

Assessing sustainable agriculture and food systems in Africa: Thematic areas and indicators of progress

Sustainable agriculture denotes all aspects of food production that is economically viable, environmentally safe, socially acceptable, capable of persisting and has the ability of securing the present without jeopardising the future (Robertson & Harwood, 2013). The concept of sustainable agriculture is still subject to definitional misconceptions thereby rendering its implementation very difficult (Velten, Leventon, Jager, & Newig, 2015). Sustainable agriculture involves different agricultural enterprises including crops, livestock, fisheries and forestry. Some of the age-long cropping practices in Africa include farm rotation, multi-functional cropping systems, leguminous plants used as mulch, soil organic matter ploughed into the soil, conservation tillage and use of the ecosystems as a form of soil conservation techniques. Furthermore, since the agriculture sector plays a very important role in the economic development of sub-Saharan Africa, sustainable agriculture could be viewed in the light of food systems which is capable of addressing the challenges facing Africa if adequately harnessed (Adenle, Azadi, & Manning, 2018). Sub-Saharan Africa has history of perennial food crisis (Okigbo, 1993; Weil, 2013). There is, therefore, the need to address the development in agriculture in a way that is sustainable with the aim of overcoming food insecurity and food crisis in the region.

Sustainable agriculture is gaining wide recognition and prominence but not without its challenges which have come to the fore as a result of misunderstandings and controversy based on divergent perceptions and concepts. Adenle & Agboola (2011) identified land use system, government institutions and infrastructures, agricultural technology, climate change, agricultural bio-diversity, conservation of agricultural bio-diversity and resource allocation as major factors that will enhance sustainable agriculture in Africa. Therefore, allocation of resources to agriculture or inadequate investments in agriculture can pose as a major impediment to agricultural sustainable agriculture and food systems.

The ecological and social price of sustainable agriculture and food systems include depletion of soils, erosion, soil contamination, decline in the farm family labour, loss of bio-diversity, deforestation, and reduction in water resources. Moreover, there have been different changes faced by agriculture as a result of the positive changes experienced by man and his environment. Some of these changes are as a result of technological advancements in form of mechanization, increased awareness of chemicals and chemical use, favourable and non-favourable government policies (Abubakar & Attanda, 2013). Some challenges and problems associated with non-use of cleaner agricultural production (Verma, Jaiswal, Meena, Kumar, &

Meena, 2015) could lead to nutritional and health challenges (Kyomuhendo & Adeola, 2021). Not practising sustainable agriculture could further reduce soil fertility and natural resources found in the soil. In sub-Saharan Africa, the agricultural sector lags behind considerably than other regions, this is as a result of small pieces of fragmented farmlands which accounts for over 80% of farmlands of less than two hectares used for food and animal production (Shimeles, Verdier-Chouchane, & Boly, 2018). Besides, agriculture has been found to be one of the most important drivers of biodiversity loss (Oberc & Arroyo, 2020). The crisis of loss of natural biomass and climate change also threaten sustainable agriculture and food systems in Africa.

1 | EMERGING FRAMEWORKS FOR SUSTAINABLE AGRICULTURE AND FOOD SYSTEMS IN AFRICA

The review of recent literature and policies in Africa suggest key aspects of sustainable agriculture and food systems in Africa. These key priority areas with specific dimension of sustainability (social, economic, environmental and governance) are schematically presented in Figure 1.

1.1 | Agri-entrepreneurship

Agriculture has over the years been associated with the locals and natives of communities and this has made it to be seen as a low technology based enterprise. However, this narrative is fast changing since agriculture has now changed from a local native enterprise to a technologically based industry (Lans, Seuneke, Wageningen, & Klerkx, 2017), but it is not yet universal as is the case in many African nations compared with other countries in the world. This situation is as a result of economic incapacitation of majority of the smallholder farmers have less than two hectares of farmland, inaccessibility to inputs, input supplies, the difficulty of accessing loans, and inadequate technical knowhow of new technologies (Obisesan, Salman, Adenegan, & Obi-Egbedi, 2019). Agricultural entrepreneurship is an emerging aspect of sustainable agriculture and food systems. Agricultural entrepreneurship is doing agriculture in a business-like manner and this must be learnt by all involved in agriculture, including youth and women (Lans, Verhees, & Verstegen, 2016; Minyangu et al., 2021; Obisesan & Olayide, 2021). The art of doing business

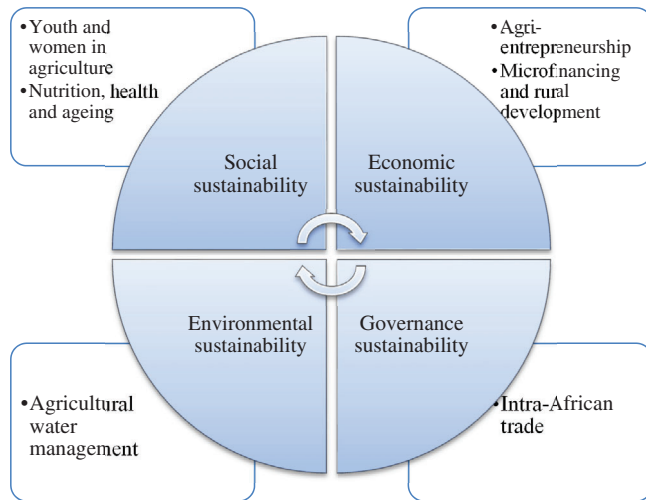


FIGURE 1 Schema of sustainable agriculture and food systems in Africa.

Source: Author

must be learnt because there are series of steps and technicalities involved which has to be taught founded on the experiences of the different farmers. In doing agricultural entrepreneurship there are some important factors that has to be put into consideration which are the environment in which agriculture is to be carried, understanding of the sector as a whole, the participants or the farm families, gender, accessibilities to entrepreneurial trainings and skills (Hulsink, Dons, Lans, & Blok, 2014; Obisesan & Olayide, 2021). When there is a proper and adequate training as well as understanding of the operations of agribusiness by a farmer agricultural entrepreneurship will become a glimmer of hope bringing forth multiplicity in the farmer, the community, the nation and the continent of Africa. This can be learnt from the experiences of the European Union on the contribution of agricultural entrepreneurship for a sustainable development as seen in the research carried out by Martinho (2020) compared to the challenges of entrepreneurship in Nigeria (Obisesan & Olayide, 2021). Consequently, an understanding of agriculture as an enterprise is expected to inculcate the habit of climate-smart agricultural practices into farmers (Rosenstock & Nowak, 2018). This has to be taught and learnt hence the need for stakeholders at all levels to ensure sustainable agriculture and food systems through agri-preneurship (De Massis, Kotlar, Wright, & Kellermanns, 2018). Further, specific indicators like regulations and taxes, gender, firm characteristics, finance and infrastructure have been identified as major business obstacles of female entrepreneurs (Obisesan & Olayide, 2021).

1.2 | Micro-financing and rural development

Micro-financing activities has been found to have positive impact on the economic growth and savings (Nwude & Anyalechi, 2018). Micro-financing also increases agricultural productivity because farmers

were found to be more proactive in saving when they were adequately funded. There was also an increase in farmers' diversification which resulted into their ability to respond better to risks and shocks occasioned by the inconsistencies common with agriculture as a business or enterprise. Therefore, in order to accelerate rural progress and transformation of African communities to areas where poverty will be a thing of the past, adequate funding of farmers' agricultural projects and monitoring of farmers cannot be overemphasised (Vetrivel & Kumarmangalam, 2010). The role of microfinance institutions or micro-financing as a boost for rural poverty reduction is another important take on agricultural sustainability in developing countries.

Further, there are significant differences between the engagement of young men and women in agribusiness and contributions to rural development. These differences are largely explained by land tenure system, socioeconomic background, and demographic characteristics (Minyangu et al., 2021). Hence there is need to reduce inequality in agricultural and economic resources in Africa.

1.3 | Agricultural water management

Although, it is believed that there are sufficient fresh water globally, however, agriculture alone accounts for 70% of withdrawals. This is as a result of tremendous increase in food production. There are three main factors that has been influencing the demand for water globally (OECD, 2012). These factors are: change in dietary preferences, population growth, and increasing wealth. However, a review of the impact of agricultural water management in the Americas by Valipour and Access (2016) showed that the condition of the countries was a major determinant factor of water availability and accessibility. Therefore, sustainable water management has become one of the challenges of sustainable agriculture and food systems of the 21st century (WEF, 2013; Wheeler, Bark, Loch, & Connor, 2015). Furthermore, the United Nations in 2004 defined water scarcity as "the point at which the aggregate impact of all users impacts on the supply or quality of water under the prevailing institutional arrangements to the extent that the demand by all sectors, including the environment cannot be fully satisfied" (United Nations, 2004), this therefore implies that water scarcity in this context is as a result of demand for, supply of and governance. In essence, economic growth and upward shift in the standards of living of most emerging economies like countries in Africa is increasing the demand for water. Since agricultural practices and livestock management are now shifting from outright dependence on rainwater to irrigation (Olayide, Tetteh, & Popoola, 2016; Wheeler et al., 2015).

The rate of water withdrawal has been on increase globally due to population increase, but at different levels in the Africa. A review of the evaluation of irrigation practices in one of African's largest economies "Nigeria" shows that inconsistent government policies, low awareness backed by poor political will, lack of technological know-how and inadequate financial capacity has been hindering the supplemental supply of water to farmers (Adelodun & Choi, 2018). This would suggest that in order to have water usage and in a highly

efficient manner, there is need for farmers to be better informed on the use an application of irrigation systems (Garcia et al., 2020) and be educated on practice of climate-smart agriculture (Olayide, Tetteh, & Popoola, 2016). The connection between agriculture and water is very strong (Olayide, Tetteh, Porter, & Popoola, 2016). Sustainable agriculture cannot be achieved without successful water management practices. Crops and livestock cannot be managed with inadequate supply of water, therefore, there is the need for holistic and macroeconomic planning that will include agricultural policies with water needs and supply management.

Agricultural water infrastructure investment is germane for economic growth, export earnings and foreign direct investment into agriculture in Africa (Nhlengethwa, Matchaya, Greffiths, & Fakudze, 2021). Agricultural water infrastructure investment is particularly important for agricultural commodities like cereals, staples, and cash crops. Hence, sustainable agriculture and food systems require investments in climate smart agriculture (Olayide, Tetteh, & Popoola, 2016).

1.4 | Youth and women in agriculture

Going by the unprecedented level at which youth unemployment is reported in Africa which is a worrisome narrative, engaging youths and women in organised, classified, diversified, well presented and organised systems of agriculture will change the face of African development for the better (NEPAD & African Union, 2013; African Union, 2020). The agricultural sector has been adjudged as the most important sector of the African economies providing jobs to more than 70% of the populace. However, youth participation in agriculture business in Africa is very low (Ogunmodede, Ogunsanwo, & Manyong, 2020). Furthermore, women play significant and vital roles in agriculture in Africa. They comprise more than 60% of agricultural labour force in Africa, however their control of productive assets and resources is limited despite their importance to agriculture (Price, 2019). Widely, most women are saddled with the responsibility of child care, food preparation as well as in the different stages of agricultural and food processing both as small scale or large. Again, there is the need to consider the significant differences (including land tenure system, socioeconomic background, and demographic characteristics) between the engagement of young men and women in agribusiness and contributions to rural development (Minyangu et al., 2021).

1.5 | Intra-African trade

Boosting of intra-African trade has the potential of advancing the regional integration amongst African nations (Geda & Hussein, 2015). However, this is challenged by complexities in import and export regularities and duties, weak infrastructure and lack of productivity and adequate facilitation of trade. Intra-African trade, therefore, hinges on the political will of African

leaders to make trade facilitation within Africa easy and attractive. If intra-African trade is pursued and handled with the aim of producing a 100% positive result, the relative impact on economic growth and investment will cause a ripple effect of growth and development (Were, 2015). Although, trade amongst countries is not a new phenomenon, it has however become paramount because of the newest wave of globalisation sweeping all over the world. This has in a way created more openings for better and active trade as a result of technological improvements, telecommunication and easier transportation system; leveraging on technological progress for trade facilitation by African countries will continue to impact positively on the continent. This is also expected to improve the continents goods, outlook and presentation to the outside world (Singh, 2010). The African continental free trade area (AfCFTA) is one of the newest achievements of the continent. This is expected to create a single market with over 1.3 billion people, generating an output of \$2.2 trillion and contributing to improvement in the welfare of inhabitants of Africa (UNCTAD, 2019). However, the expected differential welfare effects of the AfCFTA should necessitate the building of capacity for increase agricultural production, pursuit of product diversification and sophistication, innovative investments, adoption of high international products standards, and strategic industrialisation (Shinyekwa, Bulime, & Nattabi, 2021).

1.6 | Nutrition, health, and ageing

It was predicted that population increases in sub-Saharan African could pre-empt diverse nutrition and disease disorders as a result of food insecurity (Steyn & Walker, 2000). This, coupled with different social unrest and socioeconomic challenges, may further affect food availability. Steyn and Walker (2000) suggested that there might be no increase in the economic status of the people whilst there would rather be an increase in the rate at which health facilities would be deteriorated. Many African nations are currently faced with the challenge of food insecurity, inadequate health facilities and nutrition-based disorders due to coronavirus pandemic. The recovery plan from coronavirus pandemic should involve sustainable agriculture and food systems that enhance resilience and pragmatic transformation.

The recovery and resilience strategies should be built on diverse nutritional and healthy agricultural commodities which are locally prepared as healthy and medicinal diets by majority of the local communities. This proposition is supported by Marsman et al. (2018) and Shlisky et al. (2017) who noted that healthy diets have shown to provide resilience to age related diseases, frailty as well as social, biological and cognitive imbalances. Undoubtedly, the production of healthy and nutritional crops and herbs is achieved through agriculture and food systems. Therefore, land use for agricultural purposes, especially in the production of crops and medicinal herbs, will further enhance the healthy living and ageing of Africans.

Kyomuhendo and Adeola (2021) noted that rising incomes and urbanisation are leading to nutrition transition, with traditional foods being substituted with foods high in meat, fats, refined sugars, and oils. Consequently, there is emergence of communicable and non-communicable diseases. On the other hand, changes in diets are contributing to overweight/obesity and under nutrition/underweight in Africa. Therefore, organic food production can encourage growing of vegetables and fruits which will help to

boost nutritional wellbeing as well as promote the production of local organic foods that are environmental friendly and socially sustainable.

The synthesis of sustainability dimensions and indicators of progress of sustainable agriculture and food systems in Africa is presented in Table 1. The synthesis reveals critical indicators for measuring progress towards sustainable agriculture and food systems in Africa. These indicators are also captured and parameterised in the

TABLE 1 Synthesis of sustainability dimensions, thematic areas and indicators of sustainable agriculture and food systems in Africa

Sustainability dimension	Thematic areas	Indicators	References
Social	Youth and women in agriculture	<ul style="list-style-type: none"> a. Percentage of people with ownership or secure rights over agricultural land (out of total population) by sex b. Share of women amongst owners or rights-bearers of agricultural land, by type of tenure c. Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex 	<ul style="list-style-type: none"> a. FAO, 2017a b. Ogunmodede et al., 2020 c. Price, 2019. d. Obisesan & Olayide, 2021 e. Minyangu et al., 2021
	Nutrition, health, and ageing	<ul style="list-style-type: none"> a. Coverage of farmers by essential health services b. Household's health expenditure in relation to budget c. Proportion of agricultural area under productive and sustainable agriculture d. Use of organic fertilisers and integrated pest management e. Adherence to sustainable agricultural practices that better contributes to biodiversity f. Density of health worker and distribution 	<ul style="list-style-type: none"> a. WHO, 2014 b. Marsman et al., 2018 c. Shlisky et al., 2017 d. FAO, 2017b e. Kyomuhendo & Adeola, 2021
Economic	Agri-entrepreneurship	<ul style="list-style-type: none"> a. Average income of small-scale food producers by sex and indigenous status b. Farm output value per hectare c. Farm profitability: Economic viability of the farm d. Availability and use of information on farm economic performance 	<ul style="list-style-type: none"> a. Martinho, 2020 b. Lans et al., 2017 c. Lans et al., 2016 d. Obisesan & Olayide, 2021 e. Minyangu et al., 2021
	Micro-financing and rural development	<ul style="list-style-type: none"> a. Access to or availed credit b. Access to availed insurance c. On farm diversification d. Proportion of off-farm income 	<ul style="list-style-type: none"> a. Nwude & Anyalechi, 2018 b. Owusu-Ankamah & Sakyi, 2021 c. Minyangu et al., 2021
Environmental	Agricultural water management	<ul style="list-style-type: none"> a. What is the seasonal variation in water availability? b. Does farmer use water to irrigate crops? c. Is the farmer aware about issues of water availability? d. Are there water organisations in charge of water allocation among users? 	<ul style="list-style-type: none"> a. FAO, 2017c b. Garcia et al., 2020 c. Adelodun & Choi, 2018. d. Valipour & Access, 2016 e. Nhlengethwa et al., 2021 f. Olayide, Tetteh, & Popoola, 2016 g. Olayide, Tetteh, Porter, & Popoola, 2016
Governance	Intra-African trade	<ul style="list-style-type: none"> a. Are agricultural export subsidies available to farmers? b. Are there aid for trade commitments and disbursements? c. What is the trend and proportion of intra-Africa trade? 	<ul style="list-style-type: none"> a. Geda & Hussein, 2015 b. Were, 2015 c. UNCTAD, 2019 d. Shinyekwa et al., 2021

Source: Author.

TABLE 2 Status of progress on agricultural transformation in Africa

Status	Country	Number of country	Percentage
No data	1. Algeria; 2. Comoros; 3. Egypt; 4. Libya; 5. Rep. A. Saharawi; 6. Sao Tome & Principe	6	11
No change/fall back	1. Botswana; 2. Djibouti; 3. Equitorial Guinea; 4. Eritrea; 5. Guinea-Bissau; 6. Lesotho; 7. Malawi; 8. Mozambique; 9. Namibia; 10. Somalia; 11. South Africa; 12. South Sudan	12	22
Progressed	1. Angola; 2. Benin; 3. Burkina Faso; 4. Burundi; 5. Cabo Verde; 6. Cameroon; 7. Central Africa Republic; 8. Chad; 9. Congo; 10. Cote d'Ivoire; 11. Dr Congo; 12. Eswatini; 13. Ethiopia; 14. Gabon; 15. Gambia; 16. Guinea; 17. Kenya; 18. Liberia; 19. Madagascar; 20. Mauritania; 21. Mauritius; 22. Niger; 23. Nigeria; 24. Senegal; 25. Seychelles; 26. Sierra Leone; 27. Sudan; 28. Tanzania; 29. Togo; 30. Tunisia; 31. Uganda; 32. Zambia; 33. Zimbabwe	33	60
On-track	1. Ghana; 2. Mali; 3. Morocco; 4. Rwanda	4	7
	Total	55	100

Source: Computed from Africa Agriculture Transformation Scorecard 2019 (African Union, 2020).

policy framework of measuring progress in Africa Agricultural Transformation Scorecard (AATS) of the African Union (African Union, 2020).

2 | POLICY FRAMEWORK AND PROGRESS TOWARDS SUSTAINABLE AGRICULTURE AND FOOD SYSTEMS IN AFRICA

Africa has always demonstrated commitments to overcoming challenges of sustainable agriculture and food systems, and subsequently developed policy framework for tackling challenges in the continent. The continental policy framework for promoting and enhancing sustainable agriculture and food systems in Africa is the Comprehensive Africa Agriculture Development Programme (CAADP). The African Union Assembly of Heads of State and Government adopted the CAADP in 2003 in Maputo, Mozambique as the Flagship Programme of the African Union for agriculture and food security.

Historically, the first decade (2003–2013) of CAADP implementation demonstrated that Africa had well-crafted, home-grown framework guiding policies, strategies and actions for agricultural development and transformation. This was instrumental in raising the profile of agriculture to the centre of development agenda at national, regional and global levels. It also facilitated mobilisation and alignment of multi-stakeholders partnerships and investments around national agriculture and food security investment plans (NAIPs) that have been developed through the CAADP process. In 2013, CAADP was further elaborated, refined, and repositioned for agricultural transformation in the continent. The commitment for agricultural transformation inspired the African Union Heads of State and Government to adopt the Declaration on Accelerated

Agricultural Growth and Transformation in June 2014 in Malabo, Equatorial Guinea. The Malabo Declaration sets the Africa 2025 Vision for Agriculture which is implemented within the Framework of CAADP as a vehicle to implement and achieve the First Ten-Year Implementation Plan of Africa's Agenda 2063. Amongst other commitments, the leaders committed to Mutual Accountability to Results and Actions by conducting a biennial Agricultural Review Process known as the Africa Agriculture Transformation Scorecard (AATS) that involves tracking, monitoring and reporting on implementation progress in achieving the provisions of the Malabo Declaration. This Commitment translates, this time, a stronger political will for African Union Leaders to effectively achieve Agricultural Growth and Transformation on the Continent by 2025 with a focus on improving livelihoods and shared prosperity for African citizens (African Union, 2018, 2020).

So, what has been the progress on the AATS? It is often said that what gets measured, gets done. The AATS measures the progress of agricultural transformation for improved livelihoods, shared prosperity as well as sustainable agriculture and food systems in Africa. So far, the continent has had two rounds (2017 and 2019) of the biennial review and reports on the AATS (see Table 2). Table 2 gives the current status of the AATS by country and in the continent. The status report reveals that on four countries (Ghana, Mali, Morocco, and Rwanda) are on-track in achieving improved livelihoods and shared prosperity by 2025. Although, 33 other countries (representing 60% of countries in the continent) have made significant progress and milestones, they have not achieved the minimum benchmark for being on-track. This result, therefore, indicates that much work is still required for Africa to achieve its own set targets of agricultural transformation for improved livelihoods, shared prosperity as well as sustainable agriculture and food systems.

3 | CONCLUSION

This paper has presented a review and analysis of the thematic areas and indicators of progress on sustainable agriculture and food systems in Africa. The specific thematic areas of sustainable agriculture and food systems include, agricultural entrepreneurship; micro-financing and rural development; agricultural water management; involvement of youth and women in agriculture; intra-African trade; and nutrition, health and ageing.

The continental policy framework for promoting and enhancing sustainable agriculture and food systems in Africa is the Comprehensive Africa Agriculture Development Programme (CAADP). The first decade (2003–2013) of home-grown framework demonstrated the commitment of the continent for agricultural development and transformation. The re-commitment of Africa Union Heads of state and governments to the CAADP process in 2013 further emphasised the need for agricultural transformation and sustainable development in the continent. The process of recommitment led to the adoption of the Declaration on Accelerated Agricultural Growth and Transformation in June 2014 in Malabo, Equatorial Guinea. The Malabo Declaration sets the Africa 2025 Vision for Agriculture which is implemented within the Framework of CAADP as a vehicle to implement and achieve the First Ten-Year Implementation Plan of Africa's Agenda 2063.

The overall outlook of the continental home-grown indicators of progress on sustainable agriculture and food systems was encapsulated in the Africa Agriculture Transformation Scorecard. The AATS current report on the AATS revealed that only 7% (represented by four countries) were on-track in achieving sustainable agriculture and food systems in Africa by 2025. This low level of performance in self-assessment of the progress of the continent leaves much less to be desired. It, however, calls for prioritisation of the thematic areas and invigoration of investments (domestic and foreign) in sustainable agriculture and food systems in Africa.

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