

Review

The Role of Agriculture and Non-Farm Economy in Addressing Food Insecurity in Ethiopia: A Review

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Abstract: In Ethiopia, famine and extreme poverty are a result of insufficient food relief, poor macroeconomic factors, climate shocks, undiversified livelihoods based on low productivity in rain-fed agriculture, coupled with institutional incapacity. To serve as a context, this paper provides a comprehensive review of the conceptual framework of human development and capability paradigm to food security. In addition, it highlights evidence and a comparative analysis of the Asian green revolution experience, and places emphasis on sustainable and intersectoral growth through agricultural transformation and promotion of rural non-farm economy agenda to reverse the trends of protracted food crises in Ethiopia. Rapid, science-led, and employment-intensive agricultural growth, accompanied by the promotion of the rural non-farm sector, is of great importance to the rural economy. These will bring about farm sector competitiveness and enhanced productivity, environmental outcomes, acceleration of human development, new opportunities provided to the small-scale food producers, and desirable changes to the rural landscape. The study further introduces a brief analysis of the prominent role of social protection instruments in strengthening food entitlements and basic capabilities, including individual agencies. It suggests that actualizing sustainable food security and hastening human development under Ethiopia's exclusive settings require the recognition of the rural economic heterogeneity as well as holistic and pragmatic policies, which promote sustainable and inclusive growth.

Keywords: agricultural transformation; non-farm economy; food entitlement; poverty alleviation; sustainable human development; Ethiopia



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1. Introduction

Food security remains a core dimension of the human development and capability paradigm, Sustainable Development Goals (SDGs) as well as the development agenda of the African Union [1–4]. The concept of food security has been subjected to multiple evolutions, hence, its first definition in the Hot Springs of United Nations Conference on Food and Agriculture in 1943. The development of the doctrine concludes with the concepts of availability, accessibility, utilization, and stability in all dimensions, which shape the four pillars of food security [5–7]. The Committee on World Food Security defined food security as “a condition that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” [7].

Strengthening food availability and entitlement underpins basic human capabilities and sustainable human development, namely, “well-nourished people exercise their freedoms and capabilities in different domains—the essence of human development” [8,9]. The food security agenda reflects the understanding and interpretation frameworks of key stakeholders. Such discourses or frameworks shape the governance and development pathway [10].

Both Sen's entitlement approach [11,12] and capabilities analysis [13,14], which is a keystone of the human development and capability paradigm, remain fundamental to the conceptualization of the determinants of nutritional deprivations. The entitlement analysis addresses famine as socio-economic predicament rather than food availability challenges, and alludes to four different mechanisms through which households avail themselves of food, including production (production-based entitlement), sale or barter of physical assets (trade-based entitlement), sale of labor power (labor-based entitlement), informal gifts from individuals and formal transfers from government (transfer-based entitlement). Entitlement can further presuppose a household's capability to express effective demand for food [15].

Another more political lens, which attributes food insecurity to the governments and the "aid-industry", considers food crisis as the natural outcome of economic and political systems rather than failure of food-supply, development, livelihood systems, or climate change [16,17]. This perspective recognizes famine as a crime, and reproaches political systems to breach the social contract and allow famine to occur or increase. It also attributes food crisis to the relief industry, which often declines to collaborate with public entities or authorities arguing the principle of neutrality [18].

Burchi and De Muro [19] explored the nexus between food availability and nutritional capabilities, and facilitated the concept of food security by proposing a framework for the analysis of these issues through a human development and capability lens. Assessing food security through this approach is rooted in three basic steps: (1) analysis of food entitlements; (2) analysis of basic nutritional capabilities; and (3) analysis of the capability to be food secure. The authors assert that this approach enables an analysis that transcends incomes, entitlements or livelihood related frameworks, and determines the root causes of food insecurity. Thus, food insecurity can stem from deprivation of basic capabilities, which determine people's wellbeing, positioning the study of food security within the broader conceptual framework of wellbeing, freedom, and development. The authors further argue that the scale of proceeds and endeavors of low-income households can affect their living, chances of emancipating from poverty, and food insecurity. Such actions include diversification of income-generating activities or adoption of coping strategies for food security in the long run.

The Universal Declaration of Human Rights was adopted in 1948 to advance and guarantee the freedom and dignity every individual is entitled to without discrimination. One of these rights is the right of people to a quality life. It is generally acknowledged that every human being should have adequate conditions of livelihood with effective and functioning entitlements to guarantee these rights, notably food and necessary social assistance and security. This underpins and further substantiates the opportunities for positive synergies between social protection and food security [20]. Social protection approaches emphasize the urgency to protect people from the detrimental effect of risks and shocks and support strategies like safety nets [21,22].

Humanitarian discourse conceptualizes hunger and food insecurity as a consequence of disaster such as war, and drought that can trigger food production failures. The development approach attributes food insecurity to chronic poverty that raises people's exchange entitlement failures [23]. This development discourse of food security focuses on the necessity for the demand-steered policies in agriculture and rural economy [24,25].

Agricultural transformation is acknowledged as the only sustainable pathway and pro-poor economic growth in Sub-Saharan Africa (SSA), by driving growth in the overall economy and facilitating the absorption of excess labor through growth in the rural non-farm economy [26,27]. In the continent, the green revolution strategy sponsored by firms and humanitarian agencies, particularly the Rockefeller Foundation and the Bill and Melinda Gates Foundation, which established the Alliance for a Green Revolution in Africa, has become salient in the new millennium [28,29]. Agricultural transformation during the green revolution from 1960 to 1990 shaped the rural economies of Asian and Latin American countries. However, the adoption of similar policies in Sub-Saharan

Africa (SSA) had limited success, owing partly to locally unsuited seed varieties [30] and failure of human and institutional capacity [31]. Thus, Sub-Saharan African countries must put emphasis on holistic and pragmatic policies aiming at sustainable growth through agricultural transformation and the broad-based rural economy.

There are linkages between agricultural transformation, economic growth, and poverty alleviation in Ethiopia. Within the past decades, the country's economic growth averaged 10.9% per year since 2004 with 8.3% as annual per capita growth. This performance positioned Ethiopia amongst the world's rapidly developing economies [32]. The agriculture sector in Ethiopia represents 40% of the Gross Domestic Product (GDP), 80% of exports, and about 75% of the labor force [33]. Growth in agricultural value and total farm factor productivity in Ethiopia accounts for 8.35% and 2.68%, respectively. Every 1% in agricultural growth implies 0.9% decline in poverty, while every 1 United States (US) dollar generated from crop production stimulates a further 1.23 US dollars in the nation's economy [34,35]. Although the rate of utilization of improved seeds was only 5.6% in 2016, a percentage increase in use of improved seeds results in 0.14% reduction in poverty rates. Likewise, each percentage growth in cash crop production induces 0.58% in poverty alleviation.

However, the state of agriculture in Ethiopia is progressively declining as a result of numerous challenges. For instance, only 34% of agricultural households used fertilizer in 2016. In addition, only 5% of farmlands are under irrigation and smallholder farmers' crop productivity is far below the regional average [33,36]. About 38% of smallholders cultivate 0.5 hectares (ha) and often cannot achieve their family's consumption needs [37]. In spite of the low productivity, post-harvest food losses range from 15% to 27% for maize, wheat, haricot bean, and sorghum, often due to pits and mud storages or pests, fungi, rodents, and other animals that destroy grains [38]. There is deficiency of accountable and operative administrative capacity, absence of continued intergenerational commitments to changes, legal restrictions, government crowding out private sector leadership, and inadequate mechanization and supply of agricultural inputs. Input and output price restrictions are also problems for smallholder farmers in this 21st century. Some of these constraints are the sale of imported cereals at subsidized prices that reduce price of local grains, deficiency in access to agricultural technologies, credit facilities, and agricultural inputs and failure of scientific research [37]. Lack of adequate policy instruments to stabilize the price of agricultural products and protect the profits of peasants constitutes another key challenge for farm households. The absence of this mechanism coupled with uncoordinated food support erode peasants' inducement for higher productivity and output and stimulate downward pressure on cereal prices, generally below costs of production [39].

Despite these challenges, intersectoral or inclusive and sustainable agriculture-led economic growth, enhanced nutrition, improved resilience of authorities and vulnerable population, supportive regulatory surroundings will constitute a sustainable solution to Ethiopia's protracted poverty and food crises. Agricultural transformation in Ethiopia will depend on administrative, societal, and technological adaptation, commitment to rebuilding and enhancing farmers' living standards [37].

In Ethiopia, in the face of low agricultural productivity, destitute households with fewer non-agrarian skills are pushed into low-paid non-farm activities to maintain food security. In the country, the percentage of households' participation in non-agrarian income-generating activities is 27% at national level. Rural non-farm employment enables them the generation of supplementary incomes and assets accumulation required for children education, cloths, health services, expenditures growth, and welfare [40,41].

This study addresses four questions, which are: First, what is the nexus between agricultural growth, food security, and pro-poor development? Second, what are the main drivers of agricultural transformation as it was the case during the Asian green revolution? Third, how does agriculture relate to rural non-farm economy and what are the implications of both sectors for food security and poverty alleviation? Fourth, what prospective positive synergies exist between adequate social protection instruments and food security outcomes in the country's endeavor to actualize both "No Poverty" and "Zero Hunger"?

2. Drivers and Impacts of Poverty and Food Insecurity in Ethiopia

2.1. Causes and Effects of Poverty Incidence

Ethiopia is ranked 174th out of 188 low human development countries worldwide. The country's 2019 Human Development Index (HDI) of 0.485 is below the average of 0.513 for nations in the low HDI group and below the average of 0.547 for Sub-Saharan African countries. However, Ethiopia has sustained relatively substantial progress in the last 15 years. The progress in the country's HDI has resulted essentially from health outcomes, with life expectancy contributing more than the education sub-index and the income index. The country's multidimensional poverty index was 83.5% with a 58.5% intensity of deprivation in 2019 [37,42,43]. The rate of poverty and hunger was aggravated during the Derg regime [44]. Poor households in 2016 were more poverty-stricken compare with destitute households in 2011 [36]. Poverty is essentially a rural phenomenon in Ethiopia, owing to unequal access in terms of basic services between the rural and urban areas. For instance, the majority of children in agro-ecoregions have limited access to vital services compared to those in urban areas. The poverty rate dwindled from 30% to 24% in 2011 to 2016.

Among Ethiopian regions, poverty incidence in 2016 was highest in Tigray (27%), followed by Benishangul-Gumuz (26.5%), Amhara (26.1%), Oromia 23.9%), Afar (23.6%), Gambella (23.1%), Somali (22.4%), Southern Nations, Nationalities, and Peoples' Region (SNNP) (20.7%), Addis Ababa (16.8%), Dire Dawa (15.4%), and Harari (7.1%) [45]. In agro-ecological zones, the poverty rate in 2016 was 31.7% in drought-prone lowlands, 25.4% in moisture-reliable lowlands, 23.6% in moisture-reliable highlands, 21.9% in pastoral areas, and 20.8% in drought-prone highlands [36,45]. Figure 1 shows the poverty rate by agro-ecological zones in Ethiopia, 2016.

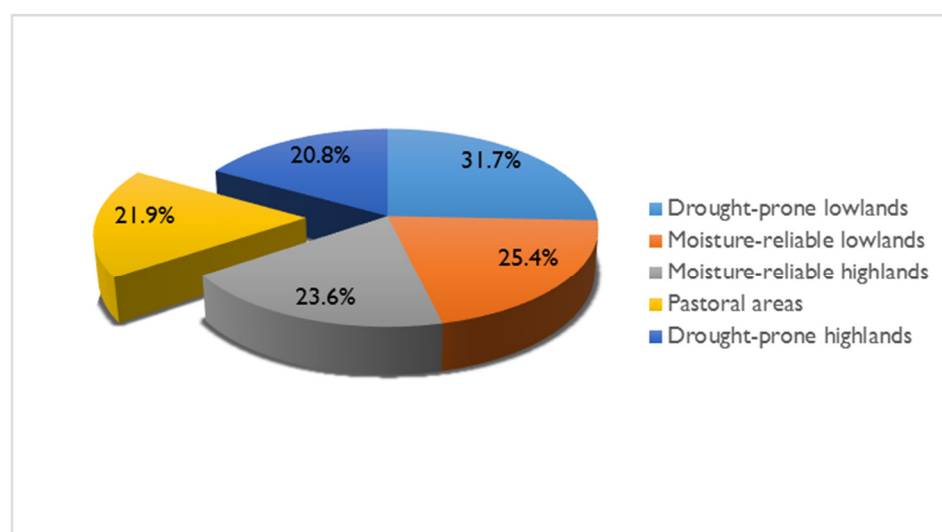


Figure 1. Poverty rate by agro-ecological zones in Ethiopia, 2016. Source: [45].

The share of multidimensional poverty in 2017 was 59% in Amhara and Oromia regions, 57.4% in SNNP, 53.7% in Tigray, and 50.6% in other Ethiopian regions [46]. Risk factors and shocks including drought, conflict, price fluctuations, flooding, illness, death of household members, particularly family heads, and joblessness trap households into poverty. This results in significant losses in consumption, incomes, and households' assets [47–50]. The situation affects smallholders' access to insurance systems, supply of credit amenities, participation in non-farm activities, diffusion and adoption of agricultural technologies in particular drought-resistant seed varieties, and water resource management amenities [51].

Although high prices and good weather guarantee the adoption of modern inputs, induce high returns and poverty reduction for well-endowed households who are well

connected to markets, the risk of falling into poverty is high, mainly for rural inhabitants due to their reliance on rain-fed agriculture [52,53]. Moreover, insecure land tenure system restrains long-term rural–urban migration, due to the risk of land loss by farmers [54]. In Ethiopia, despite most peasants benefit from urban spillover effects on agricultural prices and access to modern inputs, the magnitude of their profits is very marginal [55]. Although the figure indicates a decreasing trend in the poverty over the years, the rural sector is more poverty-stricken and this is a course of concern since the majority of the rural populations are engaged in agriculture. Figure 2 shows the trends of national, rural, and urban poverty in Ethiopia from 1995 to 2015.

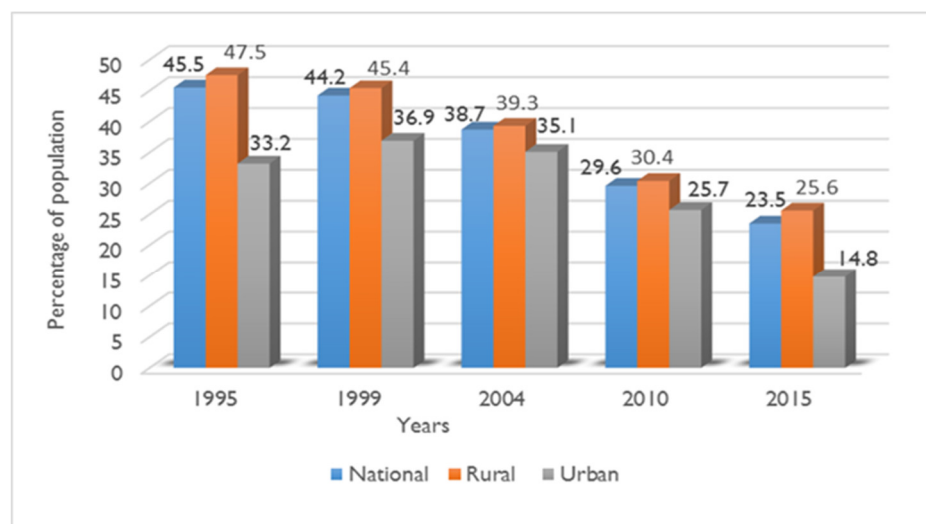


Figure 2. Trends of national, rural and urban poverty in Ethiopia. Source: [56].

2.2. Causes and Effects of Food Insecurity

Ethiopia is classified as a low-income food-deficit and protracted crisis country ranked 79th out of 84 nations on the global hunger index. The country records annual food crisis since the 1984–85 famine with average humanitarian relief by 21% [57,58]. Approximately, 57% of the population is food insecure, out of which 25 million are below the survival threshold [37,59]. Chronic and transitory food insecurity issues are acute, with 85% of the total population permanently at risk of food shortage [60,61]. From 2000 to 2016, household food expenditure dwindled from 65% to 51% with over 32% of rural households investing more than 65% of their incomes on food consumption compared to 18% in urban settings [62]. Across Ethiopia's regions, the incidence of food poverty was 32.9% in Tigray, 31.3% in Amhara, 28.3% in Afar, 17.2% in Gambela, 12.2% in Dire Dawa, and 6.3% in Harari [63]. In 2010, food prices shocks reduced consumption of urban households from 10 to 13% [52].

The adversarial impacts of incomes shocks result in 3% decrease in annual earnings in Ethiopia [64]. In 2011, drought in the Horn of Africa contributed to 30% of productivity failures, which resulted in a consumption decline by 15% in Ethiopia [65–68]. The 2015 El Niño-induced drought caused crop losses estimated from 50 to 90% in some Ethiopian regions and plunged over 27 million people into food insecurity, representing nearly 20.5% of households, of which 18.1 million required food support in 2016. About 31% of total households in Ethiopia, with 24% located in urban areas and 33% in rural areas, have inadequate caloric consumption (<2,550 kilocalorie (Kcal) per adult equivalent per day). Starchy staples amount to 71.4% of total calorie consumption, illustrating a highly unvaried diet [62,69].

The inadequate food production and persistent food shortfall results in the country's dependence of humanitarian food aid, reflecting the chronic nature of food insecurity [70]. Food relief has become an institutionalized response to address chronic food deprivations

in Ethiopia [71]. However, the rise of food aid flows dwindles both prices and peasants' incomes and ultimately limits domestic production [72]. Table 1 highlights the trends in local grain crops production and demand from 2012 to 2016.

Table 1. Trends in local grain crops production and demand from 2012 to 2016.

Year	2012/13	2013/14	2014/15	2015/16	2016/17
Population	85,838,000	87,952,000	90,074,000	92,205,000	94,352,000
Grain production (metric tons)	25,105,002	27,442,716	29,148,155	29,849,531	28,813,467
Domestic Production consumed (metric tons) 11	15,663,010	15,069,520	17,984,412	18,426,116	17,457,619
Per capita consumption per year (kg)	182.5	171.3	199.7	199.8	185.0
Food Needs (metric tons) 12	18,712,684	19,173,536	19,636,132	19,636,132	20,568,736
Deficit/surplus (metric tons)	(−3,049,673)	(−4,104,016)	(−1,651,720)	(−1,210,016)	(−2,622,456)
Deficit/surplus (percent)	−16.3	−21.4	−8.4	−6.2	15.1
Total Food imports (metric tons)	788,644	845,872	913,076	1,934,123	763,533
Per capita import (kg)	9.2	9.6	10.1	21.0	8.1
Per capita grains available including imports (kg)	191.7	180.9	209.8	220.8	190.2

Source: [73].

Climatic shocks coupled with violent and protracted conflicts in Ethiopia stem in displacement, migration, thereby affecting jobs and sustainable livelihoods opportunities, and constraint faster poverty reduction and food security.

Ethiopia is one of the biggest worldwide food-aid recipients and the largest in Africa. Food relief amounted to between 5 to 15% of total annual cereal production [74]. More than 7.8 million are permanent beneficiaries of social protection scheme under the Productive Safety Net Program. Every year, emergency humanitarian food relief supports an additional 3 to 5 million people. The numbers that invariably face risks and vulnerabilities are higher than both Productive Safety Nets Programme (PSNP) and urgent assisted populations [37].

In rural Ethiopia, endemic food crises, which are salient features of poverty, shape livelihood strategies, social interplays, rapports to the land and ecosystem, the pattern of production and consumption. Over the last six decades, low level of non-farm activities, inadequate management of natural resources, biodiversity and ecosystem losses, dwindling size of landownership, demographic pressures, and institutional capacity issues intensify the adversarial impacts of drought and induce depletion of productive assets and adaptation capacities [75,76].

Climatic shocks coupled with violent and protracted conflicts in Ethiopia stem in displacement, migration, thereby affecting jobs and sustainable livelihoods opportunities, and prevent food security and faster poverty alleviation. Cramer [77] refers to these displacements as “the separation of people from their means of production”.

There are three key groups of food crises experienced in Ethiopia. First, is the severe hunger accompanied by absolute consumption, assets breakdown, and high level of human and livestock mortality. Secondly, food disasters associated with acute food shortage during which humanitarian aid contributed to ward off the peril of massive mortality. The third group is the quotidian hunger that yields malnutrition, illness, low productivity, as people are unable to afford sufficient dietary requirements. Endeavors to overcome the challenges of food insecurity are limited in Ethiopia [57].

Three pillars, namely, dynamic emergency readiness, efficient development agendas, and appropriate management are fundamental to achieve structurally food security in Ethiopia [78].

3. Agriculture Linkages with Food Security and Poverty Alleviation: The Asian Experience

Enhancing food consumption and addressing extreme vulnerability are vital and urgent, as both form key sociopolitical issues, which often induce high levels of violence and unrest. Food security and shared prosperity through agricultural economic growth

are pivotal for social cohesion, stability, and survival of most political regimes [79]. Agriculture is also vital to promote high-level agricultural technology amongst small-scale food producers, environmental sustainability and decline in the Gini index of total income. Actualizing these multiple role of agriculture implies change in political economy to avoid anti-agriculture biases, and consolidate agriculture governance [80,81]. Structural transformation of agriculture has the potential to guarantee food security and promote human development.

Agriculture shapes food availability, exclusively with high-priced transport, precarious trade and imports. It defines food entitlements for poor people who depend on its production for earnings, job opportunities and sustainable management of natural resources. Agricultural intensification hastens linkages with rural non-farm economy, thereby, higher multipliers overall growth [82]. High productivity can be cost-effective with diffusion and adoption of advanced new technologies and outputs markets liberalization, which stimulates producer prices. Thus, public agricultural investments have high rate profits, thereby, adding to a country's aggregate gross domestic product (GDP) [83–85]. In the mid-1960s, India, Indonesia, and the Philippines enhanced small producers-powered agricultural growth through substantial public expenditures, which involved price guarantees to enhance smallholders' profits [86]. Over the years, agricultural transformation measures adopted by Asian countries included climate smart technologies, irrigation, investment in human and rural development, financial investment, and income diversification. Such diversification strategies are essential for households' wellbeing during the agricultural off-season, and constitute certain means of economic and social security for more people that are vulnerable.

The green revolution approaches are systematic transformations in agricultural practice pertaining to political, social, and economic systems. Policy assessment will capitalize on recognition of this transition as an innovation, which implicates complex interactions between a number of people, groups, structures, and corporations. This contrasts with conventional views that tend to apply a simplistic, linear theory of change where programs are implemented, cause changes in grower behavior, production, revenues, and poverty rates [87]. Green revolution agendas in Sub-Saharan African countries including Ethiopia should be the subject of thorough impact evaluations. Table 2 shows the poverty reducing effects of growth in agriculture in Africa compared with growth in other sectors.

Table 2. The effects of growth in agriculture on poverty in Africa compared with growth in other sectors.

Agriculture Sector	Impacts	Poverty Index	Others Economic Sectors
Agricultural gross domestic product growth per agricultural worker	Extra effective 2.9 times	Raising the average income of the poorest by 20%	than growth in non-agricultural GDP
1% surge in agricultural Gross domestic product per capita	Extra effective 2.7 times	dropping the \$1 a day poverty rate	than growth in industry
Agriculture gross domestic product growth	Extra effective 2.9 times	in dropping the \$1 a day poverty rate	than growth in manufacturing
1% surge of agricultural gross domestic product	Extra effective 3 times	in raising household expenditure in the poorest households	than non-agricultural growth
Agricultural Gross domestic product growth	Extra effective 4 and 1.3 times	in dropping the \$1 a day poverty rate and the \$2 a day poverty rate	than non-agriculture growth than non-agriculture growth

Source: [84,88–91].

Four intrinsic sectoral linkages illustrate how growth in agricultural income encourages poverty alleviation and food security. Direct effects on upstream production including for instance fertilizer, pesticides, packaging materials; direct downstream production growth, for instance in food processing; savings and investment linkages; indirect consumption linkages based on jobs and income growth linked to high agricultural production [15].

The substantial eradication of poverty can also result from the commercially oriented agriculture, with the poorest peasants profiting mainly through lower food prices, local la-

bor markets, expansion and adoption of technology and inputs [92,93]. Peasants can be connected to higher-value domestic and export markets through supply of raw farm commodities. Horizontal coordination of small-scale peasants is essential for inclusive value chains, which lower the transaction costs and increase the share of the value added [64]. Commercialization of production, especially export goods, supports growth of both cash incomes and food crops productivity that in turn contribute to enhance food security [94]. Globalization has the potential to strengthen the leading role of agriculture in overall economic growth of developing countries through high and rapid agricultural productivity unlike domestic consumption. In addition, globalization increases agriculture potential to enhance food security through strong multipliers to the vast, jobs-intensive, non-tradable rural non-farm economy [15]. Thus, agriculture cannot be treated as a residual sector for policy attention and investments as it accounts for 30 to 60% of aggregate GDP, 40 to 90% of the workforce, 25 to 95% of foreign exchange, and generates earnings to over half of the residents in developing world [95].

The success of green revolution in Asian countries exemplifies the powerful poverty-reducing effect of the diffusion of agricultural innovations. In India, Indonesia, Bangladesh, Vietnam, and China, growth in the food crop sector, especially in domestic rice production decreased food prices in urban and agro-ecological settings with substantial poverty eradication [83,96].

The green revolution started with transfer of plant genetics and high-yielding seed varieties. Viable use of declining arable land and water resources management, nutrition transition from cereal to meat and vegetables necessitate improved technology [97]. Biotechnology based on biosafety measures policies can contribute notably to minimize the problems associated with food insecurity and poverty [98,99]. Guidelines aiming at sustainable environmental, agricultural, and economic development underpin biotechnology legalizations and regulations policies. In India, promotion of well-regulated biotechnology by government through start-up programs, tax reductions, fund-raising, and support for academic and research institutions induced the creation of bio-agriculture and subsectors [100].

The progress of biotechnology must focus on sufficient safety techniques as statutorily enforced by the Cartagena Protocol [101]. This protocol provides an integrated strategy to the conservation of biological diversity, the sustainable use of natural resources, and the fair and equitable sharing of benefits deriving from the use of genetic resources. Biosafety is one of the issues treated by the Convention. This concept refers to the need to protect human health and the environment from the possible detrimental effects of the products of modern biotechnology. Meanwhile, modern biotechnology is acknowledged as having a substantial potential for the promotion of human welfare, specifically in actualizing pivotal needs for food, agriculture, and health care. The Convention also addresses the measures that parties should take at a national level, and sets the stage for the development of an international legally binding instrument to address the issue of biosafety [102]. The Protocol establishes procedures for regulating the import and export of living modified organisms (LMOs) from one country to another. There are two sets of policies, one for LMOs intended for direct introduction into the environment, called the advance informed agreement (AIA) procedure, and another for LMOs intended for direct use as food or feed, or for processing (LMOs-FFP) [103].

LMOs are also referred to as genetically modified organisms (GMOs), for instance seeds (for example, corn and soybeans) are key products of agricultural biotechnology that boosts crops protection and productivity [104]. This protocol seeks to “guarantee an adequate level of protection in the field of safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, considering also the risks to human health”. It further covers trade related issues [105] but does not change the rights and commitments of countries under the World Trade Organization (WTO) or already prevailing international treaties. The Protocol on Biosafety constitutes a “Biosafety Clearing House” system, enabling the exchange of environmental, scientific, technical, and legal information

on GMOs [101]. Moreover, it encourages innovation, development, and transfer of technologies, builds capacity for agricultural biotechnology, and ensures global conservation to actualize sustainable goals in agriculture [104].

Biotechnology adoption in Ethiopia is hindered by lack of clear policies to regulate it. The government needs to engage with significant stakeholders involved in this technology coupled with enhancing the capacity of researchers and an independent public knowledge on biotechnology systems [106]. The Asian green revolution experience is worth to emulate in Ethiopia and other African countries in general. Figure 3 shows the measures adopted by Asia to attain food security and alleviate poverty.

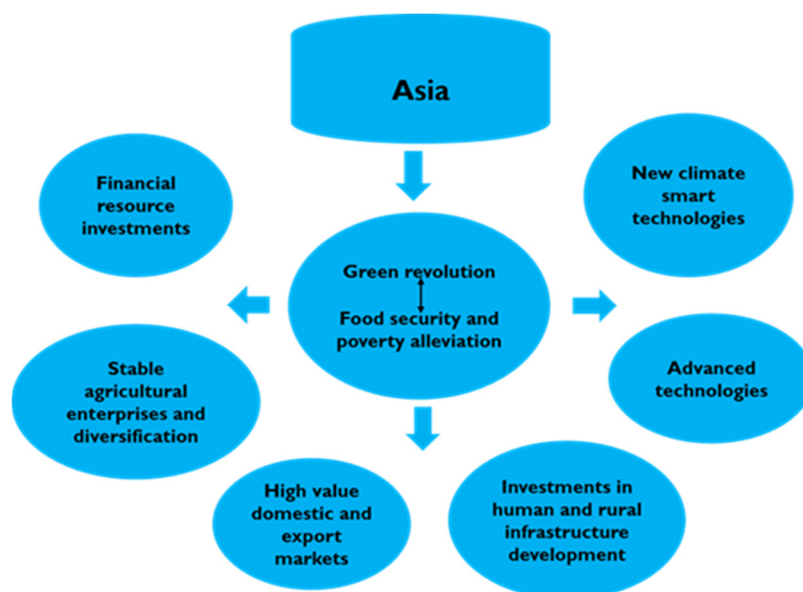


Figure 3. Illustration of measures adopted in Asia to attain food security and poverty alleviation strategy.

4. Importance of Climate Smart Agriculture for Food Security and Poverty Alleviation

Weather shocks reverse or offset a substantial share of gains in food security from technological progress and economic growth and exacerbate the low level of per capita food consumption. In Ethiopia, food insecurity patterns and rural livelihoods systems, notably agriculture, pastoralism, and agro-pastoralism, are extremely sensitive to changing climate due to their direct relationships with the ecosystems. These changes impair economic performance, and accentuate social and economic challenges, resulting in protracted crises, which sap household resilience in such a way that conventional coping strategies are non-viable [107].

Thus, a new transformative paradigm to holistic processes, notably agro-ecology, agro-forestry, climate-smart agriculture, and conservation agriculture based on indigenous and conventional practices, would preserve and sustain the natural resource base, whilst stimulating growth [108]. New climate-smart agricultural technologies help to enhance crop resistance and productivity [109]. Climate-smart and resilient agriculture involve investment of more resources, research, and pertinent policies that induce sustainable growth, higher farm incomes, food security, climate adaptation and mitigation strategies based on transfer of technologies, new strategies and models from environmental, and weather shocks perspectives [110,111]. This sustainable agriculture production system will promote maintenance of a permanent soil cover, minimum soil disturbance, diversification of plant species and contribute to achieve both “No Poverty” and “Zero Hunger” objectives in Ethiopia.

5. Agriculture Linkages with Rural Non-Farm Economy and Its Implications on Food Security and Poverty Alleviation

Several terms (off-farm, non-farm, non-agricultural, nontraditional) can be referred to employment in the rural non-farm labor market. Rural non-farm activities are non-agricultural activities performed in agro-ecoregions to generate income (notably remittances). In this regard, rural non-farm economy (RNFE) embraces value chain enterprises, for instance, agro-processing, transport, distribution, marketing, and retail, together with tourism, manufacturing, construction, mining, and self-employment activities (handicrafts, bakeries, mechanics, kiosks, and so on) [112].

There are also linkages between farm and non-farm activities. The rural non-farm economy in developing countries undergoes numerous stages of development that are pivotal for the performance of the economy [113]. The first stage is characterized by a strong connection between farm and non-farm sectors. The majority of households rely predominantly on agriculture with little dependence on rural–urban linkages. The second stage fosters a combination of suitable conditions for strong rural–urban linkages with decline in the majority of farm households' reliance on agriculture for their livelihoods. The perceived trends during the second stage are enriched at the third stage. Such trends encompass further emphasis on rural–urban linkages through sizeable involvement in sectors unconnected to agriculture, development of agro-industries and commercialization [114]. In addition to non-farm sector' strategic contribution to agricultural productivity, both sectors are complementary with potential benefits for agriculture and positive consequences. High productivity is vital for economic growth, food security, and poverty eradication. During the earliest stages of the development process of low and middle-income countries, rise in agricultural yields catalyzes economic transformation, job opportunities, and higher earnings. In addition, the increasing agricultural productivity results in more diversified and faster economic progress [115].

Non-farm activities of rural households further shape agricultural activities with consequential effects on sustainability. For instance, in Sub-Saharan Africa, where soil nutrient loss is a major issue for sustainable agricultural practices, the acquisition of inorganic fertilizers requires cash flow often generated from non-farm enterprises [116].

As additional and stable alternative sources of incomes, non-farm enterprises enable peasants to adopt a variety of new agricultural technologies and crops with high productivity associated to high volatility in output. The way rural residents spend non-farm incomes streams is decisive for agricultural efficiency or productivity [117]. As substitution of employment for the environment in some European and mountainous regions of North America, non-agricultural activities stimulates forest transition and regrowth given the reduction of extractive operations and improvement in soil fertility [118,119]. The distributional effects of non-farm sector earnings can be substantially pro-poor, spreading through agriculture and non-farm linkages. In certain cases, rural household participation in non-farm sector and secondary town development result in faster poverty alleviation and more inclusive growth patterns [120,121]. It also encourages economic growth, and a more spatially balanced structure of the population [122].

Rural non-farm activities are practiced in a number of countries worldwide and have made noteworthy contributions towards the economic growth of those counties. In China, non-farm business activities contribute to reduce rural income inequality amongst rural folks and significantly profiting the most disadvantaged households [123]. China's labor-intensive township and village enterprises (TVEs), which induced substantial growth performance, indicate the potential role of the sector to economic performance [124]. In India, though the poorest families have limited access to household income streams, the sector generates wages and job opportunities, and contributes to poverty alleviation in agro-ecoregions [122]. Profits from rural non-farms in Bangladesh, as vital sources of liquidity for investments, enabled marketers to release credit from eventual crop provisions and supported peasants' resilience in marketing [125,126].

In Sub-Saharan Africa, non-agricultural income diversification activities amount to 60–80% of farm incomes. There are multiplier effects of non-farm investment with other economic sectors. Through agricultural transformation and expansion of rural dwellers' income sources away from own farm labor, 750 million people worldwide earn US\$3.10 daily and are emancipated from poverty [127–129]. Accelerated growth in the non-farm share of agricultural household incomes offers new business opportunities that economically empower women through increase in their total incomes. In addition, non-farm sector earnings enhance rural wealth creation by connecting rural producers to urban buyers, thereby resulting in rapid social changes [130–133]. Countries with rapid job growth in the rural non-farm sector further experience fast agricultural growth [134].

In Ethiopia, in the face of low crop productivity, recurrent weather shocks, and limited job opportunities in the formal sector, employment in the rural non-farm labor market (RNLM) enables vulnerable households to stabilize their incomes and consumption. This approach is generally a defensive coping mechanism, especially in agro-ecoregions, rather than a pathway for emancipation from poverty. In the country, the three major common non-farm activities comprise of non-agricultural business or services from home (10%), selling of processed agricultural products including food and local beverages (6%) and trading businesses such as selling goods on a street or in a market (4%) [135]. The trend of household participation in the non-farm sector varies with regions and ranges from 61.18% in the Moyale district, Oromia Regional state, Southern Ethiopia to 73.44% in Northern Ethiopia [136,137]. Undertaking these enterprises sharply stimulates household income in rural Ethiopia from 20 to 35% of total income [138–140]. In addition to farming and household chores, an average of 36.6% of rural women own wage and self-employment activities in the country [141].

Despite the low share of rural non-farm economy and limited contribution to poverty alleviation in the country, rural non-agricultural households have better consumption than those relying entirely on agriculture. In the Kersa District, Eastern Hararghe zone in Ethiopia, the consumption levels of households engaged in non-farm businesses increased from 29.1% to 36.7% [142]. Household participation in non-farm sector is also positively associated with improved food security in parts of Western Ethiopia and decline in poverty in the northern Ethiopia [143,144].

Rural non-farm sectors earnings are an additional source of income and an alternative to livelihood diversification for less endowed farming families with limited production factors, namely land and capital [145]. In the Eastern Tigray region of Ethiopia, employment in the rural non-farm labor market enhanced the livelihoods of disadvantaged agricultural households and resulted in assets accumulation [146]. It constitutes a new opportunity for rural agricultural transformation and higher farm households' economic returns to promote sustainability [147,148]. Figure 4 highlights the three major common non-farm business activities in Ethiopia.

Food security and inclusive economic growth agendas through the promotion of non-farm businesses in addition to agricultural transformation require enhanced access to credit facilities and advanced agricultural technologies for better job creation, higher incomes, and decent livelihood for Ethiopian small-scale food producers [75,146]. Both farm incomes and non-farm sector earnings promote food security because rising agricultural productivity and non-farm labor markets foster the differentiation between production and consumption choices [149]. Changes in the agricultural system are inevitable as the promotion of inclusive and sustainable growth has the potential to generate job opportunities, alleviate income inequalities, contribute to the preservation of the rural landscape, and foster poverty eradication [35,150,151]. The categories of non-farm activities by sector, function, and location are shown in Table 3.

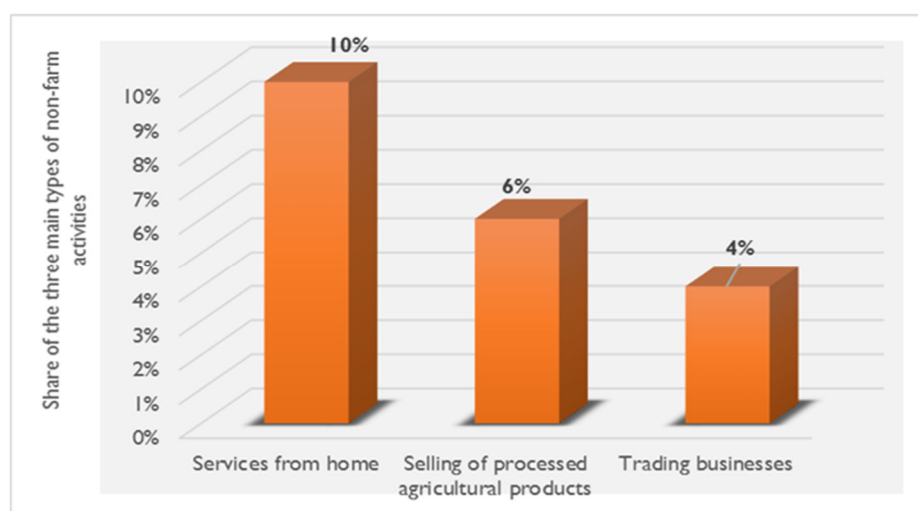


Figure 4. The three main types of non-farm business activities. Source: [135].

Table 3. Classification of the components of rural livelihood diversification.

Order	Grouping	Definition
By sector	Farm	These include production of natural products, such as crops in their raw state, and forest and fish products including livestock. It also includes remuneration for labor and sale of farm products.
	Non-farm	This entails all activities people partake in to generate incomes in diverse areas such as manufacturing, mining, utilities, commerce, transport, agro-processing, government services, selling (raw food crops, livestock, forest and fish products) etc.
By function	Salary jobs	This comprises of a boss and wage earner relationship where the wage earner is paid for delivering his services within a specific time range (e.g., monthly).
	Self-employment	This is when one works for oneself to earn incomes.
By location	On-farm	These income activities occur on the farm.
	Off-farm	These income activities take place away from the farm. It can happen at the rural, urban, national or international level.

Source: Adapted from [112,152–155].

6. Social Protection Mechanisms and Enhanced Entitlements to Food

The diverse features of social protection instruments are protective, promotive, and transformative in human development. Evidence of manifold positive synergies between social protection and wellbeing indexes is rising and expansion and institutionalization of social protection programs across countries in Sub-Saharan Africa seem to be irremediable [20,156–158]. The prominent role of social protection programs consists of social assistance to ward off interruption, and loss of incomes or food poverty and social insurance measures to promote livelihoods. Poverty alleviation is actualized by fostering household returns or agricultural production in the context of peasants, whereas protection against vulnerability can arise from income stability. Vulnerability also entails social measures associated with ostracism, which can be offset through people's empowerment. Various mechanisms can be considered in the context of social protection systems and terms of a particular range of both contributory and non-contributory schemes, which includes weather-indexed insurance, public works programs, food relief programs, and stock management strategies. These multiple instruments of social protection strengthen proceeds and access to food during good harvests to prevent prices falling below a target range. It can also release stocks during bad harvests to prevent prices rising above a target range. This contributes to meet any sudden future demand or supply fluctuations. Tools and methods supporting social protection systems can contribute to food entitlements through

higher household incomes and food crop production, in particular promotion of efficient labor markets, agricultural input subventions or input trade exhibition, public work programs to establish vital physical infrastructure for agriculture. Some of these physical infrastructures include rural feeder roads and irrigation systems. Food security can be supported through the insertion of issues related to social justice in the design and delivery of social protection schemes for instance, integration of rights-based approaches consisting of job guarantee programs, community-based targeting, and social audits [158]. Social protection plays a key role in building resilience and increasing incomes and food security; it can enhance employment generation for rural people [159].

Advance in rural employment have been observed from social protection, in either jobs opportunities or indirect effects on rural labor markets [160]. Social protection policies can provide vulnerable households with vital income security for investing in human capital and income-generation activities during times of crisis and shocks. Steady income transfers could arouse dynamic innovative capability, stimulate job opportunities and labor force participation, hence, promoting local development [161–163]. More integration of food security measures in a comprehensive pro-poor development agenda under the Growth and Transformation Plan with strong emphasis on insurance systems would be appropriate to allow the poorest and more vulnerable households in Ethiopia to improve their livelihood and facilitate their emancipation from poverty. Table 4 shows the food entitlement failures and social protection responses.

Table 4. Food entitlement failures and social protection responses.

Type of Entitlement	Social Protection Tools		Food Security Target
Production	1.	Agricultural input subsidies	<ul style="list-style-type: none"> • Increase food productivity • Prevent crop, postharvest losses and livestock mortality
	2.	Crop and livestock insurance programs	
Labor	3.	Public works patterns	<ul style="list-style-type: none"> • Ensure the availability of short-term jobs • Generate labor-intensive infrastructure development initiatives • Encourage agricultural production
	4.	Stabilization of food prices	
Trade	5.	Food subsidies	<ul style="list-style-type: none"> • Sustain market access to food • Ensure the poor are able to afford food • Guarantee appropriate market of food supplies
	6.	Strategic grain reserves	
Transfers	7.	School feeding programs	<ul style="list-style-type: none"> • Minimize starvation • Promote access to education • Promote local food production systems • Improve food security
	8.	Supplementary feeding programs	
	9.	Regulated cash transfer programs	<ul style="list-style-type: none"> • Promote children's educational and healthcare access
	10.	Unrestricted cash transfer programs	<ul style="list-style-type: none"> • Make assuage hunger or poverty

Source: [20].

7. Food Security Policies and Regulations in Ethiopia

Food and nutrition security (FNS) policies shape the governance of FNS through the institutional setting, instruments and law-enforcement choices [164]. As part of its national growth agenda, the government of Ethiopia has implemented several strategies and programs to guarantee food and nutrition security, namely the food security strategy, national nutrition strategy and program, the Seqota Declaration roadmap, nutrition sensitive agriculture strategy, school health and nutrition strategy, and the Productive Safety

Net Program through multi-sectoral nutrition coordination and integration [165]. The core inclusive economic agenda steering the holistic policies is the Agricultural Development Led Industrialization (ADLI) initiated in 1991. The ADLI policy highlights the substantial role of agricultural transformation to guarantee food security in Ethiopia. It focuses on the promotion of integrated rural-development approaches to agricultural growth in the peasant farming systems [166]. A range of policies have resulted in a supportive macroeconomic system, enhancement of rural households' welfare, deregulation of markets for farm commodities, and fostering the intensification of production of food staples through the use of high yielding variety seeds and fertilizers [167]. Through the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) 2005/06 to 2009/10, Ethiopia attained agricultural development-led economic growth. The objectives for the existing Growth and Transformation Plan (GTP) 2010/11–2014/15 is to sustain or outperform an average GDP growth rate of 11% and substantially address chronic food insecurity. The Agriculture Growth Program (AGP) 2010–2015 aimed at fostering productivity, market performance, and processing along the entire value chain of major products [168].

Ethiopia's Food Security Strategy (FSS) provides an overarching framework covering the key dimensions of food and nutrition security particularly food safety and quality. An effective food safety system is vital to safeguard the community from unsafe food consumption and induce economic performance from agricultural products [165].

The food quality and safety administration system in Ethiopia has been subjected to sustained manifold advancements predominantly during the last decade regarding enforcement of adequate food safety laws and regulations, settlement of independent public entities to govern and define standards pertaining to food safety and plant and animal health. The origin of standardization in Ethiopia dated from early 1950s when the country's economy was detrimentally affected by deficiency of pertinent standards for food, water supplies, and other commodities [169]. The major legislations ruling food safety, animal and plant health comprise of Plant Quarantine Laws and Regulations; Animal Diseases Prevention and Control Laws and Regulations; Food, Medicine, and Health Care Administration and Control Laws and Regulations. The latter, which is a more inclusive and elaborated regulatory system pertaining to efficient management and regulation of food, medicine and health care was authorized and mandated in Parliamentary Proclamation (Proclamation No. 661/2009) and the Council of Ministers (Regulation No. 189/2010). These legislations reinforce the prior food regulatory system and address specifically the development of standards, licensing, and regulation for locally produced and imported foods, in areas including production, promotion, storage, packaging and labeling, distribution, and laboratory testing [170]. Albeit that enforcement of food safety policies is essentially bound to normative regulations regarding imported and exported food and agricultural products, such legislations do not cover all segments of foods and food products supplied to the people [171].

In Ethiopia, chronic food insecurity is addressed more particularly by the Productive Safety Net Program (PSNP), which has formed the backbone of safety net activities in the country [172]. The adoption of the Productive Safety Nets Programme (PSNP) in 2005 has resulted in thorough changes in the perception of Food and Nutrition Security (FNS) and the policy options and mechanisms selected. The PSNP added a social perspective into this predominantly agricultural and economic growth related challenges [173]. The strategic objective of the PSNP is to build a platform for household investment, avert resources depletion, foster community assets, and emancipate the overwhelmingly chronically food-insecure households from recurrent emergency food relief to a more secure, predictable, productive, and systematic form of social protection.

The International Food Policy Research Institute (IFPRI)-led impact measurement indicated that PSNP is well targeted and has enhanced food security and expenditures of the disadvantaged households in chronically food insecure districts (woredas).

However, the introduction of cash transfers raised several challenges. In some woredas, cash transfers contributed to food price inflation in the initial years of PSNP.

It also failed to address food price seasonality, and adjust food price inflation to the extent that recipient preferences shifted from cash transfers back to food aid as food prices rose and the real value of cash fell. Moreover, the impact evaluation highlighted the challenges of women to equilibrate their engagement in the public works program with household chores, and their limited access to development agents.

8. Conclusions and Policies Recommendations

The Sustainable Development Goals (SDGs) of eradicating hunger, achieving food security, improved nutrition and promoting sustainable agriculture (SDG2) acknowledge the inter-linkages amongst fostering sustainable agriculture, entitling small-scale food producers, ending extreme rural poverty, and addressing climate change. Agriculture underpins food quality, food safety and nutrition, and elicits food choices, shared prosperity, and economic growth.

Stable and durable food supplies at the household level enforce the capability of a household, even with unforeseeable predicament and shocks, to actualize through income, production and transfers of adequate food supplies on a sustainable basis. In this regard, the recognition of a rural economy in transition, towards the substantial role of non-farm activities is necessary. Livelihood in developing countries combines multiple natural resource-based activities that enable rural people to diversify their sources of income and reduce their dependence on agriculture. To that end, a range of policy recommendations emerges to support sustainable and intersectoral growth through agricultural transformation and promotion of rural non-farm economy agenda to reverse the trends of widespread poverty and protracted food crises in Ethiopia:

- Rural transformation agenda aiming at agricultural growth must address a farming sector that supports multiplicity of sources of income, and from which, no considerable productivity gains, but foremost a stable supply of food and earnings is envisaged. The rural non-farm sector as essential component of rural economies, contributes to rural poverty alleviation, affect agricultural production decisions, thereby, sustainable rural development. That notwithstanding, for the disadvantaged to benefit from rural non-farm labor market they must be entitled to address the challenges of human, social, and financial capitals. Such a strategy will stem from the shape of a country's structural transformation and its development pathway. One of the key points is to understand the institutional context in which rural dwellers operate. For instance, secure land tenure and enabling growth of land rental markets can foster a transition out of agriculture by offering a possibility to return to agrarian activities. Consequently, what happens to the agricultural sector is a result of the viability of the employment in the rural non-farm labor market and institutional settings.
- Development and modernization of rural transportation systems, and information and communication technologies are fundamental as they facilitate the connection of small-scale food producers to main road networks, and enhance access to market information. Low transportation costs to urban areas owing to infrastructure investments induce a leakage of positive spillover effects from agriculture to urban areas. This situation stimulates accessibility to urban employment and complementarity between both local and urban production.
- Provision of technical support to farmers through extension services is necessary for the enhancement of local food production. Extension workers can play a very useful role as a link between farmers and other service providers or projects. They can act as important channels to disseminate information to farmers on training and more sustainable, bio-intensive farming methods.
- As an agrarian economy, sustainable agendas and investments in the agriculture value chains notably improved seed varieties, fertilizers, effective marketing of agricultural produce, and integration of rural areas will be effective pathway to faster poverty alleviation. Considerable human capital investments coupled with promotion of

formal education amongst rural population are also required to close the inequality gap between both urban and agro-ecoregions.

- Regulations on biotechnological research. The Biosafety Protocol referred to as the Cartagena Protocol on Biosafety clearly stipulates that products from new technologies must be based on the precautionary principle and enable countries to balance public health against economic gains. It for instance allows countries to prohibit imports of genetically modified organisms if they feel there is not enough scientific evidence that the product is safe and requires exporters to label shipments containing genetically altered commodities for instance corn or cotton. The Protocol, thus, provides an enabling environment for the environmentally proper enforcement of biotechnology, making it possible to capitalize on the potential of biotechnology, while minimizing the eventual risks to the environment and to human health.

More holistic and sustainable economic growth through rapid and science-led agricultural production and promotion of rural non-farm economy may strengthen resilience of local food systems and reverse the trend of extreme vulnerability and protracted food crisis in Ethiopia. This multi-dimensional strategy may enable the country to develop and implement evidence-based pro-poor policies, enhance households' participation in decision-making, access to assets, financial corporation and markets whilst stimulating decent jobs prospects and underpinning better social protection coverage.

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