



GSJ: Volume 7, Issue 3, March 2019, Online: ISSN 2320-9186
www.globalscientificjournal.com

THE USE OF SPACE TECHNOLOGY IN ACHIEVING A SUSTAINABLE AGRICULTURAL PRODUCTION IN NIGERIA

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Abstract

Since things are changing and agriculture has been seen as the major way out for Nigeria, there is the need for us to acquaint ourselves more and embrace the vast emerging space technologies in solving a number of agricultural challenges been faced by farmers today. In Nigeria and other developing countries today, the role of space technology cannot be over emphasized as it has a very long way to go in this pursuit. Climatic change and anthropogenic factors can lead to environmental resource depletion with a drastic impact on the agricultural production in a country. By addressing these issues through efficient use of space technologies it is possible for developing countries like Nigeria to ensure a sustainable path to poverty reduction through agricultural production, data was collected using a structured questionnaire administered in various agencies involved in Agriculture and Space technology, the analytical technique used for the study is descriptive statistics and likert type scale. This paper focuses on discussing the importance of space technology and its tools for decision making in sustaining agricultural production in Nigeria.

Keywords: *Space technology, agricultural production*

Introduction

Space technology offers a wide range of innovative and cost effective solutions for agricultural production and environmental sustainability; hence, many countries now appreciate the relevance of space technology in the sustenance of agriculture. The relevance of agricultural information is based on the degree of its availability to the farmers and to what

extent such information can be shared effectively with external organizations largely over the internet and other available global information infrastructure (SDI) platform. In this regard, the emphasis should be on accessibility and distribution of available information over wide range of networks and environmental information market-place (Matambanadzo,1999).

Debris is a result of human activities in outer space. Space weather, caused mostly by the interaction of charged particles from the Sun with the Earth's magnetic field, can also disrupt satellite services or even damage satellites. Although space weather is a natural phenomenon that is not affected by human activity, it still plays an important role in agricultural sustainability. Not knowing whether a satellite was damaged by space weather or by hostile action could lead to conflict. Radio frequency interference, either from natural sources or manmade and either intentional or unintentional can have significant negative impacts on our ability to use space. Many satellites also use radio waves as an important element in their functioning, including retransmitting television broadcasts or transmitting imagery or scientific data that they have collected. Interference can be generated by other satellites, terrestrial systems, or space weather. SWF, 2014

The process of global change is altering the Earth's environment and climate thereby affecting agricultural production. The implications of these changes for agricultural sustainability call for an approach that integrates the natural sciences and the human sciences. Scientists need to develop an understanding of the complexity of physical-ecological-anthropogenic systems on agriculture. In this new paradigm, the Earth's environment is seen as being influenced by the dynamic interaction of natural and social systems. Until the middle of the 20th century, environmental sciences could still be based on leisurely methods of data collection which were compatible with the relatively slow speed of environmental changes and with the scales of studies D. Simonett, 1969. Presently, constantly improved and updated information is a given for resource monitoring and management as they can capture the dynamic nature of environmental conditions such as climate change, water allocation, as well as soil and biodiversity loss B. Ostendorf, 2011

Navalgund et al. 2007 classified the current remote sensing applications into the following categories: sustainable agriculture, water security, environmental assessment and monitoring, disaster monitoring and mitigation, and infrastructure development. Other fields of research such as fisheries management, weather and climate studies have also benefited from the development of the remote sensing sector. More recently, remote sensing data have more

been instrumental in advancing the fields of ecology, biodiversity and conservation. K. Wang, S.E. Franklin, X. Guo, M. Cattet, 2010. We all know that water is fundamental requirement by all living things for cell metabolism. Continuous existence of man on this planet will definitely depend on the availability of good quality water. Several activities deter good water quality in Nigeria today. The problem of nitrate pollution in groundwater is a common global phenomenon and has been reported by various authors in many parts of Nigeria (Egboka & Ezeonu, 1990; Adelana & Olasehinde, 2003; Amadi, 2010).

The rate at which the climate is changing is a constant challenge to issues of sustainable agriculture in Nigeria. Space science research therefore plays a major role in terms of our understanding of Earth's resources, the state of the climate and the state of the earth's crust. Fred Watson (2011). It provides a significant contribution to confronting these threats through their global monitoring, communication, and positioning capabilities.

It also involves the use of space technology for a broad spectrum of space travel, space exploration and it provides a unique opportunity for developing countries to enhance their growth and development through focus on the instrumentation of designs in rocketry, satellite data acquisition, Remote Sensing Satellite, Communication Satellite, Astronomical Satellite, Meteorology Satellite, and Space Station, processing analysis and management of related software for the attainment of space capabilities. Ogunyemi (2012) Whether one considers sustainability to exist as a three-legged table consisting of the environment, the economy, and society, or as a dualistic relationship between human beings and the ecosystem.

Robert Goodland (1995) sees "environmental sustainability" as the maintenance of natural capital" The need for satellite surveillance for sustainable agriculture is needed for crop protection. Robert Watson et al (2003) Nigeria's space ambition can be traced back to 1976 in Addis Ababa when she declared to members of the Economic Commission for Africa and Organization of African Unity. Spencer Onuh (2016) Thus In 1988 the National Council of Ministers' approved the establishment of a National Centre for Remote Sensing. (NASRDA Act 2010). The Federal Government recognized the role of space science research in the attainment of rapid sustainable socio-economic development through agriculture, .Agbaje, (2008)

Aim

The paper, aims to take a fresh look at measurement processes designed to support the agricultural production through space technology.

Objectives of the Study

This major objective of the paper is to discuss the importance of space technology and its tools for decision making in sustaining the environment and the specific objectives are:

1. Identify the areas in which the Applications of Space Technology can be used to achieve a better and sustainable agricultural production in Nigeria;
2. Identify the areas of application of space technology in Nigeria;
3. Determine how the use of Space Technology for better agricultural production can be achieved in Nigeria; and
4. Access the challenges of the application of space technology to achieving sustainable agricultural production in Nigeria..

Conceptual Clarification

Sustainability

Sustainability is defined as the capacity to endure, and sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” Tools designed to assess environmental impacts exist and could be used at several levels to better take into account environmental concerns in the evaluation of Earth observation data and products supply chain. Dairon, 2000.

Space Technology

Space Technology is the specialized set of information technologies that include Aerial Photography, Remote Sensing, Surveying, and Global Positioning Systems that support a wide variety of uses. This stretches from data acquisition to data storage, manipulation, image analysis, geo-visualization /display and data output (Tsou and Yanow, 2010).

Method of Data Collection

Data for the study was collected using structured questionnaire and interview question which was administered and conducted respectively, using a two stage sampling technique of firstly purposive selection of four agencies involved in agriculture and space technology which include National Research and Space Development Agency Nigeria, Air force Headquarters Nigeria, Federal Ministry of Agriculture, Abuja Nigeria and Federal Ministry of Environment. Secondly was random selection of 25 officers each from each agency.

Analytical Techniques

Likert type Scale and Descriptive Statistics

Result and Discussion

Analysis of demographic data

NARSDA Officials 25

Air force officers 25

Federal Ministry of Agriculture 25

Federal Ministry of Environment 25

Male 72

Female 28

Total no of respondent is 100

Roles of Space Technology on Agricultural Production

The study identified the role of space technology on agricultural production as shown in Table 1 below:

Table1: Distribution of Roles of Space Technology on Agricultural Production

Roles of Space Technology on Agricultural Production	Frequency	Rank
Food insecurity vulnerability assessment	68	6th
Crop monitoring and agric production forecasting	56	8th
Estimation of crop yield	87	2nd
Monitoring health of livestock's	34	11th
Good health and education for farmers	45	9th
Flood monitoring	67	7th
Provision of water	71	5th
Transportation for marketing	74	4th
Biosynthesis and biodiversity tackling	35	10th
Good road mapping	76	3rd
Monitoring forest degradation	88	1st

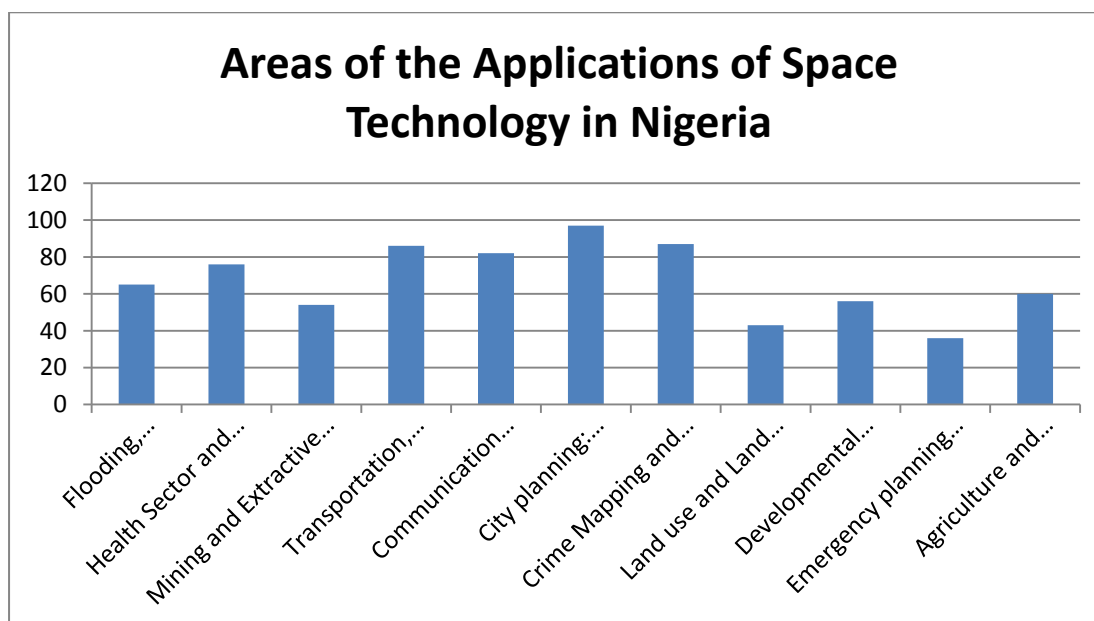
Areas of the Applications of Space Technology in Nigeria

According to the findings of the study, some of the identified areas of applications of space technology for sustainable development in Nigeria is as shown in Table 2 and Figure 1 below:

Table 2: Distribution of the areas of the applications of Space Technology in Nigeria

Aspect of Applications of Space Technology in Nigeria	Frequency
Flooding, environmental degradation and climate studies	65
Health Sector and Paramedics	76
Mining and Extractive Industry	54
Transportation, Traffic and Accident control and prevention	86
Communication Network designs and in Aviation Industry	82
City planning: Planning and Re-Planning program	97
Crime Mapping and hot-spots delineations	87
Land use and Land cover Studies for sustainability	43
Developmental control, resource inventory and allocations	56
Emergency planning and alternative route development	36
Agriculture and Precision Farming	60

Figure 1: Areas of the Applications of Space Technology in Nigeria



Challenges of the application of space technology to achieving sustainable agricultural production in Nigeria

The study identifies the following challenges of space technology applications as shown on Table 3 and Figure 2 below:

Challenges of achieving sustainable agriculture through space technology	Frequency
Corruption and lack of transparency	87
Lack of zeal on the part of Nigerian researchers and trainers	65
High rate of illiteracy and Ignorance among Farmers	89
Gender disparity	19
Poverty rate of farmers in Nigeria	45
Poor Funding by Government on research work	56

Ways in which Space Technology for better agricultural production can be achieved in Nigeria

The use of Space technology for better agricultural production can be achieved in the following ways as shown in Table 4:

Ways in which Space Technology for better agricultural production can be achieved in Nigeria	Frequency
Public Private Partnership	34
Promotion of gender equality	46
Training of rural farmers on smart farming	58
Education for farmers and children	70
Self reliance	32
Investment on researchers to develop more interest in space technology research	26
Adequate Sensitization of farmers on the importance of Space technology	78
Adequate collaboration between space agencies and agricultural agencies in Nigeria	76
Rehabilitation of climate change affected areas such as flooded areas	49

Conclusion

In order for Nigerians to have a sustainable agriculture, there is the need for us to embrace and emphasize the compulsory adoption of space technology and also not to limit it to private practice or government. There should be an awareness creation on public participatory in the decision making process which involves the citizens and their environment. Adoption of space technology in all national endeavours such as environmental monitoring, Agriculture, Climate change studies, land use and land cover studies will help foster environmental sustainability. Efforts of the National Space Research and Development Agency (NASRDA) Abuja are to ensure the use of space applications in Nigeria for good environmental inventory, monitoring and mitigation and early detection of environmental challenges and treats. If the government of the day employs and uses the avalanche of opportunities readily provided by space technology, most environmental challenges will be overcome or be reduced to the dearest minimum. This will lead to a sustained growth and development in Nigeria.

Recommendations

For Nigeria to harness the gains of space technology in solving most environmental problems, the following recommendations are necessary: -

The government should encourage capacity building to increase the capacity of expertise

Government should provide more funds for research work

Government should continue in the fight against corruption

Researchers should develop more interest in space technology research towards sustainable agricultural production

Government should improve on power supply in the country

The space agency of Nigeria NASRDA must live up to standard and improve on their effort on environmental sustainability

There should be proper collaboration between the institutions involved in agricultural sustainability such as NASRDA, Federal ministry of environment, Federal Ministry of Agriculture and so on

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