

A Model of Sustainability Education and Partnership to Achieve SDGs in sub-Saharan Africa

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Abstract: Actualization of the 17 sustainable development goals (SDGs) conceived by the United Nations in 2015 is a global challenge that may not be feasible in sub-Saharan Africa by the year 2030, except higher education play a committed role. There is need for higher education to embrace partnership and train people on the concepts of sustainability and sustainable development in the region. This paper presents a model center with curricular framework and partnership structure for the training. The Model Center for Sustainability Studies (MCSS) will enable partnerships with institutions in Africa and in advanced nations, thereby creating a global network for sustainability studies not found in sub-Saharan Africa. MCSS will train and certify public servants, government agencies, policymakers, entrepreneurs and personnel from organizations and students on aspects of the SDGs and sustainability science. It is important to add sustainability into environmental education and make environmental education a compulsory course in higher institutions and a secondary school certificate exam subject in sub-Saharan Africa. MCSS has 11 training modules that can be replicated anywhere in the world. Higher institutions in sub-Saharan Africa should follow this training perspective, to achieved SDGs, predicted 2040 against 2030.

Keywords: Sustainability, Higher education, Training, SDGs, Collaboration, sub-Saharan Africa

1. Introduction

This model centre for sustainability studies (MCSS) is unique; proposing corporate partnership for knowledge sharing as required in the United Nations sustainable development goals (SDGs). This is because, most similar centres existing all over the world do not emphasize on partnership. It is either they are not willing or they do not see the needs for partnership provided as a major tool in the SDGs. That notwithstanding, higher institutions in developed nations have established centers or institutes for sustainability studies as working platform to achieve SDGs by 2030. This is not the case with institutions in the sub-Saharan Africa, making dissemination of information and knowledge of sustainability not yet captured in the region. Unlike in the sub-Saharan Africa, many institutions in the west have developed sustainability knowledge into undergraduate and graduate degree programs. They have projected sustainability science as a new field of study necessary for actualization of SDG and protection of the planet earth. Early in this century, Clark and Dickson (2003), found sustainability science as the emerging research program that focuses on the dynamic interactions between nature and society. According to them, the challenge of sustainable development is the reconciliation of society's development goals with the earth environmental limits over a long term.

We have noted that actualization of SDGs will make possible the concept of sustainability to be applied on development of the earth and consumption of earth natural resources in the society and among nations. The general goal of this paper is to sensitize scholars and motivate higher education in the sub-Saharan Africa of their expected role in training, disseminating knowledge, and research on sustainability and sustainable development in the region following the United Nations agenda. Byrne et al. (2015) talked about infusion of sustainability education in higher institutions and the curriculum content in the teaching and learning of sustainability. This paper presents a training perspective for informal education of government functionaries and the civil society to first have a good understanding of the concept of sustainability and sustainable development across sub-Saharan Africa.

The truth is that most world universities and other higher institutions have introduced sustainable development and sustainability science programs in their curriculum. How this knowledge will spread to all parts of the world is a global challenge as important as achieving the SDGs in 2030. Cognizance of this, UNICEF 3A working tool for SDGs contemplated on how to achieve Sustainable Development Goals and recommended Awareness, Action and Accountability (AAA) as working tools, Wright et al (2022) identified that cultivating a collaborative culture among higher education will enhance awareness and knowledge sharing for actualization of sustainable development goals globally. Inland Norway University of Applied Sciences followed up to establish a Centre for Collaborative Learning for sustainable development stating that the actualization of the SDGs will become easy through collaboration among institutions globally.

The Centre for Collaborative learning (CCL) for sustainable development holds the UNESCO Chair on Education for Sustainable lifestyles and coordinates the international partner network. CCL aims to contribute to national and international projects on education for sustainable development and to strengthen partnerships on this topic. The University has over 20 years' experience coordinating international research collaboration on consumer

education and education for sustainable lifestyles through the partnership for education and research about responsible living. There are several centres of this nature in universities across United States and Europe on sustainability studies which universities in the sub-Saharan Africa can collaborate with to foster understanding and research on SDGs in the region but these centres do not seek or encourage partnership with universities in the sub-Saharan Africa..

This Model Centre for Sustainability Studies (MCSS) will harness the potentials of scholars in Federal University of Technology Owerri (FUTO) Nigeria within the context of our culture and development. The center recognizes that indigenous people of any community make the environment of that community what it is, which could impact the wider community. We stand on collaborative research with diverse scholars to address complex sustainability challenges associated with 10 out of the 17 sustainable development goals. The understanding and actualization of sustainable development varies from region to region but far low in developing regions including the sub-Saharan Africa. This is caused by a number of factors including poverty, illiteracy and technology. That notwithstanding, every member of the United Nations must follow up and not left behind, since poor knowledge of sustainable development and sustainability largely accounts for poor infrastructural development and poor environmental quality across the region.

MCSS in no small measure will contribute to the success of UN sustainable development goals, where failure of past regional and UN projects could be attributed to lack of sustainable development knowledge in the region. Institutions in the sub-Saharan Africa can establish MCSS and in collaboration with such center or institution in a more advanced nation attract fund for innovative studies. MCSS see sustainability as a worldwide concept, concerning total environment, economic, demographic, political, cultural, technological, security, and society. MCSS has the ambition to be a driving force for sustainable development through extensive and diversified research and training in Nigeria and other sub-Saharan African countries if properly conducted. Sustainability which is considered as the bases of environmental management, economic and social development is understood and operational in most developed countries but yet alien in this part of the world. It is a guiding principle of future societal changes, and all parts of the world must follow up with the principle.

In the next years and decades, sustainability would have infiltrated into the rubrics of society and the government. Higher institutions would have played their roles, thereby producing graduates who are knowledgeable in sustainability and sustainable development. This new crop of graduates will change the narratives of administration, economy and policy, thus making sustainable development a working tool in businesses, driving companies and the world market across developed and the developing nations. It is on this note that MCSS at Federal University of Technology Owerri, Nigeria is engaging 40 research associates from the university and 80 from 40 different African universities, bringing all together to create a collaborative network of researchers. This model CSS encourages partners among higher institutions in the sub-Saharan Africa and collaborating with similar centers in more advanced regions like the United States and United Kingdom specifically for knowledge sharing in sustainability research.

2. Methodology

The model Center for sustainability studies (MCSS) curriculum is ideal for addressing basic issues of sustainable development in a region or a country. In the case of Nigeria and the sub-Saharan Africa, we have isolated eleven areas of concern developed into training modules as shown in Figure 2 and discussed below as 3.1 – 3.11. Ten members of our team assessed the 17 SDGs, put them in a scale of 1-17 and critically made independent selections of the 11 areas critical to the sub-Saharan African region. On the average, the popular opinion picked Poverty, followed by Hunger, then Good health and Well-being, down to Climate action as presented in the framework. Universities in sub-Saharan Africa should follow the order of this MCSS and be committed to sustainability training, allowing other higher education to partner with them, to achieve SDGs in the region.

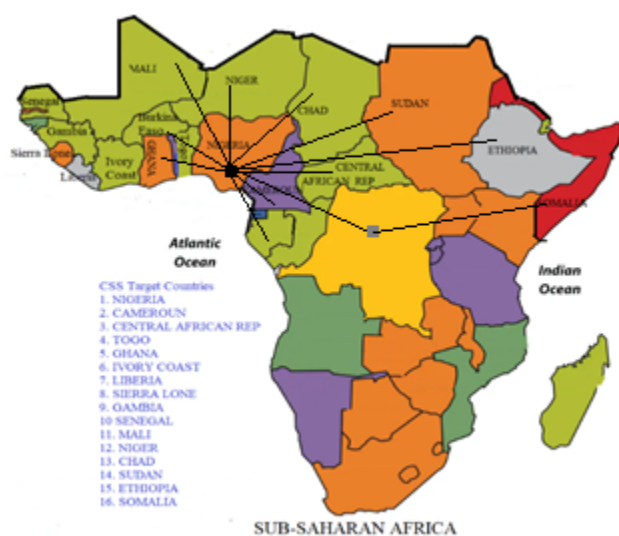


Figure 1. Showing the 18 countries of first coverage by FUTO MCSS

FUTO MCSS therefore will organize 3-6 months certificate training and 1 year post graduate certificate on sustainable development running online at the center, and 2 year master's degree on sustainability science. All programs could be extended to 18 countries in the sub-Saharan Africa as shown in the map (Figure 1). A detailed brochure will be distributed to create awareness of the program in Nigeria and in the selected countries. Other benefits will include exchange programs for graduate students and collaborative research. The collaboration will support assistance in computer and analytical software facilities, and the production of annual bulletin.

With partnership, MCSS can address local and regional sustainability challenges including Climate change, Air, Water and Land pollution particularly from oil and gas operations in the region. MCSS will also offer integrated water resources management, Energy, Clean water and Sanitation, Urban waste, Housing and Food security but most importantly sustainability training to build capacity and challenge insecurity across the region. FUTO MCSS is also found as independent platform for collaborative surveillance research over the wave of life insecurity in the region. The center will have over 120 registered research associates drawn from Nigeria and 40 other countries in the sub-Saharan Africa, 32 research assistants and technologists. These are people to receive the initial

training and who will then train others (Figure 2). The idea of this paper is innovative and incorporated into a theoretical framework representing a research perspective (Figure 2). Details of the innovative research framework or perspective are presented under discussion, while grant is anticipated for its full execution.

The MCSS project framework is simple and self-explanatory. Arrows are used to explain direction of projects and their interface. The training will feature in the form of workshops, certification trainings, compulsory undergraduate course and other methods of disseminating knowledge such as flyers and posters. The center will produce flyers and posters that will be distributed to schools and public places. As shown in the framework, the center will seek research associates and collaboration with other centers.

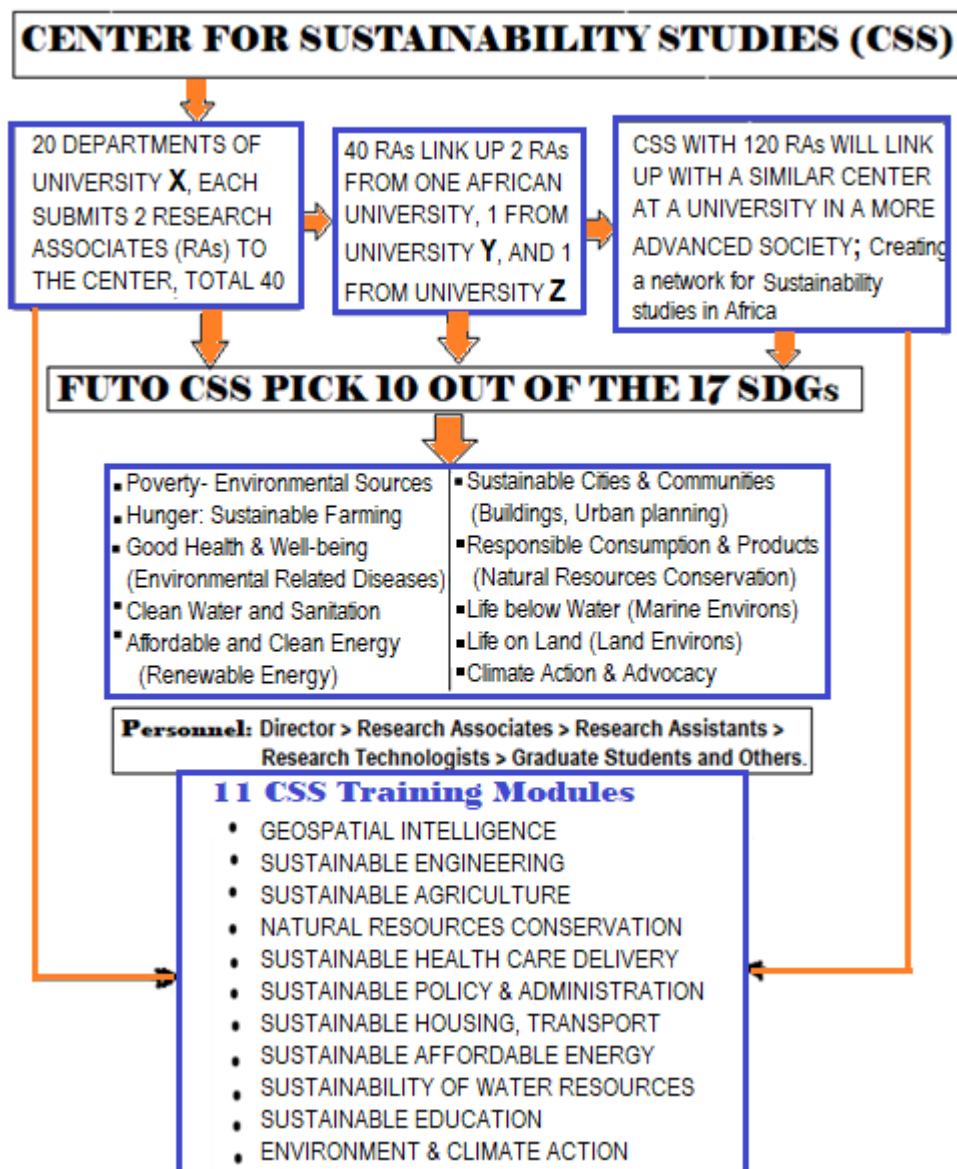


Figure 2. MCSS Theoretical Framework

3. Discussion

Below represents brief discussions of the training perspective and the MCSS curricular developed to serve as a guideline to prospective centres. More details of each training module will be available as developed at each centre.

3.1 Geospatial Intelligence Capacity Building

Geospatial intelligence is the integration of Geographic information science (GIS) and satellite imagery knowledge to obtain information described as geo-informatics. A primary project of the centre is to build Geospatial intelligence capacity among the centre research associates. This capacity building enables state of the art research outcome, enabling beneficiaries to excel in digital mapping. The wave of insecurity; terrorism, kidnapping, killing, and shooting innocent citizens, as well as gun battles between security operatives and terrorists groups, and environmental destruction in region calls for collaborative surveillance research. MCSS has set up a workstation housing GIS and remote sensing software, where research associates and assistants, including graduate students could enhance their geospatial knowledge; computer skills, statistics software and analytical skills.

No fewer than 24 research associates and assistants have already benefitted from the capacity building. It makes no sense for Nigeria to have spent millions of dollars sending micro satellites in the orbit, when researchers do not have capacity to use the imagery data and information. Geospatial intelligence capacity building provides the knowledge base for solving problems related to sustainable development in the following specific project areas:

- § Mapping of Road and Rail line
- § Investigating and monitoring terrorists activities
- § Surveillance operation on oil pipelines and over a community
- § Estate management
- § Investigating oil spill sites and Pollution studies
- § Investigating and assessing Gully erosion sites in the South-East
- § Monitoring Kidnappers Hide-out and Total security
- § Climate Change and Biodiversity
- § Investigating Desert encroachment and Drought
- § Monitoring Oil and Gas exploration and illegal mining activities
- § Air force and Naval operations
- § Air traffic control, etc.

Geospatial intelligence is the ability to present knowledge in a way that is appropriate to the decision-making environment according to Bacastow and Bellafiore (2009). To this effect, MCSS has acquired a professional mapping drone, and will equip the geospatial intelligence workstation with the under listed software: ArcGIS, QGIS, MapInfo, MODFLOW, Terrain, MODPATH, JUMP Statistics, SPSS, ILWIS, ENVI, PCI Geomatica, ERDAS Image, Accelo, Archicad, Sketch Up, City Engine, Aquarius, Freewat etc. In Geospatial intelligence capacity building, most beneficiaries are research associates with background in different areas of science. Many of them will benefit from the training in the first one year, integrating geospatial intelligence in SDGs research and terrorism surveillance research reporting. This is our primary training module which is open to all research associates and assistants in the centre.

3.2 Sustainable agriculture

Turning out thousands of graduates in agricultural science and agricultural engineering from higher institutions in Nigeria and the sub-Saharan African countries without practical orientation towards sustainable agriculture is efforts in futility. There is abundance of arable land in the region, yet there is threat on food security and hunger, looming with rising population. MCSS will address the problem of food insecurity in this training module, including a more effective management of agricultural loans and effective irrigation system using groundwater and wells for all year round food production.

Our concept of Linking institutions and neighbourhood communities with irrigation; a theoretical framework for sustainable agriculture (Figure 3) published by Nwachukwu and Egwuonwu (2012). will be incorporated in this training module. The present system of rain-fed subsistence farming neither satisfies the teaching and research needs of institutions, nor the food supply needs of the communities. In the paper, we illustrated how students and staff of agriculture in higher institutions could use acres of land from the institution, take advantage of near surface groundwater system to sink shallow wells or use nearby stream for irrigation. The possibility to incorporate host community peasant farmers to complement the all year round farming workforce largely exists. Our study confirmed this theoretical framework as practicable and to be implemented. This framework will support soil decontamination, student on-campus job, student enrolment in agricultural studies, and poverty alleviation. How individuals can borrow ideas of this framework and acquisition and management of agricultural loans will be addressed in this training module.

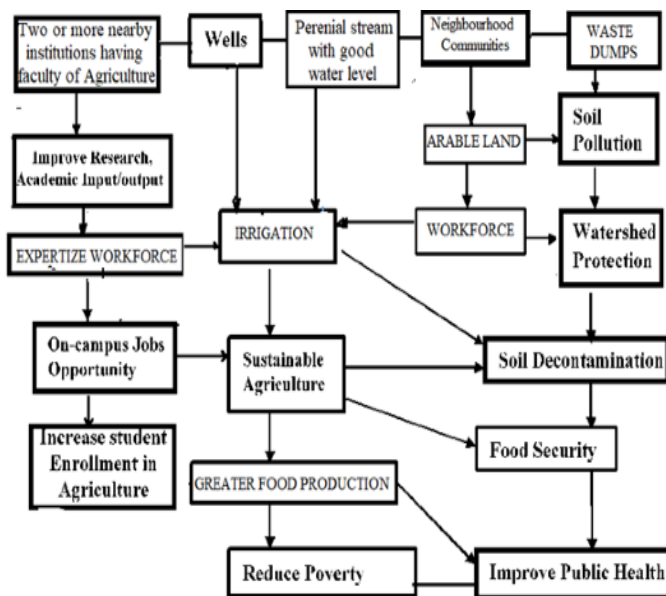


Figure 3. Framework of Sustainable Agriculture and the human impacts in the sub-Saharan Africa (Nwachukwu and Egwuonwu, 2012).

3.3 Sustainable engineering practice

In the book of Abraham (2005), “sustainable engineering transforms existing engineering, and incorporates development and implementation of technologically and economically

viable products, processes, and systems that promote human welfare, while protecting human health and elevating the protection of the biosphere as a criterion in engineering solutions” Furthermore, he stated that “the principles of sustainable engineering provides a paradigm in which engineers can design products and services to meet societal needs with minimal impact on the global ecosystem and the environment” This principles he said, should not be seen as independent elements, but rather, should be a complementary philosophy for the making of a sustainable society.

Rosen (2012), emphasized on sustainable engineering, stating the engineering uses natural resources to drive the world's economic activity, in virtually all economic sectors, e.g., industry, transportation, residential, commercial, agriculture, communication, etc. He lamented that the same engineering activities and operations generate wastes that are typically released to the environment causing environmental degradation. In his inaugural lecture, Dunmade (2016) has the opinion that “one of the things that could be done to arrest the negative trend in the society is a change from the current engineering way of doing things to the sustainable engineering approach” A sustainable engineering practice was already defined by Thorn et al. (2011) as "the integration of social, environmental, and economic considerations into product, process, and energy system design methods"

The MCSS module on sustainable engineering practice is particularly concerned with engineering structures that can stand the test of time, structures that will be environmentally friendly, technically sound, affordable and as much as possible having local impute and available. For us, sustainable engineering begins with design; the design shall not compromise environmental quality, must stand on quality materials to no health effects. Emphasis will be placed on roads and transport systems, dams, bridges, buildings, production companies and adaptations to local raw materials, computer and digital technology.

3.4 Sustainable mining and natural resources conservation

Application of sustainability principles to mining is of greater concern and more challenging to the ideas of sustainable development, as mining is the act of exploitation and consumption of limited natural resources; solid mineral, fuel minerals and groundwater. By sustainability principles however, consideration of the need to consume these natural resources in a manner that will meet present needs without compromising needs of future generations is most crucial. This sustainability principle is now more critical in mine development and operation as mine wastes and the environmental impacts of mining continue to increase and cause environmental degradation. This training module will review some existing literature and comments by authors on sustainable mining practice.

Miranda et al. (2018) stated that “a common sustainable mining framework is focused on reducing environmental impacts of mining, and strategies for assessing the sustainability of mining operations include measuring, monitoring, and working to improve various environmental performance metrics, and these are used to determine whether a mining operation is sustainable” According to him, the major issues of environmental sustainability relating to mining are, land disturbance, pollution, and reclamation of mine lands.

Another sustainable mining framework transitions borders on conservation of non-fuel mineral resources throughout their entire life cycle, including the need to reduce the quantity of mined material to reducing the rate of consumption and preserving reserves for future generations Dzombak (2018). This module will discuss transition to a broader context that

includes the entire mineral life cycle. The module will discuss assessment of mining sustainability to include an appraisal of mined products in the market and society. Emphasis will be on existing environmental sustainability metrics from mining operations as well as including life cycle metrics to assess the sustainability of production and consumption.

This MCSS module will lay emphasis on surface mining, open pit quarries and borrow pits as these are the common sites of sustainability concerns. Much emphasis will also be placed on oil and gas mining operations. Our MCSS has conducted impressive research on these areas that will be reviewed and discussed in the training. Issues of sustainable mining come with design, field techniques and waste management. Nwachukwu et al. (2017) discussed the use of 1D resistivity inversion technique in the mapping of igneous intrusive as a first step to sustainable quarry development. Nwachukwu et al. (2017), also lamented on the prevalence of abandoned borrow pits as evidence of unsustainable mining practices. They discussed the risk factors and presented a reclamation procedure. Nwachukwu and Feng (2012), investigated environmental hazards and sustainable development of rock quarries in the lower Benue Trough Nigeria. All these case studies will constitute important materials in this training module.

3.5 Sustainable health management system

An effective health system that will stand the test of time as lesson learnt from the outbreak of COVID-19 pandemic. The need to increase number and improve standard of public hospitals for good health care delivery in sub-Saharan Africa has been exposed by COVID-19. Health emergency response facilities including resilient and government health centers will be available and affordable to the public. Good health through organized efforts and informed choices of society, public and private organizations, communities and individuals will be discussed. Motivation of laboratory medical professionals to implement sustainability measures and communicate new insights and outcomes and the implementation of sustainable procurement system that aligns suppliers and contractors in the healthcare system according to Molero et al. (2021) will be included.

Current health systems across the sub-Saharan Africa are not sustainable as informed at the BMJ Analysis (2017). This is largely due to the lack of social welfare and poverty across the region, worsened by corruption on the part of government and the society. The analysis referred that sustainability is not just about finance and affordability, neither about the efficiency and effectiveness of a system. This is because an effective and efficient system that cannot serve immediate and coming generations or for a long term is not justifiable. Sustainability in health system mainly depends on factors outside the control of the health care sector. Funding and policy challenges face sustainable health system in Nigeria and other sub-Saharan African countries, and this will be addressed in the training.

Medical advancements save lots of lives every year, but push up costs considerably. It is estimated that progress in medical technology costs at least an extra £10bn a year from MedicPortal at <https://www.themedicportal.com/application-guide/>. To this effect, this training module will contain aspects of sustainable health information systems. Resilient measures associated with sustainable health systems shall be included to accommodate health

emergencies resulting from such cases like virus emission, environmental hazards, war and terrorism and erosion and flooding prevalent in Nigeria and the sub-Saharan Africa. In this subject, training emphasis will be on preventive measures such as efficient waste management and urban planning to protect public health.

3.6 Sustainable policy, administration and office management

According to Baker (2015), Sustainable Development Policy and Administration provides a learning resource describing the major issues that are critical to understanding the multiple dimensions of sustainable key development. We have integrated environmental policies, and their linkages with both economic and social policies in the curriculum. These linkages need to be strengthened to support sustainable development (OECD, 2001). Sustainability of public policy will be included as an agenda of public administration in the curriculum to account for conservative management of office equipment and materials not excluding personnel management. Policy makers in government and the private sector, as well as legislators need certification in sustainable policy making and administration including contracting, project management and sustainable procurement.

Sustainable office is difficult to come by, as people focus on building practices like installation of large windows for increased ventilation, and green roof. Sustainable offices are not about buildings. Below are 12 environmentally friendly practices for sustainable office management partly adapted from Baker (2015) that will justify this course.

- 1) Form a sustainable office team
- 2) Incorporate green challenges; digitize office; digital data storage
- 3) Form a rule to put off all appliances at close of work
- 4) Recycle everything recyclable
- 7) Insist on eco- green cleaning products
- 8) Opt for reusable office materials
- 9) Turn off the lights when no one's in the room
- 10) Print double-sided copies
- 11) Reuse failed print jobs as crap paper
- 12) Replace incandescent bulbs with compact fluorescent or LED bulbs

Sayam et al. (2019) recommended green office for sustainable environmental management. According to them, green office in the work place can be promoted through behavioural changes and efficient office management practices, by reducing the consumption of natural resources, promoting sustainable life style through enhanced employee environmental awareness. While big changes need to happen at government and industry levels, there are plenty of small changes we can make on a day-to-day basis in our offices to improve environmental quality and quality of life. On completion of this course, participants will be certified in Sustainable office practices. References will be as follows:

- Increase sustainability by reducing office waste
- Make sure shredded documents are recycled. No paper waste to landfill
- Find colleagues that live nearby and carpool with them to less cost of transportation
- Cycle to Work if your workplace is or less than two kilometres
- Install automatic lighting system capable of putting off after work
- Embrace green office procurement and sustainable office setting.
- Use environmental management system (EMS) to minimise impact

Generally, this course will address issues bothering on sustainable procurements; durable furniture, lighting, blinds, as well as green office concept regarding buildings, equipment, and waste management. It will also cover sustainable office purchases or supplies and sustainable consumption of office consumables. Discussions will include sustainability checklist and audit: a tool that is used to compare respective offices practices with the best practices for sustainability.

3.7 Sustainable housing, transport and urban development

Cases of unsustainable land use planning prevail in Nigeria causing clusters and overcrowding of cities, with poor environmental quality. There is need for sustainable urban development integrating sustainable infrastructures such as required in the areas of transport, housing and waste management. Unfortunately, there is no uniform regulatory guideline on which areas should have priority. Urban sustainability can be based on strong Economy - Self-renewing, and Self-reliance. The overall ideas of urban sustainability goes with sustainable cities to mitigate climate change and to bring people and infrastructure including social amenities, buildings, and public spaces together, with easy movement of people; pedestrian and materials within and out of the city. For example, this course will address issues of sustainable transportation as a provision of access to all groups of people in the city in a manner that is within the environmental carrying capacity of the city and is affordable to both the providers and the users of the system. Here, greater consideration will be made on provision of rail transport system. From Climate Consulting at Selecta available at <https://climate.selectra.com/en/advice/sustainable-transport>, sustainable transport contributes to a reduction in carbon dioxide (CO₂) emissions, and therefore, to a reduction in atmospheric pollution and improved air quality and public health in cities.

Alvaro and Juho (2020), described urban sustainability as a phenomenon based on positive interaction among three different urban sub-systems: social, economic and physical, where social well-being coexists with economic development and environmental quality, sharing with the concept of circular economy. As a condition, a sustainable city must be engineered for good environmental impact through urban planning and management. The 4 principles of urban sustainability including human, social, economic, and environmental shall be covered in this course. Benefits of a sustainable city cannot be over-emphasized, it accounts for a number of values: Reduction of urban stress due to noise, traffic, overcrowded public transport, and pollution. Sustainable city that will provides good education, biodiversity; increases real estate values, storm water management and food security will be discussed in this course. With increasing surge in urban populations in the sub-Saharan African cities, governments should create environmentally and financially sustainable urban transport systems. Smith (2012), stated that “as urban populations surge worldwide, cities must work together with national governments to create environmentally and financially sustainable urban transport systems”. Mapping of rail lines ahead of time should be priority of government and protecting the mapped rail lines from human encroachment a public task in the sub-Saharan Africa. Conserve land with properly planned urban and sub-urban housing estates comprising storey buildings, apartment complexes with recreational facilities and social amenities.

3.8 Sustainable energy use and service

Sustainable energy is energy that we will never be depleted, it is inexhaustible, and we have several forms of energy that can be considered sustainable in addition to the most commonly considered sources. The very sustainable energies to be discussed in this course are wind, solar, and water. There's also bioenergy and geothermal energy that should be mentioned in this course as renewable energy. According to Dilip and Tatsutani (2009), developing countries have two fold energy challenges in the 21st century: Meeting the energy needs of billions of people that lack access to energy services, and joining the global transition to clean, low-carbon energy systems. They stated that the goal of reducing greenhouse gas emissions should be aligned with developing indigenous renewable resources and reducing local forms of pollution.

In this course, aspects of energy efficiency that less energy can be used to deliver the same goods or services, or delivering comparable services with alternative energy at less cost and being environmentally friendly will be inclusive. For example, Market Business News available at <https://marketbusinessnews.com/financial-glossary/sustainable-energy/> revealed that modern energy efficient refrigerators use about 40 percent less energy than those of 2001. It was stated that in homes, refrigerator is the second-largest user of electricity (13.7%), after the air conditioner (14.1%). This training subject will emphasize the use of solar energy considering the tropical location and enough sun from dusk to dawn. Modality for government to partner with private companies that can help communities switch to solar will be discussed.

3.9 Sustainable Water Services

According to Damhauh et al. 2010 “water resources in sub-Saharan Africa have become a strategic commodity, with supply limited in terms of quality and quantity, and demand increasing due to population growth and economic development”. To this effect, most countries in the sub-Saharan Africa are not meeting up with public water needs, living the responsibility to the society. As a result, the masses have resorted to depend largely on shallow groundwater for their domestic water needs. Notwithstanding, sustainable water services making water visible to the public to improve public health is the responsibility of government and the society. To actualize this in the region, Nwachukwu (2022) in a public lecture gave the following guidelines as captured in this training module;

- Water services is responsibility of government and society
- Government could commission companies to take over water services
- Society must pay for water services at appreciably low rate
- Government must provide free space and handover existing facilities to the commissioned companies under a memorandum of understanding.
- Government must establish a central laboratory for water testing.
- States to establish Water Services Monitoring Agency (WASMA) and create employment.
- WASMA must approach society on health and environmental risks of every household drinking sachet water of poor quality.
- WASMA must seal all shallow substandard wells producing water of poor quality in Imo state.
- Water companies must follow the professional step by step groundwater development procedure.

- Society must reject proliferation of shallow substandard water wells in homes and communities to reduce well failure and degradation of groundwater, thereby conserving groundwater and reducing water related diseases.

3.10 Sustainable Education

Sustainable education is defined by Bezezinska (2021) as "Education for Sustainable Development, that allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future" According to them, "education for sustainable development means including key sustainable development issues into teaching and learning; for example, climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption, it also requires participatory teaching and learning methods that motivate and empower learners to change their behaviour and take action for sustainable development" Our sustainable education training module consequently will promote critical thinking and collaboration into the future. The module is also designed to provide digital changes to transform the way education is practiced today in the sub-Saharan Africa. Nwachukwu et al. (2014), emphasized on the importance of environmental education, describing it as early education, accessible education, education for all and education for sustainable development.

UNESCO (2014) maintained that "Sustainability education encompasses all school subjects and extends far beyond the classroom, it gives students real-world skills they can use to improve the planet, and provides today's children with the self-sufficiency they need for tomorrow" In this order, our Sustainable education module will empower learners of all ages with the knowledge, skills, values and attitudes to address the global challenges affecting sub-Saharan Africa; including climate change, poor waste management, virus emission, poverty, terrorism, drought and desertification. We drive to prepare students and learners of all ages to find solutions for these challenges, believing that education should be transformative; allowing collective decisions and actions that can improve our societies and our environmental quality, thereby preserving the planet earth. It is on this note that we call on higher education authorities in sub-Saharan Africa to make environmental education a compulsory 200 level course that can be accommodated under general studies.

UNESCO (2014) also recognized education for sustainable development as an integral element of Sustainable Development Goals (SDGs) 4 on quality education and a key enabler of all other SDGs. As the lead UN agency on ESD, UNESCO is responsible for coordination of ESD for the 2030 framework. Our goal in this training module is to make breakthrough in formal and informal learning of environmental education to the advantage of graduate and undergraduate students, secondary and primary school students, teachers, government functionaries, and the general public. We shall make efforts to prevent future environmental degradation and crises such as in the Niger delta. We shall also call on education authorities to see environmental education as education for sustainable development and integrate it into the Nigeria school curriculum, making it a GCE, WASC and NECO examination subject. All of the above knowledge shall be discussed in this training module.

3.11 Sustainable climate policy and advocacy

This module will discuss policies that invest on clean, renewable and sustainable energy, addressing the impacts of climate change on environment particularly land and water resources extended to health and well-being of human population in the sub-Saharan Africa. Sustainability issues including drought, desertification and increasing soil and water acidity should be discussed. According to climate advocacy group, there are certain things individuals can do to combat climate change;

- ❖ Waste less food
- ❖ Eat less factory-farmed red meat
- ❖ Consume less energy and water
- ❖ Talk to policy makers and dialogue on environmental policies

It is important for humans to live in harmony with nature, and maintain the balance between population growth and environmental capacity. According to UNDP, as available at <http://www.sdghelpdesk.unescap.org/> climate action is about increasing efforts to reduce greenhouse gas emission and strengthen resilience and adaptive capacity to climate related hazards in all countries. This includes integrating climate change measures into national policies, strategies and planning. In this module, climate change impacts and solution to drought and desertification in the northern part of Nigeria, decline of rivers, erosion and acid rain associated with gas flaring in the south are all critical issues to be discussed.

The SDG goal of improving education, awareness raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning actions as contained in Sustainable Development Goals Help Desk are of great concern, and available at <https://sdghelpdesk.unescap.org/learn-more-about-climate-action>. Every action taken now to reduce green-house gases emission is what doing. Policy actions to reduce gas flaring in oil and gas fields of Niger delta will constitute a major area of concern. Oriakhi (2021), recognized that improved gas utilization in Nigeria between 1990 and 2014 has reduced volume of gas flaring and consequently reduced greenhouse and black carbon emissions, thus mitigating climate actions. Afforestation policy in the 11 desert encroached states of northern Nigeria and the consequent hazards extended to life and food insecurity in Nigeria will be considered. Issues of land degradation due to high soil acidity and the consequent threat to food security is a major climate change impact that calls for immediate action and policy against deforestation to improve carbon sequestration on land. All of the above cases will be integrated into this training module.

4.0 Analysis

Poor knowledge of sustainable development and sustainability largely accounts for poor infrastructural development and poor environmental quality in sub-Saharan Africa. Level of understanding compares with literacy level and low literacy level in most African nations including Nigeria affects the rate and level of understanding and appreciation of the concept of sustainable development. In developed nations for example, sustainability science has long become a program of study in Colleges and Universities, this is not applicable in developing

African countries. How many of the governments, the organizations and persons in the sub-Saharan Africa are conscious of sustainable development of their environment and sustainable consumption of natural resources? The result is poor infrastructural development and lack of conservation of natural resources, not excluding poor environmental quality and quality of life.

Most recently United Nations embarked on goal setting for the world, with little or no consideration to literacy, social and technology status of respective member nations and regions in the world. They expect all member nations to follow up with the goals as a world order not minding their individual strength and weaknesses and this does not go well with the set goals. For example, there are several indices to show that the millennium development goal (MDG) was not successful in the sub-Saharan Africa. The MDG water for all in the year 2015 only created awareness of the human need for portable water in the region. How many of the MDG water projects in the sub-Saharan Africa were successful and today functional?

This MDG water for all project failed due to lack of preliminary or feasibility study prior to implementation. Soon as the United Nations saw that MDG projects failed after commissioning largely due to lack of sustainable development inputs and maintenance, they created sustainable development goals (SDG), yet with similar lapses as was in the case of MDG. How real is the SDGs target of 2030 and what instruments will drive the achievement? These are two important questions to be answered, considering the knowledge gap, and literacy level of only 62% in Nigeria as at 2018, <https://www.macrotrends.net/countries/NGA/nigeria/literacy-rate>; '>Nigeria Literacy Rate 1991-2023, retrieved 2023-01-22. This is as low as 30% or less in some sub-Saharan African countries. According to World population review by country (2023), how can these countries compete with UK 99%, US 88% at a global literacy rate of 86.3% based on age 15 years and above. Poverty and illiteracy go together, as formal education is often not properly delivered in poor countries. The review contained that even when education is available, a poor family might need their children to work and earn money instead of going to school, and that most of the countries with the lowest literacy are located in South Asia, West Asia, and sub-Saharan Africa, include most of the poorest countries in the world.

Developed nations average literacy rate of 96%, and developing nations 65% average literacy rate definitely will cause disparity in understanding and appreciation of the sustainable development agenda, making the 2030 target not realistic in most developing countries. It is on this note that we have projected 2040 as more realistic for the sub-Saharan Africa, believing that awareness creation, knowledge sharing and extensive training would have taken place in the first 10 years. Apart from literacy rate, poor economy and lack of industrialization are other major obstacles limiting sustainable development in the sub-Saharan Africa.

Poverty is a factor capable of preventing appreciation and actualization of sustainable development goals in poor developing nations by 2030. State of the economy, such as economic diversity accounts for the strength of development, and for any development project to stand the test of time, proper funding is required. Sustainable development may not thrive in the presence of poverty and for a nation living on huge debt. This can further be linked with technology and lack of productivity. A consumer nation depending on industrialized nation for its domestic needs can hardly facilitate sustainable development. Such nation can hardly conserve its natural resources to support sustainable development. In Nigeria for example where about 95% of the economy is based on export of crude oil without

a commensurate development in petrochemical industry has no structure to support sustainable development. The economy and development depends on the market value of oil which is fluctuating, causing budgetary failure and over-exploitation.

5.0 Conclusion

More universities in the sub-Saharan African countries should adopt this model center for sustainability studies and allow Polytechnics and Colleges of Education to partner with them, to enable knowledge sharing about sustainability and actualization of sustainable development goals. The model will enable partnership with institutions in more advanced nations, thereby creating a global network for collaborative research and supports in sustainability. Training and certification of public servants, civil servants, policy makers, entrepreneurs and personnel from organizations, and students on aspects of the SDGs and sustainability will make the desired impacts in the society. It is necessary to add sustainability knowledge into environmental education and make environmental education a 200 level compulsory course in higher institutions, and a secondary school certificate exam subject in sub-Saharan Africa. The 11 training modules designed for disseminating knowledge about SDGs and sustainability are adjustable to national needs. Presently, signing up for FUTO MCSS training is by personal contacts through the center email; css@futo.edu.ng or contact the coordinator at nwachukwu.ma@futo.edu.ng ; +2348163308776 (Call and Whatsapp). A major challenge prevailing on MCSS is availability of initial fund. If many higher institutions in the sub-Saharan Africa follow this training perspective and commence academic programs on sustainability science, sustainable development would be achieved in the region between 2030 and 2040. On the other hand, period of achievement cannot be predicted.

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