

PERCEIVED KNOWLEDGE AND CHALLENGES OF GREEN-TECHNOLOGY IN AGRICULTURE AND STEPS FOR ENHANCING A SUSTAINABLE GLOBAL ECONOMY

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Abstract

The study was carried out in Delta State, Nigeria to assess the Agricultural officers' perceived knowledge and challenges of green-technology in agriculture and steps for enhancing a sustainable global economy. The study employed an *ex-post facto* design and a descriptive survey research method. The study population was all Agricultural officer (N=98). A 29-item structured questionnaire was validated by three experts and pretested using the test-re-test technique to determine the coefficient of temporal stability which yielded a mean reliability coefficient of 0.89. The instrument for data collection was administered to all respondents who were present during the Agricultural officers Association monthly meeting (n=70). Data collected were analyzed using mean and standard deviation. The study found out that Agricultural officers have knowledge about green-technology in agriculture, but they do not know that the technology does not necessarily require large land space and the food is safe for eating. Furthermore, the study showed that the challenges hindering farmers using green-technology in agriculture include expensive nature of the technology, digital and data illiteracy among farmers, lack of technical expertise among others, and the steps to enhance a sustainable global economy include subsidize the purchase of green-technology in agriculture, utilize green-technology in agriculture in occupational transition in vocational institutions, advocate for farmer education in green technology utilization. The study recommended among others that the third tier of government should facilitate the collaboration between agri-tech manufacturers/dealers and farmers to acquire green-technology in agriculture, and Agricultural officers should upgrade themselves with current knowledge about green technology in enhancing a sustainable global economy in Nigeria.

Introduction

The concern about Nigeria's dwindling economy is growing necessitating a shift in thinking towards sustainability of the economy, good governance, the safety of the environment, and getting safe food on the table at affordable cost. This growing concern is visible in the quality of life of the people, because a sustainable economy is the envy of any nation in today's world where inequality prevails, the environment is polluted and food insecurity reigns. Enhancing a sustainable economy however, does not only rely on good governance and a good life, but it is also concerned about increasing agricultural productivity in a sustainable manner (Anagah, 2023).

It is envisage that a sustainable economy is supposed to be associated with quality agricultural information useful to the farmers, equality in the distribution of farming resources, use of innovative agricultural technologies, and enhance income that meets basic needs of the farmers, but possess a challenge that points to good governance and political will to tackle committed actions (Agbidi & Ikeoji, 2020; World Wide Fund [WWF], 2020). More so, a sustainable economy is expected to make provision for a better well-being with minimal resource usage and harm to the environment (Econation, 2023). This means, a sustainable global economy is that which enhances a nation's economic, human and material resources without generating undue food price hikes and other resources needed for food production for the significant benefit of mankind. Indeed (2022) simply describes a sustainable global economy as

the maintenance of a country economic growth without significantly causing damage to the environment.

Based on this indices, emphasis is directed to world leaders who need to look ahead and face the hurdles of making peoples life better in a sustainable manner (Sternfels, *et al.*, 2021). Sustainability is anchored on mankind harmonizing with nature (Erhun, 2015). Harmonizing with nature, is to use energy saving resources, pollutant free and high yielding agricultural innovations that support environmental best practices in food production.

Innovative technology like green-technology in agriculture require limited land space but offers plenty of high yielding productivity as it is efficient and effective in farm operations. Anagah (2023) described green-technology as an innovative type of technology that put the environment into consideration. More so, green-technology in agriculture is not concerned about the safety of the environment only, but assures farm profitability while at the same time providing food for all at affordable cost. This demonstrated that green-technology in agriculture is an eco-friendly facility that reduces damaging impact of farming practices on the environment (Azmi *et al.*, 2017).

Scholars affirmed that green-technology in agriculture has the capacity to increase farm productivity and profit without damaging the resources of the planet, increase the quality of food, and create a stable economy (Anagah, 2023; Agbidi, 2023; Owais *et al.*, 2018). Ahmed and Elfaki (2023) established that green technologies support resourceful natural resources that are capable of reducing pollution, adapt to climate change, and accommodate a sustainable economic activity.

Green-technology in agriculture is not new in Nigeria. Anagah (2023) identified some of this technology commonly used Nigerian farms to include solar energy, wind energy, biogas, biofuels, biomass, Integrated Pest Management, and organic farming. Emerging green technologies currently being used in Delta State farms also include and not limited to green houses, soilless farming and sack farming.

Recent progress in green technology in agriculture from developed countries like China, France, and United State of America points to the possibility that its widespread introduction and usage could present a good life for Nigeria farmers. Despite these benefits the technology could offer, Anagah (2023) highlighted high cost, poor technical know-how, illiteracy issues, and poor information about green-technology in agriculture as challenges limiting the potential usage by small-holder farmers in Nigeria. Agbidi (2023) implicated limited access to innovative agricultural technologies, inadequate information about the technology including application, poor network and internet connectivity issues in rural areas among others as challenges limiting small-holder farmers from using green-technology in agriculture. Furthermore, food waste, public acceptance of the technology, cost benefits are also hurdles to enhancing global economy through agriculture (Ghosh *et al.*, 2016).

These challenges seems to be tied to knowledge about green-technology in agriculture. Agbidi and Imobighe (2022) remarked that knowledge is vital to any sustainability goal. Studies have showed that farmers prefer to source information from radio while enlightened ones get information from internet sources rather than from Agricultural officers at the local level (Olayemi *et al.*, 2020). Several other studies reported that farmers are dissatisfied with Agricultural officers' information insensitivity on new innovations that could present improved income (Agbidi, 2023; Agbidi & Imobighe, 2022; Agbidi & Ikeoji, 2020; Olayemi *et al.*, 2020; Alabi & Ajayi, 2018).

Agricultural officers are senior local government staff who are responsible to coordinate agricultural policies and disseminate current agricultural information at the local government level. They are a link between state ministries of agriculture, research institute, states block extension agents and farmers at the grass-root level. Thus, the Agricultural officers are expected to help provide knowledge and skills useful for a good life for small-holder farmers at local level (Alabi & Ajayi, 2018). The primary focus of Agricultural officers on green-technology in

agriculture is to disseminate knowledge, skills and expertise to farmers connected to the benefits, acquisition, usage and technical support of the technology. The study therefore believes that the local government Agricultural officers are vital ingredient to help local farmers adopt green technology for enhancing sustainable economy.

In doing this, several actions need to be harmonized alongside understanding the knowledge level of Agricultural officers about green-technology in agriculture, the challenges hindering farmers usage of the technology and steps the third tier of Nigeria government need to take to enhance a sustainable economy. The study is therefore significant to enhancing sustainable economy as it will increase the knowledge (information & awareness) about green-technology in agriculture, and to stimulate Agricultural officers to update their knowledge on innovative solutions to food security and income sustainability, and consequently achieve a sustainable global economy.

Purpose/Research Questions

The study main purpose is to assess the Agricultural officers' perceived knowledge, and challenges hindering against farmers' usage of green-technology in agriculture, and determine the steps for enhancing a sustainable global economy. To guide this study, the following research questions were raised:

- i. What are the Agricultural officers perceived knowledge of green-technology in agriculture for enhancing a sustainable global economy in Delta State, Nigeria?
- ii. What are the Agricultural officers' perceived challenges hindering farmers in using green-technology in agriculture for enhancing a sustainable global economy in Delta State, Nigeria?
- iii. What are the perceived steps in using green-technology in agriculture as a tool for enhancing a sustainable global economy in Delta State, Nigeria?

Methodology

The study area is located in Delta State, Nigeria. The state has a rich base of agricultural products including cassava, plantain, rubber, oil palm, vegetables among others despite been known world over as oil rich state. An *ex-post facto* research design and descriptive survey research method was employed to assess the local government Agricultural officers' perception of the knowledge and challenges of green-technology in agriculture and the step for enhancing a sustainable global economy in Nigeria. This method was deemed applicable because data collected from respondents had already happened and this information cannot be manipulated.

The study population is all local government Agricultural officers numbering 98 (Local Government Service Commission, 2020). No sampling was done as all the population of the study formed the sample size due to it manageable size. A 29-item structured questionnaire was self-developed from reviewed literature for the study in a 4-point scale that ranged from four to one point corresponding to Strongly Agree (4) to Strongly Disagree (1).

The instrument for the study was content validated by three experts namely: one Professor each from the Department of Guidance and Counselling – Test and Measurement Unit and Department of Vocational Education – Agricultural Education Unit (Delta State University, Abraka), and the Programme Manager, Delta Agricultural and Rural Development Agency (DARDA). Corrections and suggestions by the experts were applied in restructuring the instrument to measure what it is intended for.

A pilot study was conducted employing the test-re-test technique to determine the reliability of the instrument by administering it twice on 20 Agricultural Officers from Bayelsa State, Nigeria. The Pearson Product Moment Correlation Coefficient of temporal stability was utilized to analyze the collected data from the two administration with the aid of Statistical

Package for Social Science. The analyzed result yielded a coefficient stability mean of 0.89, signifying that the instrument is dependable.

On granted permission by the President of the Agricultural Officers Association, the instrument for data collection were personally administered to the Agricultural officers during the monthly Agricultural officers meeting hosted by Ukwani Local Government Area of Delta State on the 15th of March, 2021. All Agricultural officers present in the meeting (n=70) completely filled and returned the administered questionnaire. Collected data were analyzed using mean and standard deviation to answer all research questions based on decision rule value that ≥ 2.50 is regarded as Agree and ≤ 2.50 as Disagree in line with each item stated.

Results

Research Question 1

What are the Agricultural officers perceived knowledge of green-technology in agriculture for enhancing a sustainable global economy in Delta State, Nigeria?

Table 1

Knowledge of Green-Technology in Agriculture for Enhancing a Sustainable Global Economy (n=70)

S/N	Items	Mean	SD	Remark
	I know that Green-Technology in Agriculture:			
1	increases farm yield-income of farmers	3.37	0.62	Agree
2	require limited land space	2.46	0.91	Disagree
3	require knowledge of farm biometrics-asymmetric	3.50	0.51	Agree
4	it is effective-efficient in farm production	3.31	0.67	Agree
5	reduces labour cost in farming	2.94	0.83	Agree
6	require the use of data-network connectivity	3.20	0.73	Agree
7	the farm produce are safe for eating	2.43	0.92	Disagree
8	it is economically friendly to the environment	3.37	0.63	Agree
9	require expertise in usage	3.51	0.50	Agree

SD=Standard Deviation

Data presented in Table 1 indicated that 7 out of 9 items had their mean ratings ranging from 2.94 – 3.51, signifying that the items were above the 2.50 bench-mark. This means that the respondents agreed that they are knowledgeable about the stated items. However, 2 out of the 9 items had a mean rating of 2.43 – 2.46. This value is below the 2.50 bench-mark, signifying that the respondents disagree with the items. The standard deviation of all the items ranged from 0.50 – 0.92, signifying that the responses did not depart usually from the mean.

Research Question 2

What are the Agricultural officers' perceived challenges hindering farmers in using green-technology in agriculture for enhancing a sustainable global economy in Delta State, Nigeria?

Table 2

Challenges Hindering Farmers in Using Green-Technology in Agriculture for Enhancing a Sustainable Global Economy (n=70)

S/N	Items	Mean	SD	Remark
1	It is not easily accessible in Nigeria	3.31	0.65	Agree
2	Existence of digital-data illiteracy among farmers	3.46	0.51	Agree
3	Poor network-internet issues in most rural communities	2.97	0.92	Agree
4	Lack of technical know-how about the technology in my LGA	3.43	0.49	Agree
5	Policy insensitivity to support green-technology in agriculture	3.19	0.75	Agree
6	It is expensive to purchase	3.47	0.50	Agree

SD=Standard Deviation

Data presented in Table 2 indicated that the mean ratings ranged from 2.97 – 3.47, indicating that the items were above the 2.50 bench-mark. This signify that the respondents agreed that all the items are challenges hindering farmers in using green-technology in agriculture for enhancing a sustainable global economy in Delta State, Nigeria. The standard deviation of all the items ranged from 0.50 – 0.74, signifying that the responses did not depart usually from the mean.

Research Question 3

What are the perceived steps in using green-technology in agriculture as a tool for enhancing a sustainable global economy in Delta State, Nigeria?

Table 3

Steps in Using Green-Technology in Agriculture as a Tool for Enhancing a Sustainable Global Economy (n=70)

S/N	Items	Mean	SD	Remark
1	Utilize green-technology in agriculture in occupational transition in vocational institutions	3.40	0.54	Agree
2	Develop small-holder farmers entrepreneurial potentials-skills in green-technology in agriculture	3.14	0.83	Agree
3	Encourage farmers by buying excess farm produce	3.33	0.63	Agree
4	Encourage training and retraining of Agricultural officers-farmers on green-technology in agriculture	3.36	0.58	Agree
5	Continue to borrow from banks to meet basic needs	1.53	0.66	Disagree
6	Advocate for farmer education in green technology use	3.39	0.51	Agree
7	Involve Agricultural officers in innovative technology information dissemination at the local government level	3.37	0.62	Agree
8	Embrace partnership with relevant stakeholders including technology manufacturers-distributors	3.39	0.51	Agree
9	Diversify farming operations to embrace value chain addition	3.34	0.56	Agree
10	Promote equality in farmland ownership	3.34	0.59	Agree
11	Encourage equality in farm input distribution to support green-technology in agriculture	3.32	0.63	Agree
12	Promote sustainable savings scheme for farmers to	3.27	0.64	Agree

	purchase green-technology in agriculture at affordable cost			
13	Create sound institutional framework to support private investment-innovations in agriculture	3.31	0.63	Agree
14	Subsidize the purchase of green-technology in agriculture for small-holder farmers	3.41	0.53	Agree

SD=Standard Deviation

Data presented in Table 3 showed that 13 out of 14 items had their mean ratings ranging from 3.14 – 3.41, signifying that the items were above the 2.50 bench-mark. This means that the respondents agreed that the stated items are steps in using green-technology in agriculture as a tool for enhancing a sustainable global economy in Delta State, Nigeria. However, 1 out of the 14 items had a mean rating of 1.53. This value is below the 2.50 bench-mark, signifying that the respondents disagree with the item. The standard deviation of all the items ranged from 0.51 – 0.83, signifying that the responses did not depart usually from the mean.

Discussion of Findings

Knowledge of Green-Technology in Agriculture for Enhancing a Sustainable Global Economy

The study showed that local government Agricultural officers in Delta State know that green-technology in agriculture requires expertise in usage, knowledge of farm biometrics and asymmetric, it increases farmer's yields and income, it is efficient and effective in production, it is economically friendly to the environment among others. However, the study found out that the officers do not know that green-technology in agriculture requires limited land space and its farm produce is safe to eat. The finding of the study is in consonance with Agbidi and Imobighe (2022) that knowledge is critical to sustainable development. In agreement, Owais *et al.* (2018) emphasized that over use of agrochemicals is hazardous to the environment resulting in long-run decrease of food quality and increase in pollution. This implies that, Agricultural officers having knowledge about green-technology in agriculture puts them in a better position to educate farmers on the benefit of using green technology. Anagah (2023) concur that green technology is a pathway to rapid sustainable economy because of its usefulness to farmers in profitability and safety of the environment.

Challenges Hindering Farmers in Using Green-Technology in Agriculture for Enhancing a Sustainable Global Economy

The finding of the study identified that green-technology in agriculture is expensive to purchase, existence of digital and data illiteracy among farmers discourages usage, lack of technical know-how about the technology, not easily accessible in Nigeria among others are challenges hindering farmers in using green-technology in agriculture for enhancing a sustainable global economy. This finding is in agreement with Agbidi (2023) who reported that limited access to innovative agricultural technologies, inadequate information about the technology including application, poor network and internet connectivity issues in rural areas are factors hampering the use of agri-tech in Nigeria. In support, Sheriff *et al.* (2020) emphasized that the inability to exchange knowledge among and between farmers, green-technology manufacturers and dealers, Agricultural officers and farmers is the reason behind farmers not using green-technology in agriculture. In consonance, Agbidi and Imobighe (2022) and Olayemi *et al.* (2020) affirmed that farmers prefer to source agricultural information from other sources rather from Agricultural extension agents. The implication of the finding of the study demonstrated that the challenges are not induced by farmers but poor knowledge distribution

and insensitivity of political leadership to support green-technology in agriculture that can improve farmer's well-being.

Steps in Using Green-Technology in Agriculture as a Tool for Enhancing a Sustainable Global Economy

The study found out that by subsidizing the purchase of green-technology in agriculture for small-holder farmers, utilizing green-technology in agriculture in occupational transition in vocational institutions, advocating for farmer education in green technology usage, embracing partnership with relevant stakeholders including technology manufacturers and distributors are identified as steps in using green-technology in agriculture as a tool for enhancing a sustainable global economy. In support of this finding, Agbidi and Ikeoji (2020) affirmed that over dependency on oil revenue created the neglect of agricultural deficiency in farming technologies and infrastructures to support a sustainable economy. To remedy this situation, is to align Nigeria economy with the path of sustainability through collaboration with relevant stakeholders, particularly connected to agricultural production (Agbidi & Imobighe; Agbidi & Ikeoji, 2020; Ogbo *et al.*, 2017). Furthermore, Agbidi and Ikeoji (2020) reported that what is critical to a sustainable economy is to encourage innovative agricultural technologies utilization for increasing food production. Alabi and Ajayi (2018) added that the role of Agricultural officers to provide knowledge and skills to farmers it to be adhered to. To this end, Sternfels *et al.* (2021) reported that steps such as utilizing innovative technology in occupational transition, massive investment in green-technology in agriculture, and aiming for sustainability are vital for enhancing a sustainable global economy in Nigeria.

Conclusion

The Agricultural officers at the local government level are seen as vital to the use of green-technology in agriculture because of the role they could play in knowledge management. Although, the Agricultural officers are knowledgeable about green-technology in agriculture except that they do not know that the technology can make use of small land space and the food is safe for everyone. However, the ability to use green-technology in agriculture is a major challenge hindering farmers.

To achieve a sustainable global economy through the use of green-technology in agriculture, steps such as subsidizing green-technology in agriculture purchase, utilizing green-technology in agriculture in transiting in-service training in vocational institutions, promoting farmer education in green technology utilization, encourage partnership with technology manufacturers and distributors alongside relevant stakeholders. Therefore, a sustainable global economy is enhanced when relevant agricultural knowledge are passed on to the small-holder farmers at the local level.

Recommendations

Based on the findings of the study, the following recommendations were made:

- i. The third tier of government housing the Agricultural officers should facilitate partnership between agri-tech manufacturers/dealers and farmers to acquire green-technology in agriculture for their farming purposes;
- ii. The Agricultural officers should regularly update their knowledge concerning innovative technologies in agriculture to enhance their job role; and
- iii. Farmers should form cooperative societies that will encourage asset build up in green-technology in agriculture.

References

- Agbidi, S.S. (2023). Barriers to small-holder farmers' adoption of agri-tech and strategies for galvanizing sustainable cassava production in Delta State, Nigeria. *Journal of Vocational and Technical Education*, 14 (1), 164 – 172.
- Agbidi, S.S. & Ikeoji, C.N. (2020). Challenges faced by Agricultural education stakeholders and strategies for achieving sustainable economic recovery in Nigeria. *Journal of Agricultural Education Teachers Association of Nigeria*, 4 (1), 114 – 123.
- Agbidi, S.S. & Imobighe, I.M. (2022). Stakeholders' perception, knowledge and attitude towards the goal to end poverty. *International Journal of Scientific Development and Research*, 7 (2), 613 – 620.
- Ahmed, E.M. & Elfaki, K.E. (2023). Green technological progress: implications on long run sustainable economic growth. *Journal of the Knowledge Economy*, 778. doi.org/10.1007/s13132-023-01268-y.
- Alabi, O.S. & AJayi, A.O. (2018). Assessment of desired competencies of Agricultural extension agents in sustainable agricultural development activities in Southwest Nigeria. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 18 (3), 11 – 20.
- Anagah, F.I. (2023). Review of green technologies use by farmers: Implications for environmental sustainability in Nigeria. *International Journal of Environment and Climate Change*, 13 (9), 75 – 34. Doi:10.9734/IJECC/2023/Y13I92206.
- Azmi, F.R., Musa, H., Abdullah, A.R., Othman, N.A. & Fam, S. (2017). Analyzing the awareness of green technology in Malaysia practices. *Proceedings of Mechanical Engineering Research*, 252 – 254.
- Econation (2023). Sustainable economy/what is a sustainable economy. <https://econation.one>sustainable-econation-one./st>.
- Erhun, M.O. (2015). A sustainable approach to economic development in Nigeria: A legal perspective. *Journal of Economics and Sustainable Development*, 6 (14), 1 – 6.
- Ghosh, P.R., Fawcett, D., Sharma, S.B. & Poinerm, G.E.J. (2016). Progress towards sustainable utilization and management of food waste in the global economy. *International Journal of Food Science*, 2016, 1 – 22. <https://dx.doi.org/10.1155/2016/3563478>.
- Indeed (2022). What is sustainable economic growth? (and how it work). <https://uk.indeed.com?career-advice>
- Ogbo, A.I., Eneh, N.C.J., Agbaeze, E.K., Chukwu, B.I. & Isijola, D.O. (2017). Strategies for achieving sustainable economy in Nigeria taking into consideration the acceptable stakeholders. *African Journal of Business Management*, 11 (19), 582 – 589.
- Olayemi, S.S., Olusola, O.S. & Merianchris, E.E. (2020). Farmers' perceptions of Agricultural extension agents' performance in Sub-saharan African communities. *International Journal of Environmental and Agriculture Research*, 6 (5), 1 – 12.
- Owais, Y., Sushree, T. & Singh, A. (2018). Organic food production through green technology: An ideal way of sustainable development. *The Pharma Innovation Journal*, 7 (6), 160 – 163.
- Sheriff, S.Y., Sule, H., Abubakar, B.Z., Maikasawa, M.A. & Agbomakha, F.I. (2020). Challenges militating against the effectiveness of knowledge management in sustainable land use and agricultural production among extension workers in Sokoto State, Nigeria. *Agricultural Sciences*, 1, 912 – 920.
- Sternfels, B., Francis, T., Madgavkar, A. & Smit, S. (2021). Our future lives and livelihoods: Sustainable and inclusive and growing. [Mickinsey.com>our-future-lives-and-livelihoods-sustainable-and-inclusive-and-growing](https://www.mickinsey.com>our-future-lives-and-livelihoods-sustainable-and-inclusive-and-growing).
- World Wide Fund for Nature (WWF). Sustainable economies. <https://www.wwf.eu>what-we-do>.