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## Agricultural challenges and future job opportunity of Ethiopian agriculture

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### Abstract

In the future decades, ensuring food security is one of the greatest challenges in Ethiopia. Most Ethiopians practice mixed agricultural activity which represents about 36.8% of the country's GDP. Therefore, this paper is devoted to reviewing the existing agricultural challenges and future prospects in the country. Majorly, it focused on the shortage of farmland, climate change, fragmentation and degradation of farmland, unevenly distributed constructions and urbanizations, pests, lack of integration among stakeholders, political instabilities, and its prospects. Despite the numerous challenges, Ethiopia has marvelous opportunities like the commercialization of fruit, vegetable, and ornamental plant productions. The country has also ample opportunity in the areas of animal production that ranks first in Africa in the number of livestock heads. The country has a huge labor force and water resources. Its proximity to Middle East markets is valuable to transport fresh products within a short period of time to the needed destination. However, Ethiopia's current fruit, vegetable, and animal production for export are very limited because of fragmented cultivation and lack of quality. The country has also a great variety of climate and soil types that enables it to grow a diversity of horticultural crops. Therefore, emphasizing agriculture in Ethiopia requires the political as well as the economic commitment of all parties concerned.

**Keywords:** Challenges, climate change, deforestation, landlessness, lack of integration, land fragmentation, land degradation and urbanization

### 1. Introduction

In the coming decades, ensuring food security for the Ethiopians will face great challenges. This is because of the rapid increment of population, change of fertile farmland to construction for the urban dwellers, climate change, decline of available natural resources, inflation of basic needs, young unemployment, political turmoil, and civil conflict (Alemu & Mengistu, 2019 <sup>[4]</sup>; FTF (Feed the Future), 2018 <sup>[48]</sup>; Simane *et al.*, 2016) <sup>[91]</sup>. Overcoming these challenges requires a greater commitment of the governments, nongovernment, and other international organizations to assurance the people's basic needs and inspire the citizens to commercialize agriculture through improving infrastructures, provision of incentives and export the agricultural commodities.

International governments and organizations could support the country not only by the provision of credit and donation but also should make sure that the political and economic environment for permitting the intended goals. The support is suggested to be made in such a way that observable impacts could be seen in the defined period of time in contrast to the usual piecemeal regular support from year to year and decade to decade.

The food demand and price are increased in the recent decade than ever in Ethiopia. The variability of food price increment occurs within a short period of time, season and years. For instance, the wholesale price unit of maize grain in the capital city of Ethiopia (Addis Ababa) alone increased from 1,469 to 5,013 from 2005 to 2012 in Ethiopian Birr (ETB) per ton (FAO (Food and Agricultural Organization of the United Nations), 2015) <sup>[109]</sup> and the price is tripled in the last five years. The overall food prices in Ethiopia were inflated from 7.4 to 15.8% between the years of 2014-2019 (<http://knoema.com/atlas>). Such food price inflation creates political instability, disorder, chaos, unemployment, malnutrition, hunger, poverty, imbalance, and inefficient resource distributions among the nations and further intensifies the international security problems in the horn of Africa (Cohen & Garrett, 2009; Chakraborty & Garrett, 2002) <sup>[23, 21]</sup>.

The urgency and complexity of the problem of lack of food self-sufficiency, the inefficiency of economic development forced the Ethiopia government to secure food at very high cost (FAO, 2011) <sup>[37]</sup>; USDA (United States Department of Agriculture), 2010). On the other hand, the agricultural problems in the developed and developing countries like Ethiopia are not the same. In Ethiopia, it is characterized by high-input and resource-intensive farming systems that harmoniously caused losses of important microorganisms, massive deforestation, freshwater scarcities, soil nutrient depletion, and high levels of green-house gas emissions and then hindered agricultural outputs (FAO, 2017) <sup>[46]</sup>.

Ethiopians have dominantly practiced a mixed agricultural activity. Their livelihood is mainly based on tilling and herding of mammals and birds with little transformation for a long period of time in history because of religion and cultural preference (Diriba, 2020) <sup>[28]</sup>. However, agriculture is still the backbone of the country which represents about 33.88% of its GDP (Plecher, 2020) <sup>[86]</sup>. The agricultural sector of Ethiopia has shown remarkable resilience over many centuries though it is now increasingly failing. The country is known for the regular food shortage that occurred due to droughts, sudden outbreaks of natural disasters, pests, lack of rainfall, and shortage of technological advancement in the past centuries. Therefore, improving the implementation of extension service in agronomic practices, afforestation, protection of livestock and crop plants, accessing financial support, and accessing time-based markets can improve the livelihood of the community (UNCTAD, 2017) <sup>[101]</sup>. Political instability, weaknesses of successive strategic development policies and shortage of financial assistance in the country is the root cause of the problem. Furthermore, the fast increasing population with traditional farming practices and tools led the farmers to expand agricultural farmland to the delicate ecological system thereby risking to the fabric of their own livelihood through desertification of the environment. Lack of sustained and intergenerational commitments to transform the legal or constitutional system for millennia made the country liable. In Ethiopia, agriculture is started during the Neolithic revolution era, ten thousand years ago. It began with the domestication of crops and animals. The farmers continued to utilize their ancient system of production despite changing ecological and population pressures. Ethiopia's population is growing into the 21<sup>st</sup> century with their generationally acquired wisdom and skills.

Ethiopia's agriculture heavily relies on oxen plow and rain-fed that by neglecting other alternative technologies since the time of the Neolithic era (Diriba, 2020) <sup>[28]</sup>. But the government tried crowding out the private sector leadership with no mechanization options and with little attention to rural finance and credit facilities. It also did not indicate methods of curbing environmental degradation that could result from the lease of the natural resources to private investment be it agriculture or mining. The problems related to basic infrastructures like roads, hydroelectric generation plants, irrigation tools, and other farm equipment availability in the country and limitation of foreign currencies for importation also limited the attractiveness of the agricultural sector to private investors (Diriba, 2020) <sup>[28]</sup>. In addition, political instability, the economic and social crisis in the Middle East countries, has their own negative impacts on Ethiopian agriculture (Bataineh & Zecca, 2016) <sup>[11]</sup>. According to Diriba (2020) <sup>[28]</sup>, the practice of mechanized agriculture in Ethiopia is estimated at 0.7% for land preparation while it is less than 0.8% for crops thresher machines. These still indicated very little transformation in the utilization of technologies in

production. Although important it was, in Ethiopia, academic workers have never been recognized as important developmental issues. A little modification has been made to bring internal transformation in the thinking and working habit of the people in the past century. However, traditional agriculture is inefficient to feed these populations unless further modifications are implemented in the policy of the country. These policy regulations may include changing the current fragmented agricultural activities into unified mechanized farming systems as a strategic developmental plan. Such developmental policy should take into account religious preference, cultural habits of the people, and protection against losses of biodiversity by strengthening the successive strategic plans. Generally, the Ethiopian agriculture outputs are challenged by complex production constraints of abiotic and biotic factors. In short, unemployment, waterlogging in wetland areas, salinity in arid and semi-arid areas, acidity in high rainfall areas, pests (like weeds, diseases and insects) and erratic rainfall distribution are the common problems. In addition, the country's agriculture highly depends on rain-fed. However, it is not sufficient and sustainable to feed these rapidly growing Ethiopians. The impacts of the mentioned problems vary across the country, and from place to place. For instance, waterlogging is highly problematic in Vertisols of the highlands while salinity is in lowland areas of the country (Merga & Ahmed, 2019) <sup>[73]</sup>. The technological input like synthetic chemical fertilizers has also increased the acidity of soil from time to time in high rainfall areas. The mono-cropping system of some crops in the central highland of Ethiopia also led to nutrient depletion (Merga & Ahmed, 2019) <sup>[73]</sup>. Therefore, this paper is devoted to reviewing agricultural challenges and prospects in Ethiopia based on the available literature.

## 2. Challenges

### 2.1 Shortage and landlessness of arable farm land in the highlands

Arable land refers to the potential of land where its soil and climatic conditions are suitable for growing crops and rearing animals. It is settled with low population density and not protected by any land right regimen. Arable land is the most basic resource for farmers' life which the majority of the energetic Ethiopians lacked or too small to use because it is divided into a number of small-sized parcels, degraded, fragmented and infertile. Nevertheless, arable land is an indispensable resource for Ethiopians to secure food and food self-sufficiency. It is projected that by 2050 the Ethiopia population will be estimated to be 171.8 million by increasing at a rate of 2.5% annually (Bekele & Lakew, 2014) <sup>[13]</sup>. This will demand an additional billion tons of cereal grains and 200 million tons of meat to be produced annually (FAO, 2017) <sup>[46]</sup>. It increased by around 70% based on the current estimation backgrounds. Ethiopia will be ranked fifth in the rate of population increment globally (UNDESA (United Nations Department of Economic and Social Affairs), 2019) <sup>[104]</sup>. This report indicated that India, Nigeria, Pakistan, the Democratic Republic of Congo, Ethiopia, Tanzania, Indonesia, Egypt, and the United States of America in descending order of population increment. This report also indicated that around 2027, India will be ranked first in the world by the population followed by China. The population of Sub-Saharan Africa countries projected to be doubled by 2050 (increased by 99%) (UNDESA, 2015) <sup>[103]</sup>.

In Ethiopia, the scarcity of arable farmland and landlessness increased than ever in general and very high in the highland

areas in particular (Diriba, 2020) <sup>[28]</sup>. It is a serious problem of rural livelihood (Belay *et al.*, 2017) <sup>[15]</sup>. It is also complicated by unequal distribution among the householders. This influenced the levels of income, opportunities, and ownership of assets. The poor farming system such as mono-cropping contributed to soil degradation and nutrient depletion and consequently low yield (Marais *et al.*, 2012) <sup>[69]</sup>. But there is a critical lack of comprehensive study on the extent of landlessness, its effects, and coping mechanisms in the country (Adugna, 2019) <sup>[3]</sup>.

In Ethiopia, the land is allocated to farmers by the state. Although the most smallholders cannot obtain more land except through resettlement and migration or wealth permitting registration as commercial farmers (Headey *et al.*, 2014) <sup>[57]</sup>. However, in recent times in Ethiopia resettlement of farmers to the new arable farmland or to other national regional states of Ethiopia are unthinkable. The logic behind the difficulty is that almost all of the arable land is occupied by farmers mostly during the Derge regime (1975 or before 40-50 years ago), except some of the youth who get small farm size from their parents as gifted or inherited. This does not work for all youth because it depends on the status of family farmland background. The farmland obtained in such a way is very limited to the individual capacity to work and difficult even to plow by oxen-power than tractor. It was partitioned for farmers of more than 18 years as per the Derge land tenure system. This is frequently partitioned up to 1991. It also reduced the plot size of farmland (Crewett *et al.*, 2008) <sup>[24]</sup>. Based on this background, the state farmland provision for the farmer is more than 30-45 years and on average the current landowner is above 48-50 years of age at a minimum level. It is too old in the case of the current context or generations. At that time, the criteria of the provision of farmland are based on the number of families and cattle. The one who owns a large family and cattle received more.

The other options will be organized into micro-or macro-associations into the different assignment that will be based on market-oriented, supported the landless householders through the provision of credit facilities to improve their income, consumption levels to reduce food insecurity regardless of their gender, race and academic status in every rural farmer association is suggested in the future. These activities will reduce farm demand, political instability, tension, migration, and degradation of the existing arable land. Therefore, multiple stakeholders including farmers, agricultural organizations, political authorities, development practitioners, researchers, technology innovators, businessmen, investors and entrepreneurs.

## 2.2. Land fragmentation

The already small size farmland of a family is further fragmented into very small pieces of land when the children inherited since it divided among themselves. This is an impediment to increasing yield and rather leads to poverty and food insecurity. Because many family members will be becoming jobless since the land is not enough to engage them as full-time farmers. It has been discovered from the Ethiopian national survey that the relationships between yield, farm size, and land fragmentation have an inverse relationship that is, a positive association between yield and land fragmentation (Paul & Githinji, 2018) <sup>[83]</sup>. In contrast to this finding, Knippenberg *et al.* (2020) <sup>[66]</sup> reported that in Ethiopia, land fragmentation resulted in food insecurity and increased the amount of time spent moving from one parcel to another that lowered agricultural output and reduced productivity. It is also difficult to implement mechanize farms, inefficient to work on it to

secure the families demand because the small farm size cultivated is yielded lower. Therefore, farm size affects agricultural sustainability in the economy, social aspects and environmental performance of agricultural production, for instance, increasing farm size has a positive impact on farmer's net profit, economic benefits, technical and labor efficiency with mean coefficients of 0.005, 0.02, and 2.25 in China, respectively (Ren *et al.*, 2019) <sup>[89]</sup>. An increase in farm size is also associated with a decrease in fertilizer and pesticide use per hectare, showing clear benefits for environmental protection (Ren *et al.*, 2019) <sup>[89]</sup>. This report is agreed with the report of who indicated that farm sizes (at both the individual and community levels) are likely to be a key determinant of the demand for intensive technologies, such as plows, chemical fertilizers, high-yielding seeds and improved natural resource management practices.

Fragmentation of farmland affects the smallholder communities highly to produce in a sustainable manner following an inadequate policy that used to respond with the available endogenous technological changes and population growth (Headey *et al.*, 2014) <sup>[57]</sup>. In Ethiopia, the farmland is highly fragmented in the central northern parts than other parts (Figure 1).

The vast majorities of smallholder farmers of Ethiopia living in perpetually substandard conditions, relying on traditional systems, undercapitalized; farm on fragmented land, depleted soil fertility with high competition of pests, and low investment in agricultural inputs (chemical fertilizer, improved seeds and pesticides) (ATA, 2014) <sup>[8]</sup>. This made the farmers unable to withstand seasonal risks of crop failure or animal deaths that even worsen the problem and force them to live in continuous poverty and are hopeless. Many are now forced to rely on welfare assistance aid and dependent on imported cereals (Diriba, 2020) <sup>[28]</sup>.

Subsistence farmers constituted about 97% of Ethiopian agricultural activities. They farm on very small plots of fragmented land and often are used unsuitable primitive techniques that are not.

## 2.3 Climate change

Ethiopia is vulnerable to climate change. It posed a huge challenge to Ethiopians. Aragie (2013) <sup>[6]</sup> reported that Ethiopia has lost a cumulative level of over 13% of its current agricultural output between 1991 and 2008 followed by climate change. For instance, rainfall is one of the most noticed climate variables in the country. It varies from season to season and year to year across agro-ecological regions [(Dega (high land), Woina Dega (midland) and kola (lowland)] of the country (Shekuru *et al.*, 2020) <sup>[90]</sup> (Tables 4, 5 and 6). Its distributions over the country are strongly.

## 2.4 Land degradation and deforestation

More than 85% of the Ethiopian land is degraded to various degrees (Gebreselassie *et al.*, 2016) <sup>[53]</sup>. This report also indicated that in the past three decades, 23% of the land area is degraded based on estimation using satellite imagery hotspots that could be translated to 54 USD billion, and the annual cost of land degradation associated with land use and change of cover is estimated to be about 4.3 USD billion. It is also estimated that over 1.5 billion tons of soil per year are lost by erosion and flooding which could have added about 1.5 million tons of grains to the Ethiopian products (Lebeda *et al.*, 2010) <sup>[68]</sup>. The eroded soil resulted in infertile soil, low moisture-holding capacity and a low amount of yield per hectare to be produced (Lebeda *et al.*, 2010) <sup>[68]</sup>. It also declines the levels of arable land



availability (Campbell, 2011; Pender *et al.*, 2006) <sup>[20, 84]</sup>. Hitherto the most of the existing literature on Ethiopian agricultural development has focused on resource degradation as the root cause of constraints to sustainable production and productivity (Headey *et al.*, 2014) <sup>[57]</sup>.

Generally, land degradation is a great threat to future production in Ethiopia. It caused severe loss of fertile soil and disturbs the sustainability of land resources due to the low supply of organic matter (Gashaw *et al.*, 2014; Taddese, 2001) <sup>[49, 94]</sup>. Its rate has increased with increasing of Ethiopians, overgrazes, deforestations, utilizes of dung and crop residues for fuel and other uses. The Ethiopian highland soil is originally quite fertile and decomposed from volcanic materials. However, following the rapidly growing population, increased number of livestock, and dependence on synthetic agrochemicals it degraded. Organic materials such as organic manure and.

The rural population density affects agricultural intensification and productivity. Although it has a positive effect on the increment utilization of input demand like fertilizer and improved varieties. But increased input alone does not increase the food supply and staple crop yields and thus farm income declines as population density increases. This is why they are unable to sustain the demand of rising rural population density as the farm sizes declined (Josephson *et al.*, 2014) <sup>[64]</sup>.

### 2.8 Lack of integration

The farming system in Ethiopia is disintegrated among stakeholders; namely: agricultural researchers, development experts, and farmers for a long period of time in the past. The disintegrated practices cost more budget and even may not meet their purpose due to mismanagement along the multiple channels. The allocation and utilization of resources through the channels mainly face corruptions that ultimately resulted in food insecurity through jeopardizing crop and livestock production and fisheries. Hence, integration of all the concerned bodies including market channels, and reviewing the poor and weakest strategic development may partly solve the productivity and agricultural production problems. Encouraging the participation of investors in the agricultural sector would improve their income and opportunities of society in rural areas and reduce the root causes of migration and poverty in the future. Vertically coordinated, more organized food systems offer standardized food for urban areas and formal employment opportunities for both rural and urban areas. Such integration of agricultural stakeholders may improve smallholder livelihoods; shorten food supply chains and impact biodiversity through inclusive and resilient food production way.

Globally, countries are interdependent on the path of sustainable development but challenged by achieving coherent, effective national and international governance with clear developmental objectives and commitments to achieve (UNDESA, 2008) <sup>[102]</sup>. Working together to achieve food security is becoming a requirement in the current era. Governments must ensure all policy areas, including trade, education, finance, and health in integrations. The integral agricultural practices to sustain its

### 2.9 Political unrest

It is almost unbelievable that policymakers, scholars, and practitioners of the most advanced technologies failed to anticipate the problems of food security and agricultural development before they unfolded in Ethiopia (Diriba, 2020) <sup>[28]</sup>. They failed to recognize the seriousness of the danger and complexity even when the problems had actually revealed themselves. Ethiopia is the country where political unrest

occurred for a long period of time that affected agricultural productivity and production in the past and at present. These situations have resulted in the losses of resources, the rising tide of hunger and poverty. The political unrest was expressed in frequent protests that resulted in the loss of the existing resources of both private and public such as mechanized farm equipment, shelters, floriculture, personal house, shops, materials, other farm equipment, and tools of the researcher's institute and campaigns are a real crisis of visions that could bring a total failure of understanding, and unwilling to work devotional following this unrest and harassment especially discouraging private investors in the agricultural sector (FAO, 2019 <sup>[43]</sup>; ILRI (International Livestock Research Institute), 2017; ATA, 2014; ATA, 2013) <sup>[62, 8, 7]</sup>.

### 3. Future opportunity

Despite numerous challenges of agricultural activities, Ethiopia has marvelous opportunities like a commercial farming investment on fruit, vegetable, ornamental plants, and beef; the huge number of the labor force, water resources, and proximity to the Middle East and other African countries to ship products within a short period of time. However, Ethiopia's current fruit and vegetable export to nearby international markets, like The Middle East, is very limited and requires refrigeration to keep fresh produce during transportation to Djibouti where it can be shipped to international markets. Government policies regarding expanding of crop production to export fruits and vegetables to the international market to improve the citizen's income are encouraging (Wiersinga *et al.*, 2008) <sup>[11]</sup>.

Ethiopia is known as the water tower of East Africa. The country is endowed with ample water resources in central, western, and southwestern parts, except dry parts of the northeastern and eastern parts which may even be supplied from the water-rich areas of the country. About 0.7% of the country is covered with natural water bodies or lakes (MoWR (Ministry of Water Resources), 2002) <sup>[78]</sup> which is around 744, 400 ha (IUCN (international union for conservation of nature), 2010) <sup>[63]</sup> and the amount of water it holds is estimated to be 70 billion cubic meters. The amount of river-based water in Ethiopia could be 124.4 billion cubic meters (Berhanu *et al.*, 2014) <sup>[17]</sup>. It has also plenty of groundwater (Ayalew, 2018) <sup>[10]</sup>. In some parts, utilization of the water resources is hindered because of the undulating topography of the country. However, Ethiopia is almost rainfall-depen-dent as there are no practices of water harvesting technology (Ayalew, 2018) <sup>[10]</sup>.

FAO (2016) <sup>[36]</sup> indicated that in Ethiopia the water flows along the Nile Basin, Rift valley, Shebelli-Juba and the Northeast coast has the potential to irrigate about 5.7 million ha. But at present, about 2.7 million ha is utilized. The reason for the underutilization of the resources and water resources, in particular, are many, among which lack of technology and finance is just to mention a few (Table 10). This report also indicated that the Ethiopian government planned the development of small-scale irrigation to 1.7 million ha between 2015 and 2020. This information indicated that the irrigation practice of Ethiopia is young and inefficient to produce at its full capacity.

Most of the Ethiopian water flows to the Western direction (69.83%), following to Eastern (33.34%) as indicated in Table 11. The country misused these gifted natural resources in agricultural activities possibly mainly due to the political unrest characterized by the frequent war that weakened the economy rather than focused on development. Having a natural resource itself, may not lead a country to success through increasing

production and productivity unless used properly. The future focus of the Ethiopian government and people will be investing in infrastructure including the promotion of water development technologies, especially investing in irrigation that provides an opportunity to improve the productivity of land and labor (Bekele *et al.*, 2007) <sup>[14]</sup>.

Ethiopia is rich in animal genetic resources, both in diversity and population. Investing in the rearing of livestock and its products including live animals, meat, leather goods, and milk is a major source of foreign exchange and household consumption values (Gelan *et al.*, 2012) <sup>[54]</sup>. Furthermore, this sector requires marketing opportunities to export to foreign countries. In addition, it is required that establishing a policy of investment that supports producing hybrid cattle, sheep, goats.

#### 4. Conclusion

Ethiopia is characterized by agricultural challenges and bright future prospects in the sector. Traditional farming systems and low production and productivity well express the current Ethiopian agriculture. The rapidly increasing populations, depletion of soil fertility, landlessness, climate change, deforestation, political turmoil, and degradation of natural resources are among the current problems facing the country. Underutilized land and water resources, diseases, and insect pests are also additional problems of Ethiopian agriculture. The rapid population growth and the higher proportion of the youth are the current challenges facing Ethiopia as these younger generations are landless. The same could be a blessing provided that natural resources could be utilized as it is needed by the labor force. The future of Ethiopian agriculture is bright because of the fact that the country is gifted with a variable climate ranging from tropics (growing tropical crops like citrus fruits) to subtropics (growing crops like apples). It is the water towers of East Africa that can be used for irrigation agriculture and more importantly hydroelectric power for East African countries in an attempt to address the problem related to global warming. Ethiopia is a preferred destination for many investors and tourists because of the unique climatic conditions it possesses. The rapidly growing population is a source of labor to exploit the existing resources for agricultural-sector investors.

The rapidly increasing populations, depletion of soil fertility, landlessness, climate change, deforestation, and degradation of natural resources are serious problems of developing nations that need urgent actions. Ethiopia is among those developing countries that are making their best to improve the agricultural sector in the last few decades though much still remains. Overcoming these challenges is not an easy task. Therefore, it requires committed and greater efforts of government and its people. Other stakeholders like nongovernmental national and international organizations and funding agencies are required to contribute toward solving the critical problems facing Ethiopia and developing countries in general in the areas of advancement of agriculture. The countries of the world are interconnected and a problem of a country obviously becomes a problem of the others in the interconnected world at present than ever. Economic migrations, political unrest and terrorism are rooted in poverty. An attempt to address the problem of food shortage in moderation of prices and enhancing distribution across a globe in addition to supporting the agricultural productivity through improved technology is becoming part of the solution. If critical issues are not addressed the food price inflation creates political instability, disorder, chaos, unemployment, malnutrition, hunger, poverty, imbalance, and inefficient resource distributions among the nations which may lead to migration. Migration may affect

the policies, jobs and lifestyles of the receiving countries that may lead to the competition of the limited resources and worst to xenophobia as observed in South Africa.

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