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Investigating the Dynamics and Trends of Sustainable Food Systems in Ethiopia: Characterizing the National Performance within the Global Context

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ABSTRACT

This paper assesses the trends of Sustainable Food System in Ethiopia, and how the various indicators evolved over time in the four food system dimensions: environmental, economic, social, and food and nutrition security. We employed quartile analysis to evaluate the relative performance of Ethiopia vis-à-vis the rest of the world by grouping the latter into lower quartile, median, and upper quartile based on their performance. The result revealed that while some positive strides have been achieved in reducing poverty headcount ratio over the past two decades, a high proportion of stunting and undernourishment, high variability of food supply, the slow-onset of adult obesity, and poor access to basic facilities for food utilization, especially when compared to the countries in the lower, median and upper quartiles, remain to be formidable challenges calling for the attention of policymakers.

Keywords*: Food system Dynamics; Sustainability; Food System Dimensions; Global Context; Ethiopia.*

1 Introduction

The quest for ending hunger by 2030 has become almost unattainable given the contrastingly increasing number of people that are facing extreme hunger worldwide. Globally, one in every 10 people goes to bed hungry; about 928 million (12%) of the global population was severely food insecure, and nearly one – in - three people (2.37 billion) did not have access to adequate food in 2020 (FAO, 2021). The number of people who are severely food insecure has increased by 148 million just from 2019 (FAO et al., 2021). Driven by diverse factors that include, *inter alia*, climate change, demographic pressure, and the recent challenges of the COVID-19 pandemic, food and nutrition insecurity will continue to be challenges of the global population now and in the future. In addition, the ever-increasing population growth and rapid urbanization have further heightened the challenge of achieving the 'Zero Hunger' target by 2030. According to the medium-variant population projection of the UN, about one billion people will be added to the global population by 2030 and 2.2 billion in three decades, from 7.6 billion in 2017 to 9.8 billion in 2050 (UN, 2017).

The highest population growth is expected to take place in Sub Saharan Africa (SSA) where the current population is estimated to be nearly doubled by 2050 (by 98%). The same projection showed that Ethiopia will stand 10th among the top ten countries globally with the largest number of people by 2050 with the projected total population of 191 million. In contrast, food and nutrition security faces severe pressure, including unbalanced food production, disruptions in the global food system, food price hikes, economic crises, and a serious diet-related health problems, such as obesity (FAO and RUAF, 2015; FAO, 2021). The persisting challenge of food insecurity and the widening food gap, coupled with the growing risk of climate change and population pressure, clearly indicate the magnitude of the problem that the global population continues to face (FAO et al., 2021). In view of this, it is now increasingly recognized that responding to the above challenges requires establishment of a sustainable food system that supports resilient food production, processing, distribution and consumption involving all value chain actors (Jennings et al., 2015; Forster et al., 2015).

As part of the global community, Ethiopia is no exception to this conundrum of food insecurity and thus, currently efforts are underway to improve food system sustainability with a major focus on food and nutrition security and environmental safety. To this end, the Government has formulated a number of policies and strategies in the last few decades. The Country Strategic Plan (CSP, 2020-2025) and the consecutive Growth and Transformation Plans (GTPs), which is now replaced by the Ten Years Development Plan (2021-2030), the Climate Resilient Green Economy plan (CRGE), the Urban Development Policy, and the National Nutrition Program are notable examples of initiatives in this regard. As well, a firm commitment was made to transform the food systems through the National Nutrition Program and the Nutrition-sensitive Agriculture Strategy which aims to improve nutrition through several pathways, including the food value chains from production to consumption. Overall, while efforts to improve the food system are ongoing, ensuring its sustainability by factoring in all the important dimensions of the economic, social, environmental and food security aspects is a highly essential and unavoidable task to moving forward.

The purpose of this paper is, therefore, to assess the trends of SFS in Ethiopia in terms of the four FS dimensions, and the relative performance of the country against other 'well', 'medium', and 'low' performing nations using a quartile analysis. Data was taken from various data sources, mainly from the World Bank/World Development Indicators/, FAOSTAT, ILOSTAT, and Climate Watch. The major limitations of this trend analysis are lack of adequate time-series data and updated data-points for some relevant food system indicators which would have enabled to make a comprehensive assessment of the various food system dimensions. Regardless, the authors believe that the assessment provides useful information on whether Ethiopia is moving in a more or less sustainable direction, how indicators change over the course of time, what level of performance do each of the four dimensions show, and which dimension/s should any future policy interventions focus on.

The remainder of this paper is structured into four sections. Section two discusses the literature. Section 3 describes the methodology. Section 4 discusses the major findings of the trend analysis in the selected indicators/dimensions. The final Section 5 draws conclusions from the findings and highlights their implications for potential policy uptake.

2 Literature Review

2.1 Understanding Food Systems

Researches and policy discourses on food security have long been dominated by questions related to the four pillars of food security: access, availability, utilization, and stability. At the same time, less attention has been given to the multi-dimensional and complex nature of food security, and the potential influences emerging from the various interactions between the social, economic, environmental and cultural factors (Ruben et al., 2019). Recent discussions, however, devote due attention to the complex interactions between the food system actors, activities and processes, as well as the potential trade-offs between the food system outcomes.

A food system refers to the various functions, processes, and actors that are embedded in from food production to consumption and waste management (FAO, 2018). It encompasses '*the complete set of people, institutions, activities, processes and infrastructure involved in producing and consuming food for a given population*' (UNEP, 2016). It includes all processes and activities involved in feeding a population, and comprises the input required and output generated at each step (Goodman, 2004). The concept of food system overlaps with agricultural system in the area of food production; yet, the former includes the diverse sets of institutions, technologies, and practices that govern the way food is marketed, processed, transported, accessed and consumed (Roberto, et al., 2014). As such, food system analysis is generally based on a systematic appraisal of the roles of various actors and the different underlying functions and processes that influence the different pillars of food security (Ruben et al., 2019).

The food system actors include farmers, businesses, consumers, government bodies, and civil society organizations that are working on the food system directly or indirectly. Similarly, the food systems functions and activities are very diverse, but highly interdependent. These functions and activities, which are widely used interchangeably in the literature, can be broadly categorized into four: i) production, ii) processing and packaging, iii) distribution and retailing, and iv) consumption and waste management. These activities affect the food system outcomes that can be categorized into four components: environmental, social, economic, and food security related (Ericksen, 2008; Ingram, 2011; FAO, 2016; UNEP, 2016).

The socio-economic outcomes mainly include income, livelihoods, employment, wealth, social, political, and human capital. The environmental outcomes, on the other hand, include land, soil, fossil fuels, minerals, bio-diversity, water and climate (Berkum, 2018). The food security outcomes comprise the four pillars of food security: food availability, food access, food utilization and stability (FAO, 2018).

Overall, it is essential to underline that the food system is not just characterized by separate activities delivering collective outcomes, but "is the dynamic interactions between these sub-systems that define the systemic properties of the food system" (Doherty et al., 2019). Béné et al. (2019) also argued that "food system is not just a linear chain of activities spreading from production to consumption, but a complex, heterogeneous and circular system replete with linear as well as non-linear feedbacks". As such, it is characterized by dynamic properties which involve information flows between the system and its components and between the system and the external environment beyond the system boundary. In sum, the concept of food system helps to understand the full range of actors and the role they play, the functions, drivers, and the complex interactions amongst them (Ericksen et al., 2009). Such a comprehensive approach would help to assess the entire system holistically and is geared towards addressing the real-world problems more realistically.

2.2 A cursory review of food system elements in Ethiopia

Over the last few decades, the food system in Ethiopia has shown rapid changes driven by rapid population growth, rising food demand, and urbanization. The population has swelled from 22.2 million in 1960 to 57.1 million in 1995, and doubled to 114.9 million in 2020 (WB, 2020). Crop production by smallholder farmers has increased nearly fivefold from 70.4 million quintal in 1994/95 to 341.8 million quintal in 2020/21 (CSA, 1995; CSA, 2021). Area of crop production has nearly doubled in the same period from 6.9 million hectares in 1994/95 to 13 million hectares in 2020/21. The increase in crop production is attributed not only to the expansion of agricultural lands, but also the increased use of modern inputs such as chemical fertilizers and improved seeds. Recent trends also indicated that the expansion of commercial and industrial crops, which are relatively new to the Ethiopian agricultural production system, and consumption of Animal Sourced Foods (ASF) is emerging. Production of commercial fruits such as oranges, mangoes, and bananas has started to take roots (IFPRI, 2021). A concomitant rise in business ventures engaged in food processing, packaging, transporting and distributing is also taking place.

While encouraging results have been observed in terms of increased agricultural production and diversification, the food systems in Ethiopia continues to face a myriad of challenges. Climate change has become one of the risk factors to impact the agricultural production and productivity. Agricultural land and water remain binding constraints (IFPRI, 2021). Dependency on food imports remains significant: food and live animal imports increased from 420 thousand metric-tons in 2000/01 to 4 million metric-tons in 2021/22; and grain imports increased from 360 thousand metric-tons in 2000/01 to 1.5 million metric-tons in 2021/22 (NBE, 2022). Low level of agricultural productivity and value-added coupled with high level of rural under/unemployment is another lacuna in the economic dimension.

In the food and nutrition dimension, despite the significant fall in the poverty headcount ratio measured at national poverty lines from 45.5% in 1995 to 23.5 in 2016 (World Bank, 2022) nearly one-fourth of the population still lives in poverty. Having nutritious food for all people remains a challenge although stunting and wasting showed a dramatic fall in the last two decades. Child stunting rate fell from 58% in 2000 to 38% in 2016; and the number of underweight children declined from 41% to 24% over the same period (CSA and ICF, 2016). Contrastingly, adult obesity has increased from 1.9% in 2000 to 4.5% in 2016. All these figures show the critical need to transform the entire food system in Ethiopia so as to achieve the ultimate objective of sustainable food system that ensures food and nutrition security for all people at all time without compromising the ability of the future population to ensure the same as pledged by SDG 2030. Summing up, ensuring food system sustainability requires understanding its multi-dimensional nature, and the

diverse elements that are embedded in the social, environmental, economic, and food and nutrition security dimensions.

3 Materials and Methods

The trend analysis and assessment of the food system performance of Ethiopia vis-à-vis the rest of the world was conducted following three major steps: i) selection of food system dimensions and indicators, ii) populating time series data, and iii) conducting quartile analysis. (Brief description of each of these steps is presented further below).

3.1 Study Design

Mixed method research design was used to assess the food system performance of Ethiopia over the past decades. Secondary data from databases were used for conducting descriptive analysis. Review of existing literatures on food system sustainability and official reports on performances and gaps on various food system dimensions over the past decades were conducted.

3.2 Scope of the Study

This is a national level analysis where selected variables from the four dimensions of food system, i.e. environmental, economic, social, and food and nutrition security, were examined. The time period ranges from over 50 years for some indicators to 14 years for others, depending on availability of time-series data for selected indicators.

3.3 Selection of Food System Indicators and Data Sources

Previous researchers suggested several guiding principles to select sustainability indicators. Policy relevance, validity, simplicity, availability of time-series data, availability of accurate and affordable data, ability to aggregate information, sensitivity to small changes, and data reliability are some of the suggested criteria (Hardi & Zdan, 1997). However, when data availability is an issue, a subset of indicators can be used to develop a profile of countries that allow rapid characterization, benchmarking, monitoring, and comparison across different scales (Melesse et al., 2020). This is especially the case when time series data is required to assess the trends of various dimensions of the food systems over a longer period of time. For this study, we initially conducted rigorous review of the literature to identify the various dimensions and components of food system sustainability. We built on previous works, such as Béné et al. (2019), Kennedy et al. (2020) and FAO (2018), to select food system indicators relevant for Ethiopia. Selection of indicators considered policy relevance, validity, measurement simpliciy, and availability of time series data. Accordingly, time-series data for selected indicators was populated from numerous databases, the major ones of which included the FAOSTAT, ILOSTAT, Climate Watch, and the World Bank/WDI databases. Data from these databases were collected, properly organized, and finally exported to SPSS and STATA for the data cleaning and quartile analysis.

3.4 Method of Data Analysis

In the absence of global standards and overall criteria against which food system sustainability is evaluated, benchmarking and assessing relative performances is well-justified (Esty, et al., 2005). In order to assess the relative food system performance of Ethiopia over the past decades, countries in the rest of the world were first categorized into three groups based on the value for each indicator for each country and, respectively, for each year using quartile analysis. Comparison was made between Ethiopia and the countries in the first quartile (Q1) that constitute the lower 25% of countries, and countries in the median (Q2) and upper quartile (Q3). If a lower target is the better for a particular indicator, for instance in the case of CO2 emission, the values of the first quartile that constitute the lower 25% of countries were considered as a 'well performing' nations; and countries in the median (Q2) and upper quartile (Q3) were considered as 'medium-performing' and 'low performing' countries respectively. On the contrary, if a higher target is the better, for instance in the case Average Dietary Energy Supply, countries that fell in the highest quartile (Q3) were considered as a 'well performing' nations; and countries in the median (Q2) and lower quartile (Q1) were considered as medium-performing' and 'low performing' countries, respectively. Based on this, the relative performance of food system sustainability in Ethiopia was evaluated against the 'well performing', 'medium-performing' and 'low performing' countries.

4 Results and Discussion

4.1 Trends in Environmental Dimension of Food System Sustainability

Air Quality

Over the last decades, total anthropogenic GHG emissions have risen more rapidly globally. According to the IPCC 2014 report, the total anthropogenic GHG emissions from 2000 to 2010 were the highest in human history and reached about

49 Giga-tonnes of CO2 equivalents per year in 2010 (IPCC, 2014). However, with over 5 billion additional people between 1950 and 2020 globally, trends of agricultural per capita emission showed a steady decrease. Similar trend is observed in Ethiopia for the same period. When the data is examined by economic sector, electricity and heat production contributed the lion's share (25%), followed by agriculture, forestry, and other related land use (24%) for the same year.

For this study, we examined the total GHG emission as well as the agricultural per capita emission as measured by CO2 equivalent to compare the performance of Ethiopia with the lower, median, and upper quartiles over the last three decades. Accordingly, the per capita GHG emission of Ethiopia is lower than the first quartile countries that have lower per capita emission (Fig. 1). Yet, given that the agriculture sector is the mainstay for the overwhelming majority of the population in Ethiopia, the per-capita agricultural emission tends to be as higher as the countries in the upper quartile (Q3) that release higher per capita emission (Fig. 2).

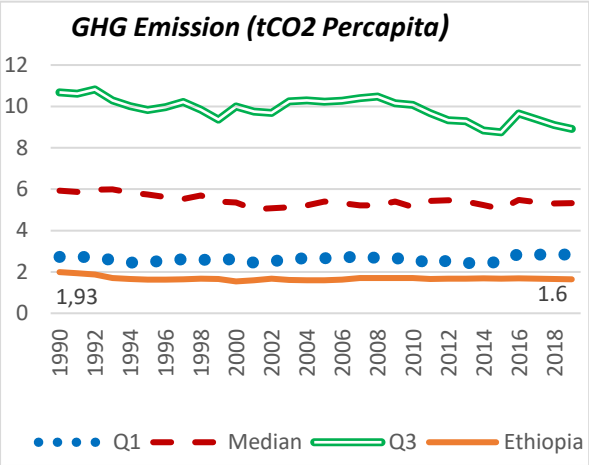

Figure 1. Total GHG Emission of Ethiopia vis-à-vis the countries with lower (Q1), medium and higher (Q3) per capita emissions (tCO2 Per Capita)

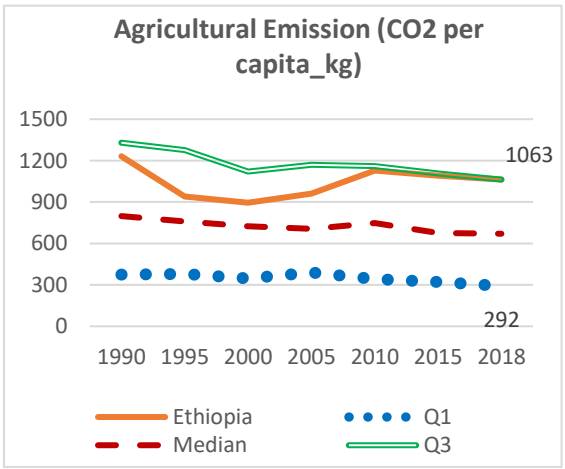

Figure 2. Agricultural Emission of Ethiopia vis-à-vis the countries with lower (Q1), medium and higher (Q3) per capita agricultural emissions (CO2 per Capita_kg)

(Source: Author's computation from FAOSTAT *and Climate-Watch* 2022)

Proportion of Arable Land versus Agricultural Land

Agricultural land is under enormous pressure associated with the increasing population, further compounded by expansion of urbanization. Changes in the land use and the continuing decline of arable land is one of the impending factors to produce what is required to feed a still growing population. From the estimated 13 billion ha of global land surface, nearly 12% (about 1.6 billion ha) of it is used for crop production, constituting both the arable land with temporary crops and the land under permanent crops (FAO, 2021). Looking at the trend in Ethiopia, the data show that expansion of land for crop production continues to take place in order to meet the food demand for growing population. The proportion of arable land versus agricultural land more than doubled from 19.7% in 1961 to 42.71% in 2019. Over time, this narrows the net land balance between crop land and other agricultural land uses which, in turn, limits the potential for expansion of agricultural production in the future. However, compared with countries in the lower quartile with a lower proportion of arable land versus agricultural land (16.2%) and countries in the upper quartile with a higher proportion of arable land versus agricultural land (63.4%) in 2019 Ethiopia stands in the middle indicating that there still exists a potential for expansion of cropland for food production (Figs. 3and 4).

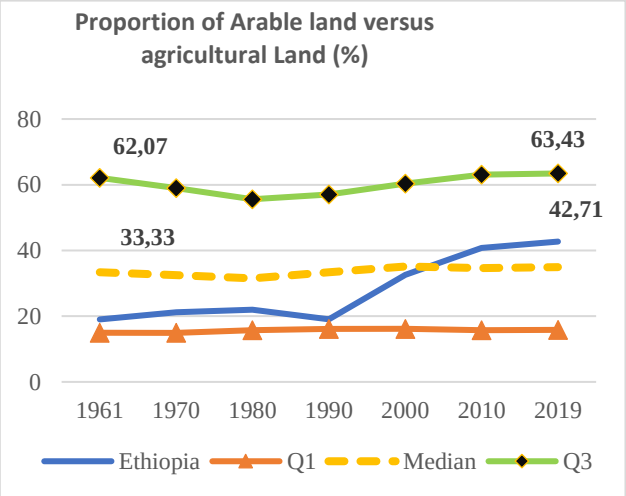

Figure 3. Proportion of Arable land versus agricultural Land in Ethiopia compared with the countries with lower (Q1), Medium and higher (Q3) arable land Proportions (%)

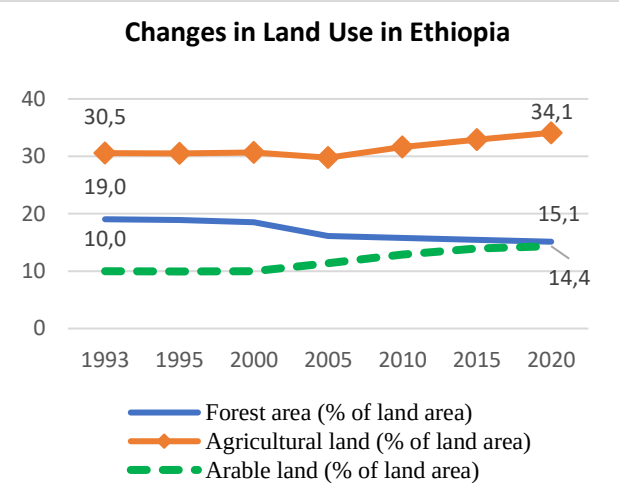

Figure 4. Changes in Land Use in Ethiopia over the past three decades

Source: Author's computation from FAOSTAT, 2022

Water Stress: Freshwater withdrawal versus available freshwater resources

Sound management of freshwater eco-system is one of the core elements of sustainable food system. High level of water stress and the overuse of freshwater negatively impact not only agricultural production and food security but also the overall economic and social development. As pledged by SDG 6.4, efficient use of freshwater resources and sustainable withdrawal and supply of the same is essential to ensure its sustainability. Over the past decades, there has been excessive pressure on the demand for water resources associated with the increased agricultural production and expansion of irrigation activities. The world's average water stress stands at 13% with significant variations across countries and regions, ranging from 2-3% in most of the sub-Saharan Africa, Oceania, Latin America and Caribbean countries to more than 100% in northern Africa (FAO, 2018). For this study water stress was calculated by the proportion of freshwater withdrawal from the available freshwater resources. Thus, the trend analysis revealed that Ethiopia withdrew higher proportion of freshwater (32.3%) compared with the first quartile countries (4.1%) and the median countries (11.3%), yet a little lower proportion compared with countries in the third quartile (36.5%) in 2018, Fig. 5. When looking at the trend for the past 15 years, the data shows that the proportion of freshwater withdrawal in Ethiopia nearly doubled from 17% in 2002 to 32.3% in 2018 (Fig. 5 and 6).

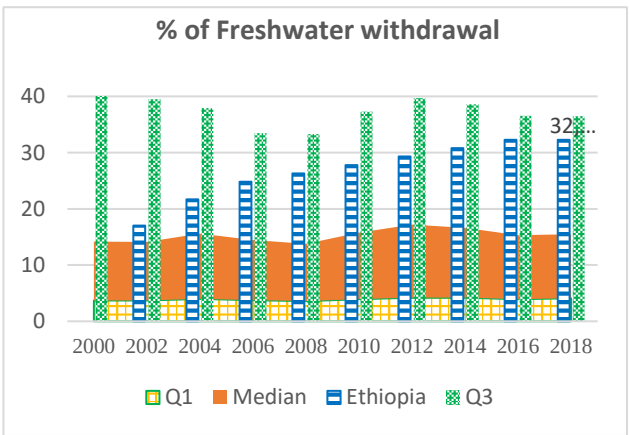

Figure 5. Freshwater withdrawal in Ethiopia compared to countries with lower (Q1), medium and higher (Q3) freshwater withdrawal (% of available freshwater resources)

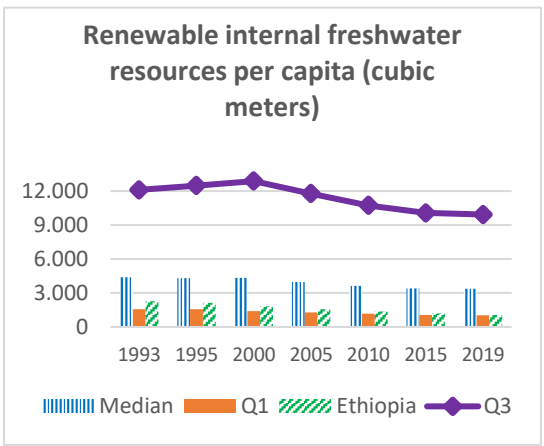

Figure 6. Renewable internal freshwater resources in Ethiopia compared to countries with lower (Q1), medium and higher (Q3) renewable internal freshwater resources (per capita cubic meters)

Source: Author's computation from FAOSTAT, 2022

Renewable energy consumption

Access to affordable, reliable and sustainable energy is one of the core elements to achieve food system sustainability. In this regard, renewable energy sources produce low level of net CO2 emissions per unit of energy production, and are generally considered as environmentally friendly. Estimates of the world energy consumption indicate that the global energy demand will increase from 546 Exajoule (EJ) in 2010 to 696-879 EJ, under different scenarios, in 2050 (World Energy Council, 2013). This global demand may significantly exceed the energy supplied by conventional sources. The shortfall may become even larger in the subsequent years due to the depletion of fossil fuels whose 80% share has started to decline in recent years. In the same vein, the share of renewable energy is expected to increase to 60% by 2030 under the higher-level ambition of the global pledge to achieve a Net Zero Emission (NZE) by 2050 (International Energy Agency, 2021). Overall, achieving the target requires working on efficient and renewable energy sources, as well as on carbon captures, utilization and storage.

In this study, the proportion of renewable energy consumption was calculated from FAOSTA, as the ratio of total renewable energy consumption from the total gross inland energy consumption in a calendar year. Accordingly, the data revealed that significant proportion (89.9%) of energy consumption in Ethiopia comes from renewable energy sources, achieving far better compared to the countries in the middle and upper quartiles, which recorded 23% and 50.1% respectively in 2018 (Figure 7). Ethiopia is also on track to achieve the global pledge of making 60% of the energy consumption from renewable sources by 2030 to meet the Net Zero Emission target by 2050.

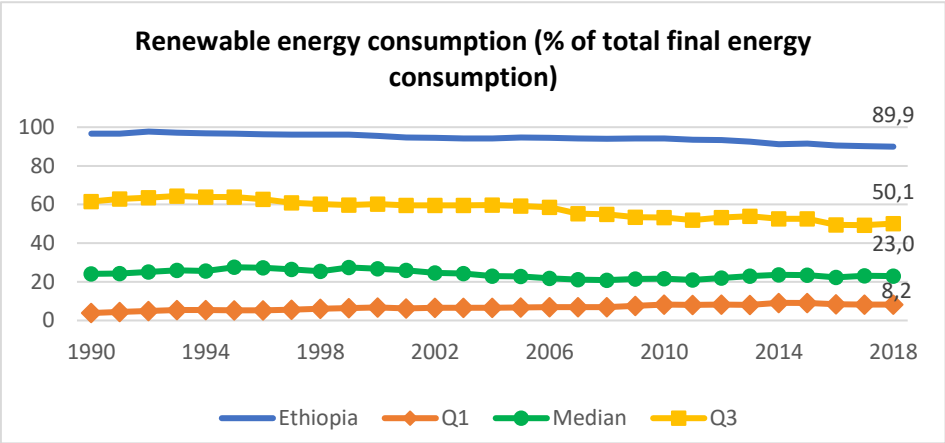

Figure 7. Renewable energy consumption in Ethiopia compared to the countries with higher (Q3), medium and lower (Q1) proportion of renewable energy consumptions (% of total final energy consumption).
Source: Author's computation from FAOSTAT, 2022

4.2 Trends in Economic Dimension of Food System Sustainability

Agriculture Value-added per worker

For agriculture to be sustainable farmers need to be well-compensated from their production in return. Agriculture value-added per worker was calculated by dividing the amount of total economic value generated from farming by the number of people that work in agriculture. When the trend for the last three decades is examined, value-added per worker is very low across much of Sub-Saharan Africa that was estimated to be 1,525.9 USD in 2019, which was much lower than the world average of 4,035.3 USD in the same year. The situation in Ethiopia is not an exception to this. The agriculture value-added per worker in Ethiopia was estimated at 804 USD in 2019, far below the Sub-Saharan Africa, the countries in the lower quartile (2,204 USD), countries in the median quartile (5, 954 USD), and those in the upper quartile (19,384 USD) (Figure 8).

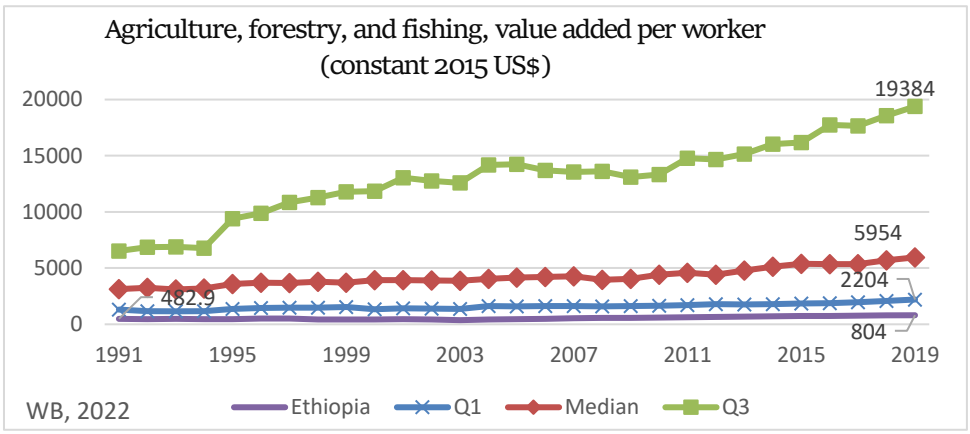

Figure 8. Agriculture, forestry, and fishing, value added per worker in Ethiopia compared to countries with lower (Q1), medium and higher (Q3) value added per worker (constant 2015 US$)
Source: Author's computation from WB, 2022

Rural unemployment

Rural unemployment and underemployment is one of the core factors contributing to poverty worldwide. While unemployment is the prevalent form of labour underutilization in urban settings, time-related underemployment appears to be the main challenge in the rural contexts where about 94% of the world's agricultural workers belong to the informal employment with notable job quality gaps (ILO, 2020).

In this study labour underutilization in rural areas was assessed using the combined rate of time-related underemployment and unemployment from the ILOSTAT. Accordingly, the trend analysis revealed that labour underutilization in rural areas of Ethiopia is very high (22.9%) compared to the countries in the lower quartile (7.5%), in the median (10.7%), and upper quartile (15.5%) in 2019 (Figure 9).

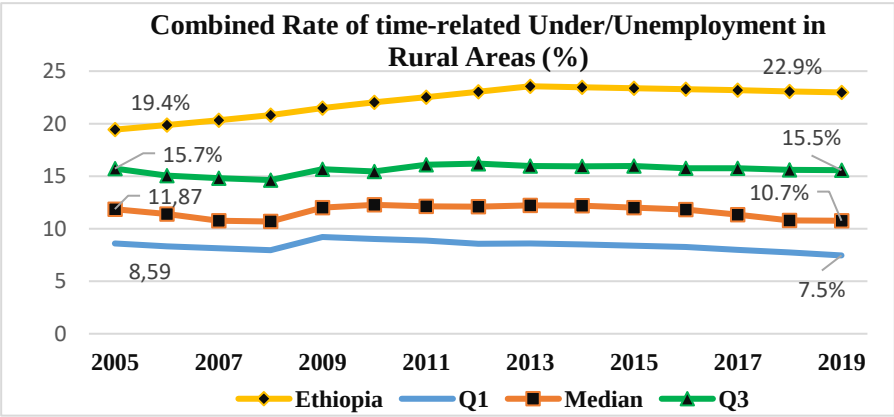

Figure 9. Combined Rate of rural time-related Under/Unemployment in Ethiopia versus the countries with lower (Q1), medium, and higher (Q3) rural time-related Under/Unemployment (%)
Source: Author's computation from ILOSTAT, 2022

Cereal Productivity

Cereals play a central role in transforming the food system and ensuring global food and nutrition security. About 48% of the total calories and 42% of the total protein in developing countries are being provided by the major cereals, such as maize, rice, and wheat (IRRI, 2023). Given the importance of cereals in the global food system and the ever-increasing demand for these crops, optimizing production and improving yield are essential elements of economic sustainability. For this study, the trend of cereal yield in the last three decades was assessed using the data from the World Bank/WDI. In this dataset, cereal yield as measured by kilogram per hectare of harvested land was estimated for major cereals: wheat, maize, barley, sorghum, rice, oats, rye, millet, buckwheat, and mixed grains. The trend revealed an interesting pattern where populations in Ethiopia doubled from 53 million in 1993 to 117.2 million in 2020 while cereal production increased nearly six-fold in the same period (Fig. 10). In contrast, while cereal yield in Ethiopia shows an increasing trend

outpacing the low-performing countries since 2010, the country is still performing well below the median and high-performing (Q3) nations in terms of cereal yield (Fig. 11).

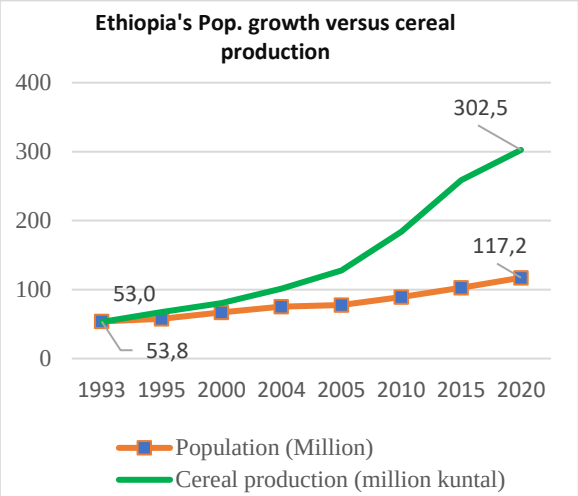

Figure 10: Ethiopia's Population growth versus cereal production

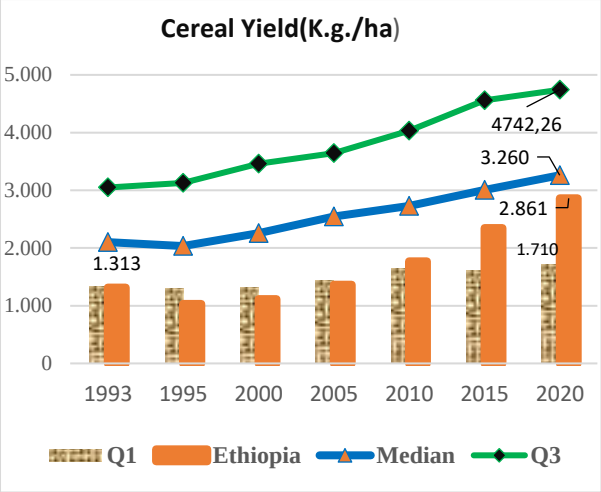

Figure 11. Cereal Yield in Ethiopia compared to the countries with lower (Q1), medium and higher (Q3) amount of yield (K.g./ha)

Source: Author's computation from WB, 2022

4.3 Trends in Social Dimension of Food System Sustainability

Female Unemployment

Women play a key role in agriculture and food security, and supporting them is very crucial for ensuring food system transformation. They are the main actors in various food system activities as farmers, traders, processors, wage-workers and consumers. Despite their importance, women face several challenges in terms of getting decent jobs, occupying better-paying wage positions and earning better incomes. Over the last 15 years, the global average on the rate of female unemployment has slightly increased from 6.2% in 2005 to 6.4% in 2020; (ILOSTAT, 2023). Contrastingly, the proportion of female unemployment in rural areas showed a slight decrease from 4.5% in 2005 to 4.4% in 2020. In Ethiopia, the rate of female unemployment in rural areas appears to be below the global average; yet, it has increased from 2.1% in 2005 to 2.6% in 2020. Comparing Ethiopia's performance with other countries in the quartile domain, the result revealed that the country is performing even better than those countries in the first quartile that recorded lower rate of female unemployment at an average rate of 3.27% in 2020 (Fig. 12).

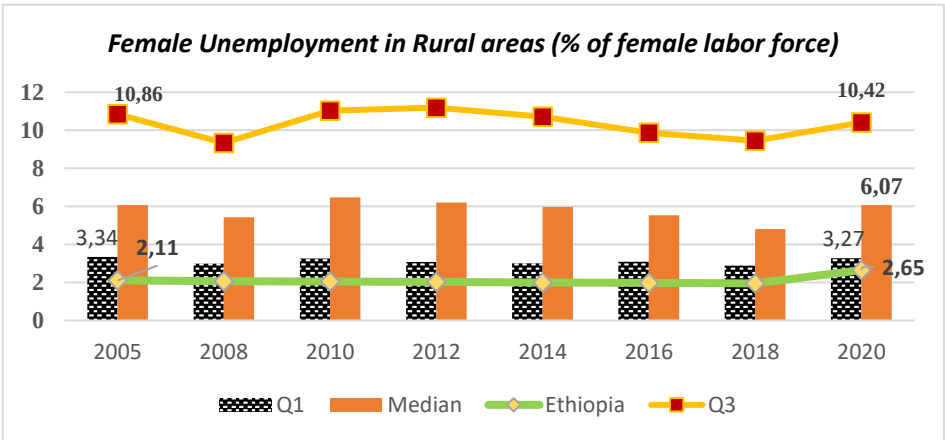

Figure 12. Female Unemployment in rural areas of Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) rate of rural female unemployment (% of female labor force)
Source: Author's computation from ILOSTAT, 2023

Apart from employment opportunities, the data on gender wage-gap that measures the wage inequality between female and male in the labour market clearly indicates that women are victims of lower wage compared to their male

counterparts. According to the data from ILOSTAT, women are paid, on average, about 20 percent less than men globally in 2020; while they are paid 73.2% of their male counterparts in Ethiopia, a wage-gap of 26.8% (ILO, 2022).

Social Inclusion

Inclusion and social equity is one of the principal values underlying sustainable food system. Inclusive food system creates better economic opportunities for marginal economic actors who are often employed in the agriculture and low-paid food system activities. This requires adequate participation of all peoples particularly that of the marginalized people, and empowering them so as to make strategic decisions within the food system. In this study, the trend of social inclusion was assessed using the *Country Policy and Institutional Assessment (CPIA)* rating of the World Bank. This indicator is a composite index consisting of 16 criteria grouped into four equally weighted clusters: i) economic management, ii) structural policies, iii) equity and social inclusion policies, and iv) public sector management and institutions. Based on this index, countries are rated annually on a scale of 1(low) to 6 (high). The result indicated that Ethiopia is one of the well-performing countries in the overall social inclusion rating, achieving well above the countries in the lower and median quartiles; yet the country is among the lower performing countries when it comes to gender equality (Figs. 13and14).

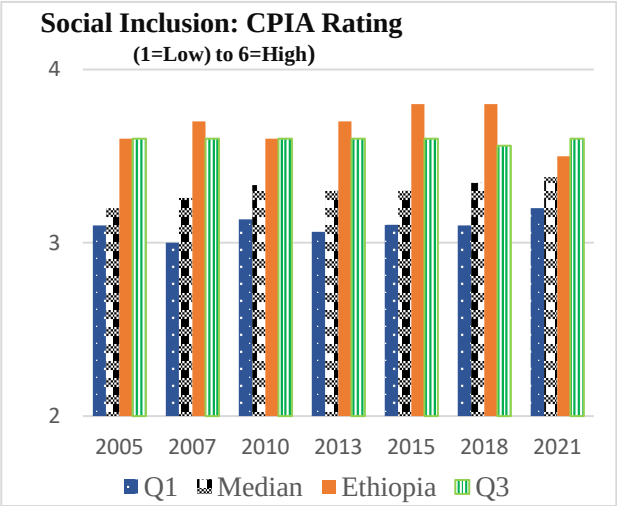

Figure 13. Trends of Social Inclusion in Ethiopia, compared to the countries with lower (Q1), medium and higher (Q3) degree of inclusion (CPIA Rating, 1-6)

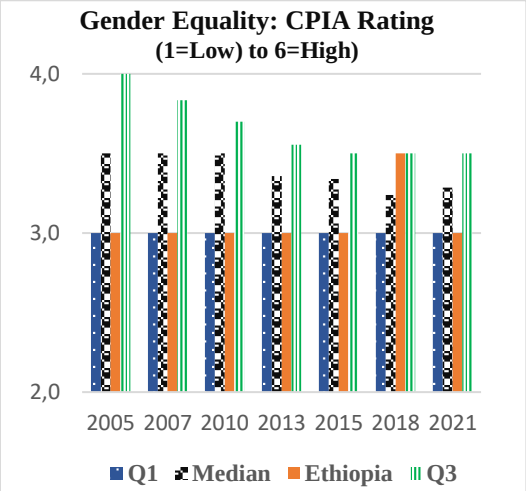

Figure 14: Trends of Gender Equality in Ethiopia, compared to the countries with lower (Q1), medium and higher (Q3) degree of Gender equality (CPIA Rating, 1-6)

Source: Author's computation from WB, 2022

4.4 Trends in Food and Nutrition Security Dimension of the Food System

Food and nutrition security is the cornerstone of the food system sustainability. The food security outcomes comprise the four pillars of food security: food availability (where adequate amount of food is supplied), food access (where peoples have sufficient resources to obtain adequate and safe food with the required nutritious diet), food utilization, and stability. The trend in each of these food security pillars is discussed hereunder.

Availability

Food availability refers to the supply of adequate quantities of food on a consistent basis, and considers the food production, distribution and exchange aspects of the food system functions. The common indicators for measuring food availability include average dietary energy supply adequacy and per capita protein supply. The dietary energy supply which is measured by Kcal/capita/day estimates the amount of calories from foods available for human consumption. Similarly, the per capita protein supply, measured by g/cap/day, estimates the amount of protein from available food for human consumption. Both of these measures do not ensure sufficient dietary energy and protein consumption by different population group within a given country, due to the issue of affordability, access and potential food loss along the food chain. Yet, they are important measures to assess the adequacy of a country's food supply to meet the aggregate energy and protein demand of the population (FAO, 2001; INDDEX, 2018). Taking the data from FAOSTAT, the trend in Ethiopia was examined for the last two decades and compared with other countries in the lower and upper quartiles. The result revealed that Ethiopia is one of the low-performing countries recording lower percentage of per capita dietary energy supply over the last two decades. Similar trend has been observed for per capita protein supply albeit the recent trend has slightly changed and the country has started to perform well above the lower performing countries since 2009 (Fig. 15). Overall, while both per capita dietary energy and protein supply have increased

substantially over the last two decades, they nonetheless remain very low and far low compared to the countries in the upper, middle, and at times in the lower quartiles (Fig. 16).

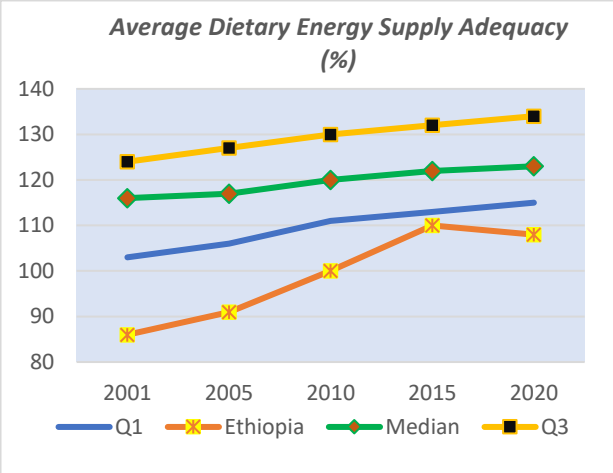

Figure 15. Average Dietary Energy Supply Adequacy in Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) average dietary energy supply (%)

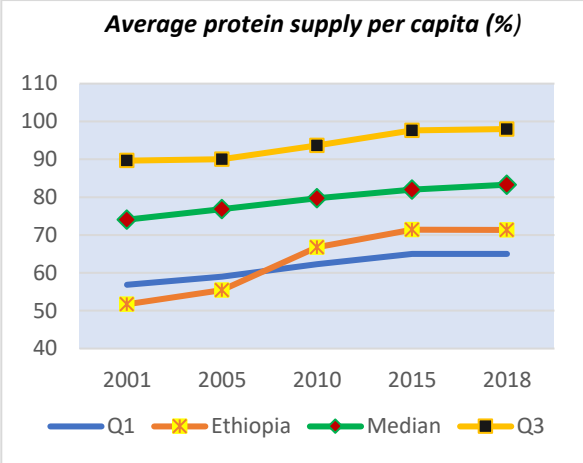

Figure 16. Average protein supply per capita in Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) protein supply per capita (%)

Source: Author's computation from FAOSTAT, 2023

Access

Food access refers to having sufficient resources to obtain safe and adequate foods for a nutritious diet, and describes the affordability, allocation and preference aspects of food security. The common indicators to measures food access include GDP per capita and level of under-nourishment. The latter refers to the insufficient food consumption to provide adequate amount of dietary energy required to meet the daily minimum dietary energy requirements in a given period, usually a year. Based on this definition, prevalence of under-nourishment in Ethiopia was assessed over the last two decades using the FAOSTAT database. The data revealed that Ethiopia has managed to reduce the level of under-nourishment significantly from 47% in 2001 down to 24.9% in 2019. Nonetheless, the level of under-nourishment is far higher than the well-performing countries in the first quartile (2.5%), the median countries (6.3%) and low-performing countries in the third quartile (15.3%) for the same year (Fig. 17).

Another important variable to measure the access dimension of food security is per capita income. We used GDP per capita measured at current USD from the World Bank database. The result revealed that although a steady increment has been observed over the last four decades, from USD 207 in 1981 to 925 in 2020 Ethiopia is among the countries with the lowest GDP per capita; far below than the first quartile (USD 1,852), the median (USD 5,928) and the upper quartile (USD 16,265) in 2020 (Fig. 18).

Utilization

Food utilization, on the other hand, considers the nutritional value, social value and food safety elements. It considers good preparation of food, appropriate feeding practices and good biological utilization of food consumed. Having access to clean fuels and technologies for cooking and access to safely managed drinking water are some of the essential elements and common indicators to assess the food utilization pillar of food security. Reviewing the trend in this regard Ethiopia has managed to improve access to electricity substantially over the last decades where the percentage of population who have access to electricity has increased from 13% in 2000 to 51% in 2020 (WB, 2022). Regardless Ethiopia is one of the countries with poor access to clean fuels and technologies for cooking where only 7.8% of the population have access to the same in 2020, far below the lower quartile (32%), the median (84.38%) and the upper quartile (99.9%) (Fig. 19).

In the same vein, the percent of population who have access to safely managed drinking water in Ethiopia has increased from 5% in 2000 to 12.6% in 2020, way below compared with the lower quartile (48%), median (86%) and upper quartile (98%) (Fig. 20).

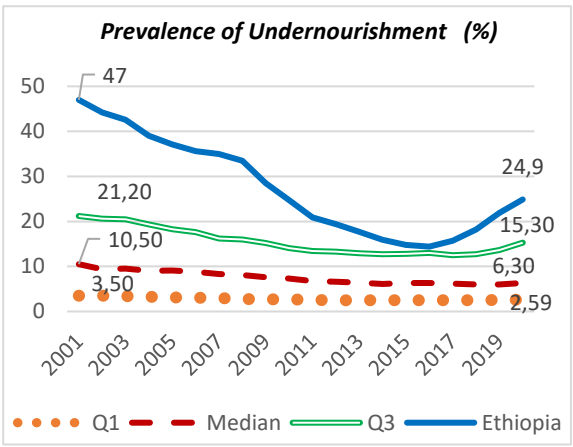

Figure 17. Prevalence of Undernourishment in Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) level of Undernourishment (%)

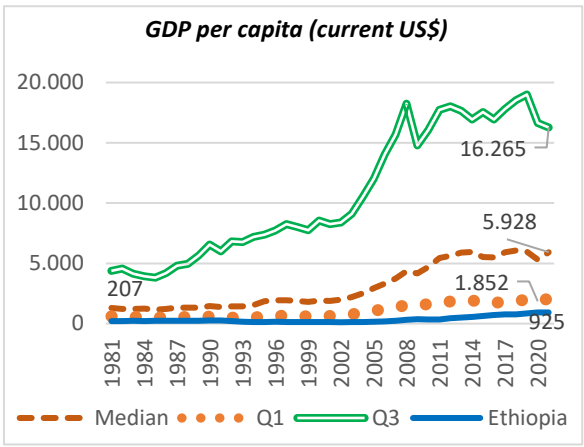

Figure 18. GDP per capita in Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) level of per capita (US$)

Source: Author's computation from FAOSTAT, 2023

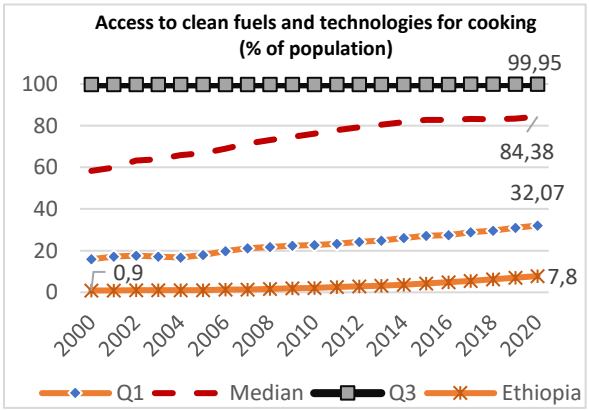

Figure 19. % of population in Ethiopia who have access to clean fuels and technologies for cooking compared with the countries with lower (Q1), medium and higher (Q3) level of access to the same (%)

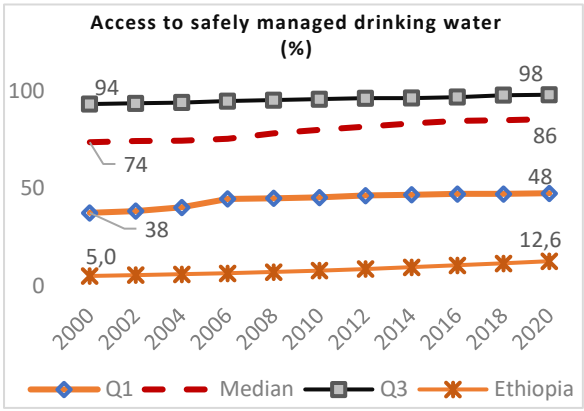

Figure 20. % of Population in Ethiopia who have access to safely managed drinking water compared with the countries with lower (Q1), medium and higher (Q3) level of access to the same (%)

Source: Author's computation from WB, 2022

Stability

Stability encompasses the three dimensions of food security, food availability, and access and utilization aspects over time (FAO, 2018). The notion is that while food intake can be adequate for a certain period of time, one can fall into food insecure status due to various reasons attributed to insufficient food availability, deterioration of nutritional status, adverse weather, political and economic conditions. Besides, variability in the food supply, usually reflected in price volatility, affects the ability of households to plan properly within their resource bound (IFPRI, 2020). A common indicator to measure food stability is per capita food supply variability as measured by kilo calorie per person per day (kcal/cap/day). This indicator measures the standard deviation of the annual per capita food supply (kcal) compared to the previous year's per capita food supply, and captures the annual fluctuations in the per capita food supply (kcal).

Taking the data from FAOSTAT, the per capita food supply variability in Ethiopia was assessed over the years, and compared with other well-performing, median and poor-performing countries. The result revealed that Ethiopia has been experiencing highly volatile per capita food supply in the last two decades where lower variability was observed from 2000 to 2006, medium variability until 2014, and high variability after 2014, well above the countries in the third quartile (Fig. 21).

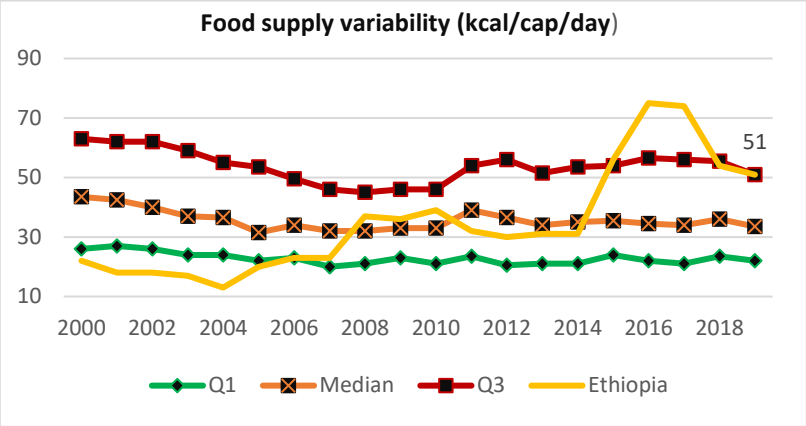

Figure 21. Food supply variability in Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) level of variability (kcal/cap/day)
Source: Author's computation from FAOSTAT, 2023

Nutrition Security

The notion of nutrition security is more than food security and refers to adequate nutritional status in terms of energy, proteins, vitamins and minerals necessary for all people at all time. The SDG's pledge to end hunger and all forms of malnutrition by 2030 requires availing healthy diets at lower cost and making them affordable to people's ability. However, according to the latest global food security report (2022), the cost of healthy diet has increased, and become more unaffordable to every region of the world. The prevalence of undernourishment at global level has increased from 8 percent in 2019 to 9.8 percent in 2021 at global level; while adult obesity nearly doubled from 8.7% in 2000 to 13.1% in 2022 (FAO et al., 2022). Yet again, the state of nutrition security can further deteriorate with increasing consumption of highly processed and cheaper foods of what are called 'empty calories' that have high content of fats, sugar, salt, and oil.

Ethiopia follows an encouraging path in reducing stunting from 57.5% in 2000 to 35.3% in 2020 (Fig. 22), while adult obesity increased from 1.9% in 2000 to 4.5% in 2016 (Fig 23). Compared with other countries in the world Ethiopia has recorded the highest proportion of stunting compared to the countries in the lower, middle and upper quartile; while the country has lower proportion of adult obesity, far lower than the countries in the lower quartile that have lower proportion of adult obesity.

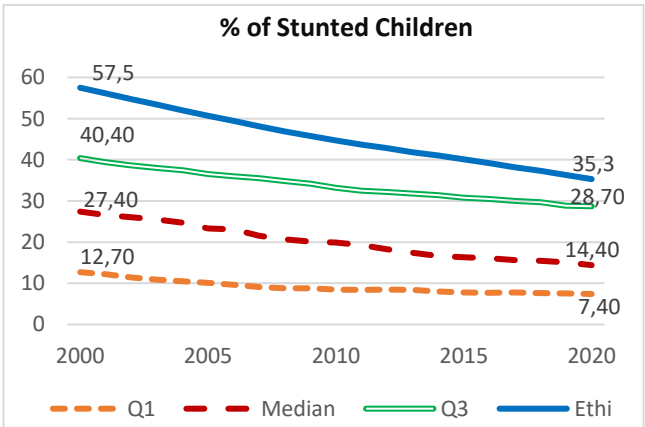

Figure 22. % of Stunted Children in Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) level of stunting (%)

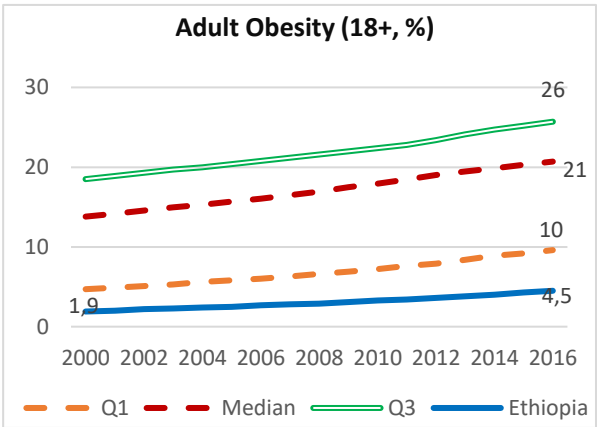

Figure 23: % of Adult Obesity in Ethiopia compared with the countries with lower (Q1), medium and higher (Q3) level of Obesity (18+, %)

Source: Author's computation from FAOSTAT, 2023

Another important indicator assessed under food and nutrition category was the overall prevalence of moderate or severe food insecurity in the population which refers to the proportion of the population facing moderate or severe difficulties in accessing food. The trend revealed that Ethiopia is among the countries with the highest rate of moderate or food insecurity where about 56.2% of the population faced moderate or severe difficulties in accessing food in 2020. This proportion is far above the countries in the highest quartile (50.3%), in the middle (27.1%) and lower quartile (9.8%) (FAOSTAT, 2023).

5 Conclusions and Policy Implications

This assessment showed the food system performance of Ethiopia over the last decades using selected food system indicators at national level. The study provided a holistic assessment on the trends of environmental, economic, social, and food and nutrition security aspects, and evaluated the relative performance of Ethiopia vis-à-vis the rest of countries using quartile analysis. The result revealed that Ethiopia is well-performing in renewable energy resources and GhG per capita emission in the environmental dimension. Particularly, the country is among the well-performing nations that source huge proportion their energy consumption from renewable sources. The proportion of renewable energy consumption in Ethiopia stood at 89.9% in 2018, much higher than the countries in the upper quartile (50.1%). What is more in the environmental dimension is the lower GHG emission per capita that was estimated to be 1.64 tons of CO2 equivalent in 2018, much lower than the countries in the lower quartile (3.27), median (5.33), and upper quartile (8.9) in the same year. However, sector-wise disaggregated data indicated that the per capita emission for the agricultural sector is higher than the countries in the median category given that the agriculture sector is the mainstay for the overwhelming majority of the population. On the other hand, the proportion of arable land compared to the overall land area shows a dramatic increase over the last two decades. The proportion of arable land from the total agricultural land increased from 19% in 1990 to 42.71% in 2019. While there is still a potential to expand the arable land further, working on intensification, maintaining forest lands and optimal utilization for other agricultural land should be the way-forward to ensure sustainability. What needs more attention as far as the environmental dimension is concerned is also the issue of renewable internal freshwater withdrawal which shows a dramatic increase over the last two decades and a decline in the per capita freshwater resources. While it is essential to utilize the water resources, particularly in the face of increasing population and a concomitant rise in the food demand, it is however, essential to maintain optimal utilization of the same to ensure sustainability of the overall food system.

In the social dimension Ethiopia has achieved lower rate of female unemployment in rural areas and higher degree of social inclusion compared to the countries in the upper, middle and lower quartiles.

On the other hand, despite the overall positive performances in the social and environmental dimensions Ethiopia's performance in the economic as well as the food and nutrition security dimensions is very poor. While some positive developments have been made over the past decades, for instance in terms of increasing agricultural value added from USD 482.9 in 1991 to USD 804 in 2019, and increasing cereal yield by more than twofold from 1,313 kg/ha in 1993 to 2,861 kg./ha in 2020 Ethiopia is still among the countries with the lowest agricultural value-added and the highest combined rate of time-related under/unemployment in rural areas, rendering lower economic benefit in rural areas.

Similarly, despite the encouraging trends over the last two decades Ethiopia has a poor performance in most of the indicators in the food and nutrition security dimension. High prevalence of undernourishment, high food supply variability, high rate of stunting, poor average dietary energy supply, poor protein supply per capita, poor access to clean fuels and technologies for cooking and poor access to safely managed drinking water are some of the characteristics. Besides, although Ethiopia has the lowest proportion of adult obesity, the slow-onset risks and the increasing trend of the same are worth noticing for policymakers. Overall, sustainability requires coherent and integrated policy implementation among various food system dimensions. In this regard, Ethiopia would benefit from optimal decision that takes into account the diverse array of policy and development goals in the environmental, economic, social, and food and nutrition dimensions. The underlying point is that the food system is getting increasingly complex, and if this complex system needs to be kept in play, integrity of the system along the four food system dimensions need to be well-safeguarded.

Acknowledgments

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Annex: List of Countries/External Territories included for the analysis

S.No.	Country/External territories	S.No	Country/External territories	S.No.	Country/External territories	S.No.	Country/External territories
1.	Afghanistan	51.	El Salvador	101	Macao SAR, China	151	Somalia
2.	Albania	52.	Equatorial Guinea	102	Mauritius	152	South Africa
3.	Algeria	53.	Eritrea	103	Madagascar	153	South Sudan
4.	Angola	54.	Estonia	104	Malawi	154	Spain
5.	Argentina	55.	Eswatini	105	Malaysia	155	Sri Lanka
6.	Armenia	56.	Ethiopia	106	Maldives	156	St. Lucia
7.	Australia	57.	Euro area	107	Mali	157	St. Vincent and the Grenadines
8.	Austria	58.	Fiji	108	Malta	158	Sudan
9.	Azerbaijan	59.	Finland	109	Mauritania	159	Suriname
10.	Bahamas, The	60.	France	110	Mexico	160	Sweden
11.	Bahrain	61	Gabon	111	Mongolia	161	Switzerland
12.	Bangladesh	62	Gambia	112	Moldova	162	Syrian Arab Republic
13.	Barbados	63	Georgia	113	Montenegro	163	Tanzania
14.	Belarus	64	Germany	114	Morocco	164	Thailand
15.	Belgium	65	Ghana	115	Mozambique	165	Timor-Leste
16.	Belize	66	Greece	116	Myanmar	166	Togo
17.	Benin	67	Guam	117	Namibia	167	Tonga
18.	Bhutan	68	Guatemala	118	Nepal	168	Trinidad and Tobago
19.	Bolivia	69	Guinea-Bissau	119	Netherlands	169	Tunisia
20.	Bosnia and Herzegovina	70	Guinea	120	New Caledonia	170	Turkiye
21.	Botswana	71	Guyana	121	New Zealand	171	Turkmenistan
22.	Brazil	72	Haiti	122	Nicaragua	172	Tajikistan
23.	Brunei Darussalam	73	Hong Kong SAR, China	123	Niger	173	Uganda
24.	Bulgaria	74	Honduras	124	Nigeria	174	Ukraine
25.	Burkina Faso	75	Hungary	125	North Macedonia	175	United Arab Emirates
26.	Burundi	76	Iceland	126	Norway	176	United Kingdom
27.	Cabo Verde	77	India	127	Oman	177	United States
28.	Cambodia	78	Ireland	128	Pakistan	178	Uruguay
29.	Cameroon	79	Israel	129	Panama	179	Uzbekistan
30.	Canada	80	Italy	130	Papua New Guinea	180	Vanuatu
31.	Central African Republic	81	Indonesia	131	Paraguay	181	Venezuela, RB
32.	Chad	82	Iran, Islamic Rep.	132	Peru	182	Vietnam
33.	Channel Islands	83	Iraq	133	Philippines	183	Yemen, Rep.
34.	Chile	84	Jamaica	134	Poland	184	Zambia
35.	China	85	Japan	135	Portugal	185	Zimbabwe
36.	Colombia	86	Jordan	136	Puerto Rico		
37.	Comoros	87	Kazakhstan	137	Qatar		
38.	Congo, Dem. Rep.	88	Kenya	138	Romania		
39.	Congo, Rep.	89	Korea, Dem. People's Rep.	139	Russian Federation		
40.	Costa Rica	90	Korea, Rep.	140	Rwanda		
41.	Cote d'Ivoire	91	Kuwait	141	Samoa		
42.	Croatia	92	Kyrgyz Republic	142	Sao Tome and Principe		
43.	Cuba	93	Lao PDR	143	Saudi Arabia		
44.	Cyprus	94	Latvia	144	Senegal		
45.	Czechia	95	Lebanon	145	Serbia		
46.	Denmark	96	Lesotho	146	Sierra Leone		
47.	Djibouti	97	Liberia	147	Singapore		
48.	Dominican Repub.	98	Libya	148	Slovak Republic		
49.	Ecuador	99	Lithuania	149	Slovenia		
50.	Egypt, Arab Rep.	100	Luxembourg	150	Solomon Islands		