologies 	Scaling out of the best practices and technologies from the pilot sites to all districts under consideration	Large scale adaptation of <ul style="list-style-type: none"> Conservation agriculture technologies Water harvesting technologies Surface and groundwater utilization for irrigation
Policy Interventions	Development of mechanization promotional acts in the region & preparation of regional agricultural mechanization strategy	<ul style="list-style-type: none"> At least one regional mechanization promotion legal document prepared, approved and endorsed by the concerned authority Regional awareness created at Zonal, District and Kebele levels Draft mechanization strategy document prepared 	<ul style="list-style-type: none"> Continues refining of the mechanization strategy document prepared 	<ul style="list-style-type: none"> Continuous refining of the mechanization strategy document prepared

4.7 Interventions

Intervention ns	Theme components/activities	Short term 3Years (2012-2015 E.C)	Medium-term 6Years (2016-2019 E.C)	Long term 10Years (2020-2024 E.C)
			Goals, where to reach	
		SMART goals, with what new approaches, tools, progressive volumes, etc. at each phase that attribute for the changed output/outcome		
		a	a+b (show only b list)	a +b +c (only show c list, a & b are obvious)
	Improve access to smallholder farmers Through cooperatives and unions	<ul style="list-style-type: none"> At least two cooperatives and unions equipped with mechanization technology, infrastructure/facilities, and skill development 	<ul style="list-style-type: none"> Scaling out of the best practices and technologies to the available cooperatives and unions in the region. 	
	Rural infrastructural development (involvement of the private sector)	<ul style="list-style-type: none"> ICT for service provision, rural access roads, rural electrification, fuel stations & mechanization service centers Mapped in the region 	<ul style="list-style-type: none"> Establishment of infrastructures (rural access roads, electrification , 	
	Identification of duty-free items and items in mechanization sector to be subsidized (small engines, water pumps, etc.)	<ul style="list-style-type: none"> All imported mechanization items & locally manufactured items for proper duty-free & subsidy would be identified 		
Post-harvest mechanization interventions	Establishment of grain depot for the region	<ul style="list-style-type: none"> The site selected and modern state of the art grain storage facility developed which serves as grain storage at the time of poor harvest, drought and to stabilize grain market in the major commodities when there is a 		

4.7 Interventions

Interventions	Theme components/activities	Short term 3Years (2012-2015 E.C)	Medium-term 6Years (2016-2019 E.C)	Long term 10Years (2020-2024 E.C)
			Goals, where to reach	
		SMART goals, with what new approaches, tools, progressive volumes, etc. at each phase that attribute for the changed output/outcome		
		a	a+b (show only b list)	a +b +c (only show c list, a & b are obvious)
		good harvest		
	Improve access to, harvesting, threshing & shelling technologies	<ul style="list-style-type: none"> Organizing rural educated youth groups in harvesting, threshing & shelling service provision Organizing university graduates (engineers) at the rural level in manufacturing threshing & shelling technologies locally 	Organization of special office in the Oromia Bureau of Agriculture to facilitate agricultural mechanization service provisions (manufacturing & services)	
	Conduct regional level harvesting, threshing & shelling technology demonstration, custom hiring service delivery, organization of field days, demonstrations, exhibitions annually	<ul style="list-style-type: none"> At least one regional machinery show organized annually Custom hiring services (combine harvesting) studied, actors identified and improvement measures taken based on the study (price-setting and quality service) 		
Post-harvest mechanization interventions	Enhance the access of metal silo, PICS bags, grain pro hermetic storage bags for grain storage (with the	<ul style="list-style-type: none"> Skill-building or rural youth artisans & micro-enterprises and manufacturers on silo fabrications 	<ul style="list-style-type: none"> Establishment of agro-dealers and machinery spare part shops in the selected 	<ul style="list-style-type: none"> Scaling out of the practices in unaddressed districts.

4.7 Interventions

Intervention ns	Theme components/activities	Short term 3Years (2012-2015 E.C)	Medium-term 6Years (2016-2019 E.C)	Long term 10Years (2020-2024 E.C)
			Goals, where to reach	
		SMART goals, with what new approaches, tools, progressive volumes, etc. at each phase that attribute for the changed output/outcome		
		a	a+b (show only b list)	a +b +c (only show c list, a & b are obvious)
	private sector involvement)	<ul style="list-style-type: none"> in all districts Medium and large scale grain silo manufactures 	Districts or at least at Zonal level	
	Improve rural farm transportations	<ul style="list-style-type: none"> Farm transportation technologies (tri-cycles, trailers, bikes) selected and access to the technologies improved 	<ul style="list-style-type: none"> Access to the technologies further refined and improved 	<ul style="list-style-type: none">
	Development of package technologies for processing	<ul style="list-style-type: none"> Assessment of sites for agro-processing parks in the region 	<ul style="list-style-type: none"> Establishment of agro-processing sites/parks on the identified specialized crop & livestock production districts 	<ul style="list-style-type: none">

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CHAPTER V: OPERATIONAL STRUCTURE AND EXTENSION SERVICES

5.1 INTRODUCTION

Agricultural development” as the motto “has been used many times in Ethiopia before and now to transform the agriculture from subsistence mode of production to commercialized farming system for improved livelihoods and national economic development. However, although, agriculture in Ethiopia is one of the oldest in Africa, it is not yet modernized nor sufficiently transformed liked with other sectors. Why agriculture has not significantly developed or transformed in Ethiopia? To put it simply, because Ethiopia has been addressing only the symptoms of agricultural development but, not the root causes of the challenges. Agriculture transformation and growth is bigger than any other development issue in the country. It must be put at the highest priority on the agenda of the Government. It entails food security, job creation, trade, and markets. Rising productivity leads not only to food security but poverty alleviation, access to education, housing, family planning, health, and many other benefits.

Frequent policy and structural changes, dependency on rainfall agriculture, low input use and output marketing, limited focus to livestock and NRM (bias to crops), limited use of irrigation and farm mechanizations and poor planning and their implementations were often cited to be the major causes for the underdevelopment of Ethiopian agriculture. NO ONE developed country has reached the current status without first transforming its agriculture.

Oromia National Regional state is one of the regions that also use the same motto for a long time. However, agriculture in the region is also remained to be with a traditional production system with little improvement realized in yield /ha for major cereal crops. Based on the information collected from the field, the large majority of farmers in the region are still observed using the traditional way of agricultural practices (draught animal and human labor for land preparation (plowing), sowing, weeding, harvesting, threshing and transporting). Similarly, more than 80 % of farmers in the region still use local varieties that are poor in yields, quality, and susceptible to pests and diseases (Chimdo, 2017). As a result, food security remains to be the major challenges of the region. Among others; poor application of scientific knowledge and innovations, poor infrastructure and facilities, limited access to agricultural inputs (seeds, breeds, fertilizers, animal drugs), weak coordination and alignment, degradation of the natural resources (water, soil, minerals, forest), weak

implementation capacity and low staff motivations have been cited by different scholars as to the major problems.

5.2 SCOPE AND OBJECTIVE OF THIS PAPER

This paper prepared as a working document is designed to analyze the current status of the agricultural extension system of the Oromia national regional state. In particular, the special focus is given to examine the agricultural operational structure of the extension system, human resource development and competence, budget allocation and utilization, institutional setups for extension service provision (F/PTC, DAs, farmer's development groups and one-to-five social networks, technology transfer, linkage) and major constraints and challenges encountered from region down to Kebele levels. The data for this paper are primarily collected from Oromia BoA, OARI, and professionals in the field of agricultural extension. Also, various reports, strategies, and policy documents, and web-based sources are consulted. At the last, possible strategies and recommendations to overcome the constraints and manage the challenges were suggested.

5.3 SITUATION ANALYSES

5.3.1 Organizational and operational structure of the extension system

In the current operational structure and functions of the agricultural extension system, the Federal Ministry of Agriculture (MoA) is the head of the executive organ under which the regional BoARD is organized. In the existing structure, the Federal MoA and Regional BoARD are linked with centralized goals and decentralized objectives and activity plans. This means the Federal MoA is responsible to formulate umbrella policies, strategies, guidelines, and directives to achieve nationwide goals. It also oversees the implementations of each policy and strategy through technical backstopping especially those regions with low manpower and capacity for implementation.

In the current operational structure, regions have more responsibility in developing their own tailored and content specific policies, strategies, and guidelines using the federal one as an umbrella. In addition, the regional BoARD is mandated to guide and coordinate the ground level of implementations of agricultural and rural development programs through providing technical backstopping to zones and Districts with special focus to those with poor capacity and facilities. Currently, the federal BoA has many "heads or department" and most of them work in a disconnect from one another.

5.3.2 Oromia Bureau of Agriculture and Natural Resource Development

As mentioned above, Oromia BoA is structurally organized under the Federal Ministry of Agriculture (MoA). As of 2017 the region has 20 administrative zones; 290 districts; and 6447 rural kebeles. The fact that Oromia is the largest of the nation, out of thirty-two agro-ecological zones available in the country, eighteen are found in the region. This means the region is generally endowed with diversified agro-ecological conditions (the highlands, midlands, lowland, the pastorals, and agro-pastorals), each with its unique characteristics, opportunities, and potentials for agricultural development.

The remarkable agro-ecological conditions and good potentials in altitude, topography, soils, water resources, biodiversity, climate, and different farming systems enable the region to produce a variety of field crops, fruits, vegetables, roots, and coffee, and different livestock species. The region represents more than 40% and above aspects of agricultural statistics and other economic and social aspects of the country. For example, considering the 2017/18 main production season, the region constitutes; 45% cultivated areas, 49% grain production, and 42% of the holders. Agricultural extension is one of the most important tools to improve the production and productivity of smallholder farmers in the region. Following the federal and regional structure, zonal and District BoARD offices are also organized from zones to the district office of agriculture and Natural resources, and the lower administration unit, the kebele.

The zonal BoARD is used as a bridge between the regional BoARD and the District agricultural and rural development offices. The zonal BoARD is intended to harmonize the top-down and bottom-up planning and coordinate implementations of the programs in their respective zones by linking the regions with the Districts concerning national and regional development policies, strategies, and programs. Structurally, Zonal agricultural offices provide technical supports to Districts and also compile reports from the districts and submit to the Region.

District Agricultural and Natural resources office is an autonomous and powerful organ since the 1990s of the decentralization of the government. The decentralization strategy empowers districts to implement agricultural and rural development programs to strengthen agricultural and rural development coordination. This means District is more responsible to execute the agricultural and rural development programs and harness changes at grass root levels. Districts are organized in the form of Cabinet, where the members are drawn from

different sectors -chaired by the head of the party at Woreda level. Based on the information from experts at the district, being the district cabinet member has some advantages (social protection, better salary, promotion, free from ‘gimgema’, and small benefits).

Structurally, although Districts are authorized and fiscally independent with their annual budget for personnel, infrastructure development, and provision of agricultural and rural development advisories, in practice, this is not always the case. The extension department organized under District offices provides training and technical backstopping to the DAs through the trained SMSs. The district extension department also oversees kebele level activities through its agricultural supervisors and DAs although they don’t have that much role on DAs and take necessary actions wherever and whenever needed.

Below the districts, kebele administration and agricultural and rural development offices are established. Just like that of districts, Kebele constitutes cabinets drawn from different sectoral offices. A kebele administration unit is a group of people led by the kebele administration who play a key role in making decisions on agricultural extension and rural development in the kebele related to their specific matters. Each kebele is further divided into farmer’s development groups and One –to- five social networks. The kebele extension unite is expected to play the leading and coordination role in all forms of technical support and administration to farmers through the local level institutions known as Farmers/ pastoral Training centers (F/PTC). Most rural Kebeles have an F/PTC built by the state, but with a high degree of variability in terms of their operation (see further explanations below under the subtopic of F/PTC).

Structurally, the zonal and District agricultural offices are the key architects behind the implementation of regional agricultural development and extension on the ground. In the structure, SMSs and DAs play a key role in the extension system, as the nexus between the ‘system’ and farmers while the party office usually authorized to make decisions on all aspects of the Agriculture sector.

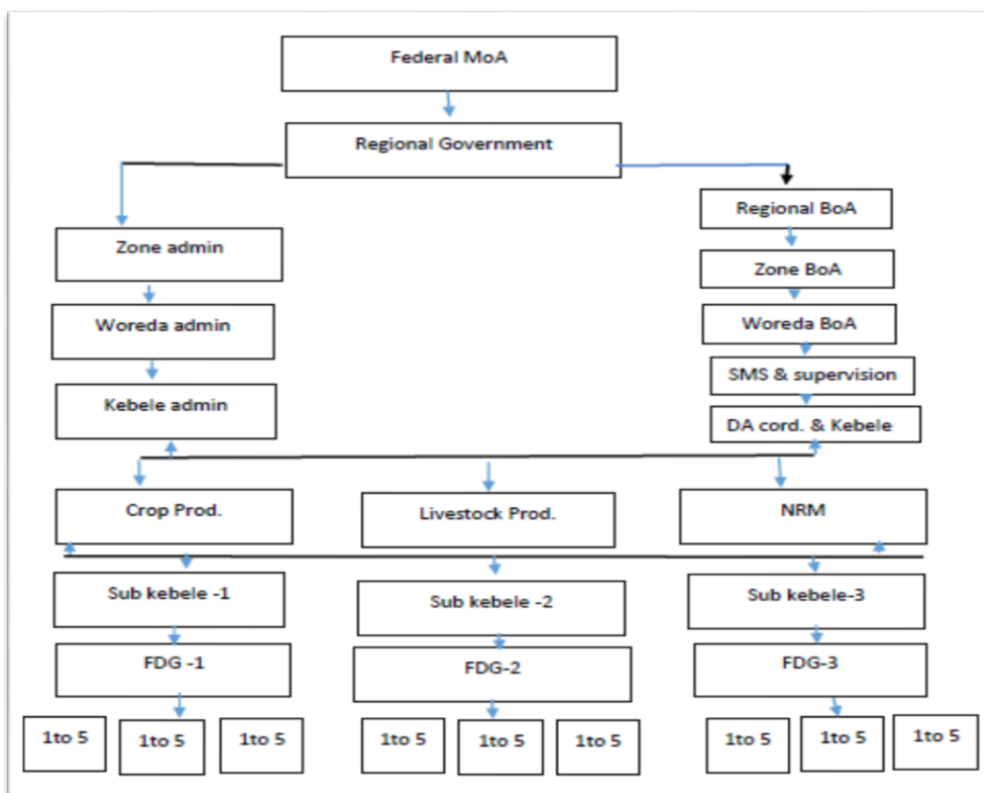


Figure 48 Operational structure of the agricultural extension system

Source: Adopted from MoA report (2015)

5.4 MAJOR CHALLENGES THAT POTENTIALLY CRIPPLED THE EXISTING OPERATIONAL STRUCTURE

5.4.1 Weak structural and operational linkages

Most experts who participated in this interview expressed that, the current operational structure and linkage in agricultural development and extension is ineffective and not functional as desired to be. Institutional alignments and harmonization to achieve the national and regional goals and objectives are generally observed to be weak. Vertical linkage and coordination across all levels of the system also observed to be somewhat fragile and superficially connected than system based and strategic alignments. This means, there is no coherent operational and well-articulated structure from federal to regions and consequently down to districts and kebeles. For instance, Federal ministry is organized as

MoA and regional Bureaus as RBoANR. Structural and operational variability among regions is also evident. For example, some regions have a zone in their structure while others do not. Instability of the system and frequent changes have also contributed to loose connections and coordination failure among regions. Limited technical support by the federal MoA to regions has also created a vacuum to disobey to the federal MoA and in most cases, the operational linkage and coordination are more through personal relationships and willing than through strategic and institutional relationships- raising big questions on the functionality and operational structure of the existing system. Currently, the Federal MoA, Regional BoANR, zonal BoANR, and District BoANR have many “heads” and “departments” but, most of them work in a disconnect from one another.

5.4.2 Institutional instability and frequent changes

The agriculture and rural development of the federal and regions are significantly affected by changes and frequent restructuring. Sometimes the agricultural sectors are merged for improved performance and at the other time, they are forced to divorce as a result of ineffectiveness and inefficiency. Often, the changes are done without any detailed assessment of the pros and cones of either for merging or separations of the sectors. A case example is that, during the last 50 years, the minister of MoA has changed 33 times and the changes were so frequent especially during the last 20 years. This means one minister only stays in his/her position for one and a half years on average. This shows that the ministers will change by the time they finish their learning cycle and ready to discharge their new roles. The same is also true for regions, zones, and Districts. For example, according to the information from the regions, for some zone and Districts, the leaders of agriculture changed 3-4 times in a year. Based on this it can be concluded that frequent changes and reforms have created instability problems, loss of confidence in staff, and institutional memory.

5.4.3 The structure is Political dominated with unnecessary interference

Theoretically, the current organizational structure gives more power and authority to Districts and kebele level institutions where the actual implementation of the agricultural programs and projects are supposed to be carried out on the ground. In practices, this, however, often challenged due to several factors among which political supremacy and unnecessary political interference are the major ones. In most cases, the political party office at all levels of the structure took the upper hand in coordinating and making decisions with regards to staff management, budget allocation and utilization, logistic arrangement, priority

setting, and event planning of the agriculture and rural development. This means, there is no boundary and limits for the political party office. The decision by the political party is not often based on scientific knowledge and facts on the ground but, based on political positions and skewed thinking to politics. Agricultural professionals have no space to make decisions other than accepting what has been decided by the political party office. In connection to this, many experts in the field of agriculture pointed out that in the existing structure, the politics and agricultural and rural development sectoral offices are unnecessarily linked with no/little complementary effects. There is no healthy communication and relationships at all levels between the two since decisions are made by the party and often one way. In the current structure, along the whole process, professionals are demotivated, disempowered, and kept aside. This has collapsed not only the agriculture development of the region but, also the political development since the attention of the political party office is partly and fully diverted to something that is beyond their roles. The inflexibility of the political system has also badly affected the whole system and the operational structure of agriculture development.

5.4.5 Top-down nature of the operational structure

Many studies and reports (Gerba *et al.* 2017); Chimdo, 2017, Belay and Dawit, 2017) indicated that the current agricultural development and extension is highly structured in a top-down approach and supply-driven than demand-driven. This means the decentralization concepts have not been well nurtured in a way that supports bottom-up planning and communicates the voice of farmers upwards. For example, extension contents or messages are mostly crafted at the Federal or regional level and linearly cascaded down to regions and districts. In turn, the extension workers are expected to communicate the contents or message to farmers, and farmers are expected to apply according to the message. When the information reached farmers through this linear way, it is diluted with different information such as, with politics and the chance of the original message to reach farmers is very low. Similarly, when the information is one side story, there is no mechanism to check its reliability and to what extent it is the priority interest of the client.

5.4.6 Weak horizontal linkage

Within the structure, different agricultural and rural development sectoral offices (agriculture, health, education, finance, rural development, etc.), are established and being operational with little coordination and linkages. Within the agriculture sector, there are

general extension directors, commodity directors, team leaders, and process owners with loose connections and collaborations one with the other. On top of this, the vertical and horizontal linkages and communications among the sectoral office's different levels (Federal, region, zone, District, and Keeble's) were found to be unplanned and if planned not consistent with no reporting and accountability system. As a result, many issues that were agreed to be addressed through enhanced vertical and horizontal linkage were left in the crack. Due to this fact, sometimes there is a complete failure for interactions and understanding—raising a big question on the functionality of the existing operational structure of agricultural development and extensions.

5.4.7 Poor performance management and technical support

According to the views of the experts, the technical and field level support by the experts has decreased significantly as compared with the last two regimes (the imperial and the Military Government). In most cases, such supports are provided either by the cadre or command post. The political cadre or command post focus on 'gimgema' and the gimgema is full of affronts and tension than it is supportive and motivating the staff engaged in the agriculture sector (Gerba, et, *al*, 2017). Gimgema after Gimgema is often haphazardly organized with no clear agendas and a pre-designed schedule. Sometimes, the gimgema meeting is ended up with ambiguity and conflict. Also, there is no clear way of the starting point and destinations-making the system to be crippled one with the other. There is no review of the past agendas and discussion points and their implementations. The Gimgema is mostly focused on personal issues than on institutional/ programmatic issues and major constraints encountered at grassroots levels. During 'gimgema' the party cadres are not usually open and flexible enough to accommodate views of the experts. On such occasions, participants have no/limited chance to interact and express themselves other than hearing the critics and accepting what has been presented by the cadres. During gimgema, those individuals who try to confront the critics and rationally defend things from the professional point of view will be linked to the poor attitude or attached to politics. Sometimes, they can be penalized i.e., may lose their jobs or transferred to remote areas even outside of their professions, collapsing the whole situation of the agricultural and rural development programs of the region, zones, and Districts (Personal Communication with experts at different levels).

5.4.8 Limited emphases to agriculture especially at District level

In a real sense, in the existing operational structure, the agricultural development and Extension work has lost the emphasis they deserve in particular at District levels. In another word, agriculture development is generally misguided by non-professionals. The emphases that were given at government and federal levels were diluted and in place, politics have received high emphases and attention. Especially at a lower level of the system, agriculture development and growth were not seen as bigger than any other development issue in the country. It was not put at the highest priority on the agenda of the Districts as it was at higher levels. There is little in understanding that agriculture development entails food security, job creation, trade, and markets and rising productivity leads not only to food security but poverty alleviation, access to education, housing, family planning, health, and many other benefits sus has political development.

As a result of limited focus, the performance of the sector in some district reported to be declining from time to time than improving due to multiple reasons (shortage of budget, leadership, lack of material resources (seed, farm implements, fertilizers, technology) and political wave) in connection to this, agricultural professionals felt discomfort since they are rarely heard and their request is seldom taken into consideration. Most forced to change their professions through distance education although they have a strong interest to stay and work for the sector (Personal communication with experts in the field).

5.4.9 False data reporting

In the past and still currently, false, and exaggerated data reporting at all levels of the agricultural and extension system become one of the national threats and main concerns. The concern is emanated partly due to inefficiency and ineffectiveness of the structure and partly due to lack of taking appropriate measures on those individuals or institutions engaged in this kind of dirty business. Based on our communication with the experts, the source of false data and reports is not only by the data generator or reporter from the bottom but the receiver from the top. Some high-level leaders are figure oriented since they are rewarded by BIG FIGURES NOT BY IMPACTs. As a result, data from the MoA and regional BoANR become unreliable and cannot be used for nationwide planning and references. There are also cases where false data are fabricated by a few individuals at the bottom level to please their bosses and want to get recognition /promotion where the reality on the ground is sometimes completely different.

5.4.10 Poor internal motivations and weak performance of the experts

Many field level observations indicated that the performance of most experts working at different levels of the agricultural sectors is poor. While some experts are playing their roles and committed enough to their organization, most other staff have lost their internal motivations, energy and not committed to work for bigger changes other than blaming and attaching things to the politics. Various reasons can be indicated for this but, poor staff and performance management, poor technical capacity, limited incentives, and lack of staff career path can be mentioned as major ones.

5.5 MAJOR DRAWBACKS IN HRD IN AGRICULTURAL & EXTENSION

5.5.1 Lack of strategy and road map for HRD and especial skill

Based on the analyses of human resources, the region does not have a strategy and visionary roadmap for human resource development. Without this, it is difficult to have well organized, talented, committed, forward-looking, and passionate experts and leaders in a different specialization.

In the current scenario, the lack of having an HRD strategy is like walking in the dark with no bright future and destination. The roadmap that shows where do we want to be in the next 10 and 20 years, what expertise or talent skills and specialization do we need for the region (Ph.D., MSc, BSc, Diploma, etc..) and what kinds of leadership and management do we need, who will substitute or replace when the predecessors retired or left the organization, where to train talent leaders, project managers, and agricultural directors are usually lacking.

5.5.2 Limited number of senior and experienced staff

As a result of the problem mentioned above under 5.1 subtopics, there are critical gaps in terms of having competent and well trained human resources that effectively support the implementation of the agricultural and extension programs as desired. For example, based on the information obtained from the regional BoANR, currently, there are a total of 6,003 staff assigned in RBoANR, 20 Zones, and 290 Districts out of which about 0.7 % are MSc and DVM; 64.6 % are BSc, and 34.6 % are Diploma holders. This clearly shows, to what extent the districts are constrained with inexperienced and well-trained staff to fully implement their respective agricultural and rural development programs since about 99% of the staff at districts are juniors. Based on the analyses, there are only 39 senior-level experts

(37 MSc and 2 DVM) assigned in the entire agricultural Districts of the region (table 47). This means, one senior-level agricultural experts will serve for nine Districts on average.

Table 47 Number of Staff in agriculture and rural development of the region (2019)

No	Category	MSc	DVM	BSc	Diploma	Others	Total
1	Region	21	-	88	23	76	208
2	Zones	39		396	90	572	1,097
3	Districts	37		3,449	1,858	1,154	6,500
Total		97	-	3,933	1,971	1,802	7,805

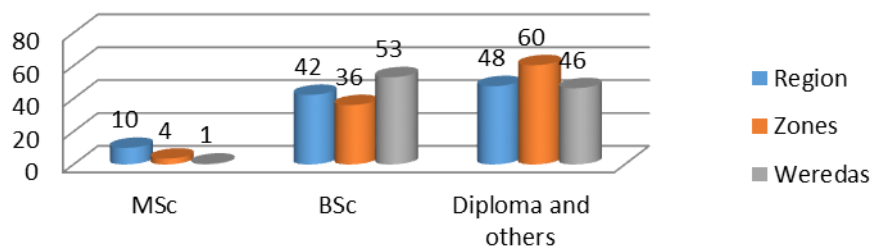


Figure 49 Existing SMSs by the level of education in %

5.5.3 Poor implementation capacity

Oromia region has great potentials for agricultural development. These potentials, however, are not fully utilized due to several reasons among which limited implementation capacity and poor infrastructure are the major ones. On top of this, there are no/limited experts representing different agricultural disciplines such as agronomy, protection, livestock natural resource management, irrigation, horticulture, etc. The existing staff cannot also coordinate and harmonize the works of the various institutions and agencies for complimentary effects partly due to the recent poor educational system in agriculture and partly due to the high turnover of senior and experienced staff.

5.5.3.1 Declining of working culture and ethics

Based on personal observations and views from senior-level officials of the ministry, the culture of working and being effective in the organization has declined related to poor HR management, poor working environments such as incentives and low remuneration. Ethically some staff is also become out of order and ineffective in their performance. According to the existing law of the country and international labor regulation, each staff who works for the government or privately owned institutions must work for eight hours/day. As there is the staff who respect the norms, regulations and keep regular office hours, there is also the staff who violet the norms and work for less than eight hours. For

instance, some staff come office late in the morning and go back home early in the afternoon with no justifications. This problem is emanated as a result of a lack of immediate actions by the management of the respective organizations.

5.5.3.2 Leadership in agriculture Development and governance issues

Agricultural is a science and also an art. Hence, except those ministers and heads of the BoA who are appointed by the government, others such as technical leaders, directors, and case team coordinators must be the professionals of the sector. Conceptually, leaders are made or born. This means there are naturally gifted leaders or emotional intelligence who can lead any sector and bring better results. But, since agriculture is a unique one and implemented under complex environments and linked with various issues (social, political, economic, and environmental factors) it is advisable to have leaders who can understand the complexity of the agriculture and accordingly make decisions and bring the desired changes. Because behind all good leadership and governance is always good results and achievements.

Although recently some spot-light changes are realized in this aspect, the literature review (conducted 2017) still shows that in Ethiopia, more than 81 % of the leaders of agriculture in four regions (Oromia, Amhara, Tigray, and SNNPR) at various levels are nonprofessionals in agriculture or converted experts, who are from another field of specializations such as education, management, law, accounting and the like (Chimdo, 2017) (Fig 50). This shows that in Ethiopia leaders in agriculture are often not assigned based on merit and competence but, on their political stand and commitment. This has paralyzed the whole situation of the agriculture and rural development of the region and subsequently led to the high turnover of the agriculture staff leaving the agriculture sector.

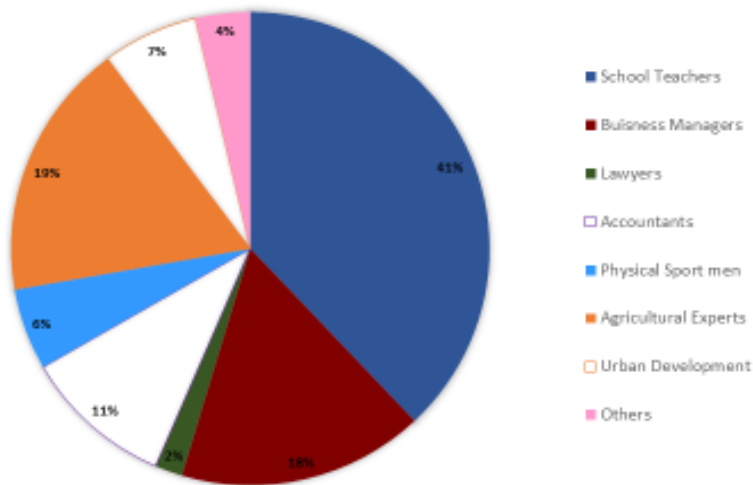


Figure 50 Limited professional leadership in agriculture

Dig--. DAs views regarding their satisfaction on the performance of the SMS

5.5.3.3 limited Incentives for the agricultural experts

In many workshops and conference organized in the region and outside the region, the issues of incentive for agricultural workers has been repeatedly raised as a major problem. Given the experts and field level observations, experts in the field of agriculture are the least paid government employees as compared with other sectors such as; the ministry of health, education, and another related sector. Let alone with other sectors, there are variations within the agriculture sector in terms of salary scale where the irrigation sub-sector is relative with better pay than the others. The low numbers of professional and implementation capacity of the existing staff are directly related to the attractive working environment, poor HR management, limited opportunity for education and career path, the incentive for materials, etc.,) to keep potential and experienced staff in the sector.

5.6 BUDGET AND LOGISTIC SUPPORT TO THE AGRICULTURAL EXTENSION

5.6.1 Limited budget allocation to agriculture and ineffective utilizations

Considering the contribution of agriculture to the national GDP, many scholars still believe that, the budget allocated to the agriculture sector is observed to be very low. This argument is supported by different reports within and outside of Ethiopia. For instance, based on the recent report from UNICEF (2017), the amount of budget allocated to the agriculture sector in the 2017/18 fiscal year is accounted for only 4%, 0.7%, and 2% of the national budget,

total national GDP and agricultural GDP respectively. Although, the agriculture sector is accounting for 36.7% of overall GDP, next to the service sector with a 39.2% share in GDP in 2017/18 (National bank report, 2018) the GDP expenditure to the agriculture sector is less than 1%.

Similarly, in Oromia region, even if the budget allocated to the agriculture sector is slightly showing an increasing trend over the past years (Table 48), the share of budget allocated to the agriculture sector in general and extension services providing institutions (BoANR, coffee and tea development authority, Livestock and fishery development agency, irrigation development authority and pastoral area development commission) in particular, is observed to be very low accounting for 9.8% and 7.5% of the total federal and regional budget respectively (Table 50 and 51). Because of the shortage of budget, more than 80% of the allocated budget to the districts goes to salary. In most cases, the operational budget allocated for one fiscal year has been finished in mid-year and sometimes even in four months. The allocated budget doesn't allow for experts to monitor field level activities and take field level corrective actions.

5.6.2 Lack of transparency and rationality in budget allocations

Based on the interview with experts of the District BoA, the process of budget preparation and allocation to the agriculture sector especially for districts lacks transparency. As a result of this, the allocated budget does not reflect the real situations of the Districts. This is partly due to the limited involvement of representatives from District who knows very well about the districts and limiting factors. According to the response from the participants, during budget allocation, the situations of districts are not deeply taken into consideration and the roles and responsibilities that the district plays as the foundation of agriculture development and transformation are largely overlooked. The main reasons why DAs and F/PTCs are not operating their tasks are related to the lack of operational budget and necessary facilities.

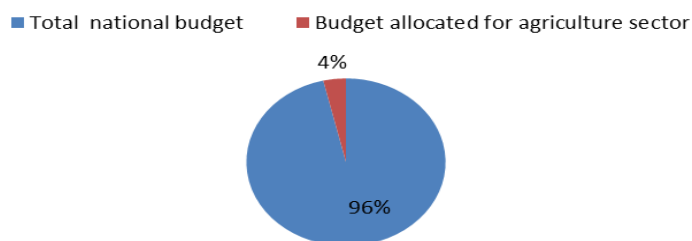


Figure 51 National budget allocated to agriculture in 2017/18

Table 48 National GDP contribution and budget allocated to the agriculture sector 2013/14 to 2017/18 (in billion birr)

Category	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18
Total GDP	630.3	696.5	1463.9	1613.5	1739.2
Agriculture GDP	251.8	267.8	544.1	580.4	600.9
Budget allocated to agriculture and rural development	6.6	7.8	9.1	9.6	12.2
Budget allocated as percentage of total GDP	1.0	1.1	0.6	0.6	0.7
Budget allocated as percentage of agricultural GDP	2.6	2.9	1.7	1.7	2.0

Source: UNICEF, 2017 and National bank report, 2018

Table 49 Budget allocated to the agriculture sector and regional institutions directly engaged in providing extension services (in billions)

Category	2014/15	2015/16	2016/17	2017/18	2018/19
Total regional budget	31.7	43.0	46.4	55.8	63.4
Budget allocated for regional agriculture sector total	3.1	4.2	4.4	5.3	6.5
Budget allocated to extension service providing institutions	2.5	3.2	3.3	4	4.9
The budget allocated to the regional agriculture sector as a percentage of the total regional budget	9.8	9.8	9.5	9.5	10.3
Budget allocated extension service providing institutions as a percentage of the total regional budget	7.9	7.4	7.1	7.2	7.7

Source: BoFEC, 2018/19

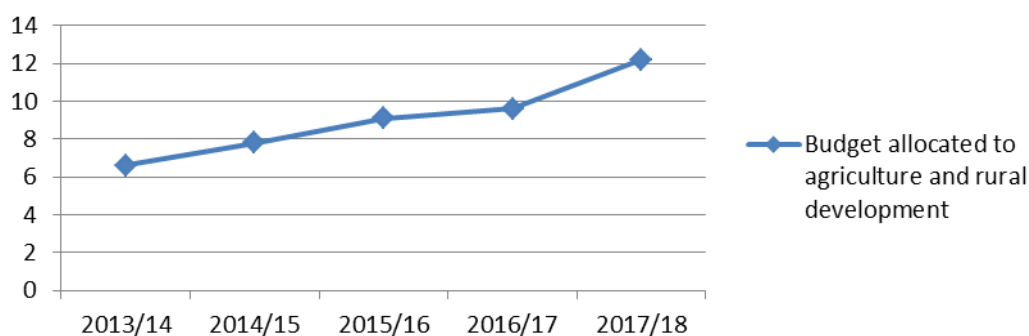


Figure 52 Trend in the national budget allocated to the agriculture sector

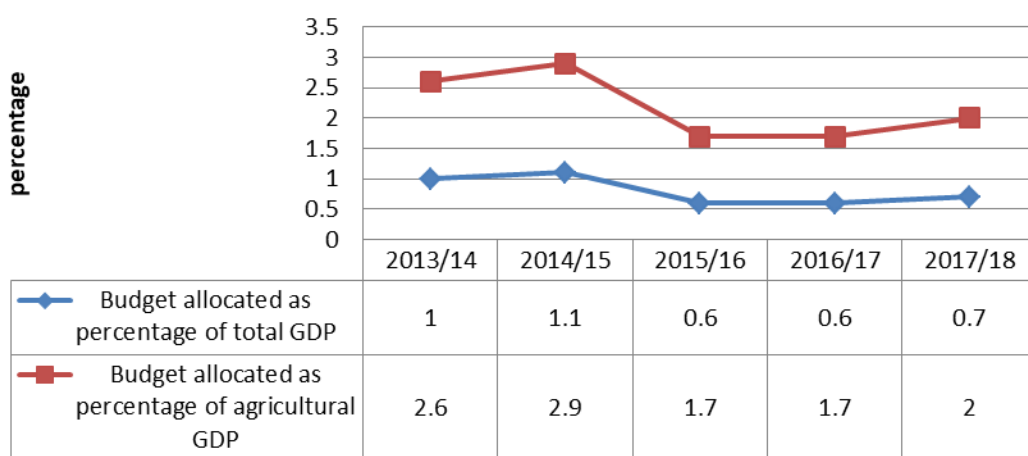


Figure 53 Trends in the budget allocated to agriculture as a percentage of total GDP and AGDP

5.6.3 Shortage of field level and office facilities

According to the information from the regional BoANR, important office and field level facilities such as tables, computers, stationery materials printers, and internet facilities are lacking. The same is also true for logistics particularly fuels and field level transports. Based on the data from the regional BoARD, currently, the bureau has a total of 205 vehicles, 14 big lorries, 2,860 motorcycles, and 3,641 bicycles that give service for the entire region (zonal BoA, District BoA, and Kebeles). This clearly shows that there is a district that does not have at least one vehicle for field level operations- critically challenging the implementations of programs and projects in the districts and region.

5.6.4 Poor efficiency in using the external resourced budgets

According to the information from MoA, there are about 3,000 NGOs in totally engaged in various forms of social and economic activities of Ethiopia. Out of this, about 1050 are found to be engaged in agriculture in general and extension services in particular. Many of these NGOs are based in the Oromia regions. The existence of different NGOs and private sectors working in the region in agricultural extension and rural development would create maximum opportunity to provide diverse and inclusive extension services to all farmers in the region. Nevertheless, in most cases, the flagship programs and projects of the NGOs are not well coordinated and harmonized with the regional programs and projects. Although recent changes are realized, the Oromia region is found to be the least in using the externally funded projects as compared with other regions (personal communication with RBOA). This is mainly a result of poor communication, limited enabling environment for NGOs, and weak coordination of the staff in the region.

5.7 SITUATIONS OF FARMER'S/PASTORAL TRAINING CENTRES (F/PTCS)

Farmers Training/pastoralist Centres (FTCs) are local-level institutions initiated by the Government of Ethiopia primarily to train and develop modern farmers in agriculture. Farmers under the F/PTC scheme are educated through organizing regular training on improved agricultural technologies and demonstration of best practices. F/PTCs also help in the delivery of relevant and timely information communication and provision of tailored extension services to different social segments and groups of farmers. Establishing F/PTCs in each kebele above all provides a unique opportunity to enhance the bottom-up extension approach which would improve the farmer's feedback system. In line with this, since 2002 and following the federal system, the Oromia region has established F/PTCs in its different kebeles. To date, about 5,738 F/PTCs were built across the region that is at different performances. For example, out of the total F/PTCs, about 1,741 are pre-basic, 2,644 are basic, 1,185 are intermediate and only 168 are at an advanced level. This clearly shows that, after 16 years of establishment, the vast majority of F/PTCs in the region are not fully operating and serving farmers as expected. Based on the recent assessment made on the F/PTCs, the following factors are the main problems for their poor performance (Oromia, 2018; Chimdo, 2017).

Table 50 Number of DAs by specialization. (Source, OBoARD, 2019)

No	Category	BSc	Dip.	L.-IV	Total
1	Plant Sciences	1,742	1,951	1,510	5,203

2	Animal Sciences	1,137	1,517	928	2,446
3	NRM	1,414	1,965	1,461	4,840
4	Animal Health	308	806	726	1,840
5	AI technician	-	-	-	-
6	Cooperatives	306	530	505	1,341
Total		3,771	6,769	5,130	15,670

5.7.1 Limited awareness by farmers on the overall importance of F/PTC

Not all farmers or pastoralists have adequate information about the F/PTCs right from the beginning. Why? Because, before establishing F/PTCs, there was no adequate consultation with farmers to clarify the intended short and long term objectives about F/PTCs. For example, during the interviewer with farmers, some said F/PTCs are established for Extension activities and training DAs while some others said for conducting of different meetings and establishing demonstration plots. This entails that; farmers /pastoralists are generally not with the same understanding of the importance of the F/PTCs. As a result of this, most farmers in the Kebeles allocated land for FTC in swamps, mountainous, sloppy, degraded, or marginal areas that are not suitable for the demonstration of different agricultural practices. Thus, most of remained idle. In connection to this, farmers see F/PTCs as government institutions rather than their property. Because of this, farmers have eventually developed bad attitudes and images to F/PTCs since most of them are not used for the intended purpose. Due to these facts, the original thought that F/PTC could bring positive changes among farmers and enhance their technology adoption has not been fully materialized.

5.7.2 Lack of adequate resources for F/PTCs

The lack of operational funds hindered F/PTCs from discharging their general roles and responsibilities of training, conducting a demonstration of new technologies, and showcasing best practices as desired to be. According to the FTC guideline (MoA, 2009), the basic physical infrastructure needed for the F/PTCs includes; classrooms, demonstration plots, DA housing, and offices, animal shade, irrigation, and/or water harvesting structure, workshop, meteorology, and a permanent exhibition centers. However, because of limited resources, these materials were not delivered to F/PTC, except where some external resources are injected by NGOs.

5.7.3 Poor design and construction of F/PTC

From the field level observations, it was clear to know that almost all F/PTC in the regions are not constructed keeping quality standard and design in the context of the region. For

instance, all F/PTCs were constructed using Iron corrugated sheets including walls, roofing, and DA offices. This makes it difficult for farmers to learn in F/PTCs especially during the hot period or high-temperature areas like that of pastorals. As a result of this, the majority of F/PTCs were used for short types of meetings and community mobilizations than for farmers' training.

5.7.4 Majority of F/PTC do not have DA houses

According to the FTC guidelines of the MoA, all F/PTCs must have adequate housing and offices available for DAs. All DAs should be required to live in their FTC housing and keep regular hours at the F/PTCs. This has never happened since all of the F/PTCs have no DA house and necessary living facilities. The housing is expected to include basic furniture such as beds, tables, and chairs for each unit and separate toilets for female and male DAs (IFPRI, 2010).

5.7.5 Limited capacity of DAs to operationalize the F/PTC

Most agree that DAs have limited technical capacity and skills to properly guide and mobilize F/PTCs. According to the study by Gerba, et al (2017), a large number of respondent farmers criticized the skills and efficiency of advisory services provided by DAs. About 47.5% of the households involved in the case study areas are dissatisfied by the extension services currently offered to them by the DAs. Given the respondents, they lack both hard and soft skills to properly drive F/PTC towards the correct directions and help farmers benefit from F/PTCs approaches. As a result, technology demonstration in F/PTC often irregularly organized and lacks continuity. Likewise, DAs lacks the capacity to integrated F/PTC plans into kebele level programs and activity plans for complementary effects.

5.7.6 Lack of support from the leaders

Generally, F/PTCs operations lack full support from the leadership at all levels. Most leadership gives focus to assign DAs in FTC without fulfilling all the necessary conditions for FTCs and arranging preconditions for DAs to play their roles. Although the issues of the F/PTCs repeatedly raised as a major concern in different national platforms, no practical actions are taken by leaders to address the issues, except leap services.

5.8 DEVELOPMENT AGENT (DAS) AND THEIR GENERIC PROBLEMS

DAs are critical resources for agricultural development. As a result, to date, the Oromia region has deployed more than 21,540 DAs. However, currently only 15,670 are reported working in the region-showing 27 % turnover. This figure is very high as compared with international labor low (11%). Three DAs per F/PTC specializing in plant sciences, animal sciences, and natural resources management and in a few cases one each animal health and cooperative experts are assigned per the F/PTC.

Considering the number of DAs in the region, the region is annually investing a significant amount of budget for DA salaries and relative incentives. For example, based on the information from the RBoA, on average the salary of one DA is about 5,000 ETH birr. This figure is relatively higher than the average salary of the DAs in other regions. With this calculation, the region is spending 78 million ETH birr/annually and nearly 5 billion birr in five years only for the salary of the DAs.

Apart from their poor working environment, the emerging private education system in the country has also created the opportunity for extension staff to leave the agriculture sector and join the growing and better –paying service centers (Garba, *et al*, 2017) However, according to the views from farmers and experts, in most cases DAs are not playing their roles as expected to be due to the following generic problems.

5.8.1 Work overload

Based on the interviews with DAs and different experts, DA's current roles are huge and hard that requires both physical and technical works. They are trapped with a lot of multi-sectoral activities that do not typically fall under their mandates. For instance, they are engaged in political activities, farmer's administration, managing land disputes, tax and credit collection, farmer's arbitration, and input distribution (seed, fertilizer, chemicals, drugs, etc.,). Most of the cases, their work is with no boundary and limits extending across the whole sectors and value chains.

DA's are often obliged to do all activities at the kebele level since many DA's works with no boundaries and limits. They have no well thought and organized activity plan and work diary. As a result, they are always with a busy schedule throughout the year engaging with seasonal and emergency and campaign based agricultural activities. On one hand, Woreda leadership expects DAs to shoulder all agricultural and non-agricultural activities going on in each kebele but on the other hand, they are the ones who demotivate DAs and consider DAs Job as unimportant (personal communication with DAs in Bora District). Their

involvement in non-extension and political affairs generally led the DAs not to win farmers' trust and acceptance, especially at this time.

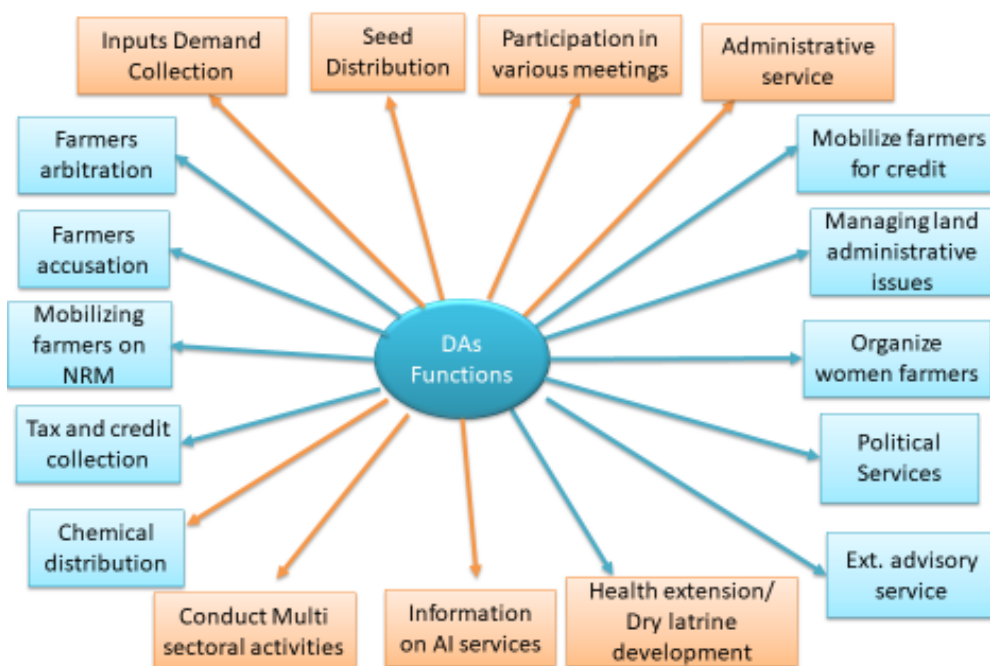


Figure 54 Multifunctioning of DAs that do not typically fall under that mandate of extension (2017)

5.8.2 Low Motivation of Das

From the assessment made, it was clear to know that DAs are not motivated and encouraged to properly discharge their duties. According to the views of the DAs, the motivation by the MoA and regional bureaus are extremely low and discouraging. For instance, out of the 200 DAs who participated in this study, 41% responded as they were strongly dissatisfied, 50 % dissatisfied, and 6 % remaining neutral. Only 4 % expressed their satisfaction with the current DA motivational schemes of the MoA. According to the DAs, their highest dissatisfaction is related to poor incentives, low rate of per-diem, lack of logistic and poor leadership at district levels. As a result, more than 92 % of DAs are found to be unhappy with their roles and hence the majority of them do not want to stay in the sector. (Chimdo, 2017).

5.8.3 Limited Career Path development for Das

In addition to poor incentive structure, DAs are said that limited opportunities for education and lack of vertical and horizontal salary promotion badly affected the morale to work in the sector. Given them, limited career structure and opportunities for further education generally led them to dislike their job. Since staying in the sector has no bright future for them, currently, they are more inclined towards looking for better opportunities than staying in the sector. For example, out of 20 DAs who went for education either through government or self-sponsorship from 2010- 2014, only 2% were observed continuing their further education in agriculture while the rest joined other fields of study such as accounting, management, law, etc. (MoAR, progress report, 2018). In addition, based on personal observation, some DAs left their job and are self-employed such as; taxi driving, petty trading, hotel manager, and barber that implies agriculture is no longer their choice.

5.8.4. Political interference and pressure

DAs, also expressed that apart from limited career path opportunities and heavy workload, political interferences and pressure from the District leadership have contributed to dislike their jobs. According to the views from DAs, district cadres are influencing DAs to do non-extension activities such as community mobilization. If DAs are not willing the chance of getting a promotion, scholarship for education, or privilege of transfer to better districts is very unlikely. In the structure, DAs are often submissive to the District and Kebele administrators, who are politically elected leaders.

5.8.5 Limited office and field level facilities for Das

Shortage of important office and field level facilities for DAs are also among important factors limiting the performance of the DAs. In most cases, important facilities and equipment needed for DAs are in short supply or absent. For DAs to work with their full potentials, they need basic office facilities (table, chairs, and stationery materials), household equipment and facilities (chair, dining tables, cooking materials,) and field equipment and items (carry bag, notebook, raincoat, boots, umbrella, sleeping bags, meter, string, and transport facilities and all-important facilities and equipment for beekeeping, etc.). Based on the information from the DAs, all relevant materials and equipment needed for the health extension (workers who are with parallel structure with DAs) are supplied to health extension workers while they are not for DAs. Because of the DAs, the ministry of health is more responsive and positive to consider the issues of the health extension workers

and creating a conducive work environment for them while this is mostly lacking from the MoA. Out of the 200 DAs involved in this study, 80 % were dissatisfied with the supply of office and field level facilities by the MoA. Only 7 % were neutral while 12 % expressed their satisfaction

5.8.6 DAs receive directives from different bosses

Since DAs are engage in multiple extensions and non-extension activities, their bosses who give orders are multiple at the District and Kebele levels. This is reported to be one of their dissatisfactions in their current jobs.

5.8.7 Irregularity among regions in DA management and benefits

Although there are national guidelines and standards on DA management and roles, this is not practically used among regions. As a result, there is high variability among regions in terms of DA salary, incentives, benefits, and overall DA management and handling. Such irregularity has created discomfort for DAs and losses of trust to work for the sector.

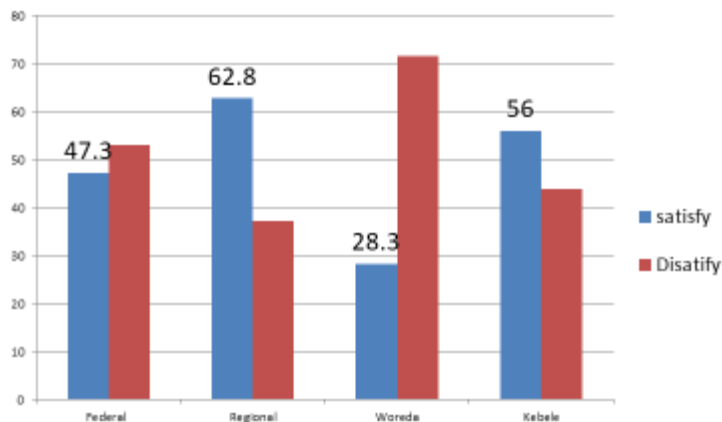


Figure 55 Satisfaction of DAs in their role (N=200)

5.9 STATUS OF FARMERS DEVELOPMENT GROUPS

Farmers Development Groups (FDGs) and 1 to 5 social networks

Based on the national guideline from the federal MoA, the Oromia region has established different working groups under the kebele management portfolio since 2011. The main purpose of establishing the group is to share labor, enhance joint learning, and collective action to scale-up technologies or best practices (Gerba et al, 2017). The FDGs (Gare in Afan Oromo) composed a group of 20-25 neighboring farmers supposed to form a group to

support one another in agricultural practices. Accordingly, to date, about 144,898 FDGs and 716, 851 one to five social networks were established in rural kebeles of the region.

Quick observations made on FDGs and One-to-five social network groups, however, indicates that although the establishment of the FDGs and one to five social networks have contributed to the relative changes in agricultural extension services provision especially at an earlier stage, they were later forced to involve in other business such as community mobilization for the politics and campaign work, resolve local conflicts and used as a tool for strengthening the state ties with farmers. As a result, recently, most farmers lost interest and energy to continue with FDG and more tempted to use their traditional way of doing agriculture. Currently, most of the FDGs and one –to five social networks are not fully operational in line with the original motives of joint learning and collective actions.

5.10 STATUS OF FARMER RESEARCH AND EXTENSION GROUPS (FRG, FREG, FFS)

In the past, the research and extension systems in the region have established different groups like Framers Research Groups (FRGs) and farmers- Research–Extension Groups (FREG) and Community Income Generating Groups (CIGs) with the main purpose to improve technology generation, verification and dissemination, and adoption. Similarly, community based informal seed production groups were established with the main purpose to produce seeds with full support from research and extension and address the shortage of improved seeds on key commodities. According to Chimdo (2005), the establishment of these groups has helped to increase the adoption of improving technologies from the research system to farmers and the dissemination of improved seeds on major commodities. These groups are continued to be used in the extension system and most cases the approach is widely embedded into the national, regional, research, and university system although recently they are not with their original momentums and spirt of linking farmers with research systems.

5.11 STATUS OF AGRICULTURAL EXTENSION SERVICES IN THE REGION

5.11.1 Extension coverage

Many reports from different sources (Brehanu *et al.*2006; Chimdo, 2017; Asfaw, 2018)) indicated that the extension services provided by the country as well as the region over the past 10 years are with limited domain and scope of focusing on the transfer of technologies and demonstration of specific commodities (mainly; Maize, Wheat, Tef, and Barely) while

high-value crops such as horticultural crops (vegetables and Coffee and spices) and the livestock sector are seldom addressed.

Similarly, the extension service of the region was biased towards the highland agricultural and potential areas than the lowland and pastoral and agro-pastoral areas using the principle of 'one size fits all' (fig 54). For instance, the extension package relatively concentrated in high land and central rift valley areas; like West Arsis, Bale, and East Hararge, East Shoa and Jima while the low land and mid-altitude areas like in Guji, Borena, West Wollega, and Kelem Wollega are with very low extension coverage. Likewise, the number of FTCs and DAs are low in lowland and pastoral areas compared with the highland areas. This means farmers in the pastoral and agro-pastoral areas were seldom reached through extension package (See fig.55)

As it is a common practice across the country, the extension service in Oromia is also biased towards cereal crops, and strategic and export crops like coffee and industrial crops like oil crops are overlooked. For instance, according to the CSA report (2017/18), cereal crops constitute 94% of the total area under crop extension package while coffee constitutes only 1% of the crop area under extension packages in the 2017/18 production year. Similarly, out of the total farmers reached through extension services in 2017, the number of males, females, and youths reached were 83%, 9.8%, and 6.8% respectively. On top of this, more than 80% of farmers who received extension service in the past years are model farmers. This clearly shows that the extremely poor people, landless, youth, and women have not received enough attention from the region.

5.11.2 Mismatch between demand and supply of input (seed)

The shortage of Improved seed is one of the main reasons for the underdevelopment of Ethiopian agriculture. Mellor and Dorsha, 2011, cited by Gerba, 2017) remarked that the lack of seeds is the most serious problem in meeting agricultural growth targets. According to CSA (2018), only 11% of the total crop areas were covered by improved seeds. This entails that, the large majority of farmers, in the region, are still using the traditional crop varieties that are poor in yield and quality and susceptible to diseases and pests. The number of improved seeds used per ha was as low as 44 kg. Cereal crops constituted the larger share i.e. 97.7 % of the total volume. The three major cereal crops; maize, tef, and wheat constituted the larger share (86%) of the total volume of improved seeds used in the production year. Poor access to seeds, high price for both seed and fertilizer, low quality of

seeds, untimely delivery of inputs (seed and fertilizer), and inappropriate advice on seed and fertilizer uses are reported to be the major problems.

As a result of relatively improved extension service, the demand for seeds has increased significantly. However, the number and capacity of seed producers in the country never match with the demand of farmers. In Ethiopia, the current national seed supply for self-pollinated crops ranges between 10-15%, covering about 10% of the total land area. Except for maize, the use of hybrid seeds is significantly negligible. The country's conventional seed distribution system is characterized by a long supply-chain, mismatch between demand and supply, untimely delivery, lack of accountability among seed value-chain actors, and high budget/time constraints for governmental structures at various levels.

On the other hand, although, to date, the research system has generated more than 2000 scientific knowledge, technologies, and practices, it is reported that less than 20% of them are used by farmers. Lack of promotional work after the release of the technology, weak linkage among the technology generators, technology multipliers, finance, marketing, distribution, and extension remained to be the major generic challenges.

5.11.3 Access to credit services

Credit service is an important enabling environment for farmers to invest in agriculture. However, microfinance institutes in rural Ethiopia are poorly developed and provide only limited services (Gerba *et al.*, 2017). The initial credit ceiling for a farmer is about 3,000 ETB/person. As reported by the same author, the major challenge is the “group collateral system” and “in advance saving” requirement to access the services. It needs a group of five to ten farmers with similar interests and commitments. The other challenging issue that keeps farmers outside the credit cycle is the interest rate. The microfinance loan interest rate in Ethiopia ranges from 15% to over 24% per year depending on the types of microfinance, public or private, respectively. It is difficult for farmers to settle their debt quickly. As a result, farmers are afraid to access loans because of high-interest rates and possible debt accumulation. Apart from the high-interest rate, farmers are also discouraged by lower output prices and bad experiences of enforcement to repay the debt.

The majority of farmers have still limited access to credit services. As reported by CSA (2017/18), of the total sample households interviewed, only 847,200 reported that they had access to credit services. This means the majority of agricultural inputs are sold in cash to all farmers regardless of their purchasing capacity. Access to credit services from microfinance institutions demands group collateral of about five to ten farmers. It is

challenging for farmers to find peers with common interests and commitment. Practically, this means they have limited access to credit, a lack which impedes technology adoption by resource-poor.

5.12. LINKAGE BETWEEN PARTNERS ENGAGED IN AGRICULTURE

Despite many attempts made to create strong linkages between research, extension, and farmers in the past many years, effective linkage and coordination have been lacking in the process of agricultural development and extension service provision. Experts interviewed on these aspects indicated that ADPLAC at the time of its establishment had good motivation and spirit to enhance agricultural development sustainably. However, this momentum gradually declined, and even currently linkage platform meetings become inconsistent. As a result, issues that are challenging the agricultural development and critically affecting the provision of extension services such as input and output marketing and access to financial services remain unresolved. Except for planning meeting held every year, ground-level supervision and monitoring of ADPLAC has also been identified to be weak. Additionally, deficient in assigning strong and dedicated focal persons for ADPLAC within organizations has aggravated the problem. In areas where focal persons are assigned, they are neither empowered nor are they sufficiently familiar with their responsibilities.

The following key bottlenecks hindered ADPLAC from fully functioning and bringing greater impact as expected. Focused on micro-level issues than system levels; the annual meeting is simply an assembly of hearing progress reports from regions; the decisions made during the annual meetings rarely addressed during the incoming annual meeting; limited participation of HLIs/ATVETs; and weak responsibility and accountability system in the linkage platform are among the major problems. Very recently these problems are being addressed jointly by EIAR, MoA, and Universities by establishing sub-platform and addressing specific and contextualized linkage issues that need to be strengthened.

5.13 MONITORING, LEARNING & EVALUATION

The agricultural extension system as a whole is also criticized for its weak MEL. In Oromia, although some efforts are being made here and there through field visits, meetings, and report exchanges, there is no consistent, organized, planned, and coordinated MLE within the agricultural extension system. Also, the extension system is criticized for focusing on what has been achieved rather than giving equal attention to how things are achieved. The agricultural extension system lacks an effective MEL system with clear roles and

accountability at various levels. As a result, the information collected related to effectiveness, efficiency, and capability of the extension service is observed to be poor quality and sometimes false and exaggerated ones, which affects the decision making process in the extension system. There are critical budget and logistics problems particularly at zonal and district levels for conducting monitoring and evaluation activities. Moreover, the emphasis given for the implementation of timely reporting and undertaking of a systematic MEL system is generally very low in the region.

5.14 PROPOSED STRATEGIES TO OVERCOME MAJOR CHALLENGES

The following strategies and programs are suggested to overcome some of the important problems and challenges described above under different topics and sub-topics.

5.14.1 Regarding Policies, Strategies and Operational Structure

5.14.1.1 Revisiting the current agricultural and rural development policies and strategy

It is more than 15 years since the current policy and strategy for agriculture have been developed and being used. Among the policies we have, effective HR use, proper land use, productivity-oriented system, rural finance development, and off-farm income generations are the major ones while the pillar strategy we have is agricultural Development Led Industrialization (ADLI). Since the implementation of these policies and strategies, there were some dynamics and changes witnessed across the entire country in general and Oromia National Regional States in particular. However, it is unknown to what extent these policies, strategies, and programs were implemented by the region and what major outcomes are realized in the context of the region. Therefore, it is critical to know what has achieved and what new policy elements are needed as an amendment to existing ones to immediately and quickly fix the problems and transform the agriculture of the region.

5.14.1.2 Identification of sectoral linkage challenges and limitations

Based on the interview with the experts at different districts, each sector has its limitations and challenges to fully discharge both their own and joint roles. The limitations and challenges are partly manmade and partly due to role clarity problems among the sectors. It seems that, in most cases, each sector is dominantly work in 'silos' with no/little common strategic objectives and goals. As a result, there was no well-planned and organized way of joint performance evaluations and communication of results. Sectoral and institutional linkage is also suffered from a lack of clear outcomes and indicators emanated as a result of

clarity issues on roles, responsibilities, and accountability systems among the institutions. Sometimes, more focus is given to higher-level institutional linkage and coordination with the outside of the system without strengthening internal linkages and alignment within the sector. As a result, most agricultural and rural development activities at District levels are not mainstreamed, strategically aligned, and coordinated for better outcomes. To mitigate the challenges, it is suggested to quickly assess the root causes and critical gaps of the sectoral linkages at all levels and design mechanisms for enhanced collaborations and integration within the sectors and with other rural development institutions for greater impact.

5.14.1.3 Reconstructing the existing organizational structure

As described above under the operational structure sub-topic, the existing operational structure for agriculture and rural development is not fully operational and effective as desired. Poor horizontal and vertical communication and interactions between the actors, upper hand was taken by the politics, lack of accountability and responsibility mechanisms, frequent changes of the operational structure governance and leadership related issues, and poor incentives for agricultural experts made the structure not to fully work and yield considerable outcomes. To mitigate these problems and improve the operationalization of the structure and thereby improve efficiency and increase effectiveness, the existing structure needs to be reconstructed with more clear and defined roles and responsibilities given to the regional, zonal, and District BoA with clear responsibility and accountability system.

Avoid uniform structure and the same development formula and a prescription for all districts and Kebeles: Districts and Kebels are highly variable with their potentials, opportunities, potentials for agriculture, human resource capacities, infrastructure development, and their location. As a result, districts must be supported and capacitated considering the actual situation of each District and in the way that these potentials and opportunities are fully utilized and capacity gaps are addressed sustainably by avoiding one prescription for all.

5.14.1.4. The demarcation between politics and agricultural development

Both political development and agricultural development are critically important for our country to grow and develop. However, from the interview results from SMSs and DAs, it was understood that the current operational structure starting from regional BoARD to

Districts and Kebeles are mostly structured in a way that enhances political development than agriculture (Chimdo, 2017) or there is some misunderstanding of individuals in the structure in keeping a proper balance between the two. As a result, the relationships and communication between the two in the past couple of years were observed to be unhealthy and not collaborative. The fact that the party office took overall roles in making decisions, led the agricultural experts and professionals to keep silent and become ignorant. If either the existing operational structure or the newly reconstructed one is to fully work and yield considerable outcomes, there must be a boundary between the party office and the agricultural office. This, of course, requires delineating the roles and responsibilities and accordingly reshaping of their relationship for complimentary and mutual effect. Empowering agricultural experts and professionals to lead the sector with full authority and responsibility could be an immediate solution. While the focus of the party remains on the development of politics, it could also play a role in creating an enabling environment for agriculture to develop and grow.

5.14.1.5 Introduce Culture of Merit-based Leadership assignment for the sector

The leadership assignment for the agriculture sector should be made on MERIT and knowledge bases except for those Ministers and Bureau Heads who are directly appointed by the government. The rest including the StM and D/Bureau Heads and directors should be professionals who came to the position through competitions and relevant experiences. This professional will not be changed whenever the minister changes and can be used as a backstopping and keep consistent organizational memory.

5.14.1.6 Create and reinforce a culture where false data report is Zero tolerance issue

As briefly described above under the general problems, false data/fabricated data/exaggerated data reporting become one of the national threat. In some areas or locations, it also becomes the acceptable norm since no measure is taken against this both by the higher and lower-level management of the organizations. The contributors to this paper strongly believe that no one could benefit from such kind of dirty exercises. To alleviate the problems, strong actions need to be taken on those individuals who engaged in such kind of business through Developing Result Based Monitoring system (RBM). Because, considering the current data issue, the team does not believe that having zero tolerance and improved management may not be adequate to urgently address these generic issues. Therefore, we

must put in place systems or techniques liker RBM that counter-check results right on the ground and by introducing GPS measurement, Drone supported estimation, etc.

5.14.2 Human Resource Development and Capacity

5.14.2.1 Strategy for Human resource development and special skill

Based on the analyses of the human resource of the region, the region is highly constrained with a shortage of senior staff to fully implement its program across the entire region since about 90 % of the existing staff are juniors with BSc and Diploma. This is mainly attributed due to a lack of effective strategy for human resource development for agriculture. To minimize the problems, the following strategies can be suggested.

5.14.2.1.1 Mapping of human resources and critical capacity gaps

Mapping of the existing staff in agriculture for their competence and capacity gaps is very essential. This among others includes; who is doing what, who lacks what, the capacity of the existing staff (technical, Knowledge, skill), the performance of each staff, specialization (crop, L.stock, NRM, gender, extension, marketing, etc.,), poetical gaps and why the gap has been created including their root cause, behavior and attitude of each staff as well as their interest to work in agriculture (as an expert? as an agricultural leader? or as party leader? Or consultant? etc.,) need to be identified and well known.

5.14.2.1.2 Developing a road map for human resource development

In the developed world, every organization has its strategy for human resource development. They have a Visionary road map and career path development both for the short and long term. The roadmap must show where do we want to be in the next 5 and 10 years, what expertise or talent skills and specialization do we need for the region (Ph.D., MSc, BSc, Diploma, etc.,) and what kinds of leadership and management do we need, who will substitute or replace when the predecessors retired or left the organization, where to train talent leaders, project managers, and agricultural directors. Having a clear road map for HRD is the best opportunity to develop talent, committed, visionary, forward-looking, and passionate leaders in a different specialization.

5.14.2.1.3 Enhance efficiency and effectiveness of HR

5.14.2.1.3.1 Change mind-sets at all levels

To bring changes, first, our mindset and old way of thinking need to be changed. Because change is determined based on our mental readiness and acceptance. Today, the issue of change in mindset becomes the top priority concern nationwide since our working culture, work ethics, commitment, loyalty to our society, and organization and determination are often deteriorating than improving. Based on information from district-level staff and our field observations, much of experts' time is being wasted on unnecessary issues and communications. Agriculture as a day to day agenda is being vanished or rarely raised and taken into account. In place, gossiping, backbiting, and seeding of wrong and false information in the social system using social media widely increased. To minimize these problems and bring back our attention to the development, strong efforts need to be made to change the mind-set our experts and citizens through school education, universities, religious institutions, and workplaces using different means (media, social mobilization) and conducting of intensive training designed to change the mindset of everyone in the organization and promoting of positive attitude and thinking at all levels.

5.14.2.1.3.2 Develop Master Training Programs (MTP)

The MTP is a unique training program that needs to be developed in the region. The MTP is only conducted by qualified, certified, and authorized professionals. It is used as an immediate strategy to overcome the shortcomings and build capacity in agriculture and other business. It is a vehicle for hands-on training, development of appropriate skill, and adoption of responsive attitudes for impactful service delivery. The MTP aims to create a pool of qualified experts in the agricultural extension to facilitate knowledge, learning, and innovation. For instance, if the MTP is on agricultural extension, after completion of the MTP course each participant is recognized as a resource person with the knowledge of the extension system and accordingly train staff in the region.

5.14.2.1.3.3 Build the capacity and professionalism of the staff in all sectors

To be more effective and efficient, all kind of business requires specialized knowledge and skills. Especially at this time, the world is increasingly using the term “professionalism” to describe their level of service provision and satisfaction. While some professionals, such as medicine and engineering, have been well known and recognized through standard

qualifications for many years, others such as agriculture and rural advisory services have only recently begun to aspire to a higher level of professionalism. The advantages of the professionalism among other include: ensure efficiency and efficacy, improved capacity (knowledge, skill, and attitude), setting high standards to improve performance and deliver relevant services as desired and job satisfaction (pride, recognition practicing without fear/interferences, remuneration /awards, support from colleagues). Given this, it is strongly suggested to build professionalism in different areas of specialization in well thought and HRD.

5.14.3. Strategies to improve budget allocation and budget utilization

5.14.3.1. Greater focus to agriculture transformation and inclusive growth

Agriculture transformation and growth is bigger than any other development issue in the country. It must be put at the highest priority on the agenda of the Government. It entails food security, job creation, trade, and markets. Rising productivity leads not only to food security but poverty alleviation, access to education, housing, family planning, health, and many other benefits. In short, it concerns the entire nation. Greater focus begins with sound planning, budgeting, leadership, and ground-level implementations.

5.14.3.2. Improve transparency in budget preparation and utilization

Most indicated that the budget preparation and utilization at zone and District levels are not transparent and hence, mostly utilized for an unintended purpose. Most resources are wasted on unplanned meetings.

5.14.3.3 Improve operational budget for Districts and their efficient utilization

As described above under budget allocation, agriculture contributes to the national GDP significantly. However, GDP expenditure for agriculture is significantly low (Below 1%). Many reports from the USA, China, India, even Ethiopia indicated that investment in agricultural extension has shown positive returns. Given the current ambition plan to transform agriculture the budget allocated for agriculture significantly low to realize the transformation. The following are suggested to overcome the problem and improve budget allocation for agriculture. Budget preparation and allocation do not take price inflation, volume, and types of activity plans given to specific districts and their prevailing constraints into consideration. Finance investment to District BoARD is the most important task to be

considered including a budget allocation for technology, human resource development, logistics, and agricultural inputs.

5.14.3.4 Establishing Matching Funds for agriculture (MF)

MF is an integrated development partnership uniting private, public, and Civil society actors to blend finance and in-kind resources for clearly defined activities aligned with a common project focus in a common interest. This mobilizes significantly more resources and leveraging synergies, resulting in a significantly higher impact.

5.14.4. Strategies to address DAs generic issues

5.14.4.1 Revisit DA curriculums in ATVETs

Many scholars and professionals have a big concern on DA's current curriculum (course choice, design, course content, scope and depth of the course, course duration and assessment, etc.). The quality of the trainers (their knowledge, practical skill, behavior, attitudes, and personality) are also believed to be the root causes of the problems. Based on the field level observation, many experts questioned whether or not the desired knowledge, attitude, behavioral, sociological, psychological, and communication course are sufficiently imparted in DAs ATVET training, in particular the current course related to levels 2 and 3. Therefore, it is a high time to revisit the overall DA training curriculum in ATVETS including their technical and physical preparations, the balance between theoretical course and practical exercise and to what extent the courses are designed to address the current DA capacity and behavioral issues and how it is tailored to region context and field-level problems.

5.14.4.2 Mapping and identifying DAs interest in agriculture

In the interview made with the DAs, more than 70 % of them have no interest at all to continue working in agriculture, especially in FTCs. On the other hand, experts and farmers have lost confidence in DA's capacity and their commitment. As a result, a quick assessment of DA's capacity, interest, educational background, current roles, and performance, and their tangible contributions must be conducted before wasting a huge resource on DAs. There is no point of keeping them unless otherwise they are interested in their roles and deliver what is expected from them. In many cases, in advance to DA recruitment, their willingness to serve farmers and interest for agriculture must be taken into consideration.

5.14.4.3 Reclassify DAs roles and responsibilities

Taking the current issues of DAs into consideration, it is essential to reclassify their roles and responsibilities for improved performance and wider acceptance by the farmers. This needs a quick fix and defining of their roles and liberating them from their undue engagement in non-extension and routine activities such as tax collection and input distributions with clear accountability, reporting lines of commands. It is highly recommended to target quality than Quantity of the DAs. Thus, few numbers of DAs with important knowledge, skills, attitude, and interest are preferred to stay in the system unlike in the past where a bulk number of DAs with no interest in agriculture is assigned to FTCs with little or no effect.

5.14.4.4. Cut down the number of DAs to two per Kebeles/F/PTCs

In many survey studies, specialists were reported to be more knowledgeable about conditions encompassed within their specialty. We believe this is the general truth for all disciplines including agriculture. However, taking agriculture as a complex business that requires to have multiple knowledge, it is also essential to have general knowledge in addition to the specialist knowledge in advising farmers in agriculture development. For instance, crop extensions must know about soil fertility and soil health not only about the crop. He/she must have a general knowledge of how soil is created, eroded, silt, and acid are developed and how the fertilizers are working inside the plant. Similarly, he /she must also know about plant protection, in particular, how to manage weeds, disease, and pests. If there are knowledge and skill gap in this, it can be simply fixed with practical training. In this case, two DAs (one for crop and the other for Livestock) can be proposed per F/PTCs than the usual practice of having three to four DAs.

In any case, generalized and area specialization based DA assignment to the kebeles must be practiced. By no means assigning three DAs (crop, livestock, NR) for all kebeles is justifiable without considering the potential of that area. No need to think “Fair” distribution on this.

5.14.4.5 Enhance Farmer-to-farmer extension (F2FE) through villager Promoters

The concept of F2FE through VP: has grown tremendously in Africa in recent years and is now quite common in most African countries (Malawi, Kenya, Uganda, Rwanda, Cameroon, etc.). VP can be selected from the village based on its capacity to mobilize farmers and disseminate innovation within the village. Apart from promoting best practices

and innovations, VP can also help in linking the DAs and the community where they are assigned to service. They also play a role in improving the feedback system. F2FE can help in building an effective, farmer-centered extension system and empowering farmers as change agents for improving livelihoods in their communities. Based on the survey of 80 organization using F2FE in different African countries found that they value the approach because it was low-cost, helped extension service expand their reach and improved accountability to the community.

Studies also reported that farmers command of local language and culture helped promote uptake of new practices, some reported that F2FE programs also promote feed-backs on new practice to research and extension and help to strengthen the capacity of communities to access information, As the approach is low –cost, it is often sustainable, with the government extension staff or farmer organization taking over the backstopping of farmer-trainers after a project ends. F2FE has the potential to improve feedback from farmers to extension staff.

In the F2FE approach, Farmer–trainers train farmers on a wide range of practice covering livestock, crops agro-forestry, and fisheries. Role and responsibility of farmers–trainers vary but the most frequently mentioned ones include training, monitoring/follow-up, advising, conducting a demonstration, organizing meetings, and acting as a liaison between farmer and development agents. Farmer-trainers often serve the farmer group to which they belong and train others outside the groups as well.

The approach is appropriate for a wide range of target groups, including women, youth, and the poor. It is particularly useful for increasing the proportion of women extension providers and women’s access to extension services. In many places, extension services can recruit higher proration of women farmers –trainers that women front-line extension staff.

5.14.4.6. Establish Center of excellences for Practical Training for DAs and Farmers

The region must have one or two distinguished Institutes (University, and Colleges) for practical training of farmers and DAs. Thus, it needs identification of universities and research institutes that can sustainably serve as the center of excellence for the training of DAs and farmers. This should be followed by the development of training curricula for both DAs and Farmers. Training DAs and farmers must focus on strategic issues such as agroecology, farming system, commodity, communication, and skill development.

5.14.5. Strategies to address F/PTCs issues

5.14.5.1 Rebuild the image on F/PTCs

Currently, farmers have lost appetite and interest in F/PTCs. To rebuild the interest and image of farmers and make F/PTC to fit with current changes and expectations, it is a high time to rebuild the image on F/PTCs and transform F/PTCs to higher-level advisory service provision institutions through well-thought awareness raising platforms. To materialize this, the following need to be conducted as quickly as possible.

5.14.5.1.1 Establish one dedicated F/PTC case team in the District structure

F/PTs have no foot and roots at District levels. If we believe F/PTCs are entry points to bring rural changes and also want to solve the previous generic problems of F/PTC once and for all, establishing strong and dedicated F/PTC case teams under the district structure is critical. The case team must be drawn from senior-level experts each specializing in crop, livestock, NRM, cooperative, and gender. The case team should be also capacitated with necessary office and field level facilities and logistics to properly discharge their roles and transform F/PTC to higher levels of advisory service institutions. The case team will have its own clear ToR. Among others, their role includes: Oversee and coordinates activities of F/PTCs in their respective districts, prepare an annual plan and budget for each F/PTC in the District, provide technical and material support to DAs, ensure provisions of quality and demand-based advisory services in F/PTCs and continuity of tailored demo plots, link F/PTC with research, universities, and NGOs in their respective location for resourcing F/PTC with up-to-date information and capacities. The case team also make a strong follow-up of each F/PTCs and ensure whether each F/PTC have achieved their intended goal or not. On top of this, it is advisable to have at least one advanced Farmers Learning Center (FLC)/ or Farmers Academy for 3-5 clusters at districts level that will consider area specialization and specific export commodities.

5.14.5.1.2 Create adequate awareness of farmers on F/PTC

Principally, the extension is nothing but to bring behavioral changes among farmers. This can be through establishing consultation and awareness-raising platforms and the use of communication media. Farmers must know about F/PTC and their intended goals since they are the ones who benefit or lose. On top of this, they must know what is expected from them or what role they should play in transforming the existing FTCs to better advisory service

platforms. The whole idea of awareness-raising is to ensure high demand by farmers on F/PTC.

5.14.5.1.2.1 Rebranding F/PTC to Farmers Advisory Service Centers (FASC)

The rebranding and restructuring of the F/PTC should be started from renaming as a result of its negative connotation and bad image by farmers in the past on F/PTC. The renaming and compressive advisory service will clear out the overall blurred concepts and thinking that F/PTC are government institutions, not farmer's institutions.

The FASC model farmers /pastoralist in addition to well-organized training sessions and capacity building programs, farmers will be provided with the whole ranges of advisory services such as improved agronomic practices in all agriculture sector including crop, livestock, NRM, gender, climate without any biases and giving more important one over the other. In the FASC model, equal focus will be also given to change the mind-set of farmers by sensitizing them that they are entrepreneurs, decision-makers, and investors that seize market opportunities and possibilities to improve productivity, family income, and nutrition. Similarly, the focus will be also given to improving farmers' business skills as an important prerequisite for the adoption of improved techniques and investments in agricultural production. In this model, farmers are also encouraged to learn by doing, testing, adopting successful technologies in the demonstration plots available in the compounds of the new FASC, and extend them to their fellow farmers. In this case, it is believed that the FASC approach will be a potential source to deliver agricultural raw materials in the required quantities and quality to the planned Integrated Agro-Industrial parks in the region.

What makes this model a unique one is that, closer to each F/PTC, privately owned Farm Service Centers (FSCs) will be established. The FSC approach initiated by ATA and jointly piloted by MoA and BoANR focuses on improving access to high-quality inputs such as seeds, fertilizers, feeds, veterinary drugs, agrochemicals, and farm implements through one-stop-shops. It also addresses the challenges that farmers could face in finding the right inputs with the right quality and amount in a timely manner. Also, FSC creates opportunities for farmers to share their experience and receive technical guidance and service that are tailored to their livelihoods. In this model, an emphasis is also put on access to knowledge, interactive learning, and networking among farmers and between farmers and other actors. In this model, there will be a strong linkage between research and F/PTCs.

5.14.5.1.2.2 Define the optimum number of F/PTC

Currently, there are two arguments by professionals in agriculture regarding the numbers of F/PTCs and their effectiveness. On one hand, those who propose to reduce the numbers of existing F/PTC to a manageable size and on the other hand those who want to maintain the existing number. In both proposals, here are advantages and disadvantages as described shortly below in table 52.

Table 51 shows the advantages and disadvantages of maintaining and reducing the number of F/PTCs

Options		Advantages	Disadvantages
Argument 1	Keep the existing number of F/PTC (one per each Kebele).	Improved accesses to extension services to farmers	High-cost implication and difficulty to resource up until farmers realize the benefits.
Argument 2	Reduce the number of F/PTCs to one for two kebeles or even less	The cost for F/PTC will be reduced by half since the current situation of FTC doesn't show good value for money. Relatively manageable, DAs numbers reduced by half	Farmers may travel a long distance to get service. May also raise some equity issues

5.14.5.1.2.3 Improve the physical structure of the F/PTC with standard, modern and approved design

F/PTCs in the region have so many limitations in regards to design and physical structure. As described above under the problem analyses, most F/PTC in the region was not constructed considering the local context. They lack standard demo plots and important facilities for training and establishing demo plots. Most of them need renovation for better services. In advance, each F/PTC must have the standard, modern design approved by the district higher-level official.

5.14.5.1.2.4 Allocate seed /operational budget for the F/PTCs

Seed many for operational and renovation costs must be assigned from the government for at least two-three years. If this is difficult, the regional government can design a mechanism whereby NGOs working in the region can take responsibility to operationalize certain FTCs and renovate them for better advisory services.

5.14.5.1.2.5 Improve the role of leadership in F/PTC management

F/PTCs or FASC to be renovated or established as new should be given wider publicity and support by the leadership and experts at all levels. Land requirements of a minimum of 3

hectares must be ensured first and the proposed location should be easily accessible, contiguous to amenities such as transport and communities. If possible, there should be also accessible to electric and irrigations and free from all encumbrance, litigation, and attachments. The performance and development of F/PTCs entirely depend on the management and leadership of the district itself.

5.15 OTHER POTENTIAL APPROACHES FOR ENHANCING AGRICULTURAL TRANSFORMATION

5.15.1 Policy incentives to resource-poor farmers

Public research and public extension institutions are a means to support resource-poor farmers. To lift resource-poor farmers to model farmer's level, there are no options other than supporting them through public research and extension services. In short, resource-poor farmers, women, youth, and disabled groups engaged in agriculture need to be incentivized through different police invectives and motivations strategies such as by providing capacity building, improved seeds, fertilizers, small farm tools, improved access to extension, loan or credit services. They can be also supported through improving governance and leadership structure at district levels and improves the disconnections and feedback system from the bottom.

5.15.2 Strengthening Input Voucher system

The approaches general help for increased application of improved agricultural inputs by smallholder farmers while modernizing the delivery of inclusive Rural Financial services in the region. Seeing that input financing through the IVS system of ATA was effective in the region where it has been piloted, it is advisable to expand this model by embedding the approach into the regional Extension system.

The Inputs Voucher system has two aspects. One is implementing it manually using the paper vouchers and the second one is automating the manual system to eVocher. Pilot regions had the most impressive results with the IVS system, which is now operationalized across the entire region, including all of the cluster districts, and implemented via Credit and Saving Institution (ACSI).

5.15.3 Strengthening Cooperative based Extension service

Cooperatives are mainly established to provide different services to their fellow members in a reasonable cost and efficient manner. Their aim is not for profit-making but, provide

tailored and customized service to their members. In this case, the farmer's cooperatives are the most responsible and accountable entity to their members. In many cases, Agri-cooperative play an important role in linking farmers to the market, they forge business relations with distant buyers, realize the economics of scale in processing and marketing, and provide advisory and other services to help their members to grow and prosperous.

In Ethiopia, about 40,000 primary cooperatives have been identified to exist out of which 25% are reported to be agricultural cooperatives (ATA, 2012). A study conducted by Quinones (2010) indicated the importance of cooperatives in agricultural extension service provision. Cooperatives can provide specialized extension services by employing extension agents and/or contracting extension service providers to maximize their expected outputs to their members both in terms of improving the quantity and quality of their produce/products. The existence of farmer's unions and cooperatives provide an opportunity for the development of value chain and provision of need-based and market-driven extension services to farmers.

5.15.4. Install Digitalized Extension service

Improved availability of, and access to, information and communication technologies (ICTs) – especially mobile phones, computers, radio, internet, and social media – has provided many more opportunities for collection, processing, storage, retrieval, managing, and sharing of information in multiple formats. Some of these applications, such as telecenters, web-portals, call centers, mobile apps, community radio, digital videos, audio and video conferencing, and e-learning platforms, have the potential to provide a wide range of services (information, awareness, promotional, advisory, knowledge, technology transfer, training, education, and much more) to farmers and another agricultural innovation system (AIS) actors in a timely, comprehensive, cost-effective, and interactive manner. For instance, a hotline advisory service system was established by ATA in collaboration with MoA and other partners organizing in 2014; a mobile phone currently helps farmers to call and access free advice on production technology or agronomic practices (ATA, 2014).

5.15.5 Privatizing seed and fertilizer distributions

Generally, extension services can be offered by numerous stakeholders, including government, cooperatives, Non-governmental organizations (NGOs), and Private sectors. However, in many developing countries, traditional extension services offered through government, agencies are often poorly funded and administered, leaving poor farmers to rely

on other forms of technical advice, or none at all. Currently, the demand for agricultural inputs has significantly improved with big gaps from the supply. On top of this, farmers complained about the quality of the inputs and their delivery time through the public extension system. As a result, farmers often inclined to opt for private seed and input such as from Pioneer PLC. They believe that the input from the private sector is relatively good in terms of quality and timely distribution even if it is expensive.

From these facts, the federal and Regional BoA must move from buying and distribution of fertilizer and other inputs to farmers. Instead, the government must focus on creating an enabling environment and quality control where multiple stakeholders are encouraged and financially incentivized to participate in extension service.

5.15.6 Enhance urban Agriculture and extension

The experience in other countries has shown that Urban agriculture significantly contributed to household food security and the national economy. The team strongly believes Ethiopia in general and the Oromia region, in particular, have a lot of potentials for urban agriculture. Thus, our agricultural transformation should begin from all directions starting from urban, peri-urban, rural districts, and then reach all the unreached areas.

5.15.7. Enhance adult/Farmer education

We strongly believe in the adult training scheme and education of farmers for improved adoption of technologies is very crucial for agricultural transformation in the rural areas. It was during the military regime that gave emphasis to it but now totally overlooked and that is why our farmer's attitude, skill, and knowledge is not changing.

5.15.8 Specialized university for Agriculture

We need to have Agriculturally Specialized Universities mainly in the two big regions, Oromia and Amhara with the mandate of educating regular students for BSc, MSc, Ph.D. and post-doctoral, training of SMSs, Upgrading DAs, training of farmers, Conduct research, provide outreach extension etc...lack of having this especially at the recent time had badly affected the growth and development of the agriculture sector.

CHAPTER VI: AGRICULTURAL FINANCE STRATEGY

6.1 INTRODUCTION

At the center of the country's agriculture are vast numbers of smallholder farmers living in dispersed rural areas. Access to appropriate financial services can help improve the adoption of agricultural technologies, smallholders' production, and productivity as well as the lives of their households. But the majority of smallholder farmers don't have access to appropriate financial services to make the best of their agricultural potential. The financing of smallholder farmers is constrained by subsistence nature of farming which is on small plots of about two hectares or less, mainly rain-fed and weather dependent, very low productivity, low economies of scale, limited use of improved seeds and other inputs; the margins are low and cash flows are unreliable. The majority of farmers are illiterate; hence they are without the right farming skillsets and practices; they don't have required financial records and management practices that are necessary for productive use of credit. Smallholders are endowed with very limited assets and soft collateral to guarantee loans other than personal guarantees; land titles are not widely available and/or their enforceability is not clear.

Microfinance institutions are expanding the range of products and services on offer from time to time, but their main offerings remained general purpose loans with short term tenor of fewer than 12 months. Credit products designed to meet the needs of specific crops, for example, are almost nonexistent, let alone financing for specific value chains. Financing agriculture is considered as risky venture as it is affected by climate and since loans cannot be repaid regularly before harvest, requires specific expertise to assess smallholder loans for agricultural activities; but most MFIs don't have those required staff skills, technology, and back-office processes and hence poor fit in their offerings to smallholders. A top-down drive by the government has led to a proliferation of rural financial cooperatives (RuSACCOs), although it is yet to bring the hoped-for improvements in access to finance to the rural people. Rural financial coops remained tiny, weak and oftentimes few of them share the 'spirit' of cooperation among their members. There is some attempt by donors that introduced credit guarantee mechanisms to encourage banks to take risks to lend to agricultural production and marketing activities with aim of enhancing value chain financing and credit via lending to smallholder producer or marketing groups/cooperative.

KEY QUESTIONS TO BE ADDRESSED IN THIS REVIEW OF AGRICULTURE FINANCE?

- What are the practices in agriculture financing in the context of Oromia regions,
- What are the experiences and challenges of microfinance institutions, rural financial cooperatives (RuSACCOs), and other financial services providers to finance To what extent different actors in the rural and agricultural ecosystem enhance and/or hinder the effectiveness of rural financial services?
- What types of smallholder farmers have demand for agriculture specific products and services?
- What business models would be appropriate for delivering agricultural finance to smallholder producers?
- What is the relationship between credit and agricultural productivity of smallholders? What are the key factors that drive the productivity of smallholders, including credit?
- What are the areas that may need collective actions across sector actors to improve smallholder's access to finance?
- What are the demand-side constraints that hinder provisions of tailored financial services for agriculture?
- What are the regulatory and policy hindrances for the provision of effective agricultural finance

6.2 UNDERSTANDING SMALLHOLDER FINANCE

Designing suitable financial services for smallholder finance requires a deep understanding of the diverse nature of smallholder farmers. Policymakers and financial service providers need to address the following specific questions to better understand smallholders.

- What is the profile and needs of smallholder farmers (smallholder segmentation)?
- Which segment is currently served and not served by financial institutions (FIs)?
- What products are suitable for which segment of the smallholders?

Research conducted by CGAP³⁹, Consultative Group to Assist the Poor, a world bank research department recognizes smallholder farmers as a heterogeneous group ranging from subsistence farmers struggling to survive to emerge entrepreneurs who are successfully managing their farm as a business. The research distinguishes three smallholder segments of decreasing size: non-commercial smallholders (or subsistence farmers), commercial smallholders in *loose* value chains, and commercial smallholders in *tight* value chains. The

³⁹Agriculture Finance Support Facility, 2015; Christen & Anderson, 2013)

farmers in these segments are likely to have very different needs and capacities, face distinct challenges and strive for different objectives.

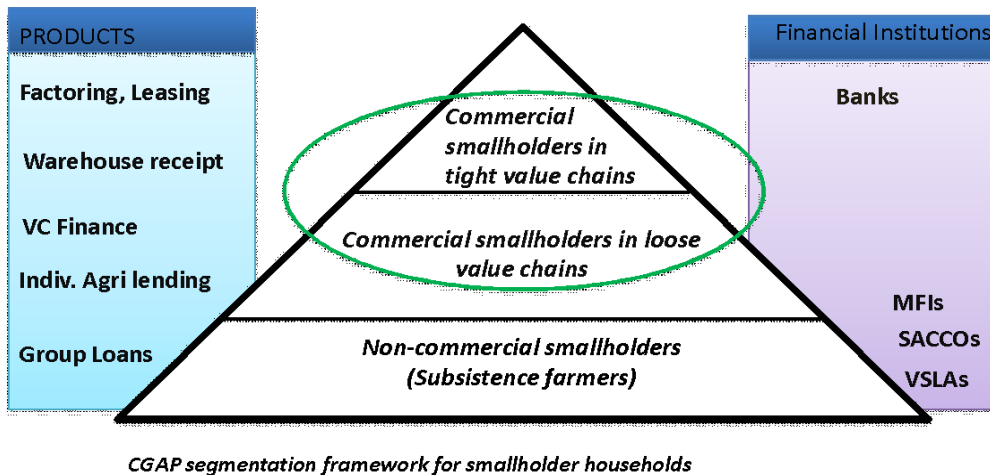


Figure 56 Inclusive Agri finance pyramid

CGAP has provided a framework for segmenting smallholders based on what they grow, how they engage with markets (as buyers and/or sellers), how those markets are organized. Understanding this segmentation framework will help policymakers and financial institutions for better design of interventions for enhancing smallholder productivity. The three segmentations of smallholders according to CGAP are as follows.

The three segmentations of the smallholders can be explained as follows:

- *Commercial smallholders in tight value chains*: derive a sizeable portion of their agricultural income from higher-value specialty crops sold to regional international buyers on a contract basis.
- *Commercial smallholders in loose value chains*: Produce a mix of staple and high-value crops and engage in local or regional spot markets
- *Non-commercial smallholders*: primarily subsistence farmers who tend to produce staple crops for household consumption and only engage in local, informal markets

The commercial smallholders in loose value chains are the missing middle where financial service is lacking because they are too small for commercial banks and too big for MFIs.

When we see the financial landscape or ecosystem, it appears that MFIs are addressing the lower market segment (subsistence farmers) while banks are to some extent addressing the large commercial farmers. But there is no or less agricultural finance that caters to the missing middle to unleash the potential of transforming the agriculture sector.

The subsistent smallholders are served by MFIs through a group lending methodology and SACCOs or VSLA through a personal guarantee or saving linked loans. These loans are usually small in size, short duration, and are a general-purpose loan for any activities in rural areas including petty trading or off-farm activities. Because of limited access to finance, still, a significant proportion of the population is borrowing from money lenders (at exorbitant rates), and friends, relatives, and from other informal networks like Iqub.

The financial needs of commercial farmers cannot be addressed with the conventional general-purpose financial service. They need dedicated crop and value chain specific lending methodology such as value chain financing, individual Agri loans, warehouse receipt lending, asset finance, leasing, etc.

Financial Inclusion: Ethiopia has developed a financial inclusion strategy to address the critical shortfall in financial services in the country. According to the report of Findex 2017, a survey conducted by the World Bank in 2017 (financial inclusion in Ethiopia is improving. This survey indicated that account ownership among the adult population (adult of age 15+) in Ethiopia has improved from 22 percent in 2014 to 35 percent in 2017. This is mainly done by predominantly urban-based commercial banks. As such, in Ethiopia, close to two-thirds of all adults are ‘unbanked.’

Rural areas are constrained by poor access to finance; and around 11%% of the rural adult population have access to loans through rural-focused institutions (MFIs, RuSACCOs).

Table 52 Financial Inclusion in Ethiopia

Account Holding	Percent
• Account (%age 15+)	34.8 %
• Account, rural (%age 15+)	32.4 %
• Account, young adults (% ages 15-24)	28.2%
Borrowing	
• Borrowed from a financial institution, rural	11.1%
• Borrowed from family or friends (% age 15+)	30.9%

Source: Findex database, 2017

6.3 CONSTRAINTS OF SMALLHOLDER FINANCE

Smallholder farmers face several constraints to be served by suitable financial services. These could be categorized into supply-side constraints, demand-side constraints, policy and regulatory constraints, and ecosystem constraints.

6.3.1 Financial service providers and supply-side constraints for smallholders finance

The transformation of smallholder agriculture requires financial services that encourage smallholders to invest in improved agricultural inputs, practices, equipment, and farm tools for improved productivity at the household level. Smallholder farmers often do not get productivity-enhancing financial services to invest in their agriculture. There are various supply-side constraints for the provision of suitable agricultural finance for smallholders. Financial service providers consider agriculture as a risky venture and are less willing to provide loans to smallholders.

Commercial Banks (including CBE, OIB, and many other banks): They are the predominant actors in terms of presence and volume of financial services it offers in the region. It mobilizes a large share of savings from a large number of rural and urban people and provides a significant amount of loans to a few rich people in the urban business. Commercial banks channel capital from poor rural areas to rich urban businessmen. Commercial banks do not have the methodology and business interest to serve smallholder farmers.

Development Bank of Ethiopia: The Development Bank of Ethiopia (DBE) is a state-owned development finance institution. The DBE is supervised by the Public Financial Enterprises Supervising Agency (PFEA), which is a Directorate under the Prime Minister's Office. Major or priority areas of DBE's financing include: Commercial agriculture, agro-processing, manufacturing & Extractive Industries as well as lease financing for Small and Medium Enterprises (SMEs)

For the past fiscal year (2017/18), the bank has dispersed 39 billion birr from a total of 59 billion approved. However, to the surprise of the banking industry standard, the non-performing loan was further escalated to 39.4 percent which is almost 40% from its worst performance of 25% during 2016/17 (Capital, 2018). As the bank mobilizes huge fund from foreign sources and domestic this seek strong attention and follow-up by the government is required so that the bank could do a strong appraisal of each project proposals before

lending (with strong supervision of the loan and a follow-up technical support after lending). Development Bank of Ethiopia (DBE) plays a critical role in supporting the rural sector through wholesale lending to MFIs and SACCO unions by collaborating with international programs like Rural financial Intermediary programs (RUFIP), a program of IFAD. The program has brought a remarkable impact in supporting the rural sector by availing concessional lending service to MFIs and SACCO unions at a reasonable interest rate and terms. Further scaling up and enhancing such kind of successful initiatives is key for the growth and sustainability of the microfinance sector and SACCOs to expand their reach and range of services/products sustainably.

Cooperative Bank Oromia (CBO): It is the only cooperative bank established purely by cooperatives majority of which are agricultural cooperatives owned by small-older farmers (and has a primary objective of enhancing smallholder access to finance). As there is no cooperatives law, the bank has got its license through commercial banking regulations and this has negative implications as CBO has to meet the minimum capital requirement for the commercial banks which forced CBO to sell some of its share to other private sector operators and also lend the lion share of the money to big business and other private sectors to survive in the banking industry. As per the central bank's requirements, CBO was expected to regularly avoid lending to smallholders agricultural initiatives (that has no collateral), it has, however, made significant efforts in providing credit to agricultural cooperatives engaged in production, marketing, processing, and export of agricultural products. Unlike other banks, CBO is continued in financing small-holder cooperatives business at all levels (primary, unions, and tertiary or federation levels). It has also supported in strengthening RUSACCOs and saving mobilizations and financial intermediations (by encouraging borrowers to save their money in CBOs and also by supporting or creating linkages with SACCOs (SACCO unions).

CBO has therefore shown proven success in lending for agricultural cooperatives that have been engaged in agri-businesses and value chain activities like coffee, dairy, and apiary/honey value chains, grain trading, agro-industry (flour factory, bakeries, processing plants, malt barley, etc.), and many others cooperative businesses like agricultural mechanizations, leasing, seed sector

Microfinance Institutions (MFIs) and saving and credit Associations (SCCOs): MFIs and SACCOS are the only financial service providers for urban and rural poor populations. Over

the last 2 decades, MFIs have demonstrated a proven and sustainable methodology to serve rural people. Group lending methodology was a dominant and successful lending methodology to serve the poor unbanked rural populations.

MFIs and SACCOs have grown radically in terms of outreach and diversification of financial products over the last 10 years. There are 35 MFIs and over 20,000 primary SACCOs operating in the country by the end of 2017. Despite this growth in financial institutions in numerical terms, the sector has not kept

Limited Innovations in financial product design to serve SHF

MFIs and SACCOs have a strong ambition and methodology to serve rural populations than commercial banks. However, their loan products and terms are not tailed to the needs of commercial not meeting the demands of cropping cycles, and its lending approach focuses more on group lending, but have less reach to remote and geographically dispersed areas as compared to RuSACCOs.

Group lending methodology is the dominant lending approach by MFIs to reach and serve the unbanked poor segment of the population both in rural and urban areas. The group lending methodology is a general-purpose loan aimed at financing subsistence farmers, non-farm activities, with small loan size and short repayment terms. The average loan size is 6,875 birr per borrower and one-year terms (AEMFI 2017 reports).

The group lending methodology does not serve the needs of commercially oriented, entrepreneur farmers who produce high-value cash crops for markets. Besides, its loan term is too short to finance not improved input, and other agricultural technologies. The loan products are not targeted to and meet specific crops and value chain financing needs. Most entrepreneurial and commercial farmers need crop-specific financial services that are sufficient to finance the full production cost like improved inputs, farm equipment, and other production, harvest, and selling related investments.

Transformation of smallholder agriculture will not be realized through conventional group lending microfinance products, rather requires innovations in suitable financial services or product design aimed at financing the required investment costs for improved agricultural productivity of commercially oriented entrepreneur farmers and other agribusiness sectors in the selected value chains. These include:

- Value chain finance
- Warehouse receipt lending
- Individual Agri loans,
- Equipment /farm asset finance
- Machinery leasing
- Others: Digital financial service,

It requires efforts mindset change to professionalize MFIs operation and another ecosystem improvement for MFIs to engage in this complex product offering for enhanced productivity of smallholders.

- First, MFIs have to transform in their operation modalities and develop agricultural expertise for dedicated financial service design for specific crops and value chains,
- Secondly, MFIs have to collaborate with other stakeholders to maximize the value of their financial service to smallholders - linkage with nonfinancial service is needed.
- Finally, MFIs need sufficient liquidity/loan fund to serve the growing need of emerging farmers,

Despite the increasing number of SACCOs in Ethiopia, they generally provide limited options for products and services to their members. Most of the financial products offered by SACCOs lack diversity, flexibility, and quality. Many SACCOs have very limited capacity to design and deliver tailored and diversified financial services to their members.

SACCOS could not mobilize sufficient savings to meet the credit need of its members. A small saving amount leads to the small loan amount. Generally, the one-size-fits-all approach is the way products are designed and delivered in most SACCOs. Loan terms, size, payment modalities are not tailored to the needs and preferences to meet the financing need of smallholder farmers.

SACCOs are constrained by many factors to provide sufficient financial services to agriculture;

- Weak management and governance of SACCOs
- Lack of knowledge and professionalism in product design for Agri financing
- Poor Internal system, weak financial and risk management system
- Limited product ranges to meet the diverse nature of smallholders need

- Insufficient regulatory oversight and support services to SACCOS
- Severe liquidity and weak financial linkage

Liquidity constraints

Both MFIs and SACCOs are severely constrained by a shortage of liquidity (loan fund) to serve the growing need of emerging and market-oriented smallholder farmers. There are several reasons for the lack of liquidity by these institutions which includes:

- Low level of saving mobilizations,
- Lack of financial linkage among financial institutions (e.g. MFIs & SACCOs cannot borrow from commercial banks which have excess liquidity),
- Lack of APEX body for wholesale finance (e.g. SACCO federations),
- Closed financial system to bring foreign investors,

There is excess liquidity sitting there could be translated to productive investments if all actors consider and design the means to reach the smallholders using MFIs and other retail financial service providers that can favorably reach the smallholders.

6.3.2 Demand-side constraints for smallholder finance

Smallholder farming should be a viable business and should demonstrate a reasonable risk profile for financial institutions to engage in the financing of smallholder agriculture. The provision of suitable financial service for smallholder agriculture is affected by many demand-side constraints. These constraints include;

- a) Lack of structured value chains and poor agricultural input supply system,
- b) Lack of strong farmer organizations,
- c) Smallholder lack of collateral to access high loan size individual loans,
- d) Risks related to natural disasters like drought, frost, disease, and pests,
- e) Lack of experience and clear policy guideline on contract farming

Lack of structured value chains and weak coordination among stakeholders: Successful agricultural value chain finance is based on the strength of the relationship and collaboration of the actors and service providers in the agricultural value chains. Financial institutions face low risk in lending to well-functioning value chains where all stakeholders cooperate to supply inputs and market agricultural commodities.

Financial institutions perceive agriculture as a risky business if the chain is not well coordinated for the effective and efficient supply of agricultural inputs. In Ethiopia, the input supply system like improved seeds and agrochemicals is not well functioning to satisfy the needs of smallholders engaged in high-value cash crops. Farmers face challenges like availability of inputs at the right agricultural season, the right amount and variety, quality, and at a fair price. The same applies to livestock and fisheries development inputs (like improved breed, feed, fodder, equipment, etc.,). Thus, availability, accessibility, affordability of key agricultural inputs are the major problems that make it difficult for smallholder farmers in this chain to maximize the gain from this sector by investing in productivity-enhancing inputs. In addition, smallholders face challenges in getting access to reliable markets for their produce. All these make financing smallholder agriculture an unattractive venture for financial institutions to design innovative financial services. Financial institutions also lack a reliable partner in the value chain to finance value chain commodities.

Lack of Strong & Vibrant Farmer Organizations: The cooperative system of input distribution is not functioning well for some key agrochemicals and improved seeds. Producer Organizations or Cooperatives are very inefficient in the supply of agricultural inputs and marketing of agricultural produce. Farmer organizations are weak due to structural, internal, and policy constraints.

- Cooperatives are not run by professional staffs, and the volunteer management committee lack incentives to effectively manage the day to day business of the cooperatives
- Cooperatives do not have the autonomy to craft their business opportunity and design their business models,
- Cooperatives are promoted by the government offices and often serve as a tool for political purposes,
- Cooperatives are dominantly run with a philosophy of community service with less attention to the sustainability of the institution,

The implication is that those farmers do not get improved inputs for improved farm productivity, and could not get a reliable market to sell their produce. In the absence of a strong farmer organization, financing agriculture becomes a risky business.

Lack of collateral for smallholders: Smallholders lack suitable and acceptable collateral to get higher loan size individual loans to invest in agriculture. As a result, most FIs shy away for such market segments. These smallholders opt for high-cost informal financing sources (such as traders' finance and money lenders).

Poor agricultural extension service: The agricultural extension service lacks the skill and resources and commitment to serve smallholders with improved agricultural practice. Farmers lack knowledge and skill for improved productivity and reduce risks of agriculture.

Risk of smallholder agriculture: Smallholder agriculture face risks such as drought, flood, pests, disease, price, and market risks. In the absence of a strong risk mitigation strategy for smallholders, financial institutions lack the courage and have a lower risk appetite to avail financial service for crop and value chain specific sectors. Small-holders are also risking averters and shy away from taking a loan to engage in high risk and high return investments that boost agricultural productivity. Hence, the government and its development partners should invest in initiatives that could reduce not only production and marketing risks but also on interventions that could reduce post-harvest losses and build the resilience of the small-holders in parallel with the farm and non-farm business development services.

6.3.3 Enabling Environment

Financial service provision for agriculture is also constrained by a lack of enabling environment and policy framework.

The government's heavy involvement in the operation of cooperatives and the distribution of inputs are the key areas that affect financial service to agriculture. Besides, a closed financial system for foreign investors in the form of capital or loan, and Lack of central financing body (like SACCO Federation), and lack of a separate regulatory body for financial cooperatives are affecting the capacity of lack of these institutions to extend sufficient loan to stallholders.

The absence of financial linkage and wholesale lending mechanisms between different financial institutions is another enabling environment that has affected financial service to smallholders. For instance, the over liquid commercial banks could have been linked to the chronically under liquid MFIs and SACCOs.

Finally, lack of financial education and literacy among the general public and especially rural community hinder the mobilization of sufficient savings for on-lending to smallholders.

6.4 THE CASE OF MALT BARLEY VALUE CHAIN FINANCE

Malt barley is one of the emerging cash crops in Arsi and West Arsi Zones of Oromia regional states. Due to the general increase in income and urbanization, beer consumption in the country shows an increasing trend year by year at an average of 20% per year. As a result, the demand for malt barley by malting factories and breweries has increased; which creates an opportunity for smallholder farmers to increase production and productivity through increased application of inputs and agronomic practices. GTP-II recognizes the malted barley as one of the industrial crops and target to increase production and productivity of smallholder.

Farmers faced challenges in the availability of improved inputs and access to finance to improve the production and productivity of malt barley. The availability, quality, and distribution system of improved seeds and agrochemicals was a critical challenge. To solve this problem Heineken has introduced improved seeds called travel variety, which has demonstrated a high productivity improvement than local varieties.

To improve access to suitable financial service to malt barley produces, Buusaa Gonofaa (BG MFI) has designed tailored malt barley input loans for smallholders to invest in malts barely productivity-enhancing inputs like improved seeds, agrochemicals, fertilizers, and other related costs.

The malted barley value chain loan operates in the more or less structured value chain where Heineken provides improved seed, agrochemical importers provide the required critical chemicals and BG MFI provides the required financial service for smallholders to buy these inputs. The concerted effort in the provision of inputs and finance has drastically changed the farming system and the overall value chains for the betterment of smallholder farmers. Productivity has more than doubled, farmers have higher income and breweries have sourced sufficient barley from local farmers instead of imports.

KEY RECOMMENDATIONS OR OAD MAP FOR AGRICULTURAL FINANCE

- 1) Facilitate availability of sufficient loan funds or Liquidity for MFIs & SACCOs:
Oromia regional government should devise a strategy for availing sufficient

liquidity for MFIs and SACCOs operating in Oromia region. The specific strategy could entail the following’

- Creating and fostering financial linkages among financial institutions for the flow of liquidity from over liquid commercial banks to under liquid MFIs and SACCOs. For instance, CBO and OIB could develop wholesale lending strategies using MFI & SACCO unions as retailers of credit to smallholder farmers.
 - Establishing a credit guarantee mechanism for MFIs and SACCO unions to borrow from Commercial banks at favorable conditions like interest rates, payment terms, etc. Oromia regional government has to commit resources and willingness to avail credit guarantee mechanism or risk-sharing arrangement to encourage financial institutions to cater to their financial service for high risk, high return cash crop, and marketable agricultural value chains. This can be taken as a smart subsidy.
 - Formation of regional SACCO Apex/Federation by SACCO Unions in the Oromia region. The SACCO federation will have the role of liquidity and fund management and form a strong institution for lending to primary SACCOs.
 - Create enabling environment for FIs to access targeted foreign capital/loan to specific FIs
- 2) *De-politicize* and Professionalize Cooperatives: Oromia regional government should allow cooperatives to embrace business orientation in their service and craft their profitable business ventures independently, without interference from local authorities. Cooperatives should be allowed to fully operate within the principles that govern cooperatives especially the autonomy and independence and ensure members' economic participation. For instance, the government should allow cooperatives to set their price, and enter into a business contractual agreement without the consent of the local authorities. The margins that unions and coops add to inputs prices should create an incentive to undertake this activity and ensure long term sustainability of the institutions. Thus, cooperatives should decide the modalities and types of services offered by the cooperative to members and non-members.

Besides, cooperatives should be supported to hire professional staff that are fully responsible and capable to deliver services based on economic incentives without compromising the cooperative principles.

In a nutshell, we recommend producer organization/ cooperatives must operate in a business-like model for sustainable and efficient service to smallholder farmers.

Concerning this, cooperative offices/agencies at all levels should be a separate bureau or office on its own instead of reporting to agricultural offices/bureaus or the MoANR so that it could be resourced sufficiently to independently and professionally support the cooperative societies at all levels.

- 3) Encourage private models for agricultural input distribution: The distribution of agricultural input should be allowed under the private sector for more efficiency and effectiveness to serve smallholders. Private input dealers, operating under profit motives will have more incentives to deliver inputs at the right time and amount for smallholders to improve productivity. The government should rather focus on quality control and regulations.
- 4) Coordinate financial education and literacy programs: Financial literacy for institutions, local governments, and the community at large to mobilize public saving is one of the key areas that the government should prioritize.
- 5) Establish Regional platform for agricultural finance: The platform could be a forum for discussion among industry experts and researchers on local policy issues, coordination among stakeholders, and for sharing best practices in agricultural finance.
- 6) Institutional capacity building and professionalization of FIs to design a financing strategy that focuses on the government's commercialization cluster and other organized groups of farmers on a specific value chain finance for agricultural commodities.
- 7) National Bank of Ethiopia should promulgate specialized law for licensing, operation and supervision of cooperative Bank: To support the financing of cooperative business and specifically for meeting diverse demands of agricultural cooperatives for financial services, there has to be a special law that enables cooperative societies at all levels to establish cooperative banks and get access to

saving and credit services tailoring to the needs of cooperative societies while also meeting prudential standards and regulatory requirements for healthy performance of the bank.

- 8) Scaling up and out of the current innovative lending, saving mobilization and other financial services of COBs: CBO has been successful in lending for agricultural cooperatives that have been engaged in agri-businesses and value chain activities like coffee, dairy, and apiary/honey value chains, grain trading, agro-industry (flour factory, bakeries, processing plants, malt barley, etc.), and many others cooperative businesses like agricultural mechanizations, leasing, seed sector
- 9) Special law for saving and credit cooperatives (SACCOs) should be promulgated: If this proclamation is issued it could ensure the financial soundness/financial prudence of SACCOs so that it could responsibly operate financial services for the grass-root communities especially the smallholder. Such prudential regulation could be done by the National Bank of Ethiopia for SACCO unions or federations and the SACCO federation will, in turn, do the same supervisory role for the primary and union level SACCOs. In parallel, cooperative offices should possess the required skills or expertise in the areas of financial services and financial cooperatives in particular.
- 10) Engaging DBE in innovative agriculture sector financing: DBE should be engaged in innovating financing of transforming the agriculture sector with an emphasis on commercial agriculture and agro-processing initiatives that are linked to smallholders (as out-grower schemes or via contract farming) to transform the sector and boost commercialization of the agriculture sector (please note that without linking smallholder to buyers, traders, processors, commercial farmers we cannot bring the desired change in the sector).
- 11) Need for enhanced and strong complementary interventions in the sector (including coordination across the sub-sector): Access to financial services and credit, in particular, is the fuel of agricultural transformation but it should be complemented by other transformational initiatives in the sector namely: i) availability and interest for adoption of improved inputs at the required quality, quantity, and affordable price; ii) availability and drive for adoption of improved technologies and related services (small-scale irrigation technologies,

mechanization/equipment, sustainable land management/NRM initiatives, iii) quality and demand-driven extension services (including specialized extensions) linked with agricultural research iv) autonomous and competitive/professional producer organizations and many others market support/value chain development initiatives.

CHAPTER VII: COMMERCIALIZATION

7.1 INTRODUCTION

7.1.1 International Experiences

This document review considers largely on the prevalence of smallholder farming, the trends seen in the growth of production, and the forms and processes that smallholder commercialization has been realized.

7.1.1.1 Asian countries

In Asia, agricultural development has largely been achieved through the efforts of millions of small-scale family farms (less than 2 ha); A fragmented land structure does not appear to have limited agricultural growth. Indeed, from the late 1960s, most Asian countries saw a Green Revolution in cereal production (maize, rice, wheat) as improved higher-yielding seeds, with fertilizer and irrigation, allowed food production to increase faster than the population growth.

Since the 1990s, this has been followed by even more impressive growth in the output of higher-value produce (mainly for domestic and regional markets): including livestock products, farmed fish and shrimp, fruit and vegetables, beverage crops, and some industrial crops. Most of this has also come from small-scale family farms as higher yields of food crops made it possible to free up land for cash crops and livestock.

Consequently, producing on a small scale has not proved an obstacle to commercialization. Where lump investments have been needed (e.g. for farm machinery), either small-scale machines have been produced (such as two-wheeled tractors) or rental and hire services have emerged.

Raising farm output has, therefore, been achieved through the intensification and commercialization of small farm production, which has been done, in large part, through private initiative – even if public investments (including in rural roads, electricity, and banking) have been critical. Better roads and booming cities have expanded market opportunities, while improved technology (e.g. improved seed and fertilizer) made a response to these opportunities possible. Traders have helped to link farmers to the market while also providing inputs and technical advice on credit.

However, despite the technological advances and the shift to growing higher-value crops that may allow farm households to escape deep poverty, across the continent, most farm households in Asia receive half or more of their income from off-farm activities and

employment. A wide range of non-farm activities is observed: operating small businesses, working locally for wages, and migrating or even commuting daily to urban centers for paid work. Additional employment in local, non-farm economies, along with the high levels of migration and commuting, are distinctive features of modern, rural Asia.

When it comes to the groundwork, in most Asian countries geographic focus & commercialization development plays a central role in the development of agriculture and agro-based industry through the agro-based cluster, agro-industrial clusters, and industrial corridors like Special Economic Zones (SEZs) of China, Incheon Free Economic Zone (IFEZ), South Korea, East Coast Economic Region (ECER), Malaysia. One of the commodity & geographic focus agricultural development approaches in Asia is The Western GAP Cluster in THAILAND. This area is mainly characterized by vegetable production and has a total vegetable area of 35 200 ha (Korpraditskul, 2005. India has also had success with the agricultural geographic focus approach through clusters and integrated agro-food parks.

7.1.1.2 Latin American Countries

Latin America is rather different from Asia. Large farms dominate the area cultivated and grazed land, although the majority of holdings are of 5 ha or less. Latin America's agriculture has grown strongly since the 1960s, much of that growth coming from expanding the farmed area. Since the 1990s, exports have been rising rapidly: for South America in 2010, around 60% of the output by value was exported. Some of these large farms have thus become models of efficient farming on a large scale farm.

While the implementation of the agricultural commercialization work, in Latin American countries, the most significant commodity & geography focus approach implemented through fruit development cluster & corridors which achieved significant success taking a large proportion of domestic production and exports. Brazil, Chile, and Mexico each successfully developed a cluster approach in specific geographic areas for fruit production, which now accounts for nearly half of the national fruit production in each country. In Mexico, Michoacán locality, Avocado cluster planted in 83,055 hectares which comprise 88% of the national production. In Brazil, Petrolina Juazeiro location, Mango planted in 10,432 hectares comprise 25% of national production and 90% of total fruit export.

7.1.1.3 African Countries

The pace of transformation in Africa has been uneven across the region, and the underlying causes are still not fully understood and the same is true of agricultural commercialization

where the interventions and the achievements are varied across the regions. In most reviewed cases, two factors encouraging commercialization in Africa: on the demand side, higher prices and better access to markets; and on the supply side, the diffusion of improved technology — both of which may be the result of public policy and public investment.

Better market access is the most common and powerful driver of expanded agricultural production. Better market access entails not only physical access, but also reduced costs of transport that should result in higher prices being offered by traders at the farm gate, and by infrastructure improvement and through the creation of a new market, new settlement, and urbanization.

The other main driver of commercialization has been technological advances that have improved productivity, or have removed a severe technical obstacle to producing crops or raising livestock in particular environments - or reduced the physical risks faced by farmers. High-yielding improved varieties of some of the main staple crops were bred allowing farmers to double or get more yields, without affecting another environment of production. The other point is perhaps technology does not of itself lead to enhanced production and commercialization, unless there is a market opportunity that makes it worth using the technology. Technology-assisted production for import substitution can enhance commercialization.

Meanwhile in the process by which smallholders' commercialization takes place and follows is unique pathways. The usual path of commercialization of smallholder agriculture starts with growth in the marketable surplus of agricultural commodities in both agro-ecologies (highland and low land). Furthermore, diversification of the marketed portion into staples and other food crops is another alternative for smallholders' commercialization and or market-oriented production system and cash and high-value crop production is another path of smallholders' commercialization.

Similarly, the critical conditions that need to be in place, if efforts to promote agricultural commercialization are to benefit a large proportion of smallholder agricultural producers. While considering agricultural commercialization, among the key features to be taken, is involving smallholder farmers including a larger number of women and youth, since they are the vast majority of the farming population. In this case, considering youths and their aspirations is important. Young people's aspirations are not just about economic opportunity – status is important. Young people's interest in farming will likely be positively related to their ability to put together or gain access to, the resources needed to farm on a 'commercial'

basis (i.e. land, credit, labor). Young people's aspirations suggest that small-scale commercial farming is the farming type most likely to attract them in the future.

Broad-based smallholder commercialization will require more active state engagement in service provision. Smallholders need access to a range of pre- to post-harvest services: finance, extension advice, input markets, market information, and linkages to improve the efficiency of production. Few of the required services will be entirely private sector-driven under current conditions in Africa. Farmer organizations – if strengthened – may assist with providing some. There nearly always has to be some state role – if not in service provision, then in its coordination and regulation.

Likewise, in Sub-Saharan African countries like Kenya and Nigeria have attempted to implement commodity & geographic approach similar initiatives such as economic zones concentrated around agro-processing activity: Kenya's fruit clusters have increased the production and market value of green beans and avocados. Cluster initiative in Kenya enhanced value chain and increased production of high-quality avocados by 40%, while Nigeria's agro-processing zones have focused on nationally-prioritized staple crops. In Nigeria 14 Special Crop Processing Zones (SCPZs) established across the country focused on specific priority commodities Cereals: Rice, Sorghum, and Maize; Fruits and Veg.: Onions, Tomato; Livestock and Fisheries.

7.1.1.4 Lessons

Need for growth of the supply side: - Considering as on basic driver of SHF commercialization, the diffusion of improved technologies and agricultural practices are critical to boosting the agricultural produce which ultimately increases marketable surplus,

Better market access: - Creating favorable conditions for farmers to get a market signal before getting into production will make them invest more. Accessing the market infrastructure will not only increase farm gate prices but also facilitate new settlement and urbanization that has a power to rural economic diversification,

Agriculture should be as inclusive as possible: - Young people's aspirations show they are most likely to maintain engagement in farming if they are supported to become commercial smallholders.

Promoting broad-based commercialization: Strategies to support farmer organizations need to be tailored to their various roles. Range of pre- to post-harvest services: finance, extension advice, input markets, market information and linkages to improve the efficiency of production is vital,

SHF focused commercialization is the base: Agricultural development has largely been achieved through the efforts of millions of small-scale family farms. It has not limited agricultural growth and commercialization.

Thinking on to link the large-scale farm with SHF could be the emerging development path. Agriculture labor productivity should be grown (Mechanization- small-scale machines, rental and hire services). Lump investments

Grow land productivity faster:-Raising farm output achieved through Intensification and commercialization of small farm production, which has been done, in large part; public investments (including in rural roads, electricity, and banking) have been critical. Allowed food production to increase faster than population growth

Shift to High-value products:-The composition of agricultural output has shifted to more impressive growth in the output of higher-value produce

The role of infrastructure is tremendous:-Better roads and booming cities have expanded market opportunities, while improved technology (e.g. improved seed and fertilizer) made a response to these opportunities possible. Traders have helped to link farmers to the market while also providing inputs and technical advice on credit.

Expansion of off-farm activities:-Most farm households in Asia receive half or more of their income from off-farm activities and employment

Linking agriculture to the rest of the economy:-When it comes to the groundwork, in most Asian countries geographic focus & commercialization development plays a central role in the development of agriculture and agro-based industry

Geographic area focus approach:-While implementation of the agricultural commercialization work, in Latin American countries, the most significant commodity & geography focus approach implemented through fruit development cluster & corridors which achieved significant success taking a large proportion of domestic production and exports. In Sub-Saharan African countries like Kenya and Nigeria have attempted to implement commodity & geographic approach

7.1.2 Domestic Experiences

In Ethiopia, there were similar initiatives and programs in the past that attempted to integrate and link interventions within the agriculture sector to broader economic plans through geographic area focus approach to realize market-oriented agriculture and ensure food self-sufficiency. Such efforts like the Development Growth Corridor (DGC) initiative during the

Plan for Accelerated and Sustained Development to End Poverty (PASDEP) period, the current agro-industry corridor initiated with the integrated Agro-Industrial Park and the Agricultural Commercialization Cluster initiative had strong conceptual grounding. Therefore, reviewing the past and current domestic experiences will help to identify key strengths and gaps.

7.1.2.1 Development Corridor Initiative

Oromia, like other Regions, has tried to take forward the Development Growth Corridor initiative in 2006-2010. The overall goals & objectives of this initiative were to reverse food security problems sustainably and transform the food insecure and pastoral areas to centers of development.

To make a paradigm shift and bring overall societal transformation in the Region through the utilization of the Region's human and natural resources. Similarly, it was believed to ensure equity and balanced development in the region. The initiative also considered lessons drawn from the past years which indicate it is impossible to bring the aspired development in these areas unless efforts and resources are coordinate. It was believed that in those past years, various programs focussing on ensuring food security have been prepared and implemented whereas the expected results have not been obtained in terms of addressing the problems on a sustainable basis due to the enormity of the problems and lack of coordination.

This engagement at Regional level after analyzing the prevailing potentials, it was believed to change the food insecure areas to food surplus areas and even to development centers. Moreover, major problems in the highlands of Oromia, which is linked with population pressure on limited resources, improper utilization, and management of the natural resources and lack of good governance, are taken as the main area of focus. It also shows some initial progress such as -commodity and geography prioritization where the region was divided into three development corridors among which the two development corridors are subdivided based on prevailing socioeconomic characteristics, resource potentials, agro-ecology and topography characteristics. These include South East Oromia Development Corridor: This corridor is subdivided into four sub corridors including all anas in East and West Hararge zones, Borena, South Bale and Guji, and Southern Highlands of Oromia; Central Oromia Development Corridor consisting The Oromia Rift valley and Central Oromia Highlands; Western Oromia: Consisting seven zones, Horo Guduru, East Wellega, West Wellega, Kellem Wellega, Illuababora, and Jimma zones.

During the short stay of the initiative, a lot of strengthens have been observed. Priority commodities were identified in those geographic areas. Large scale irrigation development activities along potential river catchments have started which approach water-centered development approach, mobilization of community leaders, identification of implementing organizations, and creation of new institutions including technical committees, research groups. Furthermore, some areas have started to refocus on more targeted initiatives for priority commodities like coffee, cereals, horticultural crops,--. As far as the implementation strategy is concerned critical strategic issues in corridors & sub corridors were identified and prioritized, selection of sectors at the regional level that would take the ownership and responsibility of the work and also ensure the participation of the other sectors has done. However, even if important learnings and some results on the ground observed, key challenges identified during implementation which can be seen in two parts.

Strategy and approach: One of the challenges was weak transformation readiness and commitment to take the initiative forward and lack of common understanding of DGCs across and within regions and sectors in its full sense. The second is lack of inclusion within the regional & sectoral strategic plan in a well-crafted manner considering this initiative will bring a system change shortly rather than thinking the overall initiative as an onetime exercise & a top-down the assignment. The third gap is the way it translated into on-the-ground where there were weak decision making and rigorous monitoring mechanism supported by the change agents considering as systemic intervention.

Implementation modalities and resources: From the implementation point of view one of the key problems of the program is trying to move all elements ahead within a limited time instead of focus on the points of the system where small changes are likely to cause large shifts. Moreover, low specialization and diversification, low focus on markets & limited value chain approach and above all provision of support to the commercial agriculture sector through new types of financing mechanism, on the condition that smallholder and emergent farmers are incorporated and that there are clear benefits for local communities, recognition of the important roles of different private-sector players in the successful execution of the approach were untouched. Similarly, insufficient financial resources, major infrastructure gaps & poor market linkages between producer and agro-processors which supported market

infrastructure and capable institutions are some of the challenges encountered in the initiative.

7.1.2.2 Agro-industry Growth Corridor Program

Agro-industry Growth Corridor is one of the current on-going government programs which aimed to solve the current agriculture and agro-Industries challenges in the country under the Integrated Agro-Industrial Park (IAIP) project where demand-driven production instead of subsistence farming, integration of the supply chain to provide farmer-market linkages that allow efficient flow of products, showing for potential and investment opportunities in the Agriculture and Food Industry will be realized.

The establishment and selection of AIGC have been done with a good methodology and approach which also includes formulating selection criteria & scoring method. A good selection of strategic agricultural commodities for industrial processing developed and through which election of strategic agricultural commodities done with its economic importance. Delineation of AIGC also made for the selected commodities.

Finally, a total of 17 AIGC were identified from eight Regions out of which 5 are in Oromia such as -Central Eastern Oromia, North-Western Oromia, Western Oromia, Eastern Oromia, and Southern Oromia. Priority commodities were also identified like wheat, barley, haricot bean, fava bean, tomato, potato, fruits, & vegetables, dairy, fish, poultry, honey, and meat.

However, apart from identifying priority commodities and delineating corridors, so far very limited ground-level execution done on productivity enhancement intervention that helps to increase marketable surplus. Similarly, mechanisms that make farmers commercial-like input credit and output finance arrangements, lack of commodity-based development strategy and roadmap, a clear strategy to establish major public & private sector alignment not yet placed.

7.1.2.3 Agricultural Commercialization Cluster (ACC)

Agricultural Commercialization Cluster (ACC) initiative is one of the commodity & geography area focus approach implanting across 4 major regions in the country. Its main purpose is to align actors and clusters interventions within a geographical area across the value chain to facilitate efficient implementation within the zone, district, and farmer clusters, to maximize impact for the improved livelihoods of smallholder farmers. In its implementation chain ACC clusters of 3-20 adjacent districts which produce the same

priority crops and receive commodity-specific support across the value chain which help to initiate specialization and diversification areas and on the ground clusters of 30-60 smallholder farmers with adjacent plots who coordinate activities as if one farm and receive targeted support across key points of the value chain.

During ACC implementation, in the pre-launch period, clusters were selected in a three-step process: *Commodity Prioritization*: based on production potential, SHF coverage, market opportunity, comparative advantage, and other strategic drivers; *Selection of Candidate Clusters*: considering production potential, natural resource endowment, and ideal cluster size and *Cluster Prioritization*: based on infrastructure, value addition capacity, access to markets, and presence of institutions and initiatives.

According to the above criteria, ten strategic commodities in grains and horticulture have been prioritized across 300 prioritized districts grouped into 30 high-potential clusters out of which 125 districts grouped into 10 clustered are found in Oromia. For each commodity, the 5-year strategy aligns a market-based vision with realistic bottom-up targets. Four (4) strategic market drivers informed strategy for each commodity such as Import substitution; Export / agro-processing; increased productivity and improved quality.

This approach tried to promote an active dialogue between the private and public sectors through commodity strategic platforms or commodity value chain alliance, in this case, the malt barley value chain alliance can be mentioned as a startup effort where a lot of learnings found. Instead of covering everything, it tried to focus on limited value chains (5 in case of Oromia) and specific geographies 125 districts clustered in 10 geographic clusters). It also prioritized food security crops as well as import substitute crops. It also initiates public organizing support activities around clusters that are easier and more focused and effective than other strategies to support the development of the agricultural sector.

However, while identifying commodities and geographic areas land use plans didn't consider well as a major factor. During implementation crops preferred by farmers as rotation crops and commercially viable have not to be given due attention. The identified agricultural commodities are only cropped specific and the livestock sector didn't get much attention which makes the initiative prioritization and differentiation problem. Moreover, one of the critical factors that makes the value chains ineffective very low productivity that makes them marketable surplus low that could be resulted from weak support made to change farmers' attitude on-farm practices and marketing. The role of cooperatives also

minimum in accessing finance and play a significant role in aggregation and collection of agricultural produces.

7.1.2.4 Lesson for Oromia

From the above briefly reviewed initiatives and program, the following lessons are therefore learned which will be taken towards attaining success in transforming the Region's agriculture:-

- Need for commodity identification/Prioritization: - Prioritizing agricultural value chains in both food, import substitution and export commodities including livestock and horticulture are important. Considering the trade-offs, tailor the choice of value chains, cross-cutting enablers, and & geographies differentially achieve the government's goals. The focus should be profitability for the farmers, including attention to sustainability, quality storage & processing. Heavier integration and more effective execution of multiple, prioritized interventions across the value chain: Production through value addition through marketing and export are crucial.
- Need for geographic-area focus approach/differentiation: - More productive and surplus production areas that can well be connected to markets, irrigated land can support SHF commercialization. For areas remote from infrastructure, poor quality land, less well connected to market different strategies are needed. Differentially targets value chains and geographic areas with tailored strategies. This makes us not to fail to focus on critical resources
- Need for private sector engagement: - Key value chain participants need to assume ownership of executing growth agenda for agriculture. The sector highly supported by the private sector which should be well maintained with less government interference. There needs to be a platform that enables both partners engaged well. Heavier integration and more effective execution of multiple, prioritized interventions across actors: Smallholder Farmers, Coops and Unions, Youth, Local Private Sector, Large Firms are important.
- Production intensification/Commodities productivity enhancement is critical: - increasing commodity production and productivity to expand household and Regional food availability, reduce dependency on the importation of key crops, increase marketable surplus will contribute sustainable growth. This should be done through

bold interventions like increasing availability of input credit & output finance, expand mechanization service providers which can bring rapid transformation

- Infrastructure investments:- The important lesson learned is supported the development of storages, rural roads and irrigation to target export zones are also crucial for the effective transformation
- Transformation readiness and commitment. In similar transformational agenda initiatives, one of the big challenges was weak to take the initiative forward and lack of common understanding of initiatives across and within regions and sectors in its full sense. Considering this initiative as a system change with rigorous monitoring mechanism, keeping in mind youth unemployment challenges and the role of agriculture is critical.
- Work on critical enablers: - The success of SHF commercialization relies on how well farmers supported to change their attitude on farming practices and taking agriculture as a business as quickly and effectively as possible. The critical enablers in this regard help farmer with who farmers trust and interact regularly, this could be a person who providing extension knowledge. Similarly, agricultural cooperatives can provide technical assistance to farmers in addition to create access to storage, equipment, finance, marketing services.
- Import substitution as a strategic market driver: - Agricultural development with a focus on self-sufficiency via import substitution, lowers food crop & other agricultural processed products importation and drives down inflation. And import dependency is hurting Nigerian farmers, displacing local production and creating rising unemployment. Import dependency is neither acceptable nor sustainable fiscally, economically, or politically.
- Need for effective institution & market information systems: - should also be made available for farmers to have adequate planning and circumvent risks and uncertainties.
- Finding the right starting points for scale: - Focusing areas within specific geographies or particularly influential value chains are good. As changes begin to occur, the most critical success factor is that allowing for learning and that is flexible enough to be adjusted as understanding progress is critical.

7.2 National Policy & Strategy Documents

7.2.1 Agricultural & Rural Development Strategy

The Government of Ethiopia (GoE) has designed and implemented several development strategies over the last few decades, with the goals of accelerating growth, reducing poverty, enhancing sustainability and inclusiveness, and eliminating the country's dependence on overseas development aid. Among these, the Agricultural Development Led Industrialization (ADLI) policy document has been the central pillar of Ethiopia's development approach since 1993. Subsequently, similar strategies developed which indicate our agricultural growth will be market-led, especially the international market.

This strategy clearly stated that to implement market-led agriculture, basically, four critical interventions should be worked on. These are, expanding rural infrastructures, accessing rural finance, establishing commodity area specialization & diversification, and lastly presence of government intervention where there is a market failure.

“----- በገበያ በተለይም በዓለም ገበያ የሚመራ የግብርና ዕድገት አቅጣጫን መቀየስ የግብርና ልማት ፈጣንና ቀጣይነት ያለው እንዲሆን ለማድረግና ግብርና ሌላውን የኢኮኖሚ ዘርፍ መርቶ በፍጥነት ለማሳደግ እንዲችል የግድ ተፈላጊ የሆነ ጉዳይ ነው። **ለዚህም የአካባቢ ስፔሻላይዜሽን ዕውን ማድረግ ያስፈልጋል።**-----” ግብርና-መር የልማት የስትራቴጂና አብዮታዊ ዲሞክራሲ, መጋቢት 1997.

“----- የእያንዳንዱን የገጠር ቀበሌ ልማት ለማፋጠን ስንረባረብ፣ በአካባቢ ስፔሻላይዜሽን ማዕቀፍ የልማት ቀጠናዎችን የመፍጠር ዓላማና በነዚህ ውስጥ የልማት ማዕከላት የመፍጠር ግንዛቤ ይዘን መሆን አለበት።” ግብርና-መር የልማት የስትራቴጂና አብዮታዊ ዲሞክራሲ, መጋቢት 1997

Accordingly, there are efforts made by the government to expand rural roads through regular work, especially accessing rural roads to connect every kebele with district and each other, rural electrification is one of the areas where government focused on with its overall limitations concerning coverage and quality.

However, so far among the key pillars used to implement market-led agriculture, the establishment of area specialization and diversification pillar is not yet properly implemented. Similarly, one of the key systemic bottleneck in all agricultural sectors, accessing input and output finance/rural financing didn't get due attention as per its importance.

GTP I & GTP II

7.2.2 Industry Development Strategy

The National Industry Development Strategy like the agricultural sector strategy has put market-led agricultural production as a pre-requisite to speed up the development of agro-industries. It also concluded fast industrial development can be realized based on the

effectiveness and efficiency of the agricultural sector through manufacturing agricultural inputs and consumption materials; using the agricultural product as raw material and process. It emphasized the development of industry goes interlinked with the agriculture sector.

“----- ፈጣን የኢንዱስትሪ ልማትን ለማረጋገጥ እንዲስትረግ ግብርና የሚያስቀምጥለትን አቅጣጫ ተከትሎ ለግብርና ግብዓቶች እና ፍጆታ ዕቃዎችን በማምረትና የግብርና ምርቶችን ተቀብሎ እሴት በመጨመር ለገበያ በማቅረብ ላይ አተኩሮ ከግብርና ጋር በተሳሰረና ተመጋጋቢ በሆነ አካሄድ እንዲያድግ ማድረግ ያስፈልጋል፡፡-----“ የኢንዱስትሪ የልማት ስትራቴጂ ነሐሴ 1994

7.2.3 The new Ethiopian Agricultural Extension System

Ethiopia has developed the new agricultural extension system which transits the extension system from extension to extension-plus, which means the system will add an important core function called market-oriented in the traditional extension service delivery. The system has the objective to transform Ethiopia’s agriculture through the implementation of a pluralistic extension system and by providing demand-driven and market-oriented extension services to male, female, and youth farmers, pastoralists, and agro-pastoralists.

It includes value chain/ ACCs approaches as one of the key guiding principles. It identified facilitating market linkage and value chain development as a pillar to transform subsistence farming to commercialize through the implementation of the VC approach.

The strategy also clearly put key bottlenecks like insufficient understanding of market-oriented production system, limited knowledge, and skills of extension staff to facilitate value chain development, ineffective linkage among value chain actors, limited access to market information, and collective marketing. It also indicated building the capacity of the technical staff at various levels to provide market-oriented extension services, promoting Value Chain-Based Extension Services via enhancing institutional linkage, promoting value chain-based linkage platforms (input and output market development), improving access to Market Information and Collective Marketing (producers, aggregators, and marketing) and linking with ICTs as a basic strategic intervention to fully implement the system on the ground.

7.2.4 Lesson for Oromia

From the above briefly, strategy documents reviewed the following lessons are therefore learned which will be taken towards attaining success in transforming the Region’s agriculture:-

- Need for the effective institution: - Institutions facilitating commercialization are very important. Well-functioning markets and collection centers are institutions essential to commercialization since markets are more than the physical places where the exchange of commodities occurs. Farmer organizations including farmer groups, cooperatives, and other forms of organizations relate either to producers associations or trade associations involving marketers and enterprises are needed.
- Improved infrastructure: - Improved infrastructure facilitates the movement of commodities, people, and information and therefore facilitates the process of finding new commercial opportunities and gaining from price difference over space and over time. The building of new infrastructure and the rehabilitation and the proper maintenance of the existing one are both essential.
- Putting the new extension system on the ground is crucial: - It is very crucial to execute the strategy, clearly design & implement the approach to put the extension system on the ground. Therefore, people who guide farmers to grow high-value crops which increase income, advising him to produce what market required, improving his farming practices to produce quality products, supporting farmers to invest on his farms through accessing input credit is required.

7.3 DETERMINANTS OF GEOGRAPHIC FOCUS & SHF COMMERCIALIZATION

This section discusses the determinants of Agricultural Commercialization in general. In the context of agriculture, commercialization means the growing reliance on agricultural production or the whole agricultural sector on the market to sell produce and purchase inputs and human labor for production. So when agriculture is successfully commercialized, farmers to a greater extent depend on the market, even for their food, and not on their produce.

The process of agricultural commercialization can take place in two ways in the context of smallholder farming: - First, smallholder farm (SHF) households *shift* from semi-subsistence agriculture to production mainly for the market and, in the process, come to rely increasingly on purchased inputs (and also labor) for their production. Second, smallholder farm households are *complemented* or *replaced* by medium- or large-scale farm enterprises that are predominantly/purely commercial.

Generally, the commercialization of smallholder agriculture can be affected by internal and external factors. Internal factors refer to the household level, which includes agro-climatic conditions and risks; access to markets and infrastructure; community and household resource endowments; input and factor markets; laws and institutions; cultural and social factors affecting consumer preferences, production and market opportunities and constraints (Future Agriculture, Policy Brief 051, 2012).

There are also exogenous factors like population and demographic change, urbanization, availability of new technologies, infrastructure, and market creation, macroeconomic and trade policies that affect commercialization. These factors affect commercialization by altering the conditions of commodity supply and demand, output and input prices, transaction costs, and risks that farmers, traders, and others in the agricultural production and marketing system have to cope with. The following are key determinants of agricultural commercialization.

7.3.1 Lack of surplus production/No sufficient marketable production

In Oromia, there is a shortage of surplus food products and also limited produce purely for commercial purposes. Taking what is true for the whole of Ethiopia as applying also to Oromia, as such surpluses on staples have not yet been attained. However, commercialization requires the production of surplus above the own demand of the smallholder household and also the production of products (even if not surplus) for the market by a commercial farmer. For this, the agriculture sector should be improved technologically and through diversification of the target or production-for own consumption as well as for sale on the market. Transformed agriculture guarantees the production of surpluses at all times; growing dominance of marketed produce over subsistence consumption; growing of high value-addition through agro-processing. Developed and modernized agriculture promotes the commercialization of the rural economy as a whole including its dominant smallholder farmers. Generally, the marketable surplus is extremely low in the case of food staples whereas the proportion of cash crops like coffee, etc., is high

7.3.2 Low commercial/market-oriented attitude, knowledge

The skill and attitude required for successful commercialization are highly limited among the subsistence producers. The concern of the subsistence producers is just to produce the amount that can safely support the household from one harvest time to another. The extent of awareness about modern business and the capacity to seize and put to use any opportunity

available and to make choices between available options depends on the literacy level. In the Oromia region, the proportion of the population that completed grades 1-4 is about 50%, 5-8 is about 33%, 9-10 is about 7%, a diploma is about 2% and degree is about 0.86%. These figures are extremely low by any standard. The government should do everything possible to change the situation.

7.3.3 Lack of focus on prioritizing commodities & geographic areas

Resources are scarce and are distributed unequally across different geographic areas. It is thus, important to prioritize the production of products that promote the efficient use of scarce resources like land, physical capital, skilled manpower, foreign exchange, etc. The country has diverse agroecology ranging from arid to semiarid, sub moist to humid, and per humid zone. In the dry areas, rain-fed agriculture is unthinkable, in the sub moist zone, there is a small window of operation period especially for land preparation and planting. Moisture is also critical during the seedling and flowering period. In these zones, moisture conservation technologies like tied ridges have been employed in some places. This technology is adopted by most farmers and has rescued the crop from total failure in most sub moist zones.

7.3.4 Poor rural infrastructures

In Ethiopia as a whole and Oromia, the rural areas are underserved with basic infrastructure such as roads, electricity, water supply, schools, health facilities, etc. for example, only about 48% of the households in Ethiopia and 43% of the households in Oromia have access to drinking water supply sources within 1 km distance during dry seasons. As regards access to road, in 2011, about 29.5% (national) and 23% (Oromia) of the people had access to all-weather roads within 1km distance while 36.5% (national) and about 30% (Oromia) of the people had access to dry weather roads within 1km distance.

These figures have improved somewhat by 2018, but still, the fact on the ground reflects the poor nature of the infrastructure in the country as a whole. The situation is even worse with internet access, a service which the most important service in business transaction and information and knowledge sharing. Generally, although there are improvements in overtime, poor rural infrastructure is a major limiting factor for the transformation of the agricultural sector.

7.3.5 Low international competitiveness: Commodity quality standard

7.3.5.1 Low input credit & output finance

Access to finance is critically important for the commercialization of agriculture. As more than 64% of smallholder farmers in Ethiopia are producing on less than one hectare of land, it is crucial to enhance their income by improving productivity through access to financial and agricultural services. Farmers need finance to purchase inputs and tools that can help improve productivity and create a marketable surplus. Currently, the Ethiopian financial sector consists of 2 public banks including the Development Reports show that bank of Ethiopia (DBE), 16 private banks, 14 private insurance companies, 1 public insurance company, 31 microfinance institutions and over 8200 Saving and Credit Cooperatives (SACCOs) in both rural and urban areas. The geographical distribution of bank branches was highly skewed to major towns and cities. Nearly 34 percent of bank branches were located in Addis Ababa (NBE, 2013/2014). This limits rural areas' access to financial services.

Microfinance can be defined as the provision of a broad range of client-responsive financial services to poor people through a wide variety of institutions. Microcredit activities in rural and urban Ethiopia were initiated by local and international NGOs (Wolday, 2004). According to Pischke (1996), there were 30 NGOs in Ethiopia who were delivering microcredit services but concentrated in urban areas.

In Oromia, access to finance by the vast smallholder is highly limited despite some improvements in the past. The report shows that people depend on informal sources and arrangements like Iqqub, friends, rural money lenders, Iddir, etc. The formal financial service based on collateral submission does not help the Smallholders. Micro-financial high-interest rates and limited scope limits the access of smallholders in remoter areas to financial services. The special arrangement needs to be designed to open opportunities for those who especially live in remote locations. The geographic cover of microfinance needs to be expanded.

7.3.5.2 Incomplete execution of policies and strategies

Most of the time, rather than addressing the issues related to the lack of public market infrastructure and support mechanisms through increased funding for an extension, research and other long-term public investments, Government has traditionally opted to make interventions in the supply of inputs and in crop marketing arrangements - which are primarily driven by short-term interests and easy to do tasks. Therefore, the Government persists with interventions in activities usually associated with private sector provision, and

neglected interventions associated with the provision of public goods and services. This cycle needs to be broken and appropriate public and private sector roles identified and strengthened.

It is possible to observe how the effectiveness of public research development and extension services is hampered by chronic under-funding due to the crowding-out effect of largely politically motivated expenditures. The total Regional agricultural budget increased nearly -- - percent between --- and ---. Investments critical for increasing farm productivity, such as irrigation infrastructure, received only --- percent of the budget. Operating costs under which research and extension fall received only --- percent of the budget in ---.

If the smallholder productivity is to be improved, there is a need for a larger share of public expenditures for agriculture to be allocated to the provision of public goods and services, such as extension, agricultural research, and productive investments (e.g., irrigation), rural finance and other important catalytic tasks. However, it is unlikely the Government will withdraw completely from the oversight of agricultural inputs marketing. Execution of area specialization and diversification approach as one of market-led agricultural growth strategy and development approach is not yet getting full attention in its real sense.

7.4 RECOMMENDATIONS & STRATEGIC PILLARS WITH HIGH-LEVEL IMPLEMENTATION TIMEFRAME

7.4.1 Recommendations

The agricultural production and commercialization thematic area which is related to commercializing smallholder farmers is a vast topic. At a minimum, it requires a comprehensive analysis of issues related to food security, livelihood, and sustainable farming practices, and commercialization of smallholder farming systems and other market-oriented activities. Covering all these issues through in-depth analytical work is beyond the scope of this study. As such, the focus of this thematic area is to provide recommendations and brief strategies that enhance Regional agriculture production & productivity and smallholder farmers' commercialization. The recommendations can be organized around the following areas based on the reviews and lessons learned made from the previous topics.

7.4.1.1 Design and implement commodity and geography area prioritizing and differentiated approach

Agricultural production potential in Oromia, both in terms of natural resource endowment and economic viability, varies widely across rural space. There is, therefore, a need for

geographically targeted approaches to identify specific high potential areas, For agricultural production and smallholders' commercialization to succeed, there must be identified priority agricultural commodities, productivity enhancement enablers, and differentially targeted geographies with a tailored strategic approach. As part of an agricultural transformation plan, we have to tailor the choice of commodities, enablers, and geographies to differentially achieve the Regional state chosen goals.

Focusing on different tailored strategies, like raising the productivity of smallholder farmers and social safety net in more remote areas where high food shortage and less well-connected market, working more in potential areas where raising farm productivity or shifting the mix of production to include high-value crops and livestock for boosting of export revenues or import substitution is recommendable. Weighing the trade-offs among multiple objectives and towards several different goals, including feeding the domestic agro-industries to bring growth in agro-processing, reducing youth unemployment, increase export, import-substitution, etc. should clearly be defined.

Accordingly, clustering and formation of different agro-ecologies and commodity suitability based on the above-stated assumptions are essential. Therefore, it is recommended to revisit the existing agroecology zonation works which aimed to increase productivity and shift farmers to semi-commercial and commercial-stage initiatives with the methodologies and criteria used to form area specialization with diversification and commercialization that lead ultimately the growth centers. Major shifts in production patterns have taken place into cassava

7.4.1.2 Increasing Farm-level Productivity of Smallholders

In Oromia, an average crop & livestock productivity levels of smallholder production systems are below their potential. There is a big productivity difference between the so-called model farmers, which are very few in number and the majority subsistence farmers. This low productivity leads to chronically low levels of farm incomes for smallholders. Furthermore, low and declining smallholder yields of agricultural commodity livestock & crops lead to inadequate raw material supply for agro-industries. Therefore, for smallholders to commercialize, there must be high productivity and marketable surplus.

One of the main constraint affecting the low levels of productivity of smallholder production systems is low utilization of improved agricultural inputs which is not because of lack of knowledge on its importance and low interest, rather could be affordability problem that must be addressed well. Therefore, accessing input credit for farmers at the level they can

use the full package recommendation should be done. Moreover, in areas where there is a need to engage farmers to produce more to have enough marketable surplus like avoiding net wheat importation, targeted farmer input subsidy complementing with pre-cultivation prices signal for farmers and supplemented by changes in farming practices should have to be taken into consideration.

The other greatest constraints facing smallholders not to have adequate surplus production is the lack of a business-oriented approach to farming. This is applied to most commodity sub-sectors. The roots of this problem are complex and partly from many ‘hard to measure’ cultural and attitudinal factors associated with farming and most smallholder farmers (SHF) view agriculture as a way of life and not as a business. This should be addressed through what and how farmers should be trained, especially, farmers who produce cash crops should have to take “farm Business training” rather than only the traditional technology package training. Coops extension system

The way SHF performs their farm activity independently and in a fragmented way is another weak practice that farmers follow and limit their productivity. When farmers grow different commodities and work separately the chance to share their experiences and farmer-to-farmers’ knowledge sharing ability diminished. Moreover, it will be very difficult to show enough market supply in a particular area. Therefore, the existing “farmer-production-Cluster” initiative within the “ACC” project should be scaled up well. This approach also has an advantage in making farmers exercise similar farm practices through best practice sharing in addition to expanding farm mechanization particularly those that can be done by mechanization service providers.

Liberalization of the agricultural input supply and distribution is another key factor that has the potential to increase farm-level productivity. Making the private sector, including cooperatives to highly participate will make farmers get diverse types of inputs in particular places. The purpose is not only to increase farm input access to farmers but also to make farmers get quality products at competitive prices. Along with this, engaging highly the private sector and cooperatives in mechanization service provision in a systematic way. Therefore, the current “farmers Service Centre”, “Agricultural One-Stop Shopping”, “Direct Seed Marketing”, “Cooperative-based Seed Production”, “Mechanization Service Center” approaches piloting are highly recommended to the expansion of agro-dealer modalities.

Farmland ownership/tenure system and renting/leasing issues believed to have high implications on farmland investment that leads to production boosting. Along with this, the

large share of fertile farmland owned by an aged farmer population versus young groups having the challenge of acquiring access to farmland are issues that should be seen in the long-term.

7.4.1.3 Expanding Rural Financing/ Access to finance

One of the big issues related to the low use of improved technologies is the affordability problem for all farm input costs. This problem, even if express high in subsistent farmers, it is also true for the model farmers who believed to afford it, need short-term and medium-term credits for agricultural input purchase because as their income is increasing, they need to diversify their farm practices with additional complementary technologies live, livestock, horticulture, small mechanization tools, etc.-. This time the need for input credit is increasing because of the type and amount of inputs farmers' are using growing high since farmers recognizing different factors are pushing to use more inputs. These factors could be declining of their farm soil fertility, high crop pest pressure (both intensity, prevalence), need for supplemental feed for livestock, need for veterinary medicines & treatments --etc.). In some areas, farmers will not farm unless they are sure to have those inputs as it is very risky.

The provision of medium and long-term credit is unlikely to happen to farmers due to agriculture is characterized by relatively low profitability and high risks (e.g., price and weather fluctuations) associated compared to other sectors. Furthermore, output finance credit for private aggregators and cooperatives has not yet touched or solved properly.

Therefore, the issue of credit in the Region and the country at large needs to be viewed in the broader context. However, as far as the farm productivity enhancement and shifting of smallholder farmers from subsistence to semi-commercial and commercial farmers concerned, there is no other option than strengthening rural microfinance institutions. Accordingly, for transformation on-farm productivity & commercialization to come under rural micro-finance institution strengthening framework, working aggressively on rural saving and credit cooperatives is very critical. In this regard, the current implementing Input Voucher System (IVS) can be considered as an entry point through filling identified gaps and work on the emerging issues raised during implementation.

7.4.1.4 Improving Market-linkage Mechanisms to farmers produce

Most farmers lack knowledge of markets, both in terms of current practices, how the price is negotiated, what qualities particular market requires, and the likely future market functions.

They are not, therefore, in a good position and not well-equipped to negotiate effectively with buyers. Therefore, there should be support from responsible institutions to place effective farm-to-market linkages through different approaches, like linking farmer to domestic private traders; linkages through a leading farmer for those products in the cluster; linkages through cooperatives; linking farmer to the agro processor; linking farmer to an exporter and contract farming.

It is recommended to use different operating modalities and approaches to link farmers to potential buyers that could be incorporated into recommended best practices suited to the specific conditions of different sub-sectors. One of these models is using out-grower schemes or nucleus, farm models. While working on this model, challenges that could occur such as the issue of side-selling and side- buying which is linked to general problems related to weak law enforcement, the lack of business orientation of smallholder farmers, a widespread dependency mentality which further complicates developing an independent and business-oriented smallholder farming community should be addressed well. To be more systematic and effective, different commodity-based platforms established along the value-chains is important.

Along with any out-grower model, one of the good operations is to have hands-on control over the input delivery and extension services as a means to secure adequate volumes of high-quality raw material. This also makes it possible to deliver specific extension messages to contracted smallholders to collect adequate volumes of raw material, according to the desired quality standards. This extension service, delivered by the nucleus farmers or any company can also shift to cooperative based extension service delivery. Furthermore, farmers are organized into informal groups or clusters as a channel for input distribution, dissemination of technical support, and marketing arrangements. There should also be a support on the development of appropriate farmer organizations, especially in the areas of strengthening their business orientation and capacity, since it would make smallholders more attractive business partners for agri-businesses and input-credit provision by the companies. The expansion of consumer association will help to strengthen urban-rural linkages.

7.4.1.5 Improving and strengthening investments in rural infrastructure

To realize smallholder farmers' commercialization, especially, like farmers with fragmented land and found in rural areas where there is poor infrastructure, there should be an investment in infrastructures that have the potential to generate new opportunities, improve

accessibility and facilitate forward and backward linkages. Such infrastructure assets may include irrigation infrastructure, storage, rural roads, rural electrification, and other facilities. Development of infrastructures related to markets like a market information system, primary and secondary market centers for key commodities in all sub-sectors are necessary. Therefore, as Oromia is a large Region and resources for infrastructure development are extremely limited, a need for geographically targeted approaches for infrastructure investments. The strategic focus for infrastructure development should be on those rural areas which have the highest potential for agricultural growth and linked activities. URAP, NMIS, MC, ISWG, CS should be seen ready to scale up.

7.4.1.6 Develop & strengthen appropriate farmer organizations to ensure broad-based rural growth and development

The development of appropriate farmer organizations is critical for individual farmers to capture economies of scale and for developing the business orientation of smallholders. Strengthening the capacity of existing and new farmers' organizations and producers groups, especially building their business orientation, would make smallholders more attractive business partners for agri-businesses and input-credit provision by the companies.

For market-driven agriculture to happen, commercially oriented farmer organizations are needed. This should not be confused with old-time politically motivated farmer cooperatives. Well-functioning associations can reduce transaction costs and risks to agribusinesses, which make credit delivery, input supply, extension, and produce collection easier to manage.

Smallholders need technical support and training in business management skills to establish and operate effective associations. A justified public intervention would be to support the development of farmer organizations, especially during their infant operational period particularly soft skill training and capacity building on critical infrastructures like storage construction and RuSSACos office establishment. This could include the facilitation of business development services to viable and commercially oriented farmer's organizations in the areas of group formation, group governance skills, and farm planning skills, market intelligence training, and business skills and training on contracts and understanding contractual obligations.

7.4.2 Strategic Pillars

The agricultural production enhancement and smallholder commercialization can be organized around the following three strategies:

Strategic Pillar 1: Increase Production and Productivity

Increasing farm productivity is a key to not only the Regional agriculture growth but also enable the development of smallholder's commercialization to achieve its given mission. Improving the existing mechanisms to make smallholder farmers based yield increments, such as farmers' technology package training delivery, input supply, and distribution and monitoring & support mechanism should be stressed well. Furthermore, continue to work on the development of new innovative approaches and arrangements from current on-going initiatives for farm productivity improvement will have a significant impact. A commodity prioritization and geography area focus differentiation approach; accessing farmers with input credit or strengthening rural finance; liberalization of agricultural input supply and distribution and ensuring most household farmers grow more than once where water is available are considered as critical areas of interventions,

Implementing commodity prioritization and geography area differentiation approach

(Both for Crops & Livestock)

Instead of one-fits-for all approach, focusing on different tailored strategies, like raising the productivity of smallholder farmers and other options in more remote areas where high food shortage and less well-connected market, working more in potential areas where raising farm productivity or shifting the mix of production to include high-value crops and livestock for boosting of export revenues or import substitution is should be designed and implemented

Hence, zonal/district level clustering and formation of different agro-ecologies and commodity suitability based on the above-stated assumptions is critical. Revisit the existing agroecology zonation works which aimed to increase productivity and shift farmers to semi-commercial and commercial-stage initiatives with additional criteria like land-use planning to identify geographic areas and the methodologies and criteria used to form area specialization with diversification and commercialization should be implemented.

Such prioritization of geographic clusters and commodities will work on commodity value chain approach & strategies, resulting in a targeted scope and focus with interventions and methods of implementation. Regional agricultural goal drivers for each commodity, such as

import substitution; export / agro-processing; increased productivity, and ensuring food security in remote and moisture stressed areas will be used as a base. The strategic commodities will accommodate grains, horticulture, and livestock subsectors across prioritized districts grouped into their potential. To ensure effective implementation of this approach institutionalization and additional governance structure like commodity value chain alliances will be designed.

*Accessing input credit through strengthening rural micro-finance institutions (RuSACCo)
(Both for Crops & Livestock)*

Adoption of agricultural inputs has been increasing over the past few years in the Region. However, only a fraction of the Region's potential for agricultural productivity from modern inputs adoption has been exploited. One of the key bottlenecks is the affordability problem of smallholders to access improved agricultural inputs. Therefore, effective rural micro-financial institutions with strong governance, management, and customer service culture is crucial. In this case, RuSACCos are ideal to facilitate as a short-term intervention not only for accessing credit but also to mobilize huge savings.

This time while RuSACCos membership has grown rapidly in the Region, member size, infrastructure, and lending are low. Therefore, identify major SACCo challenges through study and discussion with the relevant stakeholders; build their capacity, to become self-sustaining, supporting them to increase total savings and increase total loan disbursement some major intervention areas to implement.

*Improving and liberalizing agricultural input supply and distribution
(Both for Crops & Livestock)*

Agricultural inputs are key for improving crop production and productivity. Increasing the availability and quality of improved agricultural inputs can increase the yield potential of the crop by significant folds. Among others, unavailability of quality inputs at the right place, time, quantity, coupled with poor promotion system and inefficient input demand forecasting system are the key factors accounting for limited use of improved agricultural inputs. This necessitated to recommend and strategize how to improve the input supply & distribution channels to identify possible supply & distribution channels as actionable recommendations to increase production & productivity and also input trading as part of agricultural commercialization.

Therefore several actionable measures should be taken to scale up the currently implementing initiatives on different agricultural supply and distribution channeling, like cooperative-based seed production, direct seed marketing, agricultural one-stop shopping (establishment of centers and shops). This should again be supported by the right incentive for the high participation of the private sector and farmers cooperatives along with placing correct regulation mechanisms and enabling environment like directives and regulation that help implementation on the ground.

Boosting small scale irrigation

With the growing effects of climate change on weather patterns and opportunities for increasing yields by producing more than once a year, boosting irrigation will be needed. This also has great potential for the reduction of rain-fed agriculture dependency and making all farmers have one water source option. Considering the importance of irrigation it is good to identify the largest opportunity for household-scale irrigation which lies in shallow groundwater, which can be tapped with simple pump technologies. Groundwater resource is a reliable water source (if renewable and safely exploited), on-demand water, well-distributed/available in many places and requires less institutional prerequisites for managing

Therefore, providing valuable and critical information on the spatial and temporal distribution of shallow groundwater resources and identifying potential irrigable area based on the potential shallow groundwater resource, developing the identified shallow groundwater resource development and management should be one of the key interventions.

Expansion of mechanization services for farmers

Expanding the access and use of mechanization by smallholder farmers is key to achieving higher productivity and post-harvest loss. But this sector faces challenges such as the low capacity of service providers and a lack of effective business models for providing mechanization services. Therefore, incubating as many service providers as possible through unlocking key problems of the sector such as a challenge to finance for private providers with high collateral requirements, problem-related to repair and maintenance, service providers typically requirement on assistance with technical capabilities for operators and mechanics along with training support with general capabilities in overall business operation, financial management and marketing are critical tasks during implementation. Furthermore, it is quite necessary to incorporating youth enterprises a service providers.

Strengthening crop protection & livestock health activities

Crop pests are frequently mentioned as a major constraint to increased food production and higher agricultural productivity. A crop/yield losses reach sometimes up to 100%. In this case, without an adequate crop protection practice, a reliable food supply cannot be guaranteed. Agrochemicals/pesticides are predominantly used by small-scale farmers which spread across large areas of the environment to increase yields. This has brought not only food safety problems in the Region but also causing bad image on export commodities. This should be replaced via a series of best-practice methods including Integrated Pest Management (IPM) which helps farmers produce crops cost-effectively and sustainably.

The most effective way of reducing the impact of pesticides is by reducing their use, in addition to a good understanding of pesticide hazards, the ability to read a complex label and follow its instructions, access to and correct use of personal protective equipment and well maintained and correctly calibrated application equipment by SHF. This also supported by strengthening the regulatory framework for pesticide control, effectively control the distribution and use of pesticides, trade, management, use, and disposal of pesticides.

This time mismanagement of pesticides has resulted and will also result in the accumulation of large stockpiles of obsolete pesticides that are now considered hazardous waste. Therefore, good stock management and storage of pesticides throughout their distribution lines are important in preventing loss, damage, deterioration and inappropriate use should get attention before things are too late.

Urgent attention should also be taken on animal health since the magnitude of losses affecting improving food production, increasing food security, and enhancing producer profitability. Therefore, we have an obligation to address the serious and profound occurrence of livestock diseases as a prerequisite for livestock development.

Strategies and implementing procedures should be revisited how they are placed and working on different categories of livestock diseases, such as for major epidemic diseases, how all aspects of veterinary services and a clearly defined chain communication with partners; for the control of endemic diseases how harmonized and standardized control strategies is being pursued; for control of chronic or non-infectious diseases how it is supported by clinical veterinary services.

Moreover, promoting the concept of a comprehensive veterinary service that relies on effective public service and a viable private sector should be in place. Planning and

execution of animal disease prevention and control tasks relying on Preventing, Detecting, and Diagnosing Animal Diseases should be attained.

Generally, the key tools for the regional control of animal diseases should focus on the availability of adequate information, proper services for the diagnosis of disease conditions through rural animal health infrastructure establishments, vaccines of appropriate quality, and functional veterinary service.

Urban Agriculture

Urban agriculture generally refers to food and other agricultural products grown within a city or peri-urban area, produced directly for the market and/or household use. It also presents a means to generate income and improve living conditions in both urban and peri-urban areas. This sector has no formal support from the public side and moves along with any interest groups.

The most common constraints to urban agriculture are inadequate institutional/legal frameworks, limited access to agricultural inputs and post-production services, inadequate technical knowledge of urban agricultural practices, and other problems related to extension service delivery.

Therefore, a new approach will be required that incorporates awareness-raising about urban agriculture, expanding information and knowledge through extension work, incorporating urban agricultural components into the existing extension systems and integrating into new investment areas. In this regard, in placing urban agricultural activities, we should follow an approach that identifies which urban and urban areas are with maximum potential for starting and expanding urban agriculture and then supports the necessary actions to help those towns realize this potential.

Working on soil fertility and health improvement including soil acidity

Soil fertility and health are some of the key sources of agricultural productivity. Fertile and healthy soils are the basis for healthy food production. Therefore, improving soil fertility and health practices integrated within the overall production system can effectively increase crop and livestock productivity. In this case, innovative steps are needed rather than a business-as-usual approach which lacks the potential to cope with challenges related to low fertile and poor healthy soil.

In this regard, the first intervention should be developing a holistic strategy to promote the adoption of best soil health and fertility management practices that encompasses developing, validating, and scale-up Integrated Soil Fertility Management (ISFM) technology packages to maximize the efficiency of nutrient and water use and improve agricultural productivity.

With the framework of ISFM, based on the current given Regional soil fertility status and fertilizer recommendations, developing soil test -crop response index-based fertilizer recommendation & rate and incorporating within the agricultural extension system is important. Furthermore, for its effectiveness, establishing and strengthening soil testing laboratories through the availability of sufficient financial resources to support research and development limited support facilities, establishing well developed human and physical capacity development plans (training, timely supply of consumables, and logistics) is crucial.

Fine-tune, developing and implementing solutions to address acidity, salinity, and waterlogging problems to increase fertilizer use return should be the prior intervention. Moreover, we have to think about how soil-test specific fertilizer recommendation types and with their recommended rates can be accessed to farmers easily. To satisfy future demands of such fertilizers, more fertilizer blending plants should be established in different locations of the Regions based on pre-defined criteria.

Improve rural farmland rights & securing land access for the youth as a means to household investment and agricultural productivity;

There is a growing of evidence suggesting that securing land and resource rights for men and women has a positive impact on food security and broader development outcomes, such as household investment, agricultural productivity, women's empowerment, nutrition, and more robust rental markets for farmland. When land rights are secure, farmers invest more in their land and agricultural productivity improves. Conversely, when these rights are insecure, people have more limited incentives to invest labor and capital to improve soil, plant perennial crops, manage rangelands, and invest in irrigation.

The possible role of secure legal title in providing farmers with access to medium-term and more extensive credit is highlighted by many studies. In some areas, possession of a land title is often a mandatory precondition for commercial (formal) or official bank loans. Therefore, even if the land ownership security issue is still debatable and needs further policy dialogue, a clear formal title backed by a legal system capable of enforcing property

rights should be fully implemented with the current rural farmland cadastral certification system.

Attracting educated young people into farming has to focus on addressing the challenges that discourage them from farming, including access to land, inputs, finance, and markets. The challenge to access land even greater for youth. This challenge for youth to access land is a serious one and the policy actions to address this challenge should be seen in depth.

The most binding challenges to accessing secure land include: - Over-reliance on inheritance which limits choices in terms of timing, size, quality and location of land; Undeveloped rental land markets; Lack of resources to rent land; Inadequate access to information and lack of legal protection of land rights for the youth; and Lack of provision for youth in state-sponsored land redistribution programs

Therefore, governments need to revisit appropriateness of its land policies through building on some past domestic and international initiatives to develop policy actions to enable youth to acquire land and contribute to the modernization of African agriculture

Strategic Pillar 2: Ensuring commercially oriented smallholder farmers

Improving the efficiency of agricultural marketing mechanisms to encourage smallholder commercialization is critical for farm productivity improvement. To realize this there is a need to continue supporting the development of appropriate farmer organizations, improving different market linkage mechanisms, accessing rural finance for both farm input and output, and encouraging private sector participation. There should also strengthen risk management practices by smallholders dealing with weather-related risks that directly affect the household choice of production systems and willingness to participate in commercial agriculture activities.

Strengthening Farmer Organizations focusing on Cooperatives engaged in value addition and processing

Strengthen primary and secondary farmer's cooperatives are crucial not only to link farmers' produce to potential buyers and input-credit provision but also to engage in value added and agro-processing to create viable and commercially oriented farmers sustainably. In this case, the facilitation of store construction, market intelligence training, and business skills and training on contracts and understanding contractual obligations should get attention.

Establishing and strengthening consumer associations in nearby urban to create strong urban-rural linkage is one of the many focus areas.

Expansion of rural input and output credit facilities

As farmers engage commercially oriented farm activities robust rural micro-financial institutions (MFIs) with strong governance, and strategic and feasible business plans are important. In this regard, strengthening farmers rural saving and credit cooperatives have a paramount contribution to access the rural financing needs in addition to other rural MFIs. Microfinance institutions with diverse products which can answer not only the short term input credits but also medium and long term credit requests by farmers. With special attention, for RuSACCos Key capabilities be assessed and interventions prioritized in a standardized way be worked on.

Improving market linkage mechanisms

Putting clear diversified models & approaches to link farmers to potential buyers and improvement of market access is critical to promote commercialization in agriculture production. Experiences show how significant market access in commercialization development is and as those areas that market access is easier, there is more non-farm activities that exist in the areas and the average income of a farmer is also higher. Therefore, the establishment of linking smallholders with agribusiness enterprises through the development of best practice models of contract farming and the development of nucleus estates and large enterprise models based production systems supported by enforcement measures for any default occurred should get due attention.

Supporting private Sector

To modernize and intensify smallholder farming and to improve the competitiveness of value chains, new approaches and partnerships need to be considered. Therefore, to maximize the benefits of the private sector for food and nutrition security through increase productivity and SHF commercialization, concrete efforts are needed.

For this purpose, the establishment of regional sector-specific public-private strategic platforms to mobilize business interests, sustainable market-linkage and investments particularly through analytical work and facilitation of public-private dialogue within commodity cluster areas will be encouraged

Rural village towns strengthening and establishment

Small village towns are an important but often neglected element of rural landscapes and food systems. They perform several essential functions, from market nodes for food

producers and processors to providers of services, goods, and non-farm employment to their population and that of their surrounding rural households. They are the center to begin for making rural economic source will start diversified from fully primary agricultural products to other economic sectors.

There are four main benefits of small village towns in regional and rural development. The first one is by acting as centers of demand/markets for agricultural produce from the rural region, either for local consumers or as links to wholesale markets. Access to markets is a prerequisite to increase rural agricultural incomes, and the proximity of local small market centers to production areas is assumed to be a key factor. Second, by acting as centers for the production and distribution of goods and services to their rural households. Such concentration is assumed to reduce costs and improve access to a variety of services, both public and private for rural households. Hence, services include agricultural extension, health, and education (and access to other government services), as well as micro finances, services such as small petty trades and wholesale and retail sales of produced and manufactured goods from within and outside the region.

Third, by becoming centers for the growth and consolidation of rural non-farm activities and employment, through the development of small and medium-sized enterprises or the relocation of branches of large private or parastatal enterprises. And finally by attracting rural migrants from the surrounding areas through demand for non-farm labor, and thereby decreasing pressure on larger urban centers.

Strategic Pillar 3: Improving rural infrastructure that is crucial to raising productivity

Underdeveloped infrastructure contributed to low levels of market access and technology penetration. Therefore, improving rural infrastructure is crucial to raising productivity. Improvements in rural infrastructure by promoting the construction of farm-to-market roads and enhanced communications, the establishment of the well-designed and broadly accessible market information system, having market centers across all levels, infrastructures related to product quality inspection and certification and irrigation schemes are those should get attention.

Developing a market information system for the agricultural sector

Market Information System can support the rapid growth of the agricultural marketing sector and commercialization of smallholder agriculture through collecting, processing, and disseminating data and other information on the situation and dynamics of agricultural

markets. It helps all actors make informed decisions related to where, when, and through which channels to sell and buy produce. Farmers can obtain better prices for their produce by running price and volume comparisons for nearby markets. By developing market infrastructure, the volume of marketable surplus increases as earning opportunities are made more transparent, and upstream market actors are also able to make profit-maximizing decisions on the volume and composition of their product sourcing and sales. Market information is also useful in the context of obtaining early warnings of food security difficulties. Therefore, a coherent, well-integrated, reliable, and quality-controlled market information system by assessing the existing and previous MIS limitations that prevent these systems from delivering the full range of benefits should be established. It is generally insufficient to supply farmers with market information alone, farmers require assistance with interpreting this information and provides training for extension workers to supply such advice is critical. Furthermore, for reliable MIS, availability of organized market center are important.

Improving & establishing agricultural products grades and standards systems as strategic tools for market penetration

Since agricultural products can have a vast array of characteristics such as weight, size, shape, density, firmness, tolerance to insect damage, cleanliness, color, taste, odor, maturity, blemishes, moisture content, etc., a system for clear communication between buyer and seller is vital. Such a system improves the efficiency of markets and helps make them more transparent. It can also serve to differentiate and segment in positive ways that define market niches and in negative ways that present a barrier to entry for certain market participants. It also makes it possible to improve the incentives for quality and safety, make market information meaningful, facilitate price/quality comparisons, etc

Therefore, step-by-step processes should be done to establish useful agricultural products grades and standard (G&S) system through selecting what product or products to address first, usually the most traded or those with the most export potential; identifying stakeholders like government Ministries such as Agriculture, Trade and Health; conduct resource assessment that covers who has done this sort of work? Where can technical assistance be found? How much funding is available? Who can assist in the work? ; Determining the specific sectoral and national needs like "What exactly do we want to accomplish with these grades and standards?" and "What are the specific needs of the

different stakeholders.”; Determining which entity or entities will be responsible for four aspects of grades and standards: development, updating, and assessment, training is required for growers, inspectors, buyers, and technicians, coordination with international standards -- on both the international and national levels and enforcement.

Strengthening rural infrastructures

Adequate rural infrastructure raises farm productivity and lowers farming costs and its fast expansion accelerates agricultural as well as economic growth rate. It is proven that the combined effect of availability and utilization of infrastructure plays a strategic role in producing larger multiplier effects in the economy with agricultural growth. The farmers’ willingness to adopt productivity-enhancing technology also depends very significantly on the infrastructure and market situation with which they are faced.

It is believed that the major focus of infrastructure investment should be on irrigation, transportation, electric power, agricultural markets, and all infrastructures related to livestock crop & livestock health, etc. These not only contribute to agricultural growth at the macro level but also the wide disparity between different regions concerning the growth of agriculture. Therefore, strengthening of the efforts made so far, meanwhile efficient provision and maintenance of these infrastructures will make the agricultural sector able to contribute significantly to overall economic growth. Furthermore, concerted efforts should be made to identify the priority infrastructures for different areas.

Strategic Pillars, Suggested Intervention and Indicative Timeframe [On-going]

Given the above broad and high-level strategies, the Region needs to consider key interventions that need to take place immediately, for medium and longer-term to energize the existing agricultural production enhancement and SHF commercialization. In the below table, the three main strategic pillars are presented along with priority interventions, and an indicative timeframe.

Table 53 Strategic pillars, Suggested Intervention and Indicative time frame
[Ongoing]

Short-term (up to 1 year)	Medium-term (1-3 years)	Long term (3-5 years)
Strategic Pillar 1:- Increase Production and Productivity		
<i>Implementing commodity prioritization and geography area differentiation approach</i>	<i>Implementing commodity prioritization and geography area differentiation approach</i>	<i>Implementing commodity prioritization and geography area differentiation approach</i>

<ul style="list-style-type: none"> Defining clear goal/strategic drivers to implement geographic area focus approach 	<ul style="list-style-type: none"> Defining clear goal/strategic drivers to implement geographic area focus approach 	<ul style="list-style-type: none"> Defining clear goal/strategic drivers to implement geographic area focus approach
<ul style="list-style-type: none"> Conduct a crop & a few horticulture commodity prioritizations and geographic area differentiation using clear criteria and methodology 	<ul style="list-style-type: none"> Conduct all horticulture & a few livestock commodity prioritizations and geographic area differentiation using clear criteria and methodology 	<ul style="list-style-type: none"> Conduct all livestock commodity prioritization and geographic area differentiation using clear criteria and methodology
<ul style="list-style-type: none"> Placing crop & a few horticulture commodity approach/value chain, cropping system and pattern planning, implementing & M&E system 	<ul style="list-style-type: none"> Placing all horticulture & a few livestock commodity approach/value chain, cropping system, and pattern planning, implementing & M&E system 	<ul style="list-style-type: none"> Placing all livestock commodity approach/value chain, cropping system, and pattern planning, implementing & M&E system
<ul style="list-style-type: none"> Institutionalizing the approach with additional governance which ensure private sector engagement 	<ul style="list-style-type: none"> Institutionalizing the approach with additional governance which ensure private sector engagement 	<ul style="list-style-type: none"> Institutionalizing the approach with additional governance which ensure private sector engagement
<ul style="list-style-type: none"> Develop crop & a few horticulture commodity strategy formulation and impact assessment for each identified areas based on the identified commodities and goal drivers 	<ul style="list-style-type: none"> Develop all horticulture & a few livestock commodity strategy formulation and impact assessment for each identified areas based on the identified commodities and goal drivers 	<ul style="list-style-type: none"> Develop all livestock commodity strategy formulation and impact assessment for each identified areas based on the identified commodities and goal drivers
<ul style="list-style-type: none"> Develop prioritized highest systemic & other intervention 	<ul style="list-style-type: none"> Develop prioritized highest systemic & other intervention 	<ul style="list-style-type: none"> Develop prioritized highest systemic & other intervention
<ul style="list-style-type: none"> Placing best implementation modalities including the role of government and private sector, operational structure, program management approach, financing model, human resourcing, monitoring and evaluation (M&E) 	<ul style="list-style-type: none"> Placing best implementation modalities including the role of government and private sector, operational structure, program management approach, financing model, human resourcing, monitoring and evaluation (M&E) 	<ul style="list-style-type: none"> Placing best implementation modalities including the role of government and private sector, operational structure, program management approach, financing model, human resourcing, monitoring and evaluation (M&E)

CHAPTER VIII: STATUS, CHALLENGES AND POTENTIAL INTERVENTIONS FOR NATURAL RESOURCES MANAGEMENT IN OROMIA

8.1 INTRODUCTION

Natural resources are fundamental for transforming agriculture as they have been playing a significant role in the technology development of agricultural products and also critical in ensuring sustainable development. Furthermore, natural resources are important for local communities in rural and urban areas for diverse needs. Studies show that the livelihoods of 70 percent of people living in poverty directly depend on natural resources (UNEP, 2019).

Nature and nature's contributions to people are vital for human existence and good quality of life. For example, more than 75 percent of global food crop types, including fruits and vegetables and some of the most important cash crops such as coffee and cocoa rely on animal pollination (IPBES, 2019).

Agriculture is dependent on natural resources for many inputs including genetic material, soil nutrients, and pollinators. Agriculture has been the primary sector both for food supply and economic growth of Ethiopia as it accounts for approximately 38% of the gross domestic product, provides employment for about 80% of the population, and generates about 90% of the export earnings. Crop production is estimated to contribute on average about 60%, and livestock accounts for 27% and forestry and other subsectors account for 13% of the total agricultural value at the national level. Oromia has the largest share of these contributions in the country, e.g., 70% of coffee production for export is from the region.

However, our agriculture needs transformation as traditional practices of crop and livestock production have been causing continuous natural resources loss and ecosystem degradations. The government has shown commitments to increase productivity to feed the ever-increasing human population and reducing importing of food grains as well as industrial raw materials through agricultural intensification using all kinds of appropriate technologies and irrigation.

Natural resources (land, water, biodiversity (plants and animals), climate, energy, and others) are the basis of life. Agriculture is the direct indicator of aggregates of these natural resources potentials in a country. A nation with potential natural resources is potential for agriculture where the resources are used based on scientific knowledge with suitable management options for improving agricultural productivity and production along with sustainable environmental safety. This can be achieved when natural resources are managed

and utilized based on scientific knowledge and technologies according to the potentials and limitations of existing resources, and rehabilitation of degraded resources with appropriate integrated natural resources management interventions.

However, due to traditional management practices for subsistence life in the Region and Country (food, fiber, energy source, construction, economic benefit, and others), limited application of scientific knowledge and technologies in the agriculture sector and low-level awareness and capacity to use available technologies by local communities, agricultural productivity remained low. This, in turn, caused an increased demand for agricultural land for the ever-increasing human population encouraging agricultural land expansion into forest, wetlands, and rangeland ecosystems. Unregulated use of natural resources, overexploitation, and degradations of these resources has resulted in a vicious circle in agriculture and community livelihoods. Under severe situations crop failure and abandoning of croplands, e.g., soil acidity areas in the highlands (West Oromia, four Colleges, Illubabor, BunoBede, Jimma, West Shewa, Guji highlands, and others), and aggravation of saline soils in the lowlands, moisture deficit areas such as rift valley and Awash Basin.

Loss and degradation of natural resources have caused frequent droughts, floods, serious food and feed deficit, malnutrition, and poverty increasing challenges in livelihood options of local communities and the society at large. These challenges call for immediate action in restoring and or rehabilitating natural resources and their ecosystems. Sustainable management of the existing remnant natural resources such as natural high forests is also equally important.

The Government of Oromia National Regional State noted the major problems in the natural resources sector and renewed its commitments to rehabilitate and sustainably manage the Region's natural capital in a way these resources contribute to transforming agriculture and sustainably used in the Region and beyond. Following this commitment, this document was prepared to identify the status of natural resources, challenges in the sector, and potential intervention options for sustainable utilization of the Region's natural resources.

Therefore, inventory and mapping of existing natural resources that have been directly supporting the agriculture sector were identified as an important starting point to document the status and trends in of these resources. Conservation and proper utilization of remnant natural resources for present and future generations is a necessity, not an option for any responsible government. With the continued deforestation and ecosystem (forest,

rangelands, wetlands, and water bodies) degradations, top priority should be given to natural resources management to achieve the sustainable development goals and also for effectively implementing Ethiopia's Climate Resilient Green Economy (CRGE) Strategy.

The major components of natural resources considered in this document include:

1. Arable lands Management;
2. Forest Management
3. Rangeland Management
4. Wetlands and water bodies Management;
5. Protected Areas and Biodiversity Management and
6. Environmental Protection.

8.2 ARABLE LAND MANAGEMENT

Agricultural lands are the “playing ground” for agricultural production and require sustainable management and use. However, the balance between arable land and agricultural population shows huge gaps from time to time due to population pressure that forces traditional communities to convert grazing lands and forest lands to croplands particularly in the highlands, suitable for human life and crop production, at the expense of the environment. Declining crop productivity drives farmers to bring new and often more marginal lands, such as sloppy landscapes, that are susceptible to erosion and have little response to improved management practices (agricultural inputs such as fertilizers).

Arable lands in Oromia are land areas suitable for potential crop production and cultivated lands currently used by the farming community. Under the current crop production in Oromia, in rain-fed agriculture, cultivated lands can be categorized into two groups (1) intensively cultivated lands, and (2) traditionally cultivated lands which are managed by relatively rich farmers and poor farmers (majority), respectively. There are vicious cycles in cultivated land management of Oromia “poor farmers make poor lands, and poor lands, in turn, make poor farmers, i.e., overexploitation of nutrients from the soils resulting in declining land and crop productivity that causing food insecurity and poverty”. This cycle must be broken by the agricultural transformation that supports poor farmers to relief from such cycles through modern agricultural production.

Intensively cultivated lands are managed relatively by using mechanization (tillage and harvesting machinery) and modern agricultural technologies (improved seeds, chemicals (fertilizers and pesticides) for increasing crop productivity and production (input-intensive crop management). However, the major constraints of this intensive management system are mono-cropping of cereals (maize and bread wheat) that resulting in soil nutrients depletion, enhance soil erosion, and persistence of pests (weeds, insects, and diseases), and then declining of both land and crop productivity (ecological degradation of fragile lands). A typical example is the rising of soil acidity in high rainfall areas of the highlands due to land resources degradation (nutrients depletion due to leaching and erosion, crop removal, and no crop residue maintenance).

Traditionally cultivated lands are managed by using low agricultural technologies and crop management practices. Agricultural production is generally subsistence, i.e., low input-low output agriculture for hand to mouth and poverty trap of rural communities. In general, arable lands are fragmented and shrinking due to population pressure and use of lands for uncontrollable non-agricultural purposes (villages/rural towns, expansion of urbanization and industrialization, infrastructure development, and others). Decreasing land productivity is caused by nutrient mining, soil erosion, no organic matter restoration, and, generally, degradation of soil resources supporting crop production.

Under current low agricultural productivity and production in the region due to arable land shrinkage and degradation, agricultural transformation is a very important concern for the region to supply sustainable and adequate food, feed, industrial raw materials, and to support economic growth based on the needs of increasing human population, while ensuring sustainable arable lands for the benefit of existing and future generation.

Arable land management is the managing of physical, chemical, biological, and moisture content of soils that favor potential productivity and production of diversified crops in diversified farming systems and potential agro-ecologies of the region.

However, many complex and interrelated challenges facing the agriculture sector on potentially arable lands of the region.

8.2.1 Challenges in Arable Land Management

8.2.1.1. Soil fertility management

Declining soil fertility becomes serious challenge to crop production in the region due to significantly depleted soil organic matter as a result of widespread use of biomass and animal manure for energy source and animal feeds, topsoil erosion, depleted macro- and micro-nutrients (N, P, S, K, Ca, Mg, Zn, Cu, Fe, B, etc. due to erosion, leaching, and crop removal), acidity- and salinity-affected soils; generally, degradation of soil physical, chemical and biological properties that end to less land and crop productivity in the region. Moreover, fertilizer types used for agriculture are imported from abroad and less access to farmers (only DAP and urea in the past for nitrogen and phosphorus sources), and multi-nutrient fertilizers and blends recently, high in price and the quality is not regulated properly. Most farmers do not apply the required amount of fertilizers and yield is decreasing. Moreover, where soil fertility is exhausted and crop yield is extremely reduced, farmers convert their croplands to *Eucalyptus* trees plantation (adaptable to climate change and tolerant to poor croplands with no management, and serve as income source). The soil is getting more infertile and to bring back cropland is very difficult to uproot and remove the established *Eucalyptus* plantation. Therefore, great care is needed by the farmers not to convert their croplands to *Eucalyptus* plantation which requires high energy to uproot trees' stumps after cutting the trees from the farmlands and the lands get more deterioration in soil fertility.

8.2.1.2. Acid soil management

Challenges

Acidification occurs due to eroded fertile top-soils and depleted organic matter, depleted nutrients (leaching, erosion, and crop removals) in high rainfall areas. Approximately 80% of acidic soils are expected in the highland Nitisols of Ethiopia.

Acidic soils are characterized by low pH, high exchangeable Al concentration, high available Mn concentration, low concentrations of exchangeable Ca, Mg, and K, low base saturation percentage, low available P and high P fixation capacity, low organic matter, absence of OM-clay mineral complexes, low microbial activity, sensitivity to erosion, low water-holding capacity, low permeability to air, water, and roots (high soil strength), slow

water infiltration rate, sensitivity to compaction by heavy machinery. In general, most acid soils are low infertile, have poor physical, chemical, and biological properties.

Consequently, acidic soils cause declining soil fertility (a nutrient deficiency, N, P, K, S, Ca, Mg, and micronutrients), the prohibition of microbial activities (low organic matter decomposition), limited tolerant crops (finger millet, noug, indigenous low productive crops) are grown, while maize, wheat, teff, barley, faba bean, soybean and other sensitive crops (high productive potentials) are out of production, crop failure and abandoning of land for more than three years, or Eucalyptus plantation on croplands (acid-tolerant and adaptable to climate change on degraded lands with no management). Therefore, acid soil management requires amelioration with lime application, soil/water conservation measures, proper soil fertility management based on soil nutrient deficiencies, and others in diversified agro-ecologies of the highlands of Oromia.

8.2.1.3. Water-logged Vertisols management

Challenges

They are occurring in the highlands and covering a large proportion of agricultural areas of Ethiopia. They account for about 70% of all highland soils with slopes from 0-8%. The high clay content of the Vertisols is responsible for their heavy water logging in highland areas with abundant rainfall and relatively low evaporation rates. This imposes severe restrictions on the traditional agricultural use of these soils and only 25% are currently cropped mainly using residual moisture. Excess waterlogging and low soil fertility (N, P, K, and others) hinder the productive potential of Vertisols in the main rainy season in the country.

8.2.1.4. Salt affected soils management

Challenges

Excessive accumulation of certain ions and salts impacts levels of other nutrients, limits the availability of water and disrupts the osmotic tension of soil, and can result in some excess accumulation of specific ions (Na, Cl, B, F, and others) and/or salts (e.g., HCO_3^- , CO_3^{2-}). This leads to stunted plant growth. Salt affected soil tends to occur in the presence of conditions such as shallow groundwater tables, inefficient irrigation practices and poor drainage (human-made or natural), natural salt seeps, and the high evaporation of surface moisture or insufficient annual rainfall leading to leaching of salts from plant rooting zone.

8.2.1.5. Rehabilitation of degraded arable lands

Challenges

Arable land degradation is the deterioration of resources on the land which includes (1) soil erosion by water and wind mainly loss of topsoil by surface erosion, gully erosion and offsite degradation effects, sedimentation; (2) Chemical soil degradation mainly fertility decline (e.g., four times the amount of nutrients removed in cropland compared to the amount returned with manure and fertilizer), and reduced organic matter content, acidification, and salinization; (3) physical soil degradation compaction, scaling and crusting, water-logging; and (4) high rate of land degradation has a sensitivity to climate variability and change (drought, flooding, etc.).

8.2.2 Proposed Interventions

8.2.2.1 Soil fertility management

- Revising of soil fertility assessment and mapping at certain intervals (soil dynamics) to address heterogeneity and deficiencies of soils in diversified agro-ecologies (database)
- Implementation of rural land policy and strategy
- Strictly following integrated land use plan for allocation of suitable and fertile lands for agriculture (issue of existence) (avoiding conflict among sectors competing for land resources, urbanization, industries, and other investments)
- Use of mobile soil analysis kits to analyze soil nutrient deficiencies at “the spot” for farmers’ croplands
- Checking of non-functioning of fertilizer blending factories and use of multi-nutrient fertilizer types for crop production (sources, types and standard nutrient contents of imported fertilizers are very essential)
- Strong care and feasibility study for the establishment of any fertilizer factories (blending and manufacturing plants)
- Soil test crop response based nutrient application for diversified major crops and soil types in diversified farming systems and agro-ecologies (inorganic fertilizer use based on balanced nutrients application approach according to the deficient nutrients in the specific area based on soil fertility assessment and mapping database)

- Use of multi-nutrient chemical fertilizer types with high nutrient contents and standard quality (considering soil acidity and salinity conditions in the areas, avoid acid-forming fertilizer types and aggravating salty soils)
- Crop residue management (organic matter restoration) and land cover improvement (mulching to avoid exposure of crop fields to erosion hazards)
- Application of animal and green manure, and compost (organic fertilizers application for increasing organic matter content and sustainable crop production)
- Availability of alternative energy sources for rural communities to substitute animal manure and crop by-products (maize and sorghum stalks, cobs) for energy source (biogas, energy-saving stoves, solar energy, etc.)
- Crop rotation (legumes as bio-fertilizer sources after cereals and suitable rotational crops in the cropping systems, and breaking of cereal mono-cropping)
- Fallow and intercropping of nutrient fixing leguminous trees with crops (e.g., N fixing fertilizer trees as agroforestry (tapping nutrients from deep soils)
- Integrated soil fertility management (potential crop and its variety, inorganic fertilizer, organic fertilizers, advanced and integrated sustainable land management, minimum tillage, soil and water conservation, pest management (weeds, insects and diseases))
- Strategic plan for soil fertility assessment and management
- Strengthening research and extension works on soil fertility and health
- Strengthening research and extension linkage in the use of suitable technologies and best management practices
- Capacity building on human resources, research and extension facilities
- Strengthening and expansion soil laboratories for soil analysis services
- Access to inputs and technologies for soil fertility management (financial capacity)

8.2.2.2 Acid Soil Management Interventions

- Inventory, monitoring, and updating of soil acidity and mapping based on the severity of acidity (database) in diversified agro-ecologies
- Amelioration of acidic soils by application of lime in quantity and quality based on the standard extraction methods following severity of soil acidity, lower pH < 5.5 requires priority amelioration (e.g., currently exchangeable acidity method is used for acid soil management in maize, wheat, teff, barley, and pulse production)

- Strong care and feasibility study is required for the establishment of lime crushing factories according to lime particle size required (fine, medium and coarse to serve at least more than three years)
- Production of quality lime by micro-enterprises with mobile crushers where the lime sources are available
- Restoration of the organic matter content of the soils, i.e., crop residue management
- Integrated acid soil management (integrated soil fertility management in combination with a lime application, lime, and organic materials, and other combinations)
- Integrated management of termite damages in acid soil areas (insecticide application, traditional removal of termite queen, etc.)
- Use of acid-tolerant crops with proper soil fertility and agronomic management practices
- Access to acid soil management inputs (particularly lime) and best management practices
- Strategic plan for soil acidity assessment and management
- Strengthening research and extension works on soil acidity management
- Strengthening research and extension linkage in the use of suitable technologies and best management practices for acidic soils
- Capacity building on human resources, research and extension facilities
- Strengthening and expansion of soil laboratories for soil analysis services (acidity and fertility)

8.2.2.3 Water-logged Vertisols Management Interventions

- Delineating and mapping of water-logged Vertisols for improved management (database)
- Drainage of excess water with ridge and furrow (mechanized), broad bed and furrow (local practice)
- Soil test crop response based nutrient management
- Tolerant crop production (e.g., rice in Fogera Plain, Gondar)
- Integrated Vertisols management
- Surface and subsurface drainage of Vertisol if affordable
- Harvesting of drained water for off-season irrigation

- Strategic plan for water-logged Vertisols assessment and management
- Strengthening research and extension works on Vertisols management
- Strengthening research and extension linkage in the use of suitable technologies and best management practices for Vertisols
- Capacitating research and extension system for water-logged Vertisols management

8.2.2.4 Salt affected soils management interventions

- Proper inventory, monitoring and mapping of salt-affected soils (database) for appropriate management based on the severity of salt types in salt-affected areas (Prevention is better than reclamation in moisture deficient, high infiltration and serious evaporation prone dry areas)
- Appropriate drainage of shallow groundwater tables
- Provision of Adequate surface and subsurface drainage
- Know the soil type, type and level of salt in the area that determines types of plants grown (considering temperature regimes at reproductive phase and grain filling stage) and their yield potentials (input-output based cost-benefit analysis)
- Quality irrigation water sources, efficient irrigation practices, and drainage system
- Leaching of natural salty soils with quality irrigation water out of plant rooting zones
- Tolerant plants (food and forage crops and trees) production
- Planting of vegetations (trees and grass species) reducing salt contents of salty soils
- Soil test crop response based nutrient management in salt-affected soils
- Integrated reclamation practices for salt-affected soils (organic matter restoration using manure and residues (straw, cornstalks, sawdust, etc.), application of gypsum to improve water infiltration and reclamation, tillage to break the crust and mix amendments, and others)
- Strategic plan for salt-affected soils assessment and management
- Capacitating research and extension system for salt-affected soil management
- Strengthening research and extension linkage in the use of suitable technologies and best management practices for prevention and reclamation of salt-affected soils

- Capacity building on human resources, research and extension facilities for the management of salt-affected potential areas for crop production following integrated land use plan
- Strengthening and expansion of soil laboratories for soil analysis services (salts and soil fertility)

8.2.2.5 Rehabilitation of degraded arable lands interventions

Degraded arable land rehabilitation requires different integrated physical and biological conservation measures based on topography, slope, soil types, climate conditions, and other factors in diversified agro-ecologies to control soil erosion and runoff; organic matter depletion and declining soil fertility, i.e., deterioration of soil physicochemical and biological properties.

In general, sustainable land management is “the adoption of land-use systems that, through appropriate management practices, enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources”. It includes the management of soil, water, vegetation, and animal resources.

8.2.2.6 Integrated land-use plan based landscapes/watershed management

- Identify, delineate, monitoring and mapping of severely degraded arable lands
- Based on the severity of degradation, prioritizing rehabilitation and restoration areas
- Integrated sustainable land management: degraded arable lands restorations, management and use in high rainfall areas (integration of physical and biological conservation measures, organic matter restoration)
- Use of suitable cropping systems (perennial and annual crops) according to land use plan (farming systems and agro-ecologies)
- Integrated crop management practices based on diversified farming and agro-ecologies (high rainfall areas)
- Integrated soil and water conservation measures, organic matter restoration, cropping systems, and crop management practices in dry areas
- Strategic plan for sustainable degraded arable lands assessment and management
- Strengthening research and extension works in the management of landscapes of arable land areas

- Capacitating research and extension system for arable landscape management

Opportunities

There are great opportunities that help the transformation of the agriculture sector in Oromia. The region is endowed with potential natural resources, arable lands for rain-fed and irrigation agriculture; irrigation water sources (surface and groundwater); deposit of lime resources (acid soil amelioration); gypsum deposit for salt-affected soil reclamation; phosphate and potash deposits for fertilizer industries, coal deposit in Yayo area, Illubabor Zone, for urea fertilizer factory, and other resources that can be carefully exploited for agriculture, without negative impacts on the environment, are a gift of nature for Oromia and proper characterization, management and utilization is a necessity.

Moreover, rural land policy and strategy, integrated land use plan, a commitment of the government to give priority for the agriculture sector, focus on agricultural investment, and others are helpful opportunities for agricultural transformation in Oromia. These can be implemented by the integration of potential human, physical, and capital resources of different institutions by using scientific knowledge, skill, and technologies with the participation and accountability of all concerned stakeholders including farmers in Oromia.

The way forward

Available potential arable lands for sustainable crop productivity and production depend on how the lands are managed for simultaneously increasing the required crop production while ensuring a sustainable environment. The need to produce more food from limited arable lands whilst improving environmental performance through sustainable intensification requires great care.

It follows that if there is a relatively little new land for agriculture, more food needs to be produced, and achieving sustainability is critical, then sustainable intensification is a priority. Sustainable intensification means simultaneously raising crop yields, increasing the efficiency with which inputs are used, and reducing the negative environmental effects of food production. Hence, availability of modern knowledge, technologies, and best management practices from local and international access is the pivot of the agricultural transformation of traditional agriculture to modern agriculture for food and nutrition security, and to contribute to economic growth and better livelihoods under the current alarming climate change conditions.

In general, the base of sustainable agricultural transformation will be the proper implementation of an integrated land-use plan prepared for Oromia. Limitations facing in the process of integrated land-use plan implementation have to be improved based on the currently available knowledge, skill, and technologies (particularly GIS supported digital land resources inventory, monitor and mapping) and allocating potentially arable lands according to the land use plan for crop production. This is a very basic concern for the security of arable lands for sustainable cropland management, improving crop productivity and production to feed the existing population and at the same time to maintain limited arable land resources for the future generations.

8.3 RANGELAND MANAGEMENT

Improving crop and livestock production practices for higher food security and farmer income while reducing emissions has been one of the four pillars of the Ethiopian Climate Resilient Green Economy (CRGE) Strategy that aimed at fostering development and sustainability and achieve middle-income status by 2025. Managing rangeland to increase its carbon content and improve the productivity of the land was one of the priority areas of the initiatives identified in the CRGE Strategy with a focus on increasing the productivity and resource efficiency of the Livestock sector.

Rangeland ecosystems are ecologically and economically important for livestock production, erosion control, carbon storage, source of medicines, tourism, recreation, source of high-quality water, clean air, wildlife habitat, and biodiversity conservation. Sustainable rangeland production is based on grass management, animal management, and livestock marketing. Grazing management is the foundation of grassland-based livestock production since it affects both animal and plant health and productivity.

Rangelands provide fodder for about 360 million cattle and over 600 million sheep and goats at a global level and also provide for millions of livestock in Ethiopia. As a result, some 9% of the world's beef and 30% of the sheep and goat meat is attributed to the rangeland based livestock production system. Moreover, livestock milk and game animals in terms of tourism attraction generate considerable economic revenue. Furthermore, they are important ecosystems for social and cultural practices directly related to natural resources. The other important point to be noted is that pastoralists use their livestock for wealth accumulation as a symbol of social status and source of social security.

The rangelands in Ethiopia cover about 62% of Ethiopia and a significant land cover of Oromia significantly contributing to livestock production. For example, the Borana rangelands are among important rangeland areas for livestock production. Livestock production heavily relies on rangeland resources. Almost all livestock forage in the pastoral production system and about 50% of the feed budget in the agro-pastoral and mixed production systems come from rangelands. The benefits of these rangelands go beyond the provision of forage to the herbivorous domestic livestock population. Rangelands are habitat for the country's rich plant and animal genetic resources and offer diverse environmental services including soil carbon stock, conservation of soil and water resources, and the scenic beauty of landscapes.

Rangelands are primarily found in arid and semi-arid lands where other land uses, such as crop cultivation, are not economically feasible. These arid and semi-arid rangeland ecosystems are characterized by frequent drought, unreliable and erratic rainfall patterns, high temperature, high levels of temporal and spatial variability in biomass production, limited precipitation, sparse vegetation, highly variable soils, frequent salinity, and diverse topography.

Conservation and sustainable management of rangelands is a prerequisite for sustainable development as there are many direct benefits and economic advantages obtained from them including foods, fibers, forage for grazing animals, medicines, fuel, building materials, and industrial products, as well as recreation and hunting. Studies show that managed and biodiversity-rich rangelands can easily recover from negative impacts of droughts compared to less diverse and unmanaged rangeland ecosystems.

The major rangeland resources in Ethiopia are vegetation (both herbaceous and woody), livestock (cattle, goats, sheep, and camels), wildlife, and their products. In many rangeland ecosystems, livestock holding per household is composed of cattle, goats, sheep, donkeys, and camels. Animal genetic diversity allows pastoral community and farmers to select stocks or develop new breeds in response to environmental change, threats of disease, new knowledge of human nutrition requirements, changing market conditions, and societal needs. For example, the Borana cattle breed, which is an East African Short-horned Zebu type, was developed by Borana pastoralists in Oromia. The Borana breed is raised primarily for meat production and shows high resistance to heat, ticks and eye diseases.

Rangelands also play a significant role in the regional and national economy in Ethiopia as almost all export live animals and major animal products do come from rangelands. The share in the local markets is also significant. Many of the plant species in rangeland ecosystems have multiple uses supporting the livelihoods of pastoralists. This is justified by their use as forage, medicaments, food, construction, and cultural ritual activities. Livestock genetic diversity contributes to food security at present and will help to secure future food security by allowing the supply of a wide range of products under diverse environmental conditions.

Oromia rangelands are also rich in wild edibles that are used by communities to contribute to ensuring their food security. Communities use the wide range of wild plants and animals to supplement their diet, making it more diverse and nutritional, and thereby contributing to good health.

Gums and resins contribute to local livelihoods, in terms of both cash income, gained by selling products to buyers and subsistence value. Besides, gums and resins do contribute to the regional and national economies. About 35 species of *Acacia*, *Boswellia*, and *Commiphora* have been identified as potential producers of commercial gums and gum resins in Ethiopia.

In general, sustainable rangeland management is significant to reduce poverty and ensure food security. It has a direct contribution to improving the livelihood of the poor. On the other hand, food security is particularly compromised by the loss of provisioning ecosystem services and the loss of species that can be harvested for food in addition to decreased productivity from the livestock calling for addressing existing challenges in the rangeland ecosystems of the Region.

8.3.1 Challenges in Rangeland Ecosystems

There are many challenges threatening rangelands in Oromia causing rangeland degradation and loss of natural resources. Studies show that both the quality and quantity of grazing resources had declined over time and the trend is also in the downward or decreasing direction. Biomass production of highly palatable grasses was reported to be low, which might have resulted in the poor forage quality. Major threats to rangeland ecosystems and species include overgrazing, frequent drought, expansion of crop cultivation, the encroachment of invasive woody species, and biodiversity loss.

Overgrazing was caused by the presence of too many animals on the limited rangeland, unsustainable management of rangelands, and also as a result of woody plant encroachment. Overgrazing reduces palatable plant leaf areas, which reduces the interception of sunlight and plant growth resulting in low primary productivity that directly contributes to low livestock production and productivity. Overgrazing occurs when plants are exposed to livestock grazing for extended periods, or without sufficient recovery periods. It reduces the usefulness of the land and is one cause of desertification and erosion. Overgrazing is also seen as one cause of the spread of woody plants encroachment

Woody plant encroachment has been a major problem in most rangelands in Oromia. An increase in the encroachment of woody plant and herbaceous biomass production is negatively correlated. Bush encroachment has an adverse influence on grass biomass production and decreases potential grazing capacity. The decrease in herbaceous biomass production directly affects livestock production, on which the livelihoods of pastoralists depend. This decrease in biomass might result in a high risk of food insecurity in the region. Furthermore, encroached woody plants cause rangeland degradation, reduce grass availability, deny livestock access to the available grass, and also the bushes serve as a home for harmful wild animals that would attack pastoralists' livestock. Bush encroachment has also negatively affected the yield of grasses which in turn suppressed productivity of livestock particularly sheep and cattle as they do not prefer bush grazing. As a result, increasing encroachment of woody species has been causing the change in ecosystem services of rangelands threatening food security and sustainability of pastoral subsistence.

Climate change is another threat to rangeland vegetation and livestock production. Increased climate variability could decrease herd sizes as a result of increased mortality and poorer reproductive performance of the animals. This decrease in animal numbers would affect food security and would compromise the sole dependence of pastoralists on livestock and their products, as well as the additional benefits they confer. Negative impacts of climate change on rangeland vegetation include changes in herbage growth and quality. For example, increasing rainfall variability in semi-arid and arid rangelands has a negative impact on rangeland productivity.

Unregulated expansion of agricultural lands into valley bottoms used as key forage resources during dry seasons is recent development contributing to rangeland degradation. Crops are grown both for subsistence and for cash incomes and are the second main income

generator after livestock. However, crop production is unsustainable due to the unreliability of rainfall in most of the lowland areas.

Another challenge related to the sustainable management of rangelands is the low level of perception on the pastoral production systems and less application of indigenous knowledge of pastoralists on resources management. Pastoralism is extensive livestock production on rangelands and is the only feasible agricultural strategy in many dry areas, particularly when assessed at a landscape scale. It relies on a diversity of grasses and shrubs as key production inputs. Dryland pastoralism depends on herd mobility to track the extremely high seasonal variability of vegetation and other resources. Pastoralism in drylands is, therefore, an adaptation to the uncertainties of dryland environments. Different studies show that traditional pastoral practices are highly tuned with dryland ecology and are more economically productive than other forms of land use in dry rangelands. However, as a result of limited knowledge about pastoralists and pastoral production systems, pastoralists have been marginalized from national economies and political systems.

The role of indigenous knowledge in responding to climate variability and change has been well recognized globally but its appreciation and recognition in Ethiopia in general and Oromia, in particular, was another practical challenge for pastoralists and pastoral production systems. Restriction of traditional herd mobility contributed to rangeland degradation and natural resource loss. In areas where mobility is limited, there is serious over-grazing and land degradation, causing low productivity.

Most rangelands in high land areas have been converted into the agricultural fields for cereal production. This calls for effective implementation of land use policy in the Region as these rangelands play a significant role not only for livestock production but also provision of diverse ecosystem services that would ensure the sustainability of the agricultural production system.

Other challenges related to rangelands include high livestock density in lowland areas, lack of livestock feeds, death of livestock as a result of frequent drought and feed shortage, soil erosion, termite damage (mounds), and soil compaction.

8.3.2 Proposed Interventions

1. Large scale rehabilitation of rangelands for increased quantity and quality of forage
 - a. Bush clearing at scale

- b. Promoting area enclosure for restoration degraded rangelands
 - c. Control soil erosion and compaction by maintaining a dense stand of herbaceous vegetation, soil moisture conservation techniques/appropriate water harvesting techniques, proper grazing management and use of mechanical structures
 - d. Establishment of fodder bank for calves, sick animals, and milking cows during dry months
 - e. Preparation of hay and other feeds during drought to increase livestock productivity and resilience during vulnerable periods.
 - f. Reseeding selected areas with desirable forage species
 - g. Use fire as a range management tool following carefully planned and identified areas
2. Water harvesting and management: Following participatory and multidisciplinary approach, implement water harvesting associated with rangeland improvement
- a. Groundwater
 - b. Rainwater harvesting
3. Strengthen Institutions: Institutional strengthening for effective development, coordination, and implementation of policies and programs to increase the productivity of rangelands and ensure environmental sustainability.
4. Tree/shrubs management for gum/resin production and market linkages for improving livelihoods of the pastoralists
5. Grazing management: Design and implement a rangeland management system that would minimize negative impacts of overgrazing
- a. Diversify livestock composition to utilize available forage in different seasons, as well as produce a variety of livestock products

- b. Promote herd mobility with the aim of opportunistic and effective use of patchy and heterogeneous resources and also minimize the effects of droughts
- 6. Establish/strengthen market linkages for proper herd size management and income generation: Saving/credit
 - a. The conversion of livestock resources into financial resources through the uptake of saving schemes which can smooth livelihood volatility.
 - b. Credit schemes may help with an investment that can increase productivity or livelihood diversification
- 7. Manage medicinal and wild edible plants
- 8. Establish/strengthen early warning systems/access to climate change information to better plan for and manage drought
- 9. Awareness-raising and training of pastoral communities on sustainable natural resources and adaptive mechanisms to the changing climate
- 10. Research in areas related to rangeland ecology and management for example:
 - a. Multidisciplinary researchers that integrate natural and social sciences aiming at improving livelihoods and resilience building in fragile dry ecosystems
 - b. Sustainability of crop cultivation in arid and semi-arid rangelands and also on the identification of drought-tolerant varieties
 - c. Contribution of rangelands for carbon sequestration

Way forward

Sustainable management of rangeland ecosystems is important for economic development and ensuring sustainability. To ensure sustainable development in the livestock sub-sector and improve the overall environmental health, the on-going grasslands/ rangelands deterioration has to be reversed. Furthermore, the continued expansion of crop agriculture into rangelands has to be halted or properly regulated following effective land use planning. Such actions are vital to address the chronic livestock feed shortages undermining the socio-

economic welfare of the livestock keeping communities and the massive feed-scarcity related to livestock mortality costing the Region and Country hundreds of millions of dollars every-time a drought strikes. It has to be noted that the main production system in rangelands especially in arid and semi-arid ecosystems is livestock breeding. Therefore, all rangeland management tools should be applied as appropriate for improving both the quantity and quality of forage for livestock.

Rangelands rehabilitation needs top priority in pastoral areas as most rangelands are already severely degraded and encroached by invasive woody species. Pastoralists' knowledge underpins longstanding traditional practices for using resources and managing climate variability. Therefore, there is a high need to recognize and apply indigenous knowledge of pastoralists on the range and water management strategies in combination with western science.

Safeguarding the grasslands/ rangelands could bring a number of other benefits to the Region and its population including alternative livelihood opportunities (eco-tourism, game farming, non-feed rangeland products, etc.), resilience to changing climate, and biodiversity conservation.

Poverty eradication, food security, provision of fresh air and water, soil conservation, and human health, all depend directly upon using and maintaining the available biodiversity in rangelands. It is important and timely to understand the fact that in many parts of the arid and semi-arid ecosystems of Ethiopia, pastoralism is the only way to convert sunlight into food. Therefore, any development intervention in these ecosystems should focus on the bigger picture of sustainable development and environmental stability. Policymakers and implementers of development plans should pay due attention to the social, economic, and environmental aspects of the interventions to bring sustainable livelihood change in the community.

Adaptation to climate change is a process of adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities. Pastoralists have had relatively high adaptive capacity in inhabiting arid and semi-arid areas. Putting in place/strengthening resilience-building policy and planning frameworks is critical.

8.4 FOREST MANAGEMENT

Oromia is endowed with diverse forest resources, including high forests, woodlands, urban forests, trees, and trees on farms, which provide diverse goods and services vital economic

development. Forests provide vital ecosystem services including the regulation of water and climate through the role they play in the water and carbon cycles. They are also reservoirs of biodiversity, including genetic resources of Arabica coffee (*Coffea arabica*) and other plants important for food and agriculture.

Ethiopia's largest forested landscapes (about 41%) are found in Oromia. The official data from the government indicates the current forest cover to be around 18.5%. Our assessment for the RFSDP of Oromia based on the 2018 image shows 22% (Biome Services 2019).

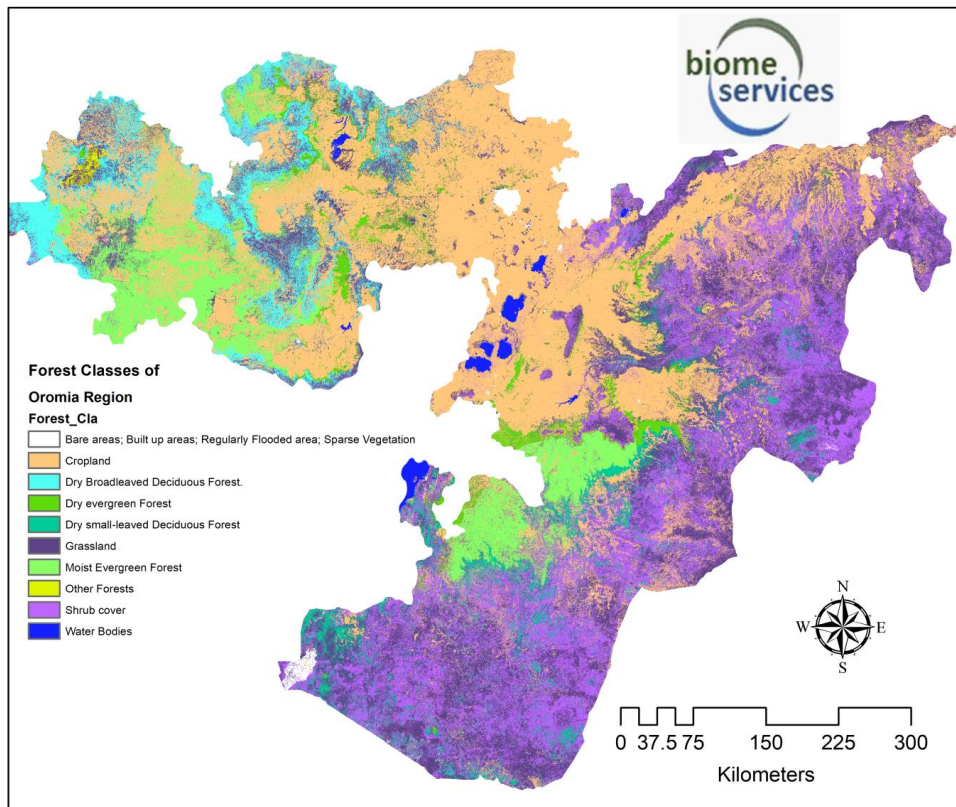


Figure 57 Forest classes of Oromia regional state

The forests are classified into different types (MEFCC 2017), namely, Acacia Commiphora, Combretum-Terminalia, Dry Afromontane, and Moist Afromontane forests. The dry and moist Afromontane forests in Oromia, which are often described as high forests, are further classified into four major classes/types, namely: Upland Dry Evergreen (Juniperus procera) Woodlands (3%), Mixed Juniper-Podocarpus Upland Evergreen Forest (13%), Humid

Upland Broadleaved Forests with *Podocarpus* (38%), Humid Upland Broadleaved Forests dominated with *Aningeria* (49%) (WBISPP, 2002).

Oromia is also endowed with bamboo resources. The region has a total of 211,723 ha of bamboo, out of which 32,670 ha belong to highland bamboo (*Arundnaria alpina*) and 179,053 ha belong to low land bamboo (*Oxytenanthera abyssinica*) (INBAR, 2017). Most of the bamboo resources are concentrated in western Oromia, namely West Wellega, East Wellega, Ilubabor, Kelem Wellega, and Horo Guduru Wellga zones.

Besides natural forests, Oromia also has sizable areas of plantation forests. Plantation forests in Oromia include industrial plantations, as well as woodlots. The total area of plantation forests in Oromia is estimated to be 411,482, of which 61,482 ha is Industrial plantations and 350,000 ha is smallholder woodlots. The expansion of industrial plantation is relatively faster in recent years, as the current average annual rate of plantation establishment is 2,220 hectares.

Woodlots are dominated by small scale private plantations undertaken essentially by farm households. Private woodlots are expanding at the fastest rate throughout rural Oromia in recent years. Many farmers are planting trees largely on marginal croplands and grazing lands, farm boundary, and home gardens.

Farmers establish woodlots because, there is a high demand for the wood products (firewood, construction wood, furniture, and farm implements). Woodlots in Oromia cover about 350,000 ha, and they are owned and managed by some 766,420 households.

Contribution of forests for agriculture and provision of ecosystem services

Forestry has a significant contribution to the national and local economies in the country. The official estimate of forestry's contribution to the national GDP was to be 3.3% in 2014/15 (MoFED 2015). The official data of forest sector contribution is a bit higher than the national average (4%) and it is planned to increase the regional GDP contribution of the sector to 8 percent by the end of GTP 2 (2019/20). The real contribution of the forest sector to the GDP is estimated to be higher. For instance, a commissioned study of the ME FCC (2015) estimated the contribution of the forestry sector to be 12.9% of the measured value of the GDP.

Agriculture and forest are also critical sectors for the green economy development of the country. The CRGE baseline scenario showed that agriculture and forestry together

contribute 85% of the total GHG emissions of the country, out of which emissions from the forestry sector account for roughly 37 % (FDRE 2011). Over 50% of the mitigation potential of the country, on the other hand, is from the forest sector. Hence, protecting and re-establishing forests for their economic, social, and ecosystem services has been given due emphasis. REDD+ is considered a promising approach to achieving CRGE mitigation goals. Implementation of REDD+ is expected to have positive environmental, economic, and social impacts. Particularly, the reduction of deforestation and forest degradation will have a positive impact on forest biodiversity conservation, watershed protection, climate regulation, and sustainable livelihoods. The Oromia regional state is a national pilot for the implementation of REDD+. The Oromia Forested Landscape Program is a national flagship REDD+ program, to be used as a pilot to generate lessons and scale up to other forested regions in the country. Besides, the REDD+ Investment Program is also implemented in 41 districts across Oromia.

Cognizant of the contribution of the forest sector to economic development, the Oromia Regional State's GTP-2 has a plan of increasing the forest cover from the baseline of 15 (2014/15) to 25 percent in 2019/20. The current forest cover of the region is estimated to be 18.5 percent.

Economic growth which is mainly derived from the agriculture sector can be sustainable when the regional ecosystem is maintained to its functional state. The forest ecosystem contributes to sustainable agricultural production in different ways:

- Forests are major production areas for major agricultural commodities. Oromia plays a significant role in agricultural development in the country. Oromia's share is 51.2% of the crop production, 45.1% of the area under temporary crops, and 44% of the total livestock population of Ethiopia (Anonymous, 2018). The forests in Oromia have direct contributions to agricultural development in Ethiopia.
 1. A good example is a coffee. Oromia produces 67% of coffee in Ethiopia. Over 90% of coffee in the region is produced in manage forests or agro-forests with high tree coverage. Coffee production areas 490,000 hectares, which is 67% of Ethiopia's coffee area (CSA, 2018), from which about 3,102,000 Qt. of coffee is produced on average, which 69% of country's total coffee production. Coffee employs millions of farmers and generates around 30% of foreign currency earnings of the country.

2. Similarly, forests are the main sources of honey produced in Oromia, and the country. There were around 3,185,361 beehives in Oromia, from which about 21,403,404 kg of honey was produced in 2017/18 (CSA, 2018). Most of these are from forest areas.
 3. Gum and Resin: - are also among commodities produced in forests. The estimated total area of dry forests and woodlands comprising gum and resin bearing species cover about 430,000 hectares in Oromia, with over 8,500 tons of gum and resin production potential per year (Girma Fitwi 2000). The three most important products are frankincense (6,000), myrrah (1,500), and gum (1,000). Though there is huge potential, less than 1% of the potential has been tapped and traded.
 4. Forests are also sources of spices, forage for livestock, thatch grass for houses, bamboo, wild plants for food and medicine. Around 85% of rural households are estimated to rely on medicinal plants for health care. Forest and tree species provide a variety of edible fruits. Edible wild forest foods make a major contribution to the dietary intake of rural people during times of food shortage. For Example, in Borena zone, wild forest foods are critical to the survival of the poor household, since they contribute approximately 15% of a household's needs in the bad years, and only 5% in good years (Bush & Alemayehu, 2000).
- Soil and water conservation services: Forests, woodlands and trees play invaluable roles in regulating water regimes, increasing percolation of rainfall into the soil, thus decreasing water run-off and soil erosion and protecting watersheds. The maintenance of water flows is vital for human life, crops, and livestock production.
 - Modification of microclimates and provide supportive services: Many trees, woody shrubs, and other forest resources play essential roles in agricultural production systems. They provide mulch, soil nutrients, shade, and forage bees and other pollinators, or they can be managed to provide protective functions such as windbreaks or shelterbelts.
 - Source of Energy- more than 90 percent of the rural households fulfill their energy requirements by using wood and wood products. The estimated amount of biomass energy consumed in Oromia in 2017 is 40,311,710.6 m³. The annual mean gross direct use value of fuelwood was about ETB 3,013 per household (UNDP, 2017). The value of wood fuel (firewood and charcoal) was estimated at 19.8 billion in 2015/16 (BoFED,

2018). Of this, an estimated of 81.3% was in-kind income for households that collect and use their wood fuel. The remaining 18.7% is estimated to be cash income to households that sell wood fuel.

- House construction- according to CSA (2016), over 92 percent of the houses (wall part) in Oromia are made up of wood and mud. Besides, wood is used as scaffolding in the construction of buildings in urban areas.
- Forest Resources for Livestock Production: Most livestock in Oromia are free-ranging, grazing in pastures, forests, and woodlands, and on crop residues in agricultural fields after the harvest. Some livestock, however, is provided feed through a cut –and-carry system, especially where “area closures” have been established for environmental rehabilitation purposes and local people are permitted to harvest grass.

In general, the economic values of forests, through provisions of goods and services high. Some studies indicated that a hectare of tropical forest has a value between US\$ 6120-16362 ha⁻¹ year⁻¹ (TEEB, 2010). Taking one service, the value of tropical forests for the regulation of water flows is 5235 ha⁻¹year⁻¹.

8.4.1 Challenges

For forests to support the agriculture sector and provide other goods and services to the economy, sustainable management of existing forests and the development of new forests in areas have low forest cover. The major challenges for forest development in Oromia are the following:

1. Lack of proper land-use plan with a clear designation of areas for forest management, afforestation, and reforestation.

Land-use planning can promote sustainable and economically viable land uses, directing activities to where they are most suited. The Oromia Regional State has conducted studies (land resource mapping process) to prepare a land use plans for most areas in its jurisdiction. However, proper land use is not yet prepared. There is no clear timeline for completing the study and the preparation of land use plan with appropriate legislation for enforcement.

2. The high rate of deforestation

The annual deforestation rate for Oromia is 1.66% (FAO 2010), which is much higher than the national average of 1.1%. Deforestation leads to land degradation- which has a huge cost on the national economy. Overall the annual costs of land degradation are estimated to be at

least 2-3 percent of Agriculture GDP. The causes of deforestation are as variable as Oromia's forest resources and socio-economic conditions. The Main causes are an expansion of farmland, shifting cultivation, commercial agriculture, fuelwood collection, commercial logging, urbanization, and poor management of natural forests. These can also be triggered by land reforms, the establishment of new settlements and villages and cattle diseases.

3. Forest degradation

Forest degradation is mainly due to management of the forest for coffee production, illegal logging/ wood extraction, and livestock grazing. Forests have multiple functions. Local communities in Oromia manage forests for their livelihoods. These include coffee and other non-timber forest products (spices, honey, bamboo, etc) production, wood extraction for timber and fuel, livestock grazing. Coffee and other NTFPs producers do not have any guidelines and technical support on sustainable forest management. Management decisions for NTFPs as well as other uses of the natural forest are made by individual farmers based on their own experience and perception appropriate practice.

4. Mandate overlap of forest and other sectors institutions

Currently, there are two main forest sector institutions: OEFCCA (the Oromia Environment, Forest and Climate Change Authority) and OFWE (Oromia Forest and Wildlife Enterprise). In practice, however, the BoANR (Bureau of Agriculture and Natural Resources) plays important roles in forest development, especially afforestation and restoration through watershed management and local level natural resources extension services. There is a clear mandate overlap on the roles and responsibilities of these three institutions.

5. Policy Disincentives for the private sector and smallholder investment

Private forest developers are expected to pay a royalty fees on forest products that they harvest. Generally, collecting a royalty on natural resources, including natural forests and minerals is logical. Royalty fee on commercial plantation forest products is not logical and is seen as disincentive. There is no royalty fee for agricultural products. Given the fact that it takes many years to produce forest products, it rather requires incentives to encourage private sector investment that such disincentives.

6. Seasonal campaign of tree planing and perceptions it creates

The seasonal campaign of tree planing without a proper plan does not add to an increase in forest cover. Forestry is a long-term investment. Forestry practice, including seed collection and preparation, raising seedling, planting site selection, site preparation, planting, and management of the established plantation has to be carefully planned. Tree plantation may also have different objectives, be it for products or ecosystem services. But, participants of campaign tree planting plant seedlings of any species made available to them. The tenure right of the planted trees or plots is also not clear. Tree planting campaigns are often led and launched by politicians. For the general public, it started to appear as if forestry is a politician's campaign than a discipline based on solid science. We need to start serious planning and implementation of forestry programs.

7. Lack of extension package for promotion and management of trees on farm

Farmers integrated trees into the agricultural landscape in different ways- as trees component of agroforestry system, small woodlots, shelterbelts, and the like, which are widely practiced. There is no extension package for the promotion of trees on the farm, and their management. An extension may include species selection, species mix/composition, spatial arrangement, and stress and stand management. Farmers practice these, with little or no extension services support. No farm forestry extension package can be used by extension agents.

8. Institutional instability

Forest and natural resource sector institutions are the most unstable. Forest and natural resource were an independent Bureau over two decades ago, for a few years. It was, then totally abandoned, restructuring forest development as a small team with the natural resources directorate of the agriculture sector. Over a decade ago, OWE was established, mainly profit-oriented state enterprise. Recently, OEFCCA was established to fill the gap in the regulatory role of the forest and environment sectors. This recent development in creating forest sector institutions is encouraging. But, it has not solved mandate overlaps. Institutions are re-structured and given mandates based on the gut feelings of politicians during a certain periods of time, not based on appropriate institutional arrangements recommended by experts in the field. Stable forest sector institutions, with clear mandates

and the long-term plan, is required to harness the economic and environmental benefits of the sector as a sector, and through its services to other sectors, especially agriculture.

9. Limited private sector engagement in forestry

Other than smallholder woodlots, the engagement of the private sector in forest development very low. This can be attributed to lack of tenure security, the long gestation period of forests, and lack of incentives to motivate in long-term investment.

Opportunities

It is globally recognized that the forestry sector has tremendous potential for protecting the environment and spurring transformational economic development. With this understanding, Ethiopia has developed a long term, multi-sectoral strategy, the Climate Resilient Green Economy (CRGE) strategy, in which forests take the lions to share. Hence, the CRGE has created political commitment towards forestry development. In the CRGE strategy forestry is considered one of the important sectors for the reduction of GHG emission. Oromia is the national pilot for forest sector CRGE, i.e., the REDD+ program. Hence, Oromia's alignment with the CRGE and other global funding programs can attract funding and solve financial constraints. Similar to the REDD+ initiative, the Green Climate fund also requires concerted efforts towards climate change adaptation where agroforestry and climate-smart agriculture could attract a significant amount of financial resources for improving agricultural resilience and productivity where drivers of deforestation and forest degradation can be minimized.

In line with the Paris agreement, there are various initiatives, including the public-private sector initiatives such as the African Forest Landscape Restoration Initiative (AFR100) – that aims to restore 100 million ha of deforested or degraded land by 2030. AFR100 aims to implement an integrated approach for reducing the pressure on forests and rehabilitating degraded forest lands, in particular through the transformation of supply chains and afforestation and reforestation programs. As part of this initiative, Ethiopia has pledged to cover 15 million hectares for Forest Landscape Restoration (FLR). Over 40% of areas suitable for FLR in Ethiopia are found within Oromia regional state. Hence, the forest sector in the region is expected to benefit from the FLR initiative.

8.4.2 Possible intervention

1. Enhance sustainable management of existing forests:

Oromia has the biggest forest resource in the country, especially the natural forests. Plantation forest cover is also growing. For example, OFWE is managing forest areas with over 7.27 million m³ standing stock. But, the age structure of the standing plantations is not planned for sustainable harvest. This has to improve over time. Improving the existing 350,000 ha plantations owned by smallholder farmers can change the demand and supply trend. Sufficient support through forest extension services, technology, and other forest management practices should be availed. Moreover, removing regulatory barriers in tree and forest ownership should be a priority action if the regional government wishes smallholder farmers to retain, plant, and use the indigenous trees.

2. Restoration of degraded forest landscape

Forest landscape restoration has diverse benefits. Degraded landscapes are a symptom of poverty if no alternative income source exists. Restoring such landscapes can provide employment opportunity, reverse environmental degradation, improve rural livelihoods, and has huge potential to sequester GHG emission from the atmosphere. Moreover, the restoration will have a direct impact on downstream lakes and dams that provides income to surrounding communities and electrical power to the nation.

Oromia Regional State has a diverse landscapes with a diverse climatic variations. For this reason, there must be careful in selecting suitable tree and shrub species in landscape restoration. In this regard, care must be taken also to control invasive tree and shrub species. Additionally, sufficient and quality seed supply is needed.

3. Afforestation of landscapes with low forest cover

Oromia has the target of increasing forest cover to 25% by 2020. Special attention needs to be given areas with low forest cover. The forest cover in Oromia is not evenly distributed. Zones in Western and Southern Oromia have relatively high forest cover. Many zones in western Oromia have well over 25% regional target for 2020. But most zones in central and eastern Oromia have very low forest cover. Most have less than 10% of forest cover. The rural landscapes in these areas are also highly degraded, hilly, and not suitable for agriculture. These zones of Oromia, on the other hand, are closer major markets for forest products. Efforts of afforestation and forest landscape restoration in Oromia should therefore focus on zones with low forest cover and high demand for forest products, since these are

excellent compelling reasons to convince the rural community, including the private sector developers.

4. Development of extension packages for smallholder woodlots and trees on the farm: agroforestry, windbreaks, shelterbelt, woodlots

Currently, there is not forest extension service in Oromia and the whole of Ethiopia. The natural resources extension work of the BoANR is mainly for soil and water conservation and general good practices of natural resources. This can be attributed to lack of forest sector institutions for decades. Over the last few years, there are forest sector institutions in the region. Tree planting is also increasing, especially by smallholder farmers. To contribute to the fulfillment of the demand for forest products, while contributing ecosystem services and supporting the productivity of agriculture, it has to be guided by expert extension services. Extension packages and guidelines for different forestry practices have to be prepared. Besides, building the capacity of existing development agents and training new ones is required.

5. Guidelines for the management of forests managed for multiple functions

Natural forests are managed for multiple functions, like conservation, forest coffee production, NTFPs production, timber extraction. For most natural forests, except those in biosphere reserves, national parks, and some managed by the community as PFM scheme, there is no management plan even for a single function. Optimizing the management of natural forest for a single, except for monoculture plantation, is also not sustainable. A good example is degradation problems in natural forests managed by farmers for coffee production. Hence, in multi-functional forested landscapes, there is a need to develop guidelines that can be used for sustainable provision of all potential functions of the forest landscapes.

6. Development of technology for the propagation of indigenous tree species

Oromo is endowed with diverse tree species that can be managed for commercial timber plantation, ornamental as well as conservation functions. But, the propagation technologies of most indigenous tree species are not well developed. Hence, it is common practice to see people planting seedling exotic timber trees on the street and in prime conservation areas. Almost all commercial tree plantations and smallholder woodlots are exotic tree species,

predominantly eucalyptus. There is an urgent need to develop technology for indigenous trees propagation, including seed collection, seed processing, storage, seed treatment, germination, and tending operations at nursery and after planing. Besides, it is also time to assess the suitability of different tree species for different purposes and promote them. With the current trend of massive tree planting exercise, relying on exotic trees will change the natural landscape in the region to an unrecognizable level.

The way forward

For the forest sector to provide essential ecosystem services, and contribute to economic development, including agricultural transformation, the sector itself requires reform. Moving forward, the following measures are required:

1. Creating an enabling environment: this includes building institutional and human resources capacity, policy, and legislative reforms. The forest sector mandates are scattered across different sectors. For effective forest sector development, the mandates related to the forest sector should be consolidated within one leading institution, with a clear direction of how this institution collaborates and works with all relevant sectors. Such an institution should have strong regulatory roles, including sign concession and forest development agreements with the private sector and state enterprises on behalf of the Oromia state. In a country that tries to provide one window services for investments dealing with multiple sectors, scattering forest sectors and creating competing institutions that are financed by the same government is a clear indication of lack of clarity on sector policies and targets. Institutional reform has to be accompanied by building human resources capacity, clear policy direction, legislations, and procedures for law enforcement.
2. End the era of ‘campaign’ for forest development, and phase into well-planned and knowledge-based forest development.
3. Embark on development of a plan for sustainable forest production and value chains: this includes establishing new commercial plantations (state, private sector, and smallholder woodlots), improving management existing forests (plantation and natural forests), development, and commercialization of potential NTFPs and development forest industry.

4. Appreciate environmental functions of forests: this includes managing forests for their ecosystem services (including supportive and provisioning services to the agriculture sector), biodiversity conservation functions, and restoration of degraded landscapes.
5. Enhance contributions of forests to rural livelihoods through purposive tree planing in rural landscapes (agroforestry, tree crops, woodlots, etc), supporting community-based forest enterprises (seeds supply, seedling, NTFPs, timber forest products enterprises).

8.5 PROTECTED AREAS AND BIODIVERSITY MANAGEMENT

Our rapidly expanding population and economies place increasing demands on the world's resources. One-third to one-half of the world's terrestrial surface has been substantially altered by human activity. Many species persist on a greatly reduced area of their former range and on increasingly fragmented landscapes. Ecosystems suitable for agriculture, such as tropical dry forests and tall-grass prairie, have almost completely disappeared from our planet. Dams are disrupting freshwater ecosystems, while the marine world is threatened by overfishing and habitat destruction. Humans are also transporting plants and animals around the globe both deliberately and unintentionally. These "invaders" threaten other species or change entire ecosystems. We are even modifying the functioning of the entire planet, changing the earth's atmosphere through the industrial release of carbon dioxide (which may dramatically change the earth's climate) and diminishing the ozone layer through the production of chlorofluorocarbons. Direct threats to biodiversity are relatively straightforward. They include habitat fragmentation, invasive species, pollution, overexploitation, and global climate change. The underlying causes of biodiversity loss, on the other hand, are often more complex and stem from many interrelated factors. The most important of these are overpopulation and overconsumption, which are compounded by social, economic, and political forces. The world has been at the age of 6th global extinction event, known as, the "biodiversity crises". In response to the challenging problem, biodiversity has been facing, many countries of the world including Ethiopia have established protected areas. Protected areas are areas of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and natural and associated cultural resources, and managed through legal or other effective means. Biodiversity is the variety of life at genetic, species, and ecosystem levels. Biodiversity can be broadly divided into agro-

and wild biodiversity. Biodiversity is useful in that it contributes in one way or another to agriculture and food production. Conservation and management of biodiversity involve in-situ which is conservation and management in protected areas (PAs) and ex-situ, outside PAs. Thus PAs are vital for the conservation and management of biodiversity resources. Agricultural crop varieties and animal husbandry have their wild relatives in the natural habitat or PAs where the former and the latter are managed and conserved in the face of the present rate of degradation and loss of biodiversity. However, agriculture and protected areas are sometimes seen as opposite ends of a spectrum. However, some protected areas can make direct contributions to agriculture, while even the most strictly protected areas can make significant indirect contributions. One of the reasons for the insufficient progress in protecting habitats and biological diversity may be a lack of appreciation of their relevance to important national priorities, especially food production. Properly designed and managed protected areas are not set aside from development; rather, they are allocated to protective management to support national development objectives. Apart from being living museums, protected areas can bring many benefits to local people, the nation, and the entire world.

Agroecology is the study of the ecology of the entire food system, encompassing its ecological, economic, and social dimensions. The approach focuses on understanding – and working with – the interactions between plants, animals, humans, and the environment within agricultural systems. Its focus on protecting the resource base while ensuring food production makes it especially relevant for meeting the needs of people dependent on protected areas. This holistic approach to food production opens the way for the successful integration of protected areas and agricultural zones. Agroecological production is based on the sustainable use and maintenance of biodiversity, and well-informed farmers, fishers and pastoralists can produce substantial amounts of food from protected areas without harming biodiversity. Thus maintaining biological diversity is essential for productive and ecologically sustainable agriculture. Diversity of crop species and the diversity of varieties within a species have traditionally strengthened the resilience of agriculture. Protected areas can contribute to this effort by maintaining wild relatives of crops. The agricultural community should be seen as part of a larger and more comprehensive ecosystem that provides both goods and services from nature through a well-managed protected system. However, the highest negative correlation was found between farmland and forest LULC types Ethiopia, as agricultural land increase forest land which consists of biodiversity decreases.

By bringing ecological principles to bear in agroecosystems, novel management approaches can be identified, building on key interactions and strengthening “virtuous cycles” in agricultural production. This includes the interchange of ecosystem services and reciprocal learning and innovation for a range of actors including farmers, farmer organizations and civil society, science, the private sector, and representatives from local and national authorities. Pest control, by an insect is an important ecosystem service provided by wild animals. Wild animals, such as birds and bats that feed on insects may have remarkable impacts on insect populations that destroy crops.

The interaction of wild animals with livestock in the vicinity of protected areas can affect livestock production. Herbivore wild animals may cause damage to crops and plantations and compete for pasture with livestock and predators kill livestock or wild animals can transfer disease to livestock and viscera.

In general, the biodiversity of terrestrial and aquatic ecosystems has provided food, including fish, plants, seeds, honey, fruits, mushrooms, and insects, as important components of the diets of local inhabitants for thousands of years. Moreover, protected areas, as indicated above provide ecosystem services, such as pollination, and pest control, with mountain areas playing a special role through their contribution to clean water and decreased disaster risks such as the impact of climate change. An estimated 87.5 % of all flowering plant species are pollinated by animals. Crops at least partially pollinated by animals account for 35 % of global food production and are particularly significant in the supply of micronutrients for human consumption. Other insects, birds, bats, and some other animals also contribute. Protected areas also generate income through ecotourism development.

Ethiopia has different categories of protected area systems. Some of these protected areas occur in Oromia national regional state which plays the role of protected areas as mentioned above. Therefore, protected areas are known to play a vital role in maintaining food security through their positive effect on agricultural productivity and generate income.

Several studies that have been conducted in the Oromia region showed that the main factors of land degradation such as deforestation, overgrazing, cultivation of marginal lands, and soil fertility depletion can be attributed to population pressure. According to some of such studies, there was poor prospects for ecological sustainability and economic viability of the current agricultural practices which need an effort to integrate development in social,

environmental rehabilitation and agriculture. This paper aims to provide information on roles of protected areas and biodiversity management in agricultural productivity to be used as a guide to increase agricultural production in Oromia region while managing biodiversity resources for sustainable development in the region

8.5.1 Challenges to PAs and biodiversity management that affect Agricultural productivity

Change in Land- use and land- cover

Studies have indicated that land use and land cover changes (LULCC) are linked to climate change, biodiversity loss, and pollution of water, soil, and air. The LULCC affects the climate of an area which in turn affects natural resources such as water, wetlands, and biodiversity. Impacts of land cover change on the African climate include a reduction in surface water transpiration and increases in surface temperature which have impacted hydrological systems, particularly in East Africa. According to some studies, Ethiopia has experienced fluctuations in the lake level of tens to hundreds of meters in the past 200 years. These have been the case in most protected areas of Ethiopia in general and in Ormia in particular such as AbijataShalla Lakes National Park and Bale Mountains National Park in particular which in turn affect agricultural production while most of the change is due to agriculture. Since Protected areas are areas of biodiversity conservation and biodiversity conservation is important for agricultural production and food security, the LULCC in Ormia have affected agriculture both positively and negatively but the change in LULCC negatively affected biodiversity in protected areas. This in turn negatively affected agriculture. Many studies showed LULCC in Ormia are due to:-

- a. The need to expand agriculture/ Agricultural expansion
- b. The consequences include -Conversion of woodland, forestland, grassland to farmlands. Habitat destruction (Deforestation in the process of preparing land for growing crops e.g. By fire, or clear-cutting), habitat fragmentation and loss in PAs leading species of plants and animals in PAs to threat and reducing species diversity and abundance of Biodiversity, negatively affecting its goods and services
- c. Settlement—Humans settle in and around PAs, cultivating land exploiting and other natural resources disrupting biodiversity, negatively impacting natural ecosystem, evolution, and ecosystem function

- d. Overgrazing by livestock grazing / Pastureland: grazing by a large number of domestic animals beyond the carrying capacity of the land in PAs. which leads to bare land and soil erosion and reduced productivity of the land
- e. Investments in and around PAs such as Soda Ash production in the surrounding areas of ASLNP, the horticulture, and floriculture in the areas of Lake Batu and Bulbula Rivers, have reduced water that flows to Lake Abijata through Horal Kello
 - 1. Invasive species (Awash NP), invading and replacing native species
 - 2. Mineral extraction (Sand and salt), affecting plant diversity in Perdition to domestic animals and as a result reduction in Productivity and food insecurity in the region
 - 3. Pest of crops and predation of livestock by wild animals in the areas of biodiversity management and as a result reduction in agricultural productivity leading to food insecurity
 - 4. Zoonotic Disease- transmission of disease from Domestic to wild or wild to domestic reducing production
 - 5. Climate change

The underlying causes of these are overpopulation and consumption.

8.5.2 Possible interventions

- 1. Putting in place land use plan and implementing

As indicated by several studies, one of the problems in biodiversity conservation and sustainable agricultural production in Oromia in particular and in Ethiopia, in general, is the absence of a proper land-use plan. Thus having land-use plan for forest, agriculture, wildlife, etc are vital for biodiversity and other natural resources conservation and increase agricultural production

- 2. Re-forestation

Reforestation of degraded lands and landscape in Oromia region particularly, the buffer zone areas of protected areas including mountain areas that can provide opportunities for both

wild biodiversity and agricultural activities so that it would reduce impacts on the environment that reduces productivity in agriculture

3. Education on the value of conserving biodiversity in protected areas of the region

Educating local people the need to conserve biodiversity, its provisional, ecosystem, and regulatory services could be useful to reduce environmental problems and increase agricultural productivity

4. Provide easy access to family planning resources.

As population pressure has been great in the region, the human population size need to be checked. Educate in parents in family planning options and when access to a variety of contraceptives is readily available, family size becomes a matter of reason and decision rather than one of chance or ignorance. Education on spaced births, delayed marriage, breastfeeding, and other cultural institutions as well as birth control measures all combine to allow parents to choose when and whether to start families and how large those families will be. This would reduce the negative impacts on biodiversity and another natural resource of the region and promote agricultural productivity

5. Change Your Energy Use

Most of the fuel energy in the Region come from natural products in areas of biodiversity protection and also used unsuitably. Studies showed that the amount of energy we use and the ways we use it affect the earth's biodiversity. We release gases that contribute to global climate change acid rain, and air and soil pollution. Ultimately, our reliance on fuels is leading to a less habitable planet for ourselves and other species. By using energy more wisely and transitioning to cleaner, renewable energy sources, we promote a healthier environment and benefit biodiversity. The following can help change the way we use energy:

- Reduce the use of forest products such as firewood collection
- Support renewable energy such as hydroelectric power, wind power
- Replace conventional light bulbs with compact fluorescent bulbs—and turn them off when you leave the room

6. Economic reform

The major change that we must make involves rewriting the economic rulebook and if rules are available implementation is vital

7. Related to investors and industries

Studies have shown that in Ormia, investment activities that have been given negatively impacted biodiversity, for instance, Gumero Tea production was in the expenses of biodiversity. However, these should be reworked or implemented. Clear guideline/implementation has been useful so that it reduces impacts on biodiversity resources that in turn affect agricultural productivity

8. Establish and Manage Protected Areas

The Ormia Regional state has some protected areas but has may vast areas of land for biodiversity management. Increasingly, protected areas are being managed for sustaining complete and functioning ecosystems to maintain a full range of ecological processes and the habitats and species that depend on them. Many scientists and conservation organizations have suggested that protecting a targeted 10 to 12 percent of each nation's land area in this way would effectively conserve a large percentage of the world's species. To enhance agricultural productivity through conserving biodiversity to obtain its services, establishing more protected areas are useful

9. Enforce policy and legislation related to biodiversity conservation

There are policies and laws regarding biodiversity conservation whether being in protected or unprotected areas in the Oromia region, however, when it comes to legal action there is problems implementation. Therefore, there is a need to enforce policies and laws and manage biodiversity that promotes agricultural productivity.

From the standpoint of biodiversity conservation, establishing the protection of biodiversity in legal frameworks at global, national, and regional levels is essential on both philosophical and practical levels. International agreements with the force of law, such as the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), simultaneously signal the world's commitment to end the trafficking in endangered wildlife

and provide mechanisms for the convention's signatories to use in achieving that common goal.

10. Watershed Management (Protected areas, water, and agriculture)

Protected areas support agriculture especially through the protection of watersheds, providing protection against floods, reducing erosion, and improving groundwater supplies. One of the most important ecological services provided by protected areas, especially given the major investments in water resource management in much of the developing world, is the stabilizing of hydrological functions. Natural vegetational cover on watersheds regulates and stabilizes water runoff. Deep penetration by tree roots or other vegetation makes the soil more permeable to rainwater so that runoff is slower and more uniform than on cleared land. As a consequence, streams in forested regions continue to flow in dry weather and floods are minimized in rainy weather. For Instance, the Bale –Ecoregion and National Park in Oromia is an important watershed area for downstream parts of the Oromia region and Somali regional state so protection of the National Park enhances agricultural productivity of the region

1. Conserve Habitats and Species
2. Develop ecotourism
3. Benefit-sharing scheme to local communities need to be available
4. Restoration and rehabilitation of degraded areas at the landscape level
5. Have a proper land use plan
6. Resettlement of people outside PAs
7. Environmental education on the importance of biodiversity and its management
8. Investment activities should consider the impact on biodiversity

The way forward

- Giving the opportunity to community living in the vicinity to co-manage forest and other biodiversity resources in and around protected areas

- The integrated approach of both PAs, biodiversity management, and agricultural productivity can enhance better yields.
- Enhancing agriculture through the protection of biodiversity in protected areas is a new approach to the protection of species, habitats, and genes. These are essential if agricultural productivity is to be sustained and rural communities are to survive and prosper. Thus conservation and management of biodiversity in Protected areas need be enhanced
- In terms of economic development, rural communities closest to the forests or other natural areas can benefit through the sustainable harvesting of wild species to meet local consumption needs, and almost all rural communities can gain at least some development benefit through proper management of biological resources which reduce the impact on agricultural productivity that need be in place.
- Promoting nonwood forest products such as honey which biodiversity in protected areas can provide alternative livelihood opportunities for local communities and reduce impact deforestation and land degradation.
- Appropriate diversification of the species, varieties, and breeds present in and around production systems can promote positive interactions that reduce the need for external inputs
- Well-planned genetic-improvement programs can produce plant and animal populations that have the characteristics needed to produce efficiently in specific production environments
- Controlling/ protecting invasive species can promote biodiversity in and outside protected areas
- Controlling pests and predator that negatively affect farmers close to protected areas which in turn negatively affect agricultural productivity
- Community-based ecotourism development which can be agro-or natural in the region could be an important option to reduce the negative impact on biodiversity and enhance agricultural productivity

- Alternative fodder provision for livestock in the areas of protected areas can reduce overgrazing
- Resettling peoples to other areas than of protected / forest priority areas can enhance biodiversity conservation and promote agricultural productivity in the region
- Modern technology is also enhancing the potential contributions that wild relatives of livestock can make to human society. The techniques of embryo transplants, embryo splitting, and artificial insemination are now sufficiently well developed to enable wild relatives to make a significant contribution to the livestock industry.
- There are not enough studies in the ecological services of biodiversity in Protected areas in Ethiopia in general and in Oromia region, in particular, indicating the need for research in this area
- Well planned intermix of agriculture and protected areas could promote agricultural productivity

8.6 WATER BODIES AND WETLAND MANAGEMENT

As defined by the Ramsar Convention on Wetlands, wetlands are “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters” (Article 1.1 of the Convention text). Ethiopia has diverse wetland ecosystems across the country, from the lowlands of Afar to the highlands of the Bale Mountains, several Crater Lakes in central highlands of the country, and flood plains of Baro and Akobo Rivers in Gambella. The major types of wetlands in Ethiopia include swamps, marshy wetlands, flood plains, natural and human-made lakes, peaty wetlands, and swamp forest wetlands. In addition, there is a large number of valley-bottom wetlands especially in the highland parts of the country but are often neglected due to their small sizes. However, these wetland types are highly degraded, drained, and used for small scale irrigation but also as grazing land in the dry season. These are often seepage wetlands and they are in many cases the sole source of drinking water for the local communities.

Wetlands are threatened ecosystems at a global scale. Wetlands provide many ecosystem services but throughout the world are exposed to a range of direct and indirect pressures. While technologically advanced nations properly document and address key issues affecting

wetlands, at other locations such as in much of Africa and in Ethiopia in particular, lack of data, resources, and methods are hindering thorough assessment. Proximity to resource availability such as water, food, and fuel has increasingly become a determining factor for human settlements, with early examples including the Indus delta and Mekong delta.

The total wetland cover of the country is not exactly known. Up to date, there is no comprehensive inventory of all wetlands in the country and studies on wetland hydrology, ecology, and biogeochemistry are sporadic. Yet some people tried to estimate the total wetland cover of the country. Some studies identified 73 major wetlands in Ethiopia and he estimated that these wetlands cover about 13, 699 km², which is about 1.4% of the total landmass cover of the country. Other estimates by FAO, based on Arial photographs and early Landsat data put the estimate at about 0.74% of the total landmass of Ethiopia for permanent water bodies and wetlands but about 2% when shallow lakes, small wetlands, peatlands, swamp forests, and seasonal wetlands are included. Therefore, based on the current estimate about 1.4 - 2% of Ethiopia's landmass could be considered a wetland. Wetlands in Oromia regional state face the same challenge as the rest of the wetland and water bodies of Ethiopia.

Ethiopia is often categorized as a 'water tower' of Africa mainly because of its 14 major rivers that crisscross the country but on the other hand also a dry country. Ethiopia is an origin for the world's longest river, the Nile, (about 85 % of the Nile annual outflow originating from highlands of Ethiopia), and the highlands of Ethiopia receiving an annual rainfall of above 1000mm, it is no wonder that the country is named water tower of Africa. The variability of rainfall patterns and wide differences in wetness across the country makes Ethiopia extremely vulnerable to climatic change and climatic variability. Highlands of Ethiopia, especially mountains, are the origin of all perennial rivers. For instance, twelve rivers originate only from the Bale Mountains and the same is true for the three other mountain ranges identified for this particular project.

With rapid population growth in developing countries and consequent increased consumptive demand, wetlands are rapidly reaching a point of no return. One development challenge for the country is the provision of water insufficient quality and quantity for human consumption and livestock production, in addition to the dependency of Ethiopia's agriculture on seasonal rainfall, which is becoming more and more erratic. It is therefore imperative that the country utilizes all its natural resources wisely and sustainably. Wetland

ecosystems in Ethiopia are highly degraded despite their valuable ecosystem services and provisions. Also, globally wetlands are highly degraded, which according to Millennium Ecosystem Assessment, “degradation and loss of wetlands (both inland and coastal) are continuing more rapidly than for any other ecosystems”. Despite this, throughout the world wetland ecosystems render a wide variety of ecosystem services. These include services such as water storage, groundwater recharge, and flood control, shoreline stabilization, and water quality control, moderation of climate, flood regulation, and hotspots for biodiversity.

Wetlands and water bodies in Oromia

The table below shows some wetlands and water bodies of Oromia with their degradation status. The agriculture productivity of the region relies on the provisioning service of these vital ecosystems.

Table 54 Some selected water bodies and wetlands in Oromia regional state

No.	Wetlands and water bodies	Area (km ²)	Recharge	Major uses	Degradation status
1	Ziway	434	Katar, Meki, streams	Fishery, livestock, recreation, local climate, irrigation, water abstraction	++ tributary rivers degradation, land degradation, and sedimentation
2	Shala	400	Furfer, Dijo, Angeilu	Mineral production, recreation	+
3	Langano	230	Teyi, small streams	Fishery, livestock, recreation, local climate	+
4	Abijata	205	Bulbula	Recreation, mining, livestock	+++ Mineral mining, drying up of Bulbula river
5	Abaya	1160	Blaten, Gelana	Fishery, irrigation	+
6	Beseka	30	Ground water	Recreation, scientific study	
7	Chitu		Ground water		+
8	Chukala	1.0	Precipitation	Recreation	+
9	Hora, Arsed	1.1	Precipitation	Recreation, Irrecha, Fish	+++
10	Bishoftu	1.5	Precipitation	Recreation	+
11	Hora, Oda, Arenguade	1.1	Precipitation	Recreation	+
12	Wonchi	8.9	Precipitation	Recreation	++ Sedimentation Land degradation
13	Dendi	15.0	Precipitation	Recreation	+
14	Bishoftu, Guda	18.0	Precipitation	Recreation	+

15	HoraKilole		Precipitation	Irrigation and Fish	+++
16	Cheleleka		Precipitation	Agriculture, grazing	Lost or beyond restoration
Reservoirs					
17	Fincha'a	345	Fincha'a, Amerti	Hydro-power, fishery, irrigation, recreation, local climate	+
18	Koka	236	Awash, Mojo	Hydro-power, fishery, irrigation, recreation	+++
19	MelkaWakena	81.6	Wabe	Hydro-power, fishery	

+ = slightly degraded; ++ = moderately degraded, requires intervention and +++ = extremely degraded and in need of restoration. Empty cells indicate that the extent of ecosystem services is unknown in these lakes. Detailed analysis of water bodies and wetlands is not comprehensive for Oromia regional state and further studies are required.

In addition to these water bodies, there are numerous rivers, streams, and other wetland types including dams, reservoirs, flooded areas, floodplains, swamps, marshes, salt marshes, irrigation fields, plantations, seasonal pans, and ponds in Oromia. Major rivers such as Muger, Didessa, and its tributaries, Dabus, Genale, and Gibe rivers provide essential water resources for the region and other regional states in Ethiopia. For instance, The Didessa River has vital supportive ecosystem services. It contributes 25% of the flow of the Abay River. As most of its catchment is relatively pristine, it regulates climate change, arrests soil erosion, and improves soil fertility. The river provides fish and vegetation and is a habitat for much biodiversity. Its cultural and supportive services may be less. Although human encroachment is increasing in the sub-basin, still the ecological condition of the Didessa River basin can be said to be good to moderate. Whereas the Muger River serves as a source of potable and irrigation water and supports the livelihood of a large segment of the farming population along the riparian. Muger River has a significant contribution to the flow of the Blue Nile in its middle course.

The objective of this paper is to provide guiding principles for increasing agricultural productivity while maintaining healthy and functioning wetlands and water bodies in Oromia regional state.

8.6.1 Challenges

Wetlands and Water bodies lie along an environmental gradient of moisture. From practical management, utilization, and conservation point of view, it is important to consider them

under the same system. In this sense, the Ramsar definition put all inland water bodies under a wetland broader definition. It is important though to recognize Ethiopia is not signatory to the convention and there is a strong argument for the inclusion of other wetland types unique to Ethiopia, such as the valley bottom wetlands.

The major causes of wetland degradation in regional states of Ethiopia are similar and we may categorize the causes of wetland degradation into two - the ultimate and proximate causes. The ultimate causes are related to population growth and bad governance that ultimately lead to poverty. When poverty prevails, it would be very difficult, if not impossible, to conserve biodiversity and their habitats. Therefore, the ultimate solution rests in tackling these root causes of the problem, which have socio-economic implications and require political will and commitment to resolving.

The proximate causes are mainly related to habitat destruction (alteration), the introduction of alien species, pollution, and overexploitation. The major cause of wetland degradation is habitat destruction which is related to several factors that include excessive water abstraction for various purposes including irrigation, watershed perturbation (sedimentation), damming, diversions, and channelization.

1. Excessive water abstractions

Any excessive withdrawal of water either directly from the wetlands or from feeder rivers and other water bodies associated with the wetlands reduces their size and ultimately leads to their disappearance; Lake Haramaya is a typical example of this case. Excessive withdrawal of water for various purposes is now becoming a serious problem all along the rift valley lakes starting from Lake Afdera in the north to Lake Turkana in the south. This is mainly the case in the Ziway-Shala basin. The effect of water diversion from feeder rivers is better reflected in the larger lakes than in the wetlands. However, as the lakes start to recede the associated wetlands will start to shrink. The flood plains are also seriously affected by the abstraction of water from rivers for irrigation purposes. The flood plains are recharged by the overflow of water from the adjoining rivers. The above consequences are aggravated by Habitat loss and fragmentation, water diversion structures, impoundments, and sedimentation of storage reservoirs.

2. Habitat changes due to agricultural practices

Historically, agriculture has been the major factor in freshwater and estuarine wetland loss and degradation through:

- harvesting food, fiber, or forest products;
- minor drainage;
- maintenance of drainage ditches;
- construction and maintenance of irrigation ditches;
- construction and maintenance of farm or forest roads;
- maintenance of dams, dikes, and levees;
- direct and aerial application of damaging pesticides
- groundwater withdrawals.

The above activities can alter a wetland's hydrology, water quality, and species composition. Excessive amounts of fertilizers and animal waste reaching wetlands in runoff from agricultural operations, including confined animal facilities, can cause eutrophication. The debate about the future of wetlands tends to divide between those seeking to develop these areas for agricultural production (crop producers and livestock husbandry and those who believe that wetlands must be preserved as much as possible in a stable state to maintain their ecological contributions to the ecological system. The perception of the premier extends up to assuming wetlands as wastelands and depending on who dominates the debate this tendency can wreak havoc on fragile ecosystems such as the wetlands.

Drainage agriculture: There are cases where wetlands have been drained and used for agriculture. Wetlands play a significant role in attenuating floods and acting as temporary storages during the wet season. This situation helps in reducing peak flows in the major rivers during the rainy season and also contributes to the base flow during the dry season by releasing what is stored during the wet season. This capacity of several wetlands is diminished due to drainage agriculture. The wet season flows are increasing from time to time while the dry season flow has been reduced significantly over the past years.

Land-use changes: Shortage of farmland has forced many farmers to use land near lake shores. The impacts of land-use patterns in Lake Ziway watershed has led to its degradation. The land use pattern in the watershed of Lake Ziway is dominated by agricultural practices.

Overgrazing: Overgrazing is a serious problem around all wetlands of Ethiopia due to the high population of livestock in the country. Grazing livestock can degrade wetlands that they use as a food and water source. Compaction of soil by livestock trampling is a common

consequence in overcrowded wetlands by livestock which can also cause eutrophication from urea and manure. Overgrazing of riparian areas by livestock reduces streamside vegetation, preventing runoff filtration, increasing stream temperatures, and eliminating food and cover for fish and wildlife. Streambank destabilization and erosion then cause downstream sedimentation. Sedimentation reduces stream and lake capacity, resulting in decreased water supply, irrigation water, flood control, hydropower production, water quality, and impairment of aquatic life and wetland habitat.

3. Watershed perturbation

Clearance of forests and the resultant erosions from surrounding catchments would seriously affect the biological and physicochemical situations in water bodies. This is especially aggravated in the absence of wetlands. In Ethiopia, there is rapid land use land cover change especially the conversion of natural forests to cultivated land, and grazing lands hold the widest part. Food and agricultural organization of the United Nations illustrated that in the year between 1990–2000 the total natural forest cover of the country has decreased by 9% with the estimated rate of 40,000ha per year while plantation has been increased only by 1%.

Fertilizers from agricultural fields surrounding water bodies may cause, through erosion, excess loadings of nutrients that could cause eutrophication in the water body. In turn, eutrophication is the main cause of fish kills and deaths of other aquatic organisms by causing depletion of oxygen. Fish kills, caused by the above problems, have been observed in Lakes Chamo, Babogaya and Hashenge in Ethiopia in the past years. Due to unwise utilization of land, deforestation, and overgrazing of watershed, soil erosion is increasing from time to time and causes the siltation of lakes, reservoirs, and rivers. Lake Haramaya, Hawassa, and Koka Reservoir are live examples affected by siltation problems, which emanate from the degradation of the wetlands. The worst scenarios are observed in Lakes Abaya and Chamo.

Deforestation is one main cause of land degradation. It is estimated that some 1900 million tons of soil are being eroded annually in the highlands. This is equivalent to an average of 35 tons from every hectare in the highlands. However, most losses are from croplands, totaling an estimated 22% of the land area of the highlands and the remaining 20% is from overgrazed grasslands and little from waste and other lands. Most of this being deposited as

sediment on grass and forest land, but the part that is carried into rivers is lost carrying away from the highlands some 1900 million tons of soil every year.

Aggradation of river channels is another problem resulting from sedimentation. For example, the stretch of the Awash in the lower valley is a case in example. As a result of aggradations of these stretches, the channels have lost their natural capacity to carry floods of even much less than peak flows. Consequently, flooding in these areas has now become a yearly phenomenon.

4. Mining activities

Sand mining is the process of removal of sand and gravel from in and around wetlands, usually rivers and flood plains. As the demand for sand increases in industry and construction, the issue has become very serious. The erosion caused by dredging can incise beds, erode banks, reduce the number of sandbars and islands, and undermine bridges and other structures all of which have the potential to impact aquatic biota.

Soda Ash mining has been taking place in Lake Abijata, and with exacerbated abstraction from feeder rivers, the lake has now lost so much water and is on the verge of complete dry-up.

5. Introduction of exotic plants and animals

As a result of disturbance and habitat degradation, wetlands can be invaded by aggressive, highly-tolerant, non-native vegetation, such as water hyacinth (*Eichhorniacrassipes*), and salvinia(*Salviniamolesta*), or can be dominated by a monoculture of cattails (*Typhaspp.*) or common reed (*Phragmitesspp.*). Water hyacinth and similar species can rapidly fill a wetland and are a threat to water quality in some areas. The invasion of water hyacinth (*Eichhorniacrassipes*) is very much noted in Lake Tana from the highland lakes, Koka Reservoir in the rift valley, and Lake Tatta in Gambella. It appears that currently it is spreading to other water bodies including Lake Ziway in the rift valley. Non-native species may be introduced on purpose. For example, water hyacinth has been noted for its ability to sequester nutrients and is used for wastewater purification. Carps are exotic fish species that degrade wetlands. Carps, introduced for various purposes, severely increased the turbidity of water resources. These species have been introduced, for example, into Lakes Ziway and Langeno as well as Koka Reservoir and are dominating the fisheries.

6. Urbanization and pollution

Cities and towns are expanding in Ethiopia and these expansions create pressure on the surrounding environment. It is not uncommon that most of these are established around water bodies and wetlands. The importance of water for urban construction and dwellers is indispensable. They are not the only a source of water, but also provide many economic, social, and environmental services. Most of these cities and towns are with no proper sewerage systems and many of the households and industries release their wastes into the surrounding water bodies.

7. Overexploitation of resources

This includes the overexploitation of fishery resources from the water bodies and also macrophytes from near shores. In many of the freshwater bodies of Ethiopia especially in highland lakes such as Lakes Tana and Hayq and Rift Valley lakes such as Lakes Ziway, Hwassa, Langeno, and Chamo, from where the majority of the fish catch is coming from, there is overexploitation of the fishery resources. This is mainly caused by the increased number of fishermen that created pressures beyond the sustainable production level of the lakes. The fishermen operating in these lakes are not all registered and the fishing gears they are using are not regulated. Some of the fishing gears are so destructive that smaller fingerlings below the table size are caught and some are wasted. Fishing during the breeding seasons of the fishes is not prohibited in some regions; even though it is legally prohibited in some, enforcement of the legislation has become a daunting task and could not be realized.

8. Climate change

Climate change and recurrent droughts are threats to the wetland ecosystems of Ethiopia. Nitrous oxides, sulfurous oxides, heavy metals, volatilized pesticides, hydrocarbons, radionuclides, and other organics and inorganics are released into the atmosphere by industrial and agricultural activities, and from vehicles. These compounds can enter wetlands through wet and dry atmospheric deposition and can adversely affect aquatic organisms and the terrestrial organisms that feed on them. There is also an increase in temperature due to climate change which is generally affecting wetlands and other ecosystems. Such phenomena adversely affect hydrological cycles, which in turn affect the biodiversity resources and various services of wetlands. Obviously, in times of recurrent drought and dry times, the pressures that would be exerted on wetlands are huge since they are the only major sources of water, fodder, and crop production, and contribute to saving lives of humans, livestock, and wild biodiversity.

9. Seismic events

The Ethiopian rift experiences frequent tectonic activity manifested as earthquakes and rarely also by volcanism. New ground cracks are being created and these cracks result in the disappearance and /or reduction of the sizes of wetlands as evidenced in the Main Ethiopian Rift. The case of Beseka Lake in the Awash valley is a good example to show the effects of seismic activities on the nature of wetlands.

10. Lack of coherent policies and institutional arrangement

In Ethiopia, wetland related concepts are incorporated in different policies and strategies (e.g. Ethiopian Water Resources, Agriculture, and Environmental policies). The Conservation Strategy of Ethiopia, which forms the basis for the Environmental Policy of the country, has also mentioned wetland-related issues. Unlike the national environmental strategy, the Gambella region's Conservation Strategy contains a separate section devoted to wetlands. But Ethiopia generally lacks a specified policy to wetlands. There appear to be strategy documents that favor irrigation agriculture through drainage at the expense of wetland ecosystems. These documents encourage the draining and conversion of wetlands into other forms of land use particularly for improving agricultural yield. The Environmental Policy in its general aim of protecting the environment highlights only the importance of wetlands for water resources management.

For instance, agriculturalists see moist fertile soil with vast potential for growing grain; fishery managers find a support base for producing fish; hydrologists calculate capacities to provide water for industry, agriculture, and domestic use; public health specialists may not see them as regulators of water quality but in contrary as transmitters of diseases such as malaria and others.

Investment in wetland management is rarely integrated. Instead, wetlands are invariably viewed by each user as single-product systems, precluding other values, while single-purpose returns fall far short of expectations. The absence of an institution duly empowered to issue and implement wetland laws and coordinate management activities is the underlying cause for the deterioration of the wetlands of Ethiopia.

Wetland management in Ethiopia also suffers from capacity limitations such as lack of skilled manpower, finance, and technology.

8.6.2 Possible intervention

Some studies classify the major causes for degradation of Ethiopian wetlands into four categories, aside from specific causes that apply to each wetland. These causes are not different from the global causes for the deterioration of wetlands, abbreviated as HIPO (*Habitat alteration, Invasive species, Pollution, Over-exploitation*). Accordingly, any possible intervention must address these causes.

The major restoration and management approaches to wetlands among others:

1. Water use regulations

Unless water tariffs introduced in areas such as the Ziway-Shalla sub-basins, ‘Tragedy of the Commons’ will ensue. Water tariffs and water costing should be implemented in all watersheds of the country but could be designed to have severe penalties in these degraded wetlands. A good start has been made in the Awash River Basin and this experience should be replicated in these degraded basins also. Water allocation committees and regulatory bodies should be in charge of water distribution based on need and efficiency. In many Districts and Kebeles, there are water use associations, but their performances have not been successful. Several water use associations around the wetlands of Lake Ziway could be mentioned in this regard. Improving the capacity of such associations will help to allocate water in more efficient and sustainable ways.

2. Watershed management to restore hydrological balance in the long term: this may include,

- Soil water conservation and enhancement programs by re-planting catchments with native trees and shrubs that can retain moisture and minimize soil erosion.
- Hydrophytic vegetation restoration typical for the wetland type(s) being established and the varying hydrologic regimes and soil types within the wetland. Preference shall be given to native wetland plants with local genetic material;
- Increase water content of uplands with terraces and bunding practices that can maintain saturated soils for a long period during the year;
- Revegetation of bare uplands is enhanced by afforestation with trees and grasses followed by *restricted access or complete access denial to closed areas*;

- Rehabilitated wetlands should be protected from human and livestock encroachments through community ownership and custodianship.

3. Buffer zone demarcation

Buffer zone delineation around rivers and lakes reduces pressure on the removal of riparian vegetation. The extent of the buffer zone should consider local conditions. Wide-ranging experience indicate that 50 -100 m buffer zone around lakeshores and major river is quite effective to protect against further degradation of lakeshores and rivers.

4. Regulation of upstream diversion

In many instances, such as Lakes Ziway and Tana, the lowering of lake levels is partly a result of abstractions taking place, not in the lake, but from feeder rivers through diversions and pumping for irrigation purposes. Such actions should be regulated and used only when planned for sustainable use.

5. Hydrological restoration

The major restoration approach for such wetlands is to restore hydrological balance through the long dry season by catchment management such as vegetation which retains soil moisture for long periods through:

- Removing eucalyptus,
- Soil and Water Conservation to increase percolation
- Water allocation in a sustainable manner.
- Prohibit drainage of wetlands by legislation
- Regulating draining and water allocation
- Catchment afforestation with trees
- Adoption of best practice climate-smart agriculture
- Careful planning and management of human settlements in wetlands

6. Restoration of valley bottom wetlands (VBW)

When the wetland features of these types of wetlands are further degraded and the agricultural features are prominent, then it can be said that the original wetlands have been compromised and converted into cropland.

- Manage Eucalyptus plantation

- Introduction of sustainable wetland farming, plasticulture, to these types of wetlands may increase the productivity of wetlands and their contribution to food security in Oromia.

7. Restoration of polluted wetlands

Among several approaches to combat pollution of wetlands, perhaps the best approach is to strengthen regulatory and enforcement institutions within the catchment and the wetland itself.

- Requiring any developmental projects to conduct Environmental Impact Assessment (EIA) studies before their implementations and Environmental Management Plan (EMP).
- In the case of polluted urban areas, environmental technologies such as Constructed Wetlands can be used to purify polluted rivers and create a green and clean urban climate that espouses rich diversity and better quality of life for the populace.

8. Proper use of resources

There is an urgent need for management plan for wetlands, which should be implemented by authorized bodies.

9. Management and Control of Invasive alien species (IAS)

Management and control of IAS need prior attention to the region.

10. Knowledge and Legislation

The Government and experts must teach communities about sustainable ways of using water without degrading wetlands. *Building knowledge and awareness of wetlands are important.* Policy and decision makers, development workers, academia and the public including grassroot communities must know about the functions and values of wetlands and the consequential negative effects that would accrue if they are not sustainably utilized. The value and role of indigenous knowledge practices should not be left out when setting up awareness, advocacy, and capacity building programs.

11. Policy and Regulatory approaches

This may include among others:

- Establish or assign a responsible institution responsible for wetlands

- Developing Land use policy and management Plans
- Developing an independent wetland policy
- Prioritization and management plans for wetlands
- Impact assessments and continuous monitoring of wetlands
- Building partnerships with stakeholders

Way forward

Agriculture remains the backbone of the Oromia regional state and Ethiopian national economy. The direct contribution of wetlands and water bodies in this sector needs further study. These ecosystems, being the main provisioners of the most important agricultural input, water, need sustainable management. Oromia has already lost several of its water bodies and wetlands. Some wetland types such as the Valley Bottom Wetlands in South Western and Western Oromia are being lost even before inventory of their biodiversity and ecosystem services are documented. Conservation, management, and sustainable utilization of water bodies and wetlands must be of first-order priority for the Oromia regional state. The assumption espoused by many in the agricultural sector that promoted drainage of wetlands for conversion into agricultural land must be halted. For Oromia and Ethiopia at large, and is primarily a dry land region and country, sustainable management of water bodies and wetlands must be upgraded to an urgent issue that demands greater attention from policymakers and implementers alike. As studies in other countries indicate, investment in wetlands pays off in many folds. Therefore, sustainable wetland resource management is not only needed in Oromia's long-term agricultural transformation and economic development, it is also an essential component to mitigate and adapt to climate change.

8.7 ENVIRONMENTAL PROTECTION: TRANSFORMING AGRICULTURE IN OROMIA WHILE PROTECTING THE ENVIRONMENT

Sustainable agriculture is the idea that agriculture should occur in a way such that we can continue to produce what is necessary without infringing on the ability for future generations to do the same. The exponential population increase in recent decades has increased the practice of agricultural land conversion to meet the demand for food which in turn has increased the effects on the environment. *Environmental protection* is the practice of protecting the natural environment collectively by individuals, organizations, environmental

activists, and governments. Its objectives are to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends.

The impact of human beings on the natural environment has been increasing over the past centuries in response to rapid population growth, rapid technological development, industrialization and agricultural expansion. *Unless we change our relationship with the environment*, these increasing pressures will limit the planet's capacity to supply the world's economies with sufficient water, energy, and other basic resources, and bring about substantial change that will *create uncertainties and instabilities*. As a result, the planet becomes less habitable, with *diminishing natural resources* and increased environmental costs. Development interventions disregarding those consequences will fail to ensure sustainability, especially in developing countries. *Before undertaking the utilization of natural resources, it is of great importance to consider environmental issues and determine all the possible impacts* which will be used as a management tool for planners and decision-makers.

Discussion concerning environmental protection *often focuses on the role of government, legislation, and law enforcement*. However, in its broadest sense, *environmental protection may be seen to be the responsibility of all the people*. The *environmental impact of agriculture* is the effect that different farming practices have on the ecosystems around them, and how those effects can be traced back to those practices. It varies based on the wide variety of agricultural practices employed in the region.

Decisions that impact the environment will ideally involve a *broad range of stakeholders including industry, indigenous groups, environmental group and community representatives*. Therefore, for each of the likely environmental impacts, relevant alternative strategies are proposed which are helpful to mitigate environmental impacts thereby safeguarding the natural resources. Accordingly, this document is about the *challenges related to environmental protection and possible intervention strategies* that need to be implemented for the successful transformation of agriculture in Oromia.

8.7.1 Challenges

1. Implementation of Environmental Laws and Regulations

Even though Ethiopia has passed various environmental protection laws/regulations and ratified various international conventions to prevent pollution, the implantation of these laws at full-scale is generally at its infancy stage. This may be due to:

- low awareness level of judiciary institutions to frame the legal issues and ensure the rule of the law.
- the low political commitment of leaders to reverse the situation on the ground.
- inadequate institutional capacities and facilities.
- poor coordination among key stakeholders.

2. Environmental Awareness Creation

Environmental protection demands cooperation and coordination of stakeholders and the general public at large. To this end, awareness creation is an evitable act for the successful implementation of environmental law enforcement. However, there is a serious gap in this regard at both institutional and regional levels.

3. Pollution from Use of Agrochemicals

Agrochemicals are inputs used to increase the productivity of cropland which include fertilizers, pesticides, herbicides, etc. Some of the chemicals used in the agricultural sector are highly persistence or they can stay active for a long period and result in *soil and water pollution* due to its residual effect. This chemical may cause damage to human and livestock health, damage to flora and fauna (nontarget effect), and pollution of soil and water. The observed challenges include:

- most of the chemicals are not legally registered while imported to the country and their distribution and application in the country cannot be traced at all.
- there is no legal system that controls the storage, transportation, and application of these chemicals on farmland.
- chemical adulteration in the black market is highly intensified.
- there is no public or private institution mandated to deliver training and safety materials to the farmers.
- non-licensed and non-professional brokers highly participating in illegal smuggling of chemicals, especially in horticultural and floricultural intensive rift valley basins.

- Eutrophication of water bodies resulted in the rapid invasion of aquatic weeds (water hyacinth) especially in rift valley lakes such as Koka, Dambel, and Batu lakes.
- there are no institutions responsible for training on chemical safety precautions and provide personal protective equipment (PPE).

4. Effect of Industrial Effluents on Agricultural Crops and Soil Characteristics

Effluent is an inevitable product of the industrial process. It is defined by the United States Environmental Protection Agency as “wastewater (treated or untreated) that flows out of a treatment plant, sewer, or industrial outfall. An increased number of industries has enlarged the disposal of effluent to open land or to natural water resources which may result in environmental pollution which is a serious problem globally. Especially, textile and leather industries are major sources of industrial pollutants worldwide.

The effluent of different industries may vary in composition depending upon the source of production. Effluent may contain essential nutrients and some toxic substances like heavy metals that may accumulate in the soil. Metal contaminated soils can cause health problems to animals and human beings when such plants are consumed. Many investigators stated that heavy metals get accumulated in soil resulted from continuous irrigation with sewage effluent. In Oromia, most of the industries are located in Finfinne and around Finfinne, and thus highly polluting water bodies especially Akaki river, Mojo river, Sabbata river, Atsebella river to a great extent. As a result, these pollutants are further affecting the agricultural activities downstream while the farmers are using the water for irrigating their farmlands.

Soil and environment are under tremendous pressure due to industrial expansion and discharge of effluents. Soil and environment are under tremendous pressure due to industrial expansion and discharge of effluents. Challenges related to industrial effluents include:

- Effluent irrigation can change soil properties, including soil infiltration rate, hydraulic conductivity, bulk density, porosity, pH, and nutrient contents.
- Many investigators stated that heavy metals get accumulated in soil resulted from continuous irrigation with sewage effluent.

- Crop species can accumulate heavy metals of effluents irrigated soils in their tissue and can cause health problems to animals and human beings when such crops are consumed.
- The extent of pollution in Akakiriver, Mojo river, Sabbata river, Atsebella river, etc is increasing and causing a significant effect on the agricultural activities of farmers downstream.

1. Ecosystem degradation and biodiversity loss

Biodiversity refers to the variety of life on earth. This variety provides the building blocks to adapt to changing environmental conditions in the future. Typical challenges may include:

- removal of vegetation cover and continued deforestation
- decrease in species diversity and genetic erosion
- depletion of water sources
- prevalence of barely exposed soils.
- aridity problems.
- invasion of invasive weeds and rangeland shrinkage.
- recurrent drought.
- desertification and climate change.

2. Climate Change

Nowadays, *climate change* is becoming *global, regional, and local issues* determining the sustainability of life on the planet. As indicated by the researchers, *change in rainfall pattern* and *rise in temperature* are becoming *major constraints for agricultural production*; although other factors also play a significant role. The local farmers also indicate that *late-onset, early offset, floods, and heatwaves* become more frequent and the resulting a *decline in crop production* and *total crop failure in drier areas*. On top of this, late-onset of rain led to *poor grass regeneration/forage deficit, water shortage, and heat stress on livestock*, and consequently *increased the mortality of the livestock, vulnerability to diseases, and physical deterioration* due to long-distance travel for water and pastures.

3. Lack of regular environmental monitoring and evaluation system

Except that the federal and regional environmental proclamations and regulations were declared and regulatory institutions were established at both federal and regional levels, so far there is no regular environmental monitoring and evaluation system established.

8.7.2 Proposed Interventions

1. Law enforcement

- enhancing awareness of judiciary institutions through short term and long term meetings, forum, and training.
- increase the political commitment of leaders.
- building institutional capacities and facilities.
- increasing coordination among key stakeholders.
- Taking legal measures in time

2. Environmental Awareness Raising

- *strengthening the existing higher-level training and education institutions* so that they can offer programs and courses in sustainable resource and environmental management for economists, planners, lawyers, engineers, sociologists and medical practitioners as well as for natural resource and environmental scientists.
- *promoting the teaching of environmental education* on a multidisciplinary basis and to integrate it into the ongoing curricula of schools and colleges and not treat it as a separate or additional subject, though this should also be done at the tertiary level.
- *providing in-service training* in such specialized subjects as environmental economics, environmental law, environmental monitoring, geographical information systems (GIS), pollution monitoring and control, and hazardous waste management.
- *formulating environmental awareness programmes* in such a way as to make them address specific environmental problems of particular localities given the extreme variability of environmental conditions and problems in Ethiopia.
- *recognizing the important role the mass media play* and to effectively use them in creating and promoting environmental awareness given the physical problems of access and communications in Ethiopia.
- *encouraging the local development of environmental awareness associations and programs* specific to particular agro-ecological zones and support them with scientific inputs.

- *initiating, encouraging, and supporting the involvement of the local community and religious leaders* in programs to promote environmental awareness.
 - *developing environmental awareness programs for urban environments* for dissemination by the mass media and foster the development of urban environmental awareness associations.
3. Interventions for addressing pollution from the use of agrochemicals
- educating on agrochemical contamination.
 - avoiding the application of banned chemicals.
 - application of chemicals based on *certified dosage and usage*.
 - introducing and implementing manual and biological methods.
 - implementing integrated pest management (IPM).
 - implementing safety precautions and establishing institutions responsible for training on chemical safety precautions and provide personal protective equipment (PPE).
 - implementing appropriate fertilizer application.
 - preventing environmental pollution from the sources.
 - enhancing institutional capacity and establishing a legal system to control illegal importation, storage, transportation, distribution, and application of agrochemicals.
 - Implementing watershed management to protect the eutrophication of water bodies which resulted in the rapid invasion of aquatic weeds (water hyacinth).
4. Interventions for industrial waste management
- There should be a comprehensive monitoring system established to trace the pollution status of water, soil, and sediment across major rivers and lakes as well as agricultural food products which may be affected by untreated industries effluent discharge.
 - Research needs to be conducted to investigate the extent of pollution-related to soil, water, and foods to protect the health of people.
 - OEFCCA, as a regional regulatory body, should analyze effluent from industries for various physicochemical parameters like temperature, pH, acidity, alkalinity, hardness, free CO₂, total solid matter, DO, N, P, K, BOD and COD before discharged to the environment.

- OEFCCA, as a regional regulatory body, should enforce the environmental laws on industries discharging their untreated effluents directly and indirectly to the environment.
5. Interventions for rehabilitating ecosystems and biodiversity conservation
- Promoting ecosystem restoration/rehabilitation
 - incorporating watershed development approach in operational development land-use plan.
 - practicing and implementing community-based participatory grazing land management
 - avoiding indiscriminate clearing and burning of bushes/shrub.
 - Avoiding/minimizing deforestation.
 - Avoiding a complete change of bush/shrub to other land-use types.
 - Promoting both in situ and ex situ biodiversity conservation methods in the Region
6. Interventions for climate change

To address the causes of climate change and minimize future catastrophic consequences, *accelerated action* is urgently needed on mitigation. At the same time, adaptation to climate change and weather variability at both local (farm) and institutional levels could be implemented at varying scales.

Farm-level adaptation practices may include:

- *improving input use*-the application of animal manure to the soil which reduces inorganic fertilizer use can improve soil water structure and water holding capacity and overall farm moisture conservation.
- *on-farm water management* which involves efficient utilization and proper water management for farm operations. it includes modification of irrigation techniques, adoption of water-efficient technologies, and improved water harvesting practices.

- *modification of crop calendars* (early sowing of crops that can mature within a short period and adapted to the local climate).
- *diversification of farm operations* (agroforestry practices).
- *undertaking soil management practices/ conservation tillage practices/* such as minimum/reduced tillage and zero tillage.
- *selection of drought-resistant crops.*
- harvesting to accommodate weather variability.

Institutional level adaptation measures may include:

- development of drought-resistant crop varieties, development of efficient technologies, and weather forecasting.
- *continuous research* to investigate the way local practices and innovations respond to climate-change-related challenges, if only to better inform policymakers and other stakeholders of the potential role local capacities can play in local adaptation, and to trigger a process of recognition and reflection.

7. Establish regular environmental monitoring and evaluation system

- *Environmental Management guidelines* will be prepared jointly with each implementing sectors and there have to be regular progress reports of implementing sectors to the regional Environment, Forest and Climate Change Authority (OEFCCA) at the end of every quarter.
- OEFCCA has to conduct monitoring and evaluation works every *two quarters* to check the validity of the reports provided by the implementing sectors and to obtain information on adverse environmental impacts, at any instant, and take appropriate advice or corrective measures as required.

Opportunities

Natural resources will form the basis for rapid socio-economic growth and coupled with environmental protection, progress towards sustainable development shall be enhanced. Specifically, the following opportunities are worth mentioning

- *country's readiness to follow the green economy development path*, its environmental benefits, and carbon trading opportunities.
- *increasing leaders' commitment, better institutional arrangement, policy, and legal instruments* to ensure environmental protection.
- *diverse agro-ecology*, ranging from hot and desert areas below sea level to humid and temperate highlands, presence of biodiversity (wild and domesticated), suitable for most agricultural activities.
- *growing trends in the political commitment of leaders* to go as far as it takes them to implement sustainable agricultural practices in the region.
- *increasing technical capacities of the institution* to implement the environmental laws at all levels.
- *a paradigm shift in the awareness of the general public* to resist the wrong practice that leads to environmental pollution and zero tolerance to shoulder further environmental risks.

Way Forward

The regional government and leaders should consider the following environmental recommendations during the implantation of agricultural transformation in Oromia.

- a) Government officials at all levels need to understand that *sustainable agricultural development* must serve as a cornerstone in the transformation of agriculture in Oromia and environmental protection requires the cumulative commitment of all stakeholders.
- b) Government officials at all levels need to commit to *reverse the current trend of economic development at the expense of environmental degradation and pollution* as well as at the cost of living.
- c) Government officials at all levels need to *consult the professional experts and follow the trend of knowledge-based decisions* as far as environmental protection is concerned rather than passing decisions for the consumption political benefits as it was the trend for the last decades.
- d) *Key stakeholders should coordinate and discharge their responsibilities* at maximum scale to replace poor farming practices that lead to adverse environmental impacts and climate change by scientifically accepted modern farming practices.

- e) *Agrochemicals should be handled in proper* care not to damage the surrounding environment. It should incorporate human and environmental safety to control long-lasting direct and indirect residual effects that give rise to soil and water pollution.
- f) the Government, development agencies and policymakers need to design policies that enable farmers to cope with the adverse effects of climate change in line with:
 - empowering them to take appropriate steps to adjust their farming practices.
 - facilitate access to credit markets.
 - ensure farmer-to-farmer extension services.
 - pay due attention to *synergies among adaptation and mitigation practices* through sink enhancement measures such as; afforestation, reforestation, and conservation of the available forest resources.
- g) *Professional experts must be given sole responsibility* to tackle environmental protection duties apart from obligatory political assignment as a campaign that usually diverts the focus from strong professional to political discourse.
- h) *Environmental and social impact analysis (ESIA)* should be conducted for any *agricultural projects in the region* and approved by OEFCCA before the commencement of the project.

Table 55 Proposed Initiatives for 2019/2020 Actions

No.	Project Title	Estimated Budget (USD)	Implementer/s
1	Ecosystem Restoration and Biodiversity Management in the Central Rift Valley Lakes, Oromia, Ethiopia	5,600,000	Oromia Environment, Forest and Climate Change Agency
2	Rangeland rehabilitation in Oromia Pastoral Ecosystems for increased quantity and quality of forage and sustainable natural resources management	25,000,000	Oromia Pastoral Areas Development Commission, Oromia Bureau of Agriculture
3	Wetland Ecosystem Restoration and Management in Jimma and Ilu Abba Bor Zones of Oromia	4,500,0000	Oromia Environment, Forest and Climate Change Agency, Jimma and Mettu Universities
4	Public Education and Awareness Raising on Sustainable Natural Resources Management using Mass Media and Schools	5,000,0000	Oromia Environment, Forest and Climate Change Agency

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CHAPTER IX: STRENGTHENING INSTITUTIONS AND ENABLING ENVIRONMENT FOR AGRICULTURAL TRANSFORMATION IN OROMIA

9.1 INTRODUCTION

The agricultural sector in Oromia has not been performing to the expected level. The average yield of major crops is below 3 tons per hectare. The trend in the yield level does not also show a high rate of increase to move the region out of poverty. Low productivity and growth are not attributable to only shortage of physical, financial, and knowledge resources, but also the withering situations in the institutional contexts. Proper institutional setting and enabling environment play a crucial role to optimize and effectively use physical, financial, and knowledge resources for economic development. This implies the need to further examine the institutional and enabling environment to be able to pinpoint institutional bottlenecks and suggest remedies. The identification of such bottlenecks blocking sectoral transformation would help one to design alternative strategies and policy interventions helping to build new institutions facilitating change. The transformation of agriculture comes when farmers start to act. Farmers as a firm are independent decision-makers, and internal and external factors and their interactions influence farmers' decisions. While farmers make their decision, institutions (formal and informal) designed by government, which are external to the farmers mustn't negatively affect farmers' decision towards transforming its agriculture, rather provide enabling context for it.

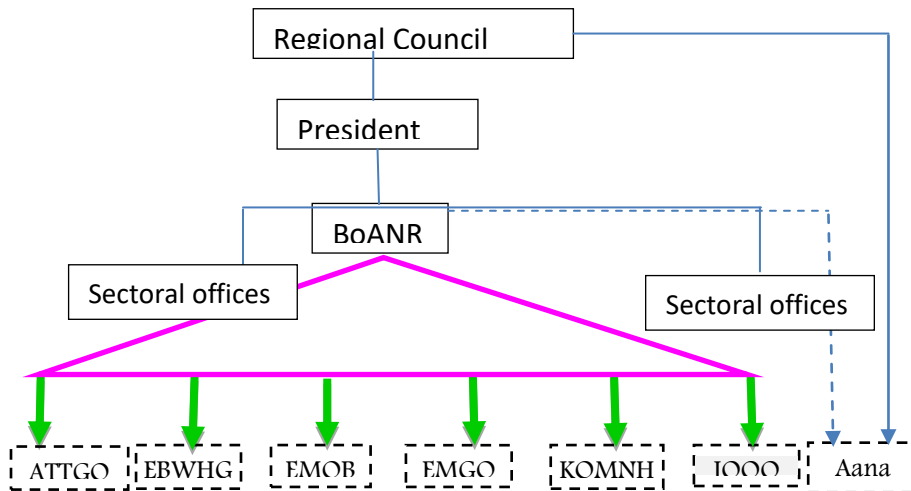
This document analyzes the key activities/functions and structural and institutional dimensions of the regional agricultural development landscape. The data needed for the analyses were collected through critical desk review and focused group discussion with key informants constituted from the various departments and affiliated institutions of the Regional Bureau of Agriculture and Natural Resources. Based on the analytical results, critical systemic bottlenecks have been identified. At the end, policy instruments and strategies that better facilitate sectoral transformation have been suggested.

9.2 SITUATION ANALYSIS

9.2.1 Structures and functions

How the government organizes its executive organs and their functions are important to facilitate and/or hinder development. For Oromia National Regional State, the president is the head of the executive organ, under which several sectoral executives are organized

(Figure 58). In addition to the policy-making, the regional council is responsible for allocating budget and overview of the implementation. Agricultural budget is allocated to the Agriculture Sector including the regional Bureau of Agriculture and Natural Resources and affiliated institutions at the region level, which is also shared for zones. Aanas are allocated a separate budget by the regional council and the regional Bureau of Agriculture and Natural Resources does not have the mandate to regulate its use.



ATTGO - Abba Taayita Galtewaan Qonna; EBWHG- Ejaansi Babal'ina Walda Hojii Gamta;
 EMGO - Eejensii Misooma Gabaa Oromiyaa; EMQB - Ejaansi Misooma Qabeenya Beeyilada;
 KQMHB- Koomishin Misooma Qindeessaa Horsiise Bula; IQQO - Insitiyuuti Qorannoo Qonna
 Oromiya

Figure 58 Structural linkage between institutions affiliated with the agriculture sector

In Oromia, power is decentralized to Aanas in 2002. This means that Aana is responsible to organize its executive structure, plan and execute development activities based on an unconditional block grants from the regional council. Thus, at a grassroots level, development activities are planned and executed by Aana. Similarly, there are sectoral offices at the regional level among which the Bureau of Agriculture and Natural Resources (BoANR) with its affiliated agencies and authorities lead the sector at the regional level. Currently, most of the sectoral offices are giving supports to the Aanas, executing projects, and compile reports that come from the Aanas. Horizontal linkage among the sectoral offices at the regional level is weak. This is mainly because, most of them are not implementers, and as such, they do not realize the problems faced during implementation to

push for coordination and strong link. However, they continue to reflect problems faced by Aanas.

In a well-functioning sectoral development system, financial, human, and physical resources (inputs) are allocated in a manner that ensures effective implementation of planned downstream sectoral development activities (see figure 59). This, in turn, is expected to result in key outputs that ensure the achievement of sectoral development outcomes and goals. However, the existing scenario in the region is quite different, where it is difficult to figure out how sectoral development goals (if it exists), activities, and inputs are linked.

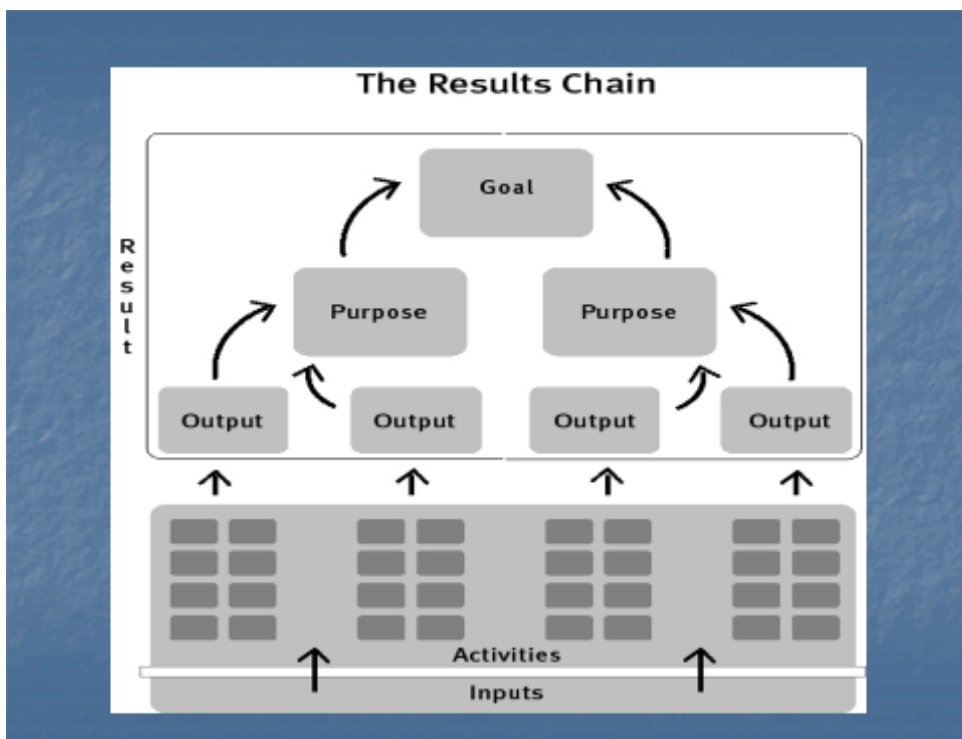


Figure 59 Results framework: structural link at different levels of inputs and outcomes

This is mainly because activity planning is done by Aanas, which are compiled at the region level. The region also includes strategic issues in the plan and it becomes the regional agricultural sector plan to be presented to the regional council. The regional plans are complementary to the Aana plan but not the entire plan of the sector where the BoANR takes full responsibility for its implementation. In terms of budget, the regional council allocates budget (unconditional block grant) to the Aanas, and it is up to the Aanas to

allocate the budget for the activities. The allocation of budget to the Aanas is not related to activities planned by the Aana. This is because of many reasons to be explained in section 2.3 below. The sectoral bureaus are supposed to support the implementation of activities at Aana level, and they can only give expert advice. This is because neither the plan nor the budget is from the sectoral bureaus, and thus the bureaus do not have the mandate to monitor and evaluate activities planned and executed by the Aanas. The other major role of the sectoral bureau is to compile a sectoral reports from the Aanas, which is initially compiled at the zonal level. Thus the linkage among inputs (budget), activities, outputs, outcomes, and goal is not clear.

9.2.2 Where does the agriculture sector fail?

Organizational structure provides systems of coordination, resourcing, and accountability. Leadership and governance then become instrumental to use the structure and powers vested thereon to realize regional agricultural growth plans. In Oromia, it appears that the organization of the sector at regional, zonal, and Aana levels are functionally disconnected. Compounded to this is the poor coordination, networking (linkage), enabling environment (infrastructure and actors' competence), resourcing, technical capability, and leadership. At different times, technically capable experts left the sector and joined federal as well as other non-governmental organizations. Lack of incentives and lack of enabling environment are the major reasons for high staff turnover.

Activity planning and budget allocation are not aligned as these are done separately: activities planned by the sectoral offices while budget allocation is more of a political decision. This means that there is no interaction between the budgeting and activity planning process. This is aggravated by poor M&E systems beyond reporting. Moreover, clientelism (client-patron relation) is the major institution in Oromia affecting how activities are planned and budgets are allocated eroding accountability in the system. This is related to party-fused executive structure prevailing in the region where everything is assumed to be accountable to the political party. Lack of appropriate capabilities at the level of individuals and organizations leading to poor technical and leadership competence of sectoral leadership at all levels hinders sectoral transformative development initiatives.

9.2.3 Analysis of institutional bottlenecks and enabling environment

- i) Functional disconnection: While decentralization is aimed at responding to the development need from the grassroots level, decentralization with no system of

accountability favored the development of pervasive patronage in Oromia. There is no vertical linkage between sectoral bureaus at the region level and the implementers at Aana level. This is influenced by the existing legal framework where Aanas are autonomous structure and the bureaus are supposed to only play supportive and advisory roles. This resulted in no accountability (coordination failure) in the system. Following the constitutional rights of Aana to govern their affairs, there is no functional and administrative connection between the Aana and zonal or regional BoANR. Institutions at higher hierarchy do not have much say in the management, staffing, and planning and implementation of agricultural activities of Aana. Rather, clientelism (client-patron relation), which is the major institution in Oromia, frame how government businesses are operationalized. This is ubiquitous at all levels of government administrative structure and is mainly the result of party fused executive structure, which is the dominant regime in Oromia. The regional bureaus do not have the authority to monitor the activities and account for the Aanas if some of the activities were not implemented. The council of Aana is expected to monitor the implementation of activities as the executives are accountable to the council. Although the theoretical power of the Aana council is recognized, practically the power is in the hands of the party-fused executive, who are the implementor. Thus, practically there is no M&E system in place and thus the executives at Aana are not accountable for their performance. The consequence is inaccurate information, the famous *gabasa sobaa*, passing through the pipe of reporting. The sectoral bureaus are the pipe through which this information in terms of planning and reporting passes.

- ii) Non-professional leadership: The agricultural sector is not led by professionals in the sector. Within the executive structure, competent professionals are missing at all levels of the structure, partly affected by the influence of politics and partly lack of enabling environment for professionals to freely exercise their duties. This has paralyzed the capacity to develop and implement development plans. Staffs are assigned not necessarily to do the core business of the sector, but what the client expects the patron to do. This emanates from preeminent power culture cultivating informal rules of the game such as corrupt/unethical operational culture, deleterious social norms and values, lack of trust, and pervasive patronage

behavior in resource allocation and utilization. This has resulted in poor sectoral competence at all levels.

- iii) Politics dominates decisions at all levels: The political party has the lion's share in the decision-making process, not only in staffing but also in budget allocation, and is the major client of the employees in the different sectoral offices. This client influences the priority of the Aana, budget allocation and thus the budgeted activities may not necessarily be for the development of the Aana, but to fulfill the interest of the client. In such a patronage system, there is no guarantee that the party is not used as a cover and the system is not used for personal interest.
- iv) Adaptation behavior to uncertainty: In Oromia, there is a widespread lack of confidence and risk-averse behavior hindering transformative undertakings. There is a lack of appropriate capabilities at the level of individuals and organizations, preventing access to new knowledge, eventually leading to incapability to adapt to changing contexts, to open up new opportunities, and to switch from an old to a new transformational trajectory. As a result, individuals and organizations remain in the path-dependency syndrome, where innovative perspectives are blocked. Such environments are not conducive for competent professionals, and the exodus of competent professionals that have been observed over the last two decades in the region is evidence.
- v) Inadequate budgeting and facilities: One of the major factors for not budgeting activities that directly affect agricultural output is the limited budget allocated to Aanas. Moreover, the process of budget allocation to sectors at Aana level lacks transparency. Most of the budget goes to salaries. Operational budgets are very much limited. From the remaining budget, a considerable proportion is also kept as reserve, which usually will not go to development activities. The remaining amount will be shared among sectoral offices, and thus experts have a limited budget for operational purposes. As a result, agricultural development agents and FTCs are not accomplishing their tasks to the expected level. Along with a lack of budget, lack of facilities, capabilities, leadership, and transformational strategy also contributed to low performance. In effect, no institutional and enabling environment ensures adequate allocation of budget for agricultural transformation in Oromia.

- vi) The low incentive for the agriculture sector: Agricultural experts say they are the least paid compared to education, health, and other related sectors. The sector suffers from low professional capacity in the organizations because of a lack of incentive (attractive work environment, career development, material incentive) to keep capable staff in the sector. Similarly, the political office holders tend delegitimizing professionals challenging the prevailing status-quo, creating an unfavorable environment for professionals, finally triggering exodus. Moreover, despite the role of agriculture as a source of growth, employment, export, food security, agriculture is the least incentivized in terms of import tariffs, taxation system, subsidy, credit, input supply, etc.
- vii) Lack of appropriate sectoral development strategies based on clustered opportunities that would accelerate growth and ensure the transfer of outcomes within the region and beyond. The current strategy of blanket approach does not lead to pronounced transformation given scarce resources. This implies good leadership should take the balance between accelerated growth in high potential areas and issues of equity. This may call for a more coordinated functional linkage between extension, research, input supply, services, value addition, and market development. The actors currently operate in a fragmented manner.
- viii) Institutional instability – agricultural institutions are merged or split too frequently often following federal level decisions. Institutional dynamism is necessary. But it should be based on critical evaluation of the performance and needs for more efficient service provision to develop the sector. Frequent reform creates instability, loss of confidence in staff, and loss of data and institutional memory.
- ix) Low efficiency in the use of external resources such as flagship programs and projects and coordinated use of resources injected by NGOs for better agricultural growth.

9.3 Recommendations

Agricultural transformation in Oromia needs more serious and decisive action. There is not much choice against this. Some of these actions can be done immediately while others could be done gradually, as they involve processes. The following are the major recommendations emanating from the above analysis:

- i) Segregation of executive structure from political party structure and create trustworthy relationship between professionals and those in the political wing. The

agriculture sector should be led by professionals at all levels. Leaders should be empowered to take sectoral decisions with accountability. If this cannot be assured, the rest of the recommendations may not bear fruits.

- ii) Develop formal institutional mechanisms to ensure budgets are allocated according to plans. There should be alignment between budgets, activities, and results framework. Expecting output without inputs is a futile exercise. It is also important to ensure that an adequate budget is allocated to inputs that are expected to result in higher outcomes.
- iii) Establish vertical linkage between the district, zone, and regional bureau and ensure accountability and effective coordination of sectoral activities. The higher hierarchy should have a say on technical issues and sector leadership assignment process. This becomes crucial when Aanas cannot effectively monitor the development activities of the Aana. The suggestions being made can be realized without jeopardizing the constitutional rights of Aanas and mere commitment to ensuring technical and leadership efficiency and hence resulting in high agricultural growth.
- iv) Due to its large size and importance, the region attracts huge programs and project resources e.g. flagship programs and several NGOs operating in the region. The region should establish a mechanism for more efficient and effective use of such resources.
- v) Review the structure and functional mechanisms of the BoANR and its affiliates and re-construct a more stable and effective organizational set-up for the sector. This should be done professionally and with critical analysis as frequent restructure is a major source of instability, a disincentive for experts, loss of data and institutional memory, and more than any think paralyzed functions at the grassroots.
- vi) Focus on professional capacity building for implementation. Employment of high caliber technical and managerial staff, building the capacity of the existing staff, and creating enabling environment becomes crucial. With these conditions, investment in innovative approaches and technologies and strategic interventions can transform the agriculture sector of the region.

Appendix Table

Appendix Table 4 List of participants on Transforming Agriculture in Oromia Agenda

Name	Organization	Responsibility	Transformation agenda of team members
H.E. Mr. Shimelis Abdissa	Oromia President	Chairperson	Promoter
Dr. Girma Amante	BOANR	Co-chairperson	
Mr. Dhaba Debele	BOANR	Owner	Initiator
Dr. Mandefro Nigusie	EIAR	Owner	Initiator
Dr. Feto Esimo	IQO	Organizer	Promoter
Dr. Abera Deresa	IQO	Organizer	Promoter
Dr. Asseffa Ta'a	IQO	Organizer	Promoter
Dr. Bezabhi Emana	Privet	Team leader	
Dr. Mohammed Hassena	ISSD	Secretary	Institutions and enabling environment
Dr. Diriba Galati	EIAR		
Dr. Sofia Kasa	EIAR		
Dr. Getachew Diriba			
Dr. Amsalu Ayana	ISSD	Team leader	
Dr. Tolosa Debele	EIAR	Secretary	
Mr. Teshome Bogale,	IQO		
Dr. Gemechu Kanani	EIAR		Technology generation service
Dr. Fekede Fayisa	EIAR		
Mr. Kedir Wako	IQO		
Dr. Chimdo Anchala,	ATA	Team leader	
Mr. Taha Mume,	IQO	Secretary	Extension service
Mr. Deresse Teshome	EIAR		
Mr. Ayana Mirkena			
Dr. Taye Tessema,	EIAR	Team leader	
Dr. Kefena Ifa,	BoA	Secretary	
Mr. Rata Wagari,	ATA		Agricultural input (seed, feed, fertilizer, agro-chemicals, breeds)
Dr. Asfaw Negassa,	Private		
Dr. Tafes Gebru	ESE		
Mr. Serbessa Negera,	Private		
Dr. Lema Fita,	EIAR		
Dr. Ulfina Gelmessu,	EIAR		
Dr. Tesfaye Kumsa	Private		
Dr. Bayeh Mulatu	FAO		
Mr. Eshetu Ararso	IQO	Team leader	Irrigation

Dr. Tilahun Wordofa	EIAR		
Mr. Lamessa Oljira	EWWSSE	Secretary	
Dr. Amana Wako	Adama Un.	Team leader	Agricultural
Mr. Bisrat Getnet	EIAR	Secretary	mechanization
Mr. Mulugeta Enki			Agro-ecology
Dr. Birhanu Danu	AAU		based
Mr. Abebe Diriba	ATA		production and
Mr. Kefyalew Tulu	OAIP		commercializat
Mr. Gemechis Melaku			ion
Mr. Reta Gudisa,		Team leader	
Dr. Beyene Taddese	Private		Rural finance
Mr. Teshome Yohannes	Private	Secretary	
Mrs. Lalise Bultuma	Private		
Mr. Getachew Mekonnen	NGO		
Dr. Gemedo Dalle	AAU		
Dr. Tadesse W/Mariam	AAU		
Mr. Tesfaye Kebede	OWWDSE		Natural
Dr. Birhanu Assefa	NGO		Resource
Dr. Yared Merdassa	OFECCA		Management
Dr. Tilahun Geleto	IQOO		
Mr. Kefyalew Assefa	IQOO		
Mr. Getachew Haile	IQOO		

