

**CHALLENGES OF 2002 WORLD SUMMIT ON
SUSTAINABLE DEVELOPMENT AND SPACE
TECHNOLOGY-RELATED IMPLEMENTATION
STRATEGIES**

Presented By

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1. **INTRODUCTION**

In 1972, the first World United Nations (UN) Conference on Human Environment took place in Stockholm, Sweden, consequence upon the recognition of environmental problems as a global issue. Subsequent UN conferences and reports, including Agenda 21 and the Rio declaration of 1992, looked at issues of environment and socio-economic development and how to sustain them for the benefits of the present and future generations.

Between Rio and Johannesburg, despite commitment to Rio's declaration to evolve a new world order on sustainable development, the situation remained un-abated with little or no improvement.

The global environment continues to suffer. Loss of biodiversity continues, fish stocks continue to be depleted, desertification claims more and more fertile land, the adverse effects of climate change are already evident, natural disasters are more frequent and more devastating, and developing countries more vulnerable, and air, water and marine pollution continue to rob millions of a decent life.

Globalisation has added a new dimension to these challenges. The rapid integration of markets, mobility of capital and significant increases in investment flows around the world have opened new challenges and opportunities for the pursuit of sustainable development. But the benefits and costs of globalisation are unevenly distributed with developing countries facing special difficulties in meeting this challenge.

At the beginning of the 2002 World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, the children of the world, including Nigerian children, spoke in a clear voice that the future belongs to them and accordingly challenged the world to ensure that through our collective actions they will inherit a world free of the indignity and indecency occasioned by poverty, environmental degradation and patterns of unsustainable production, consumption and development.

Accordingly, it is our collective responsibility to advance and strengthen the interdependent and mutually reinforcing pillars of sustainable development – economic development, social development and environmental protection – at the local, national, regional and global levels. Therefore, the focus of the Johannesburg Summit was on the indivisibility of human dignity and are resolved, through decisions on targets, timetables and partnerships, to speedily increase access to such basic requirements as clean water, sanitation, adequate shelter, energy, health care, food security and the protection of biodiversity. At the same time, we will work together to help one another gain access to

financial resources, benefit from the opening of markets, ensure capacity-building, use modern technology to bring about development and make sure that there is technology transfer, human resource development, education and training to banish under-development forever.

2. **SUSTAINABLE DEVELOPMENT CHALLENGES**

Moving towards sustainable development presents tremendous challenges. Important structural changes are needed to the ways in which our society manages its economy social and environmental affairs. Different countries may settle for different solutions, but all will have to make hard choices. Review of recent declarations and debates have revealed however, that national strategies for sustainable development can integrate many initiatives on a continuous improvement basis. The under-listed sub-titled are viewed as some of the major elements of the challenges.

2.1. **Declarations of the 2002 Johannesburg Summit**

It is against the foregoing principles that the 2002 WSSD focused on top ten strategies for the successful achievement of sustainable development.

These are:

- Making globalization work for sustainable development
- Poverty eradication and sustainable livelihoods
- Changing unsustainable patterns of consumption and production.
- Promoting health through sustainable development
- Access to energy and energy efficiency
- Sustainable management of ecosystems and biodiversity
- Managing the World's freshwater resources

- Finance and technology transfer
- Sustainable development initiatives for Africa
- Strengthening the system of international governance for sustainable development.

The achievement of the foregoing, with targets set by the UN through the Johannesburg political declaration to haul the World's 2 billion poorest out of misery and restore/nurture the damaged environmental web that sustains all of its life, creates scenarios among Nigerian geoinformation community for mass acquisition of reliable data about the nations natural resources and environment. Specifically, about 189 States of the world affirmed their commitment to the implementation of 170 agenda items which include the following; and for which Nigeria remains totally committed

- halve the proportion of global people without safe drinking water and adequate sanitation by year 2015;
- halve the number of world's poor living on \$1 a day, including significant improvement in the lives of slum dwellers, by year 2015;
- reduce the destructive fishing practices, establish marine protected areas and maintaining or restoring fish stocks to sustainably harvested level by year 2015, as well as significantly improve Africa's agricultural productivity and food security;
- significantly reduced environmental problems due to biodiversity loss and air and water pollution and develop a 10-year plan where consumption and production are sustainable and balanced by environmental protection;
- voluntary national targets for access to re-newable energy like solar, wind and wave energy;
- reduce risks of flooding and drought in vulnerable countries by promoting wetland and watershed protection and restoration, improve Landuse and planning assessment of potential adverse effects of climate change on wetlands.

- Integrate measures to prevent and combat desertification through relevant policies and programmes, such as land, water and forest management, agriculture, rural development, early warning systems etc;
- Promote equitable and improved access to affordable and efficient health-care services, in particular those affecting susceptible and vulnerable population with environmental linkages.
- Support the implementation of the vision of NEPAD through technical and institutional cooperation and human and institutional capacity building.

2.2. **Preservation of Fundamental Life Support Systems**

According to Abiodun (2003), the fundamental life support systems are air, water and food or agricultural resources; it may also include wholesome environment, shelter and access to health and education. The pre-occupation of visionary leaders of any national and its people should be how to preserve these life support systems to the benefit of present and future generations.

Accordingly, many societies around the globe, including Nigeria, are embarking on initiatives and developing agenda that could address/redress the problems of poverty, food security, protection from man-induced disasters and affordable health and housing.

For example, some of the key natural disaster/problems facing Nigeria are coastal flooding and erosion, flooding from, river flooding due to heavy rainfalls and uncoordinated irrigation schemes, harmatan and sand storms with associated dust, wind erosion and dunes build-up, droughts and desertification. Similarly, the human induced elements include toxic emission from auto-and motor-vehicles, (with associated air pollution, coughs and lungs diseases), unregulated waste disposals, deforestation (cutting, grazing and burning), oil spillage with associated pollution of ecosystem and loss of biodiversity, agricultural land degradation due to poor landuse planning and

management, gully erosion, forest fire and green-house effects. Effects of these disasters are especially damaging to the infrastructural development of the affected areas, as well as causing catastrophe in terms of environmental problems, diseases, hunger and death. Prevention of such hazards, calamity and environmental problems creates scenarios and enormous challenges to the nation in its efforts at promoting acquisition of reliable geospatial information for proper monitoring of the Nigerian environment and eco-systems.

2.3. **Integration of Regional Initiatives**

The recently launched New Partnership for Africa's development (NEPAD) by the Africa Union is, in part, a response to the repeated calls of Africa's Scientists for the urgent need to develop and apply the most practical tools possible to tackle the challenge of boosting sustainable food production, and of assessing, quantitatively, the extent and rates of desertification and deforestation and their impact on food and livestock production.

According to Mostert et al (2003), an initiative of this magnitude can only be fulfilled with African governments taking on an active roles to support and utilize the benefits of the relevant programmes. For instance NEPAD science and technology objectives must focus on the core challenges of food production, health, energy, information communications, mining and industrial production. NEPAD must provide a platform for scientific excellence in Africa in order to be globally competitive and contributing to the socio-economic development of the continent.

2.4. **Need for Good Governance and Total Commitment to Poverty Eradication**

Good governance within each country and at the international level is essential for sustainable development. At the domestic level, sound environmental, social and economic policies, democratic institutions responsive to the needs of the people, the rule of law, anti-corruption measures, gender

equality and an enabling environment for investment are the basis for sustainable development. As a result of globalisation, external factors have become critical in determining the success or failure of developing countries in their national efforts. The gap between developed and developing countries points to the continued needs for a dynamic and enabling international economic environment supportive of international cooperation, particularly in the areas of finance, technology transfer, debt and trade and full and effective participation of developing countries in global decision-making, if the momentum for global progress towards sustainable development is to be maintained and increased.

Eradicating poverty is the greatest global challenge facing the world today and an indispensable requirement for sustainable development, particularly for developing countries. Although each country has the primary responsibility for its own sustainable development and poverty eradication and the role of national policies and development strategies cannot be overemphasized. Concerted and concrete measures are required at all levels to enable developing countries, such as Nigeria, to achieve their sustainable development goals as related to the internationally agreed poverty-related targets and goals, including those contained in Agenda 21, the relevant outcomes of other United Nations conferences and the United Nations Millennium Declaration.

3.0. **THE ROLE OF SPACE TECHNOLOGY IN SUSTAINABLE NATIONAL DEVELOPMENT**

A prerequisite for meeting the above challenges and for effective management of any development is essentially our ability to manage our resources and to monitor the environmental status and its variations in the domain of both time and space. Earth observation, communication and navigation satellites play a vital role in the collection and dissemination of information, in a very timely manner providing crucial inputs required for carrying out operationally viable strategies. While the earth observation (EO) technologies, including remote sensing of natural resources and the environment, can very significantly contribute towards implementation of the recommendations arising from WSSD and the regular initiative and monitoring the indicators of sustainability, satellite communication, navigation, search and rescue and space sciences and enrich the quality of human life by transforming the entire life styles. The role of space technology for sustainable development can be defined as:

- i) Integrated Earth observation systems for sustainable environment and natural resource development.
- ii) Spatial data infrastructure development and applications for sustainable development planning, and decision-making.
- iii) Space communication applications for human development and poverty alleviation.
- iv) Preparing regional capability for emerging space technology development and applications.
- v) Education and training in space sciences and technology development application and management.
- vi) Development of the space-related industry and service sector to promote economic growth.

3.1. **Nigerian National Space Policy and Programmes**

Within the framework of the foregoing objectives and to meet the sustainable development challenges and Nigeria's aspiration to utilize space assets for the improvement of the quality of life of its people, the Government of Nigeria approved a National Space Policy and Programmes and the establishment of a National Space Research and Development Agency (NASRDA). NASRDA was mandated to conduct appropriate research and development activities and also consolidate all space science and technology-related activities to make a greater impact on developmental efforts in Nigeria, particularly in sectors of the economy such as transports, agriculture, communication, education, cadastre and urban development, rural health care delivery, solid mineral development, water resources and defence and security and protection of the environment.

The set objectives and targets of the policy were to be realized through the establishment and empowerment of six implementation centers, vis: Centre for Basic Space Science, National Centre for Remote Sensing, Centre for Satellite Technology Development, Centre for Geodesy and Geodynamics, Centre for Space Transport and Propulsion and African Regional Centre for Space Science and Technology Education.

The mandate of these Centres and NASRDA's administrative structure have been highlighted in another publication (Akinyede, 2003) Nigeria makes the development of Critical mass of indigenous manpower development, such as trained engineers and scientists, as major thrusts of the space policy. The nation is to build proficiency in satellite building, launching, telemetry, tracking and control of all kinds of satellites and satellite data utilization: and tailor the programmes within the overall strategies for sustainable national development.

3.1.1. NigeriaSat-1 Satellite Projects

The first Nigerian satellite, a micro-satellite called NigeriaSat-1, was successfully launched into low earth orbit on 27th September, 2003. The choice of NigeriaSat-1 was influenced by its low cost, affordability and the advantage of comparable performance to the expensive large satellites and the possibility to support capacity building; Fifteen (15) Nigerian engineers/scientists were trained in all aspects of satellite technology including ground station management. To date, NigeriaSat-1 has captured high quality images, using the six cameras on board the satellite, and demonstrated good commercial value. The launch has generated wide spread national attention and stimulated countrywide space awareness, especially among stakeholders and users of satellite data for geoinformation acquisition for socio-economic activities in Nigeria. Similarly, decision makers have shown a great interest and have been highly optimistic about its application potentials. The fact that data from NigeriaSat-1 is timely accessible and entirely owned by Nigeria has stimulated research and development by many relevant institutions of government and the private sectors in Nigeria. Further benefits of the availability of real-time data from NigeriaSat-1 are highlighted:

- provides an opportunity for sharing knowledge and solving the problems of digital divide in Africa.
- Being configured in Disaster Monitoring constellation (DMC) with other satellites that belong to Algeria, China, Turkey and U.K. gives it added advantage of global coverage and daily revisit with provision of real-time data.
- Has a ground sampling distance (GSD) or spatial resolution of 32m with an economic swath width of 600km; it has a minimum of five years life span.

- A camera-based system/technology with sensors in 3 spectral bands: green (0.52 -0.62m), red (0.63-0.69m) and near infrared (0.76-.9m) with strong potential for NDVI (Normalized Differential Vegetative Index), which can be used for a variety of application and inferences including desertification and famine early warning and appropriate decision-making
- Has great potential for broad spectrum of data acquisition for the National Geospatial Data infrastructure (NDGI), an initiative for geoinformation-based economy that will improve the quality of life of Nigerians and alleviate poverty.
- Mutual benefits from the DMC satellites include daily imaging capability with reduction in cloud problems and increased commercial value, setting a new international EO standard, and stimulating partner-nations-value-added business and high public profile in terms of international disaster support and out of world's first coordinated EO satellite constellation.
- With the linkage of the other satellites in the DMC, through internet facility to permit sharing of data, NigeriaSat-1 offers a great potential for disaster management and monitoring such as oil spills and environmental degradation in the Nigerian Delta area and any other part of the world.
- Provides opportunity for an array of application in many areas of socio-economic development and environmental management such as (i) effect of oil pollution on land use/cover dynamics and environmental degradation in the Niger delta area (ii) studies of the indicators of drought/desertification in part of North Western Nigeria (iii) Influence of urbanization/urban sprawl on socio-economic activities around the ancient city of Ibadan (iv) impact of land use planning and management on Kadawa irrigated agriculture, Kano State (v) influence of surface water hydrology on water resources development in part of Kaduna State (vi) coastal/beach erosion studies along Lagos shoreline.

A more detailed analysis of NigeriaSat-1 application potentials have been well documented (Akinyede, 2004).

3.1.2. **Nigeria's Proposed Communication Satellite – NigcomSat-1**

Experience in some developing countries has shown how satellite-based communication accelerated development. Ineffective communication systems are usually one of the greatest drawbacks to the socio- economic development of developing countries.

Consequently and as a follow-up to the successful launch of NigeriaSat-1, the government of Nigeria has approved the implementation of a Nigerian Communication Satellite to be called NigcomSat-1. The project is intended to provide the bandwidth requirement to address the telephony, broadcasting and broadband needs of the country. Similarly, the implementation of a functional Information Communication Technology (ICT), as a driving force behind most development and developing economics, particularly in the capture, processing, storage, management and communication or sharing of geospatial dataset, has been considered as part of the comprehensive benefits of a communication satellite.

The outline of the proposed communication satellite, based on a survey conducted by NASRDA, (NASRDA, 2003) includes a minimum of 20 hybrid transponders with 15 years life spans and coverage of the African continent, Middle East and Europe. The project is expected to commence in 2004 and the satellite itself will be launched in 2006.

A typical spin-off/benefits derivable from communication satellite is tele-medicine which can be used for the achievement of rapid public and rural health-care delivery in Nigeria. The United Nations Committee on Peaceful Uses of Outer Space (COPUOS), at the 46th Session of the Scientific and Technical Subcommittee meeting held in February 2004, recognized the broad application of tele-medicine in epidemiology, tele-surgery, offsite radiology services, cardiac monitoring, medical consultations and specialist referrals, correctional care and tele-education in medicine and therapeutic education.

3.1.3. **African Resource Management Satellite Project**

(i) **Technical Elements**

A joint satellite programme between South Africa, Nigeria and Algeria and any other interested country in Africa would form the cornerstone of the African Resource Management Satellite Constellation, laying the foundation of sustainable technology development in Africa. The ARM project is one of the key flagship projects in the NEPAD Science and Technology Ministerial Programme Areas. The countries involved would collaborate in building capacity to support space programmes in Africa. Such a programme would benefit Nigeria in advancing the realization of the objectives of its space policy. In the long term the relationship will be strengthened and used for the sustainable development of Nigeria and Africa; laying one of the foundation stones in an African Space Programme.

The African Resource Management system has been conceived with the goals of:

- building forth on indigenous knowledge to develop and transfer satellite technology.
- developing African human resources by means of joint participation and knowledge sharing.
- providing Africa with rapid, unrestricted and affordable access to satellite data thereby ensuring effective indigenous resource management in Africa by Africa.

Readily accessible yet affordable high-resolution imagery is essential for managing the vast resource expanses governed by African states. This document describes how indigenous resources, most notably the existing

knowledge base, could be developed to benefit the entire continent by meeting the growing resource management needs.

The space segment will consist of identical satellites to be built together by participating African engineers. Each satellite will have a high-resolution payload with a 2.5 meters panchromatic resolution and a 5m multi-spectral payload in 6 spectral bands. The satellites will be phased to operate in constellation and will be accessed through the integration of the individual ground stations.

One of the major outputs of the ARM System is human capacity able to build and use and evolve the African Earth Observation and Management System of which the ARM forms an integral component. The ARM initiative was proposed by South Africa and supported by Nigeria as documented in a joint space technology project proposal between South Africa and Nigeria (Mostert et al, 2003).

(ii) **Benefits to Nigeria and Africa**

Access to the proposed ARM satellite remote sensing data opens the door to a wide range of application, including

Infrastructure - Mapping new roads and settlements; Urban planning, Public transport infrastructure monitoring; Telecommunications and utilities infrastructural planning.

Water - Mapping water distribution and availability to measure the impact of droughts and floods; Collect information on how water is used in areas such as forestry and agriculture.

Agriculture and Land use – Estimating crop acreage is a proven technique for agricultural yield prediction. This enables authorities to anticipate food shortages and famines well in advance, thereby allowing adequate time to take preventative action. Precision farming techniques use satellite information to accurately identify biological features for instance water stress in plants, thereby enabling early and precise use of pesticides, irrigation and fertilizers. Benefits include improved yield, cost saving and reduced environmental impact and Agricultural land management.

Non-renewable energy resource exploration - Minerals, oil and natural gas.

Renewable natural resources protection - Detection of illegal fishing vehicles, Vegetation management and identification of alien species, Soil erosion and desertification and Forest fire detection and management.

Refugees - Refugee camp planning and monitoring, Relief operation planning and Environmental impact assessments of refugee camps.

Health Hazard Monitoring - Using seasonal standing water formation in conjunction with temperature readings in malaria prone areas to predict mosquito breeding potential. Applied in this manner, the satellite information systems can aid early warning systems for fighting the spread of malaria.

Disaster Mitigation and Management - Identifying areas generally at risk from disasters allows for action to be taken well in advance to reduce the impact and Assessing damage and relief operations following disasters, including earthquakes, volcanic eruptions and oil spills.

3.1.4. Space Application Support for Sustainable Development

In order to streamline interaction between space technology and the objectives set by the Federal Government of Nigeria for the improvement of the quality of life of its people, the Space Application Support for Sustainable Development (SASSD) programme was devised. Realisation of SASSD objectives depend on availability and speedy access to real-time data and availability of relevant infrastructures for data acquisition, processing standardisation and data sharing. This is only achievable through the appropriate SASSD programme framework which include:

- (i) geospatial data production and application for sustainable national development and

(ii) the development of a National Geospatial Data Infrastructure (NGDI)

(i) **Geospatial Data Production And Application For Sustainable National Development**

The speedy access to satellite images and the importance of accurate and accessible geospatial data for a wide range of sustainable development activities have become increasingly relevant and clear to research and development organizations as well as to decision and policy-makers. The objective of this sub-programme is achieved by combining space-derived data with GIS to produce maps and reports for planning and decision-making. Both local and international collaborations are utilized to achieve the desired results and impact on national development. The implementation of the following projects, by NASRDA falls under this sub-theme:

- preparation of Abuja maps: a compendium of image maps to promote socio-economic activities in the fields of tourism, engineering construction, agriculture, environment, urban development, utilities management and cadastre mapping with value addition and revenue generation, ect.
- application of space technology to the development for an optimum road maintenance strategy in Nigeria.
- Development of Fadama Land Information System (FLIMS) to boost wetland rice production in Nigeria.
- Forecasting hectare yields of cassava for national planning, using a remote sensing option.
- Application of space technology for rail route location and potential network development in Nigeria.

- Remote sensing and GIS in a meningitis (health application) early warning, prevention and intervention strategy.

Back-up programmes such as low-cost ground receiving station is being planned to be built in Jos and operated under the supervision of NCRS to capture data from satellite other than NigeriaSat-1. Similarly, NigeriaSat-1 ground station in Abuja will be upgraded/expanded to receive data from other relevant satellites including the proposed ARM satellite. The ground stations will be equipped with the state-of-the-art-facilities for data reception, cataloguing, archiving and data pre-processing. Apart from the fact that the ground stations will facilitate speedy access to real-time data at affordable cost, it creates opportunity for international co-operation and capacity building with the training of Nigerian engineers and scientists.

(ii) **Development of a National Geospatial Data Infrastructure**

Increasing awareness of the use of GIS technology for policy and decision making over recent years has led to efforts by the Nigerian Institute of Surveyors, the Nigerian Cartographic Association, National Planning Commission and NASRDA towards the establishment of a National Geographic Information System – NAGIS. However, given the need to adopt policies promoting greater awareness and public access along with co-ordinated geospatial data production, management and dissemination by institution in all sectors and the need for the establishment of a Geospatial Data Clearing House at various levels in the country, the NAGIS project has crystallized into an infrastructural development, a National Geospatial Data Infrastructure (NGDI). The concept and mechanism involved in this project with benefits to Nigeria have been largely documented in (Kufoniyi, 2004).

3.2. Import From UNISPACE III Conference And The Implementation of It's Recommendations

Following the successful launch of the first satellite, Sputnik-1, in 1957, the United Nations General Assembly established the Committee on the Peaceful Uses of Outer Space (COPUOS) in 1959 to promote international collaboration in space activities and peaceful uses of outer space for economic and cultural development. The Committee with its Scientific and Technical Subcommittee and Legal Subcommittee, has played vital roles in the organization of the UN global conferences on the exploration and peaceful user of outer space. The third in the series of such conferences called UNISPACE III was held in Vienna, Austria in 1997. The theme of the conference is “Space Benefits For Humanity In The Twenty-First Century”.

UNISPACE III conference was attended by representatives from 100 States including Nigeria, and recommended 33 specific actions which were adopted as the Vienna Declaration on Space and Human Development. COPUOS was mandated by the General Assembly to ensure the implementation of the recommendations. COPUOS set up 11 Action Teams to implement the recommendations accorded highest priority. The table below shows the Action Teams and Synergies between the recommendations and the plan of implementation of the World Summit on Sustainable Development. The results of the work of the Action Teams have been well documented as a UN report awaiting the General Assembly's ratification. Each of the Action Team's report contains a brief mission statement, findings, implementations already on ground or initiated, recommendations for further action and benefits to be derived from the implementation of the recommendations.

The full report can be described as a road map to the attainment of sustainable development and a fall-out of both UNISPACE III Conference and the 2002 WSSD. The successful implementation requires the commitment of all

stakeholders and the policy makers in terms of the priority to be assigned and the allocation of financial and human resources. This paper therefore recommends a high-power committee to study the report and assign responsibilities with set objectives and targets, to all relevant stakeholders in both the public and private sectors.

Recommendations of UNISPACE III Conference

1. Develop a comprehensive, worldwide environmental monitoring strategy.
2. Improve the management of the earth's natural resources
3. Enhance the capacity of the earth's natural resources
4. Enhance weather and climate forecasting.
6. Improve public health services
7. Implement an integrated, global system to Manage natural disaster mitigation, relief and prevention efforts
8. Enhance the capacity of the earth's natural resources
9. Improve knowledge-sharing through the promotion of universal access to space-based communication services.
10. Improve universal access to and compatibility of space-based navigation and positioning systems.

Plan of Implementation of the World Summit on Sustainable Development

- a) Poverty eradication;
- b) changing unsustainable patterns of consumption and production;
- c) protecting and managing the natural resource base of economic and social development:
 - i. water resources;
 - ii. sustainable fisheries;
 - iii. management of oceans, coastal environment, marine and coastal ecosystems;
 - iv. climate change, transboundary air pollution, the hole in the ozone layer;
 - v. Disaster management;
 - vi. Agriculture;
 - vii. Desertification and drought;
 - viii. Mountain ecosystems;
 - ix. Forest management;
 - x. Sustainable mining;
- d) Sustainable development for Africa;
- e) Sustainable development of small island developing States;
- f) Means of implementation:
 - (a) Poverty eradications;
 - (b) Protecting and managing the natural natural resources base of economic and social development:
 - (i) Water resources;
 - (ii) sustainable fisheries;
 - (iii) disaster management;
 - (iv) mountain ecosystems.
- c) Health and sustainable development

- d) Sustainable development in a globalizing world;
 - e) Sustainable development for Africa;
 - f) Sustainable development of small island developing States;
 - g) Means of implementation.
 - (a) Poverty eradication;
 - (b) Protecting and managing the natural resource base of economic and social Development:
 - (i) Water resources;
 - (ii) Disaster management;
 - (iii) Mountain ecosystems;
 - (c) Sustainable development for Africa;
 - (d) Sustainable development for Africa;
11. Promote sustainable development by applying the results of space research
14. Improve the international coordination of activities related to near-Earth objects.
17. Enhance capacity building by developing human and budgetary resources.
18. Increase awareness among decision makers and the general public of the importance of space activities
32. Identify new and innovative sources of financing to support the implementation of the recommendation of UNISACE III.
- Means of implementation.

3.3. **Monitoring The Earth's Atmospheric Systems**

Observations of the Earth's atmospheric system are essential for a better understanding of the atmosphere, ozone depletion, global warming, sea-level rise, atmospheric and water pollution, floods, droughts, land degradation and desertification, deforestation and loss of biodiversity, mitigation of natural disasters, freshwater availability, agricultural services and hazardous wastes disposals. These observations constitute challenges that can be met by strengthening monitoring facilities for the observation of the earth-atmospheric system and collection of reliable data, as well as provision of frameworks for promoting synergy among relevant national and international programmes to ensure linkage with all countries.

The implications of the Earth's Observing System (EOS) to sustainable development, according to Obasi, 2002, include the delivery of increasingly accurate and reliable data and warnings of severe events related to weather, water, climate and natural environment and ensuring that the warnings reach their target audience in a timely and useful manner, as well as the enhancement

of the relationship between meteorological factors and the quality of agricultural production, water resources management, aviation and marine navigation services and environmental protection.

To actualize the implementation of the EOS-related programmes in Nigeria through the provision of awareness on the usefulness of the weather observations and environmental data services, the Nigerian Government established a National Meteorological Services Agency (NAMSA) to provide the appropriate metrological services for Nigeria. Furthermore, NAMSA's to facilitate efficient linkage and cooperation with the Integrated Global Observing Strategy Partnership (IGOSP) to enable Nigeria derive maximum benefits from its various programmes such as the global ocean observing systems (GOOS), Global Climate Observing System (GCOS), etc.

Taking advantage of sharp images of the changing weather from the recently launched meteosat second generation (MSG-1) satellite, for example, all countries in Africa, including Nigeria, have agreed under a unique partnership to transform the data to useful information in support of sustainable development. Accordingly, a task force on preparation for the Use of Meteorological Generation in Africa (PUMA) and African Monitoring of the Environment t for Sustainable Development (AMESD) projects has been set up to provide better network data and services for early warning of disasters, improved food security, better health management, more efficient water and energy use and safer transport.

4. **CONCLUSION**

The 2002 World Summit provided another opportunity, following the reports of previous Un Conferences such as Agenda 21 and Rio declaration, for the leaders of both developed and developing countries to evolve a new world order on sustainable development. It is the duty of each country to take the bull by the horn and develop policies and strategies that will reinforce the three

pillars of sustainable development-economic developments, social development and environmental protection at the local, state and federal government levels.

Space technology remains a veritable tools for meeting the challenges, especially for effective management of any development in terms of our ability to manage our natural resources and monitor the environmental status and its variations in the domain of both time and space. Earth observation, communication and navigational satellites play a vital role in the collection and dissemination of appropriate and timely information, which can be achieved through the implementation of the national space policy and programmes.

Furthermore, the UN Conference on “Space Benefits for Humanity in the Twenty-first Century” recommended 33 specific actions which were adopted as the Vienna Declaration on Space and Human Development. The reports and recommendations from both UNISPACE III conference and 2002 World Summit have provided a road map to sustainable development. The successful implementation of the recommendations requires the commitment of all players. According to an Austrian delegate at the 47th Session of COPUOS, “the main challenge for good governance and sustainable development is not necessarily a lack of research and studies or a lack of knowledge but rather the continued institutional gap between the science community and knowledge production on the one hand and policy/decision makers on the other; i.e. the institutional gap between knowledge production and the political/decision-making processes and seems to be more fundamental. The time to bridge this gap and change our world for the better is now.

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