

Agricultural Transformation, Food Security and Nutrition in Africa: Sustainable Development Goal 2 in Focus

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ABSTRACT	ARTICLE DETAILS
In 2015, the United Nations came up with a development agenda. The agenda has 17 goals. Goal 2 seeks to “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”. 2024 survey of the state of food security and nutrition in the world revealed increased food insecurity. This study sought to examine the progress towards sustainable development goal 2 in Africa. The study adopted comparative analytics. It was observed that Africa does not make progress towards SDG 2 due to its weak agricultural sector. In 2022, the percentage of cropland in Africa equipped with irrigation was 5.6 %, pesticide use per cropland (kg/ha) was 0.69, share of area under organic agriculture in total agricultural area was 0.2 %, while cropland Nitrogen balance (kg per ha) was 12.6; all the least among regions under consideration. These are typical of unsustainable agriculture. To develop and transform agriculture in Africa to sustainable level, there should be (i) increase in cropland area equipped for irrigation, (ii) increase in pesticide use per cropland, increase in area of cropland under organic agriculture, and maintenance of cropland nitrogen balance to reduce environmental risk such as leaching. KEYWORDS: Agricultural Transformation, Food Security, Undernourishment and Malnutrition JEL CLASIFICATION CODE: Q01, Q11, Q16, Q18, I14	Published On: 16 December 2025 Available on: https://ijrsr.org/

INTRODUCTION

Agriculture occupies a prominent position in the economies of the world. It is the unrivalled source of food – the most essential and basic need of all humans. Nevertheless, for about three decades now, global food supply has been consistently lower than demand with attendant high food prices and hunger (FAO, 1996, 2008, 2017). Therefore, the challenge to achieve adequate food supply that matches food demand has been one major concern at the national, regional and global levels. This concern informed the International Community in 2000 to adopt the eight millennium development goals (MDGs) as a development framework of over 190 nations to be delivered in 2015. Goal 1 specifically sought to “eradicate extreme poverty and hunger” and “targeted halving between 1990 and 2015 the population of people whose income was lower than one dollar (\$1) per day and those who suffer from hunger”. In 2014, the International Community observed that the progress made on MDG 1 was very slow to meet the target. This informed the United Nations in 2015 to come up with a development agenda – Sustainable development goals – to be delivered in 2030. The development agenda has 17 goals and 169 targets. Goal 2 of the United Nations Development agenda seeks to “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”.

The study, therefore, seeks to examine progress towards sustainable development goal 2 in Africa. It also seeks to identify some missing variables in agricultural transformation matrix in Africa with a view to raising some imperatives for consideration for effective agricultural transformation in Africa for food sufficiency. The study adopts comparative analytics. This method helps uncover patterns, trends and insights by looking at things side by side to make informed decision and develop effective strategies. The paper has six sections. Following section 1 are conceptual overview and theoretical frame-work in section 2. Section 3 examines progress towards sustainable development goal 2 in some African countries. Section 4 examines the state of agriculture in Africa relative to other regions. In section 5, missing variables in agricultural transformation matrix in Africa are identified with recommendations. Conclusion is in section 6.

2. CONCEPTUAL OVERVIEW AND THEORETICAL FRAME-WORK

2.1 Conceptual Overview

2.1.1 Agricultural Transformation

Agricultural transformation is a process by which agriculture – crop production, fishery, forestry, and animal husbandry – shifts from a subsistence-oriented level to a more commercialized level. Agricultural transformation is synonymous with agricultural development, an umbrella concept which explains all positive changes for increased production in agriculture for human benefit (Essien, 2012). Agricultural transformation in any society as argued by Essien (2012) depends on the level of overall development of the society, which informs how the government and the private sector regard agriculture. If a society gives regard to agriculture as the unrivalled source of food and raw materials, agricultural transformation to the society would mean the ability of the agricultural sector to yield adequate food to the citizens, and raw materials to the agro – based and agro – allied industries. It would mean the growth of the agribusinesses, including food processing, packaging and distribution, creating new jobs and economic opportunities in agro – allied industries outside the traditional agriculture.

2.1.2 Food Security and Nutrition

The United Nations World Food Conference of 1974 conceptualized “food security” as “the supply of adequate food at all times at international and national levels (Simon, 2012). After 35 years, World Food Programme, in 2009, defined food security as “a condition that exists when all people at all times are free from hunger (WFP, 2009:170). This definition by WFP implies a condition of sufficient food supply, which matches food demand. Food security, according to FAO (2017:108) “is a situation which exists when all people at all times, have physical, social and economic access to sufficient, safe and nutritious food that meet their dietary needs and food preferences for an active and healthy life”.

2.1.3 Dimensions of Food Security

The 1996 World Food Summit, from its definition of food security, also identified four dimensions of food security which were subsequently reconfirmed in 2002. The four dimensions are: (i) availability, (ii) access, (iii) utilization, and (iv) stability

- i. Availability:** This is “the amount of food that is physically present in a country or area through all forms of domestic production, imports, food stocks and food aids”. (WFP, 2009:170). Food availability addresses the supply side of food security (Abdullah, Deyi, Tariq, Sajjad, Wagar Izhar and Aasir, 2019).
- ii. Access:** Food and Agriculture Organization, at the World Food Summit (2002) defined access as “having physical, economic and social access to food by all people at all times”. The availability of adequate amount of food in a country or region or in the world does not imply it is accessible and affordable at the household level. World Food Programme (2009: 170) consequently defined food access as ‘a household ability to access adequate amount of food regularly through a combination of purchase, barter, borrowing, food assistant and gifts”.
- iii. Utilization:** The World Food Summit (2009:170) defined utilization as “safe and nutritious food which meets people’s dietary needs”. Utilization is generally understood as the body makes use of the various nutrients in food. Utilization, as given above is necessary because availability of, and access to, food on their own are not enough; people have to be assured of safe and nutritious food which is determined by food quality, nutritional values, preparation and storage methods (Matemilola and Elegbede, 2017).
- iv. Stability:** Stability refers to the steadiness in food availability, food accessibility and food utilization at all times, and must occur simultaneously (WFS, 2009). A person needs to get access to food at all times to avoid decline in his nutritional balance. A person whose food intake is adequate today will be considered to be food insecure if he has inadequate access to food on a periodic basis. Instability in food availability will lead to instability in access to food, which will consequently reduce food utilization.,

The most critical of the four dimensions is food availability (supply), as food must first be supplied, before it can be accessed; it must be available before it can be utilized; more so, food stability connotes steady food supply.

2.1.4 Levels of food security

There are four levels of food security namely; (i) individual food security, (ii) household food security, (iii) national or regional food security and (iv) global food security (see Figure 2.1).

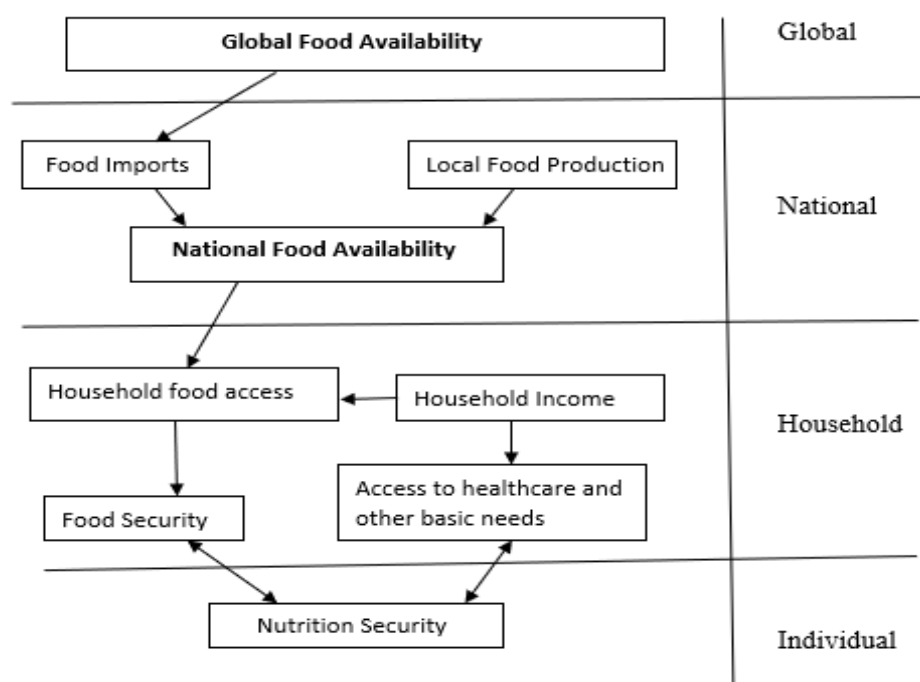


Figure 2.1: Levels of food security

Source: Adapted from Pérez-Escamilla and Segall-Corréa (2008)

Global food availability is the totality of food produced by all the countries of the world; Some countries may produce more while some may produce less. Some type of food may be produced in some countries or regions while other types may be produced in some other countries or regions. This state of affairs gives rise to food imports and exports. At the national level, food security, that is, food availability is derived from two major sources – domestic food production and food imports. Food access by households depends on national food availability. Given national food availability, household income is one major determinant of food accessibility. When a household gets access to (adequate) food at all times, it can be said that it is food secure.

2.1.5 Food Insecurity

Food insecurity is a condition engendered by acute shortage of food supply relative to food demand. It is a situation that exists when people lack secure access to sufficient amount of safe and nutritious food for normal growth, development and an active and healthy life (FAO, 2017: 108). It is a condition in which households experience lack in adequate food stock due to either unavailability, that is, no supply, insufficiency, that is, very low supply, of, or inaccessibility to food stock. Food insecurity may be caused by unavailability (no supply) of food, insufficient purchasing power, inappropriate distribution and inadequate use of food, that is, at the household level (FAO, *ibid*).

2.2 Theoretical Literature

Issues on food security have received considerable theoretical and empirical attention over the years. Some of such views are presented in this sub-section.

2.2.1 Qays's Theory of Food Supply

Qays's theory of food supply is also known as theory of agricultural intensification. This theory was developed in 1965 by Ester Boserup. Qays's theory is about the relationship between human population growth and food production. Boserup (1965), in her work "The conditions of agricultural growth: The Economics of agrarian change under population pressure" challenged Malthus' conclusion that the size of the human population is limited by the amount of food it can produce. Qays's theory in contrast states that "food production can and will increase to match the needs of the population". For instance, where population grows rapidly, the theory argues that the threat of starvation and the challenge of feeding more mouths will motivate people to improve their farming methods and invent new technologies in order to produce more food. Boserup (1965) described this as "agricultural intensification". According to Qays's theory, a farmer who has four fields to cultivate and produce food for his family might cultivate three of the fields, and leave the fourth field empty probably due to the ground being very dry, and would not support his crops. However, if the farmer has two more children, the pressure to produce more food might drive him to build irrigation canal to bring water to the fourth field or to buy a different type of seed that will grow in drier ground. He certainly would change the way he farms so as to make sure that he has enough food to support a large family (Boserup, 1965).

Boserup's theory seems to provide a model for continuous population growth. Boserup (1965) failed to consider that growth in human population is continuous, while agricultural land is static. The theory ignored the aspect of population density, increased

urbanization and erosion which reduce the size of crop land yearly. According to Pimentel, Huang, Cordova and Pimentel (1997), about 33 per cent or 1.5 billion hectares of world crop land has been abandoned due to erosion. They attributed global food shortage to lower land productivity, which is as a result of continuous environmental degradation.

2.2.2 Political Economy Theory of Food Supply

The political economy theory of food supply attributes food insufficiency in human societies to government ineffectiveness, that is, poor policy formulation and inappropriate processes of implementation of public policies, especially those that border on agriculture and environment (Winser, Blakie, Cannon and Davis, 2004). The salient argument of this theory is that political factors (bad and inappropriate public policies) greatly and adversely affect food security. Moreover, when public institutions, especially those involving directly and indirectly in agricultural financing, production, coordination and distribution are not delivering what they ought to do, food scarcity is likely to happen.

3. THE STATE OF HUNGER: PROGRESS TOWARDS SUSTAINABLE DEVELOPMENT GOAL 2 IN AFRICA

Sustainable development goal 2 is to “End hunger, achieve food security and nutrition, and promote sustainable agriculture”. This is to be delivered in 2030. Major indicators for this goal are (i) prevalence of undernourishment, prevalence of severe food insecurity, and prevalence of stunting in children under five years of age (FAO, 2024). Sustainable development goal 2 is laudable; achieving it in Africa would alleviate the continent of the burden of hunger, food insecurity and malnutrition. It would make Africa great. About ten years of adoption of this UN development agenda, and about six years to 2030, the delivery year, it is needful to examine the progress Africa has made towards SDG 2, This called for the examination of the state of hunger and food insecurity in selected countries in Africa using the three major indicators: (i) undernourishment – “the condition in which an individual’s habitual food consumption is insufficient to provide the amount of dietary energy required to maintain a normal, active and healthy life”, (ii) severe food insecurity- “the level of severity of food insecurity at which people have likely run out of food, experienced hunger and, at the most extreme, gone for days without eating, putting their health and well-being at grave risk”, and (iii) stunting – “low height-for-age, reflecting a past episode or episodes of sustained undernutrition” (FAO,2024: 226). Table 3.1 shows data on the progress towards SDG 2 in select countries in Africa, Africa, Asia, North America and Europe. From Table 3.1, between 2004 and 2006, prevalence of undernourishment in total population of Egypt was 5.9%, which rose to 8.5% between 2021 and 2023. Between 2014 and 2016, prevalence of severe food insecurity in Egypt was 8.4%. It rose to10.4% between 2021 and 2023. This indicates no progress.

Table 3.1: Progress Towards Sustainable Development Goal 2 in Select African Countries, 004 - 2023

Region / Country	Prevalence of undernourishment in the total population		Prevalence of severe food insecurity in the total population		Prevalence of stunting in children under five years of age	
	2004 – 2006 (%)	2021 – 2023 (%)	2014 – 2016 (%)	2021 – 2023 (%)	2012 (%)	2022 (%)
Northern Africa						
Egypt	5.9	8.5	8.4	10.4	24.6	20.4
Libya	4.8	11.4	11.2	19.9	30.0	52.2
Tunisia	4.0	3.2	9.1	11.3	8.8	8.6
Central Africa						
Chad	36.4	35.1	32.4	36.4	38.9	32.3
Cameroon	15.7	5.7	22.3	25.4	32.1	26.9
East Africa						
Ethiopia	37.0	22.2	14.5	19.7	42.1	34.4
Kenya	28.2	34.5	15.0	28.0	28.6	18.4
Malawi	21.3	19.9	47.7	53.5	43.6	34.0
Mauritius	5.2	5.9	5.2	10.2	9.0	8.6
Uganda	18.6	36.9	21.5	23.0	33.3	23.9
Zimbabwe	29.6	38.1	35.5	26.0	31.1	21,6
West Africa						
Benin	11.4	10.3	10.4	15.8	33.9	30.4
Liberia	33.4	38.4	38.6	37.3	35.0	26.6
Mauritania	9.1	9.3	4.6	11.6	26.0	22.1
Sierra Leone	46.2	28.4	26.7	32.3	34.9	26.0
Nigeria	7.0	18.0	11.0	22.6	37.7	34.2
Southern Africa						

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Botswana	22.9	24.3	18.4	24.4	24.6	21.6
Namibia	20.0	22.2	28.8	31.9	24.0	16.8
Eswatini	9.5	12.4	Na	17.2	28.0	21.2
South Africa	3.4	8.1	Na	8.4	22.5	22.8
AFRICA	19.9	19.9	17.2	21.6	34.0	30.0
ASIA	13.6	8.2	6.7	9.9	28.2	22.3
NORTH AMERICA AND EUROPE	<2.5	<2.5	1.3	1.5	4.2	3.8
WORD	12.0	9.1	7.6	10.9	26.3	22.3

Source: Food and Agriculture Organization (2024) *The State of Food Security and Nutrition in the World*, pp. 152 – 165.

Prevalence of stunting in children under five years of age in Egypt was 24.6 in 2012; it reduced to 20.4% in 2022. Libya experienced no progress towards SDG 2. Between 2004 and 2006, prevalence of undernourishment in total population of Libya was 4.85, which rose to 11.4% between 2021 and 2023. Also, prevalence of severe food insecurity in total population in Libya which was 11.2% between 2014 and 2016 rose to 19.9% between 2021 and 2023. In the same direction, prevalence of stunting in children under five years of age in Libya increased from 30.0% in 2012 to 52.2% in 2022. Ethiopia recorded progress in undernourishment which dropped from 37.0% between 2004 and 2006 to 22.2% between 2021 and 2023. However, prevalence of severe food insecurity in total population of Ethiopia rose from 14.5% between 2014 and 2016 to 19.7% between 2021 and 2023. Ethiopia also made progress in prevalence of stunting in children under five years of age which dropped from 42.1% in 2012 to 34.4% in 2022.

Nigeria made insignificant progress in prevalence of stunting in children under five years of age which dropped from 37.7% in 2012 to 34.2% in 2022. In the other two key indicators, Nigeria made no progress. Prevalence of undernourishment in its total population which was 7.0% between 2004 and 2006, increased to 18.0% between 2021 and 2023. Also, prevalence of severe food insecurity in total population of Nigeria which was 11.0% between 2014 and 2016, increased to 22.6% between 2021 and 2023. Prevalence of undernourishment in total population of South Africa was 3.4% between 2004 and 2006; it rose to 8.1% between 2021 and 2023. Prevalence of stunting in children under five years of age in South Africa rose from 22.5% in 2012 to 22.8 in 2022. From Table 3.1, the 20 select African countries made progress in prevalence of stunting in children under five years of age. However, only three countries-Benin, Ethiopia and Sierra Leone- from the select African countries made progress in prevalence of undernourishment in their populations. Also, only two countries – Liberia and Zimbabwe - made progress in prevalence of severe food insecurity in their populations.

On a global assessment, Africa made no progress in prevalence of undernourishment in its population. Between 2004 and 2006, prevalence of undernourishment in Africa was 19.9%, which remained so between 2021 and 2023. Africa also made no progress in prevalence of severe food insecurity which increased from 17.2% between 2014 and 2016 to 21.6% between 2021 and 2023. However, it experienced an insignificant progress in prevalence of stunting in children under five years of age which decreased from 34.0% in 2012 to 30.0% in 2022. Asia made progress in prevalence of undernourishment in its population which decreased from 13.6% between 2004 and 2006 to 8.2% between 2021 and 2023. Prevalence of stunting in children under five years in Asia also dropped from 28.2% in 2012 to 22.3% in 2022. However, Asia made no progress in prevalence of severe food insecurity as it increased from 6.7% between 2014 and 2016 to 9.9% between 2021 and 2023. In North America and Europe prevalence of undernourishment was less than 2.5% between 2004 and 2023. However, prevalence of severe food insecurity increased insignificantly from 1.3% in 2014 and 2016 to 1.5% between 2021 and 2023. Prevalence of stunting in children under five years of age dropped from 4.2% in 2012 to 3.8% in 2022. Globally, prevalence of undernourishment dropped from 12.0% between 2004 and 2006 to 9.1% between 2021 and 2023; while prevalence of stunting in children under five years of age dropped from 26.3% in 2012 to 22.3% in 2022. However, global prevalence in severe food insecurity increased from 7.6% between 2014 and 2016 to 10.9% between 2021 and 2023.

Table 3.2: Progress towards Sustainable Development Goal 2 - End Hunger - in Select African Countries, 2004 – 2023.

Region / Country	Number of undernourished people		Number of severely food insecure people		Number of children under five years who are stunted	
	2004 – 2006 million	2021 – 2023 million	2014 – 2016 million	2021 – 2023 million	2012 million	2022 million
Northern Africa						
Egypt	4.6	9.2	8.2	11.5	2.8	2.5
Libya	0.3	0.8	0.7	1.4	0.2	0.3
Tunisia	0.4	0.4	1.1	1.4	0.1	0.1

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Central Africa						
Chad	3.5	6.2	4.6	6.5	1.0	1.1
Cameroon	2.7	1.6	5.1	7.1	1.2	1.2
East Africa						
Ethiopia	28.7	27.3	14.9	24.3	6.4	6.3
Kenya	10.1	18.7	7.0	15.1	2.0	1.3
Malawi	2.7	4.1	8.1	10.9	1.2	1.0
Mauritius	0.1	0.1	<0.1	0.1	<0.1	<0.1
Uganda	5.2	17.4	8.1	10.9	0.5	0.4
Zimbabwe	3.6	6.2	5.0	4.3	0.7	0.5
West Africa						
Benin	0.9	1.4	1.1	2.1	0.6	0.7
Liberia	1.1	2.1	1.8	2.0	0.2	0.2
Mauritania	0.3	0.4	0.2	0.6	0.2	0.2
Sierra Leone	2.6	2.4	2.0	2.8	0.4	0.3
Nigeria	9.9	39.4	20.3	49.4	11.4	12.1
Southern Africa						
Botswana	0.4	0.6	0.4	0.7	<0.1	<0.1
Namibia	0.4	0.6	0.7	0.8	0.1	0.1
Eswatini	0.1	0.1	na	0.2	<0.1	<0.1
South Africa	1.7	4.9	na	5.0	1.3	1.3
AFRICA	184.6	284.0	207.0	308.7	61.3	61.3
ASIA	542.4	385.2	299.5	468.5	106.8	76.6
LATIN AMERICA AND THE CARIBBEAN	49.7	43.4	43.8	70.1	6.8	5.7
EUROPE	na	na	10.6	13.5	2.1	1.4
WORLD	788.3	722.0	568.0	868.6	177.9	148.1

Source: Food and Agriculture Organization (2024) *The State of Food Security and Nutrition in the World*, pp. 167 – 180.

Table 3.2 shows the number of undernourished people, number of severely food insecure people and number of children under five years who are stunted. From the table, between 2004 and 2006, 4.6 million people in Egypt were undernourished. Between 2021 and 2023, the number rose to 9.2 million. Number of severely food insecure people in Egypt which was 8.2 million between 2014 and 2016 increased to 11.5 million between 2021 and 2023. However, number of children under five years who are stunted dropped from 2.8 million in 2012 to 2.5 million in 2022. In Chad, Number of undernourished people which was 3.5 million between 2004 and 2006 increased to 6.2 million between 2021 and 2023; while number of severely food insecure people increased from 4.6 million between 2014 and 2016 to 6.5 million between 2021 and 2023. Number of undernourished people in Kenya between 2004 and 2006 was 10.1 million; it increased to 18.7 million between 2021 and 2023. In Ethiopia, number of undernourished people reduced from 28.7 million between 2004 and 2006 to 27.3 million between 2021 and 2023. Contrary, number of severely food insecure rose from 7.5 million people in between 2014 and 2016 to 15.1 million people between 2021 and 2023. In Uganda, between 2004 and 2006, number of undernourished people was 5.2 million; it increased to 17.4 million between 2021 and 2023. In Sierra Leone, number of undernourished people decreased from 2.6 million between 2004 and 2006 to 2.4 million between 2021 and 2023. However, number of its severely food insecure people increased from 2.0 million between 2014 and 2016 to 2.8 million between 2021 and 2023. Between 2004 and 2006, 1.7 million people were undernourished in South Africa. The number rose to 4.9 million between 2021 and 2023. Between 2012 and 2022, 1.3 million children were stunted. Nigeria's situation is outstanding. Between 2004 and 2006, 9.9 million people were undernourished in Nigeria.

The number of undernourished increased to 39.4 million between 2021 and 2023. Also, number of severely food insecure people in Nigeria between 2014 and 2016 which was 20.3 million increased to 49.4 million between 2021 and 2023. On a global scale, from Table 3.2, Africa made no progress towards SDG 2. Between 2004 and 2006, 184.6 million people were undernourished; the number increased to 284.0 million people between 2021 and 2023. Also, number of severely food insecure people which was 207.0 million between 2014 and 2016, rose to 308.7 million between 2021 and 2023. Globally, number of severely food insecure people increased from 560 million between 2014 and 2016 to 868.6 million between 2021 and 2023.

The level of food security/insecurity in any economy largely depends on the level of development in its agricultural sector. It is clear that Africa makes no progress towards the first part of SDG 2 - "End hunger, achieve food security and nutrition". This

indicates that agriculture in Africa is unable to give the continent the needed leap for achieving food security. It is therefore important to assess the progress Africa has made towards the second part of SDG 2 – “...achieve sustainable agriculture” by examining the state of agriculture in Africa in relation to the state of agriculture in other regions of the world.

4. SUSTAINABLE AGRICULTURE IN AFRICA: A COMPARATIVE ASSESSMENT

According to Food and Agriculture Organization, FAO, (2024), for agriculture to be sustainable, “it must meet the needs of present and future generations, while ensuring profitability, environmental health, and social and economic equity. Sustainable food and agriculture (SF&A) contribute to all four pillars of food security – availability, access, utilization, and stability”. The key reason FAO promotes SFA is to help countries worldwide achieve SDG 2 – zero hunger, among other goals. Six years from 2030, the expected delivery years of SDGs, it was necessary to assess if agriculture in Africa is sustainable. The assessment was done relative to agriculture in other regions of the world.

Food and Agriculture Organization (2024:vi–vii) specified four dimensions for assessment of sustainable agriculture in an economy. These are (i) economic; (ii) sustainability and environmental; (iii) production, trade and prices of commodities; (iii) and (iv) food security and nutrition dimensions. These dimensions have indices. In this subsection, key indices have been selected from the first three dimensions (economic; production, trade and prices of commodities; sustainability and environmental) since some indices in the fourth dimension (food security and nutrition) have been used in Tables 3.1 and 3.2.

4.1: Economic Dimension of Sustainable Agriculture

Economic dimension of agriculture provides an overview of agriculture in a country or region from an economic viewpoint (FAO, 2024: xi). In this dimension, three indices are used for the assessment. They are: (i) agricultural land by use, (ii) share of area equipped for irrigation in cropland area (percent), and (iii) pesticide use per cropland area (tons).

4.1.1 Agricultural Land by Use (Thousand HA)

Agricultural land is land used for cultivation of crops and animal husbandry. It is the total of area under cropland – the land used for cultivation of crops- and permanent meadows and pastures – land used permanently (five years or more) to grow herbaceous forage crops through cultivation or naturally (wild prairie or grazing land) (FAO, 2024: 55 -56).Table 4.1.1 contains data on agricultural land by use (thousand ha) in regions of the world.

Table 4.1.1 Agricultural Land by Use (Thousand HA) in Regions of the World, 2000 -2022

Regions	Permanent Meadows and Pastures				Cropland			
	2000	2010	2020	2022	2000	2010	2020	2022
Africa	857120.4	867055.9	868284.9	868423.8	231512.5	264833.9	300778.0	304754.9
Americas	781503.7	770358.1	752620.8	743752.7	369755.9	371040.4	370769.4	369325.9
Asia	1116057.1	1082896.0	1083363.8	1082673.0	561194.3	571376.6	576496.0	576913.2
Europe	180804.3	177519.9	171978.4	171196.2	303826.1	290218.2	288425.2	288302.4
Oceania	444264.8	361889.2	334965.1	341644.1	25717.5	28179.2	33390.6	34048.7
WORLD	3379750.4	3259719.1	3211213.0	3207689.8	1492006.3	1525648.3	1569859.2	1573345.1

Source: Food and Agriculture Organization (2024) *The State of Food Security and Nutrition in the World*, p. 86.

From Table 4.1.1, permanent meadows and pastures was 857120.4 ha in 2000. It increased to 868423.8 ha in 2022. Also, cropland extended from 231512.5 ha in 2000 to 304754.9ha in 2022. On the whole, agricultural land in Africa increased, permanent meadows and pastures by 11303.4ha while cropland increased by 73242.4ha. With the increase, it would be expected that agricultural productivity would increase; but this was not the case due to rapid increase in population which reduced cropland area per capita (ha per capita) from 0.28 in 2000 to 0.21 in 2022 (FAO, 2024: 91). In Americas, permanent meadows and pastures reduced from 781503.7 ha in 2000 to 743752.7 ha in 2022; cropland also reduced from 369755.9 ha in 2000 to 369325.9 ha in 2022. Cropland area per capita in Americas also dropped from 0.44 in 2000 to 0.36 in 2022. Permanent meadows and pastures in Asia, Europe and Oceania between 2000 and 2022 decreased; however, cropland in Asia and Oceania increased, but cropland in Europe decreased from 303826.1ha in 2000 to 288302.4ha in 2022. With steady increase in global population, cropland area per capita in Asia dropped from 0.15 in 2000 to 0.12 in 2022, while in Oceania it dropped from 0.82 in 2000 to 0.76 in 2022. In Europe, cropland area per capita dropped from 0.42 in 2000 to 0.39 in 2022 (FAO, 2024: 91). Africa’s cropland per capita was the least among regions under consideration in 2022 which indicates its agriculture is not sustainable. On the whole, global cropland per capita dropped from 0.24 in 2000 to 0.20 in 2022.

4.1.2 Area Equipped for Irrigation (Thousand HA)/Share in Cropland Area (%)

Area Equipped for Irrigation (Thousand HA)/Share in Cropland Area (%) in Regions of the World, between 2000 -2022 are shown in Table 4.1.2.

Table 4.1.2: Area Equipped for Irrigation (Thousand HA)/Share in Cropland Area (%) in Regions of the World, 2000 -2022

Region	2000		2005		2010		2015		2020		2022	
	'000 ha	%	'000 ha	%	'000 ha	%	'000 ha	%	'000 ha	%	'000 ha	%
Africa	13189	5.7	14169	5.8	15123	5.7	16420	5.7	16954	5.6	17043	5.6
Americas	47617	12.9	49459	13.1	51712	13.9	54568	14.7	56946	15.4	57675	15.6
Asia	199144	35.5	217189	38.2	227477	39.8	237627	41.3	248128	43.0	248213	43.1
Europe	26712	8.8	26381	9.0	25824	8.7	26129	9.0	27202	9.4	27216	9.4
Oceania	2682	10.4	3093	10.8	3241	11.5	3298	9.8	3312	9.9	3323	9.8
WORLD	289344	19.4	310291	20.5	322837	21.2	338042	21.7	352543	22.5	353902	22.5

Source: Food and Agriculture Organization (2024), *The State of Food Security and Nutrition in the World*, pp. 96 – 101.

From Table 4.1.2, Africa equipped 13189 '000 ha (5.7%) of cropland for irrigation in 2000. Americas in the same year equipped 47617 '000ha (12.9%), while Asia equipped 199144 '000 ha (35 %) of cropland for irrigation. In 2022, Africa equipped 17043 '000 ha (5.6%) of cropland for irrigation, while Asia equipped 248213 '000ha (43%) of cropland for irrigation. In 2022, from a pool of five regions, Africa's share of cropland equipped for irrigation was the least – 5.6%. Asia got the highest (43.1%), followed by Americas (15.6%). A fall from 5.7% share in cropland equipped for irrigation in 2000 to 5.6% in 2022 in Africa indicates no progress towards the second part of SDG 2 – 'achieve sustainable agriculture' in Africa.

4.1.3: Pesticide Use Per Cropland Area (Kg per HA) in Regions of the World, 2000 -2022

Pesticides include insecticides, fungicides, herbicides, disinfectants and any substances or mixture of substances intended for preventing, destroying or controlling any pests in plants and animals (FAO, 2024:56). Table 4.1.3. has data on pesticide use per cropland area in regions of the world between 2000 and 2022.

Table 4.1.3: Pesticide Use Per Cropland Area (Kg per HA) in Regions of the World, 2000 -2022

	2000	2005	2010	2015	2018	2020	2021	2022
Africa	0.32	0.40	0.49	0.56	0.65	0.71	0.70	0.69
Americas	2.41	2.91	3.50	3.92	4.16	4.66	4.62	5.11
Asia	1.33	1.52	1.97	2.02	1.94	1.67	1.90	1.87
Europe	1.47	1.56	1.55	1.77	1.72	1.74	1.77	1.64
Oceania	1.49	1.40	1.75	1.75	2.01	2.01	1.97	1.98
WORLD	1.47	1.69	2.01	2.16	2.18	2.22	2.29	2.37

Source: Food and Agriculture Organization (2024) *The State of Food Security and Nutrition in the World*, pp. 96 – 101.

From Table 4.1.2, Europe in 2000 used 1.47 kg per ha on its cropland area. It increased pesticide use to 5.11kg per ha in 2022. Oceania used 1.49 kg of pesticide per ha of its cropland in 2000, and increased it to 1.87kg per ha in 2022. Africa in 2000 used 0.38 kg of pesticide per ha of its in 2000, which increased to 0.69 per ha in 2022. Between 2000 and 2022, use of pesticide on cropland in Africa each year was not up to 1kg per ha. This, also indicates no progress towards sustainable agriculture.

4.2: Sustainability and Environmental Aspects of Sustainable Agriculture

Sustainability and environmental aspects of sustainable agriculture deal with the impacts of agricultural sector on the environment (FAO, 2024: xi). In this dimension, three indices are considered; they are: (i) Area under organic agriculture (thousand ha), (ii) share of area under organic agriculture in total agricultural area (percent), and (iii) cropland nitrogen balance (kg per ha). Table 4.2 contains data on area under organic agriculture (thousand ha), and share of area under organic agriculture in total agricultural area (percent).

Table 4.2: Area under Organic Agriculture ('000 ha) /Share of Area Under Organic Agriculture in Total Agricultural area (%).

Region	2005		2010		2015		2020		2021		2022	
	'000ha	%	'000ha	%	'000ha	%	'000ha	%	'000ha	%	'000ha	%
Africa	952.9	0.1	1023.6	0.1	1682.4	0.1	2354.8	0.2	2749.9	0.2	2758.3	0.2
Americas	7090.4	0.6	10178.2	0.9	9765.0	0.9	13847.6	1.2	13457.7	1.2	12414.8	1.1
Asia	2837.1	0.2	3271.4	0.2	4483.4	0.3	6534.3	0.4	6863.4	0.4	9147.6	0.6
Europe	6567.8	1.4	9545.1	2.0	12198.4	2.6	16570.6	3.6	17591.5	3.8	17854.2	3.9
Oceania	11763.0	2.8	11785.2	3.0	22838.5	6.3	35907.6	9.7	35944.5	9.6	35864.7	9.5
WORLD	29211.1	0.6	35803.5	0.7	50967.7	1.1	75214.9	1.6	78592.0	1.6	78035.6	1.6

Source: Food and Agriculture Organization (2024) *The State of Food Security and Nutrition in the World*, pp. 227– 332.

From Table 4.2, share of area under organic agriculture in total agricultural area in Oceania varied between 2.8 % in 2005 and 9.5 % in 2022, the highest among the five regions under consideration. Agricultural land in Europe under organic agriculture in 2005 was 1.4 %; it increased to 3.9 % in 2022. Share of area under organic agriculture in total agricultural area in Africa was 0.1 % between 2005 and 2015, and 0.2 percent between 2020 and 2022, the lowest within the period under consideration. This is another indicator that achieving sustainable agriculture in Africa in 2030 is not feasible.

4.2.1: Cropland Nitrogen Balance (kg per ha)

Cropland nitrogen balance is the difference between the cropland nitrogen input and output flows. That is, the difference between the quantities of synthetic and organic nutrients (nitrogen, phosphorus and potassium) added to and withdrawn from cropland by the production of crops and livestock. An excess of nutrients can lead to environmental risks, such as leaching, while insufficient levels of nutrients constraint yield (FAO, 2024:42). Table 4.2.1 contains information on cropland nitrogen balance in regions of the world between 2000 and 2021.

Table 4.2.1 Cropland Nitrogen Balance (kg per ha) in Regions of the World, 2000 and 2021

Region	Cropland Nitrogen Balance (kg per ha)	
	2000	2021
Africa	8.6	12.6
Americas	35.2	48.3
Asia	79.3	85.4
Europe	40.6	32.9
Oceania	4.8	14.0
World	48.3	51.9

Source: Food and Agriculture Organization (2024) *The State of Food Security and Nutrition in the World*, p. 342.

Cropland nitrogen balance is a key indicator of sustainable agriculture. The higher it is, the closer agriculture is to being sustainable. In 2000, Oceania had the least cropland nitrogen balance of 4.8 kg/ha followed by Africa (8.6 kg/ha). Asia had the highest (79.3kg/ha). In 2021, Asia had the highest cropland nitrogen balance of 85.4kg/ha. Africa had the least (12.6kg/ha). This indicates that agriculture in Africa is not sustainable.

4.3: Sustainable Agriculture: Production, Trade and Prices of Commodities

Sustainable agriculture must meet the needs of present and future generations. One basic need of all generations is food. A country or region with vibrant agricultural sector will produce sufficient food for domestic consumption and for exports. Let us examine food imports/exports situation of some African countries, and Africa relative to other regions. Table 4.3 contains information on food exports, food imports and food net trade in select African countries.

Table 4.3.: Food Exports, Food Imports and Food Net Trade in Select African Countries, USD Million, 2022

Region/Country	Food Exports	Food Imports	Food Net Trade
North Africa			
Egypt	5916	17200	-11284
Libya	49	3817	-3768
Tunisia	2055	3123	-1068
Central Africa			
Chad	115	264	-131
Cameroon	900	1662	-762
East Africa			
Ethiopia	2497	3897	-1400
Kenya	3003	3259	-256
Malawi	326	142	184
Mauritius	590	1279	-689
Uganda	1601	713	888
Zimbabwe	134	1015	-881
West Africa			
Benin	117	1157	-1040
Liberia	144	476	-332
Mauritania	924	1158	-234
Sierra Leone	80	483	-403
Nigeria	1305	6361	-5056

Southern Africa			
Botswana	145	950	-805
Namibia	1264	1015	249
Eswatini	432	393	39
South Africa	11796	6540	5256
AFRICA	62463	109394	-46931
AMERICAS	530154	368954	161200
ASIA	395922	684801	-288879
EUROPE	738000	702527	35473
Oceania	76495	24502	51993
WORLD	1803034	1890182	-87148

Source: Food and Agriculture Organization (2024), *World Food and Agriculture Statistical Year Book*, pp. 216– 230.

Table 4.3 shows that of 20 African countries considered, only five (5) –Eswatini, Malawi Namibia, South Africa, and Uganda, had positive food net trade in 2022. On regional assessment, Africa and Asia had negative food net trade in 2022. Generally, the world recorded a negative food net trade of \$87148m in 2022.

5. MISSING VARIABLES IN AFRICA’S AGRICULTURAL TRANSFORMATION MATRIX AND RECOMMENDATIONS

Progress towards sustainable development goal 2, “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” in any country or region largely depends on the level of development in its agricultural sector. Africa does not make progress towards SDG 2 due to its weak agricultural sector. This suggests that agriculture in Africa lacks the needed variables for the needed transformation. As observed, the percentage of cropland in Africa equipped with irrigation is 5.6 % in 2022, the least among regions under consideration. Also, pesticide use per cropland (kg/ha) was 0.69 in 2022, the least among regions. Moreover, share of area under organic agriculture in total agricultural area was 0.2 %, while cropland Nitrogen balance (kg per ha) was 126, again, the least in regions’ agricultural areas. These are typical of unsustainable agriculture.

In any country or region, unsustainable agriculture is one that lacks the needed variables, referred to by Mosher (1966) as “essentials”. These are: i) availability of local supplies and equipment, (ii) constantly improving technology, (iii) markets for farm products, (iv) markets for farm products, and (v) transportation and distribution network.

To develop and transform agriculture in Africa to sustainable level, there should be

- (i) increase in cropland area equipped for irrigation,
- (ii) increase in pesticide use per cropland,
- (iii) increase in area of cropland under organic agriculture,
- (iv) maintenance of cropland nitrogen balance to reduce environmental risk such as leaching.

It is apposite to note that without the ‘essentials’ in Africa’s agricultural transformation matrix, recommendations i – iv above will not be feasible.

6. CONCLUSION

Sustainable Development Goal 2, “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” is laudable. However, its achievement in Africa essentially depends on the level of development of agriculture in Africa. In Africa’s agricultural transformation matrix, the ‘essentials’ are indeed essential.

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