Satellite Earth Observation Value Added Services in the Nigerian economy. ISNET.

Conference Paper · October 2010

DOI: 10.13140/2.1.2805.5845

2 authors:

Zahrah Naankwat Musa
Delft University of Technology
33 PUBLICATIONS **246** CITATIONS
SEE PROFILE

Halilu Ahmad
National Space Research and Development Agency
36 PUBLICATIONS **294** CITATIONS
SEE PROFILE

SATELLITE EARTH OBSERVATION VALUE-ADDED SERVICE IN THE NIGERIAN ECONOMY

Zahrah N.Musa, Halilu A. Shaba (PhD)
National Space Research and Development Agency, (NASRDA,)Nigeria.
Opposite Pyakasa junction, Airport road. PMB 437 Garki Abuja.

ABSTRACT

Nigeria is prone to a number of environmental problems such as: desertification, flooding, erosion, forest fires, oil spillage, mine degraded areas, fresh water pollution, deforestation, and waste management. Though these problems are being tackled by Government at different levels, pressing issues of food production and sustainability, make government to concentrate on projects that are agriculturally based. As a result, the private sector has become active in providing Satellite Earth Observation services for many ecological problems.

A number of private companies have made their mark in the Nigerian S.E.O market. In the past, most private earth observation service companies were subsidiaries of foreign companies offering services in the construction and crude oil sectors. As the importance of remote sensing and GIS technologies became better known, the number of companies and organizations offering GIS services increased with the indigenous people also setting up smaller outfits. The report assesses the needs, current status and future opportunities for small -to -medium enterprises based in Nigeria to provide value- added satellite remote sensing services.

INTRODUCTION

Space technology applications have proven to be of great value to humanity, as means of resource utilization and catalysts for growth and development of other industries. In many space-advanced countries, space technology has brought about innovation and stimulated research to utilize various spinoffs from the space industry (ERA-STAR, 2006).

The use of satellite remote sensing techniques and geographic information systems (GIS) for the identification, mapping and analyses of environmental problems have gained prominence in recent years as high resolution satellite data have become more readily available. Earth observation ensures monitoring and management of the environment, leading to disaster forecasting, management and mitigation. Earth observation satellites view the earth from above taking images and recording environmental conditions over time. Satellites provide information about the oceans, land cover, atmosphere, geologic activities, etc. This information can be used for different applications like land use/ land cover planning, urban planning, agriculture, water resource management, digital terrain mapping, disaster management, etc. The focus of earth observation is moving in response to users need to manage the environment more effectively, monitor resources efficiently and understand evolving climate conditions (BNSC, 2002).

Nigeria as in most other African countries is prone to a number of environmental problems such as: desertification, flooding, erosion, forest fires, oil spillage, mine degraded areas, fresh water pollution, deforestation, waste management, etc. The applications of Remote Sensing and GIS in solving these problems have been recognized globally and within Nigeria, a number of universities now offer post graduate level degrees in Remote Sensing/ GIS. This has bolstered capacity to utilize satellite imagery for weather forecasting, agriculture, forestry, geology, mineral and oil exploration, town planning, etc.

.

Nigeria is located in West Africa on latitudes 10^0N and longitudes 8^0E of the equator. It is Africa's most populous country with a population of 135 million people composed of more than 250 ethnic groups. It is bordered on the north by Niger republic, on the east by Cameroon, on the west by Benin republic and on the south by the Atlantic Ocean. Nigeria has a total area of 923,768 sq km, composed of 910,768 sq km dry land and 13,000sq km water (CIA world fact book, 2008).

Fig1: Map of Nigeria (www.philadelphiareflections.com)

Nigeria's economy is dependent on crude oil found in the Niger delta region (which is a low lying area consisting of several tributaries of the Niger river and ending at the edge of the Atlantic ocean) and within the deep waters off-shore. Crude oil provides for 80% of government revenues, 90-95% of export revenues and about 97% of foreign exchange (ebizguides, 2005). Since the discovery of oil and its exploration in the 50's, other economic sectors have not been exploited and utilized as a result, unemployment among the youths is up to 49% (nbs,2007). Private companies are involved in a wide range of projects covering many sectors of the economy from farming to ICT to export of valuable resources. An inventory of some Nigerian private companies shows that almost every sector is represented and the Satellite Earth Observation sector is not left out especially now with the increase in number of natural disasters in the country in recent times (such as flooding from the northern desert areas to the southern coastal areas, oil spills in the Niger Delta and accelerated desertification in the north), projects on environmental management have been on the increase; this is indicated by the number of contracts awarded to private companies on environmental monitoring and assessment.

STATUS OF SATELLITE EARTH OBSERVATION IN NIGERIA

THE PUBLIC SECTOR

The Nigerian National Space Research and Development Agency (NASRDA) which was established in 1998 and mandated to, among other things: apply space technology for the sustainable development of the country, improve capacity building in space science and technology development, and acquire, analyze and utilize data in atmospheric science and astronomy (Chizea, 2007). The agency which is headed by a Director –general has six centres of excellence in various applications of space technology that get their funding through the federal ministry of science and technology.

Before the establishment of NASRDA satellite imagery was acquired by various government agencies /ministries without any regulation and control, but now NASRDA has been empowered to acquire satellite imagery for the government and has even launched two satellites (NIGERIA-SAT1 and NIGCOMSAT1) into orbit with a third (NigeriaSat-2) about to be launched in October 2010. The Nigerian satellite program is meant to reduce the problem of data availability and affordability, with the launch of NigeriaSat-1, a number of projects have been carried out at much lower cost and with greater efficiency. NIGERIA-SAT2 with a spatial resolution of 5m with 2.5m panchromatic will address some of the problems that need higher resolution data than NigeriaSat-1 which had a 32m spatial resolution. Furthermore, the Nigerian National Center for Remote Sensing (NCRS) one of NASRDA's centers of excellence has ground facilities to download NOAA data which can be used for projects requiring data of coarse resolution.

NASRDA as an agency has undertaken many satellite based earth observation projects in the areas of environmental monitoring and management, food security, and coastal area management. Examples of projects on environmental management include: Comprehensive mapping and monitoring of the impact of gully erosion in south-east Nigeria, Satellite based environmental change research in the Niger delta, Application Of GIS & RS In Flood Frequency & Flood Inundation Analysis In Kaduna Metropolis, Kaduna, Nigeria, etc. Negative effects of climate change such as drought and desertification in northern Nigeria which have affected farming and cultivation, make government to concentrate on pressing issues of food production and sustainability, and to undertake projects that are agricultural or ecologically based (NARSDA News, 2006).

Examples of such projects are:

- Deforestation in Nigeria and implication for biodiversity
- Study of early warning for food security in Nigeria using Nigeriasat-1
- Development of models for cassava yield prediction and food security

- Agricultural Landuse Planning Based On Terrain Characteristics Using RS AND GIS In A Part Of The Lower Benue River Flood Plain, NIGERIA
- Ground water targeting in the basement complex of Jos plateau
- Use of NigeriaSat-1 and other satellites in combination with other climatic factors to model and determine the rate and parameters for desertification early warning in Nigeria.

THE PRIVATE SECTOR

A number of private companies have made their mark in the Nigerian SEO market. In the past, most private earth observation service companies were subsidiaries of foreign companies offering services in the construction and crude oil sectors. As the importance of remote sensing and GIS technologies became better known, the number of companies and organizations offering GIS services increased with the indigenous people also setting up smaller outfits. Status data compiled on twenty four such value added SEO companies is presented in table 1 below.

Table 1: Examples of SEO Value Added Companies in Nigeria

Company name	Ownership/ Affiliation	Location
Geomatics Nigeria LTD.	Geomatics international Inc, UK	Lagos
EnvironQuest Nigeria LLC.	Local ownership	Lagos
Spatial technologies LTD.	Spatial technologies, UK	Lagos, Abuja
Survicom services Nig	MAP Consult Pte Ltd. of Singapore	Port Harcourt ,Warri
TeqAge Nigeria LTD	Local ownership	Lagos
Environmental resources management Ltd	Local ownership	Lagos, Warri
Zephyrgold	Zephyrgold international, UK	Abuja
Geo-imaging consulting	Geo-imaging consulting, Washington DC	Lagos
Soft tech engineering LTD	Local ownership	Lagos, port Harcourt
Third dimension technologies	Local ownership	Lagos
Geosys Nigeria LTD	Local ownership	Lagos
Proxy logic	Local ownership	Port Harcourt, Abuja
Satellite imaging corporation.	Spatial imaging corporation, Houston, Texas.	Lagos, Abuja
Siraj consulting engineers.	Siraj consulting engineers, Lebanon	Abuja
Reid Crowther LTD.	Reid Crowther, UK	Lagos Abuja
Africa Mapping Resources Ltd	Local ownership	Lagos
PETEST Technologies Ltd	Local ownership	Port Harcourt
Digital and spatial solutions	Local ownership	Lagos
Geographic integrated services ltd	Local ownership	Lagos/ Ilorin
Support system ltd	Local ownership	Lagos
Aerial view solutions international	Local ownership	Ibadan
Arctic spatial ltd	Local ownership	Lagos
Polaris consulting company ltd	Local ownership	Port Harcourt

A look at the geographical spread of the companies show that they are mostly located in Lagos which is the commercial nerve centre of the country, with 25% of them located in the Niger delta states of Warri and Port Harcourt, even though their activities spread to all parts of Nigeria. There are a number of reasons why private f S.E.O companies are located in Lagos and the Niger delta, the two locations are found along the Nigerian coast and are vulnerable to the effects and impacts of climate change due to their low elevation levels and proximity to the ocean. As the commercial nerve centre of the country, Lagos is one of the most populous cities in Nigeria with a population of almost 10million and a growth rate of 3.3%/annum.

The Niger delta is Nigeria's economic hub, rich in oil and gas which is the country's main source of foreign exchange, as a result, many multinational oil companies operate in the Niger delta and have large investments in property and other infrastructure within the region. The delta has over five hundred oil fields and wells onshore that will be submerged in the event of inundation and rendered offshore; this will have an effect on cost of operation (Ogba et al, 2007). However, the activities of these oil companies such as oil spillage and gas flaring have impacted negatively on the environment, contaminating the surface fresh water and affecting the livelihood and economy of the local people majority of whom engage in small scale fishing and agriculture. The United Nations Framework on Convention on Climate Change (UNFCCC) reports indicate that the Niger-delta region could be inundated with water due to the effects of climate change. Also, the Niger delta has the highest risk of water inundation in the gulf of guinea, according to Nick brooks et al, (2006), who used a 20m elevation above sea level criteria and estimated the potential coastal lands that will be lost due to SLR globally.

Already, Nigerian coastal areas recorded a 0.426m rise in sea levels between 1960-1970 according to analysis by Udofa and Fajemirokun, (1978) in (Ogba et al, 2007) and some roads within Victoria Island in Lagos have been washed away by erosion. There is therefore sensitivity to environmental problems in the Lagos and the Niger delta making them good S.E.O markets.

Figure 2 below shows the twenty four SEO companies, the length of time spent in SEO business and the number of services offered by each company. From figure 2 it is seen that companies affiliated to or owned by foreign companies have been in the Nigerian SEO business for the longest periods of 14-25 years.

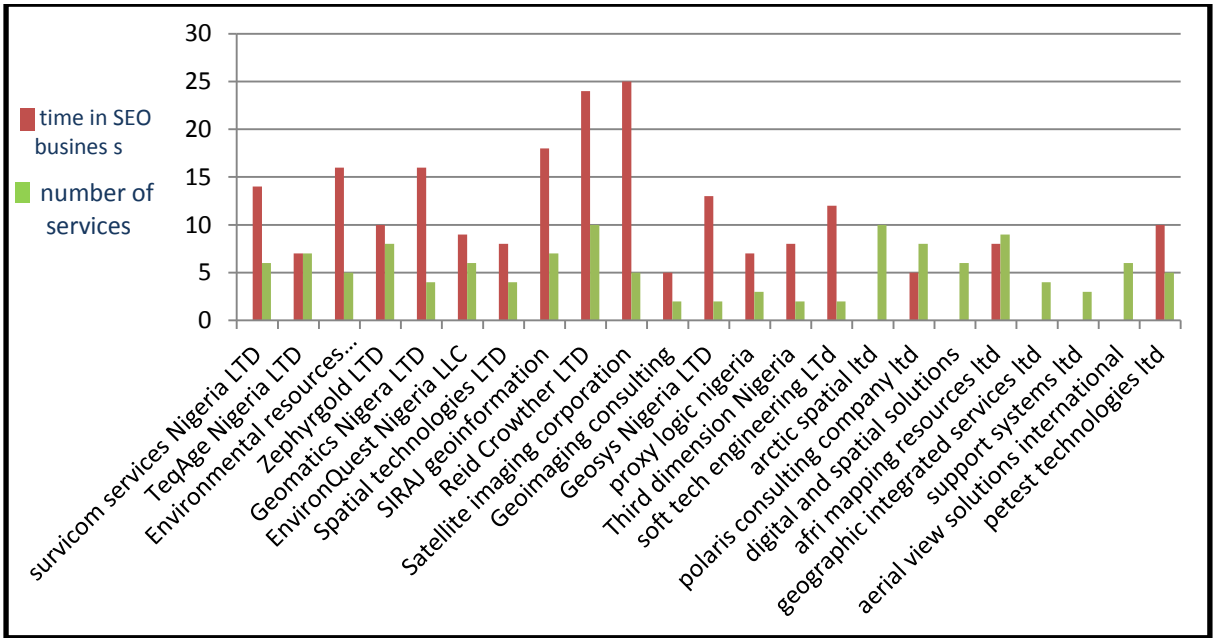

Fig2: Satellite Earth Observation business market.

EXAMPLES 0F PROJECTS UNDERTAKEN BY PRIVATE COMPANIES

Private SEO companies have been involved in a wide variety of projects providing services such as: hydrologic services like sourcing for underground water channels and drilling of water boreholes to provide water in the arid areas of northern Nigeria, oil spill cleanup and land reclamation in the oil producing Niger delta, geologic applications and waste management. Figure 2 below presents the activities of twenty four private SEO companies in Nigeria and shows the number of companies undertaking each activity.

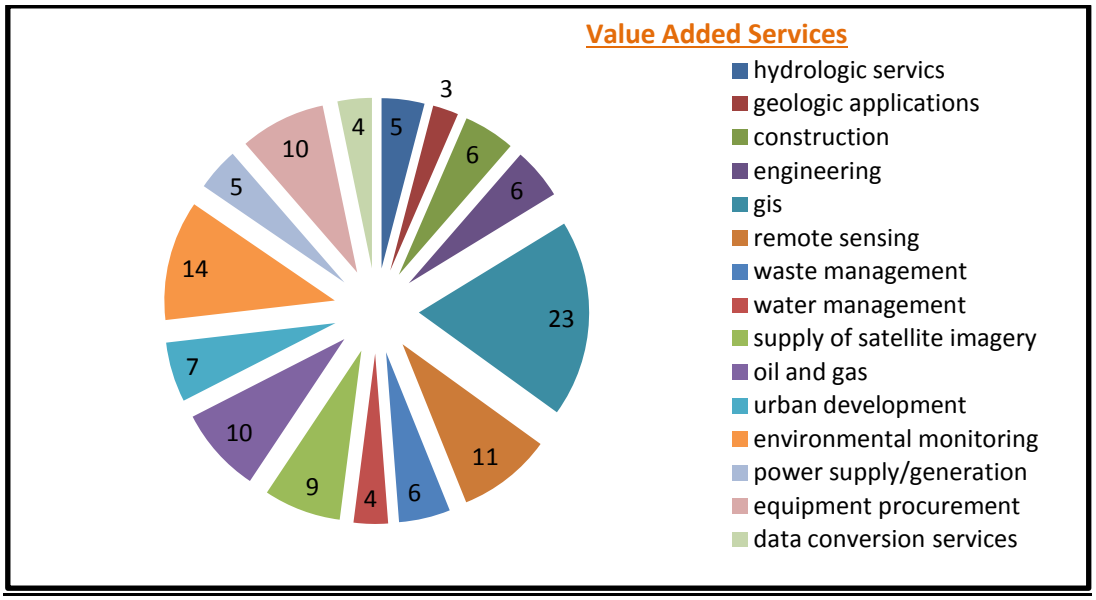

Fig3: Pie chart showing number of SEO companies offering services

Figure 3 above shows that nine of the private S.E O companies serve as regional representatives for supply of satellite imageries from companies such as SPOT Image, ESRI, KOPSAT, Quickbird e.t.c. however it should be noted that no private S.E.O supply's Nigeria-SAT1; this is because NASRDA is the only organization licensed to do so. Projects undertaken by four of these companies are presented below and it seen that the clientele ranges from government agencies to multinational oil companies like Shell, Chevron and Exxon Mobil.

POLARIS CONSULTING COMPANY LTD: Interim third Party Survey for Brass LNG, Mapping Survey of Ilado Beach, Inogbe, Lagos for Totalfina ELF Petroleum company, Offshore/Near shore Survey trace of Idoho and Ubit Pipeline to QIT at Eket for Delta Afrik/Exxon Mobil, Hydrological Study of Niger Delta Rivers from satellite images and DOS maps, Rivers State/ NDDC, Boundary Acquisition, topographic Survey Volume and Area of Tank and depth determination, and detailing at Atali.Rivers State.Anam Resources Nig Ltd.

REID CROWTHER LTD: Mapping of Makaraba area, CHEVRON Nigeria, Line mapping of metropolitan lagos, Lagos state Nigeria, Satellite imagery for Lagos island Ikoyi and Lekki peninsula, Lagos state Nigeria, Mapping of Port Harcourt, Rivers state Nigeria, Mapping of Dibi area, Chevron Nigeria, Mapping of Adagbraza area, Chevron Nigeria, Ekite state mapping of four towns, FCT water board system, Lagos state GIS system.

ENVIRONMENTAL RESOURCES MANAGEMENT LTD: Environmental Sensitivity Index Mapping (ESI) of Nigeria's outer coastline, Environmental Impact Assessments for Exploratory Drilling,Compliance Monitoring of Flow Stations and Gas Plants for SPDC (W) (1996, 97, 98).

ZEPHYRGOLD INTERNATIONAL: Base map Development for Damaturu Water Supply Project, World Bank, Design and Supervision of Okopedi- Oron James Road in Akwa Ibom State, Engineering Design of 2.3Km Bridge Over River Niger at Shintaku, Nigeria.

FUTURE OPPORTUNITIES FOR SMALL TO MEDIUM ENTERPRISES

Most private EO service providers are involved in other businesses within the country in response to various needs. Figure 2 shows that S.E.O service providers are mostly found in the southern part of Nigeria with just a few in Abuja (central Nigeria). However, from information available on their web sites, the companies have clients from all over the country. For example most hydrological projects are executed in the northern part of the country, due to the problem of desertification and drying up of streams and river channels. Therefore, there is an opportunity for new SEO service providers in the northern part of Nigeria.

Fig4: Savanna Vegetation (www.geog.leeds.ac.uk)

Nigeria has need for SAR services to address certain environmental issues that optical remote sensing imagery cannot. Such problems include the proliferation of oil bunkering and constant oil spillage by oil companies which can be monitored adequately using SAR imagery. Oil pipeline monitoring is a service that is needed in Nigeria and can be done by use of GIS technology and collaboration with private security agencies.

Fig11: Oil spill in Nigeria (dusteye.files.wordpress.com)

In recent times Nigeria has battled the issue of militant youths in the Niger delta who hide within the vast jungle of the delta areas. Access to these jungles have been a challenge to the Nigerian government, this is a problem that can be addressed with the use of RADAR imagery which can penetrate the forest canopy to show the routes used by these militants and expose their hiding places. Private S.E.O companies can tap into this unexplored area.

Moreover, States and local government authorities also have projects that require the use of GIS and remote sensing technologies; these contracts are independent of federal government projects. States are entitled to ecological funds each year to address ecological problems within their domain, most of them have made use private companies to undertake such projects but a large number of projects are still to be undertaken. Examples are: issues of gully erosion in eastern Nigeria, waste disposal and management in most Nigerian cities, combating of desertification in the north, cities/urban area street mapping and development planning in view of the effects of climate change, local government boundary delineation, e.t.c.

CONCLUSION

The consequences of human activity on environmental conditions in Africa are of great concern to governments and have an impact on developmental plans. African countries have the responsibility to advance and strengthen pillars of economic, social and environmental development both at local and regional levels There is a need to increase access to such basic requirements as clean water, sanitation, adequate shelter, energy, health care, food security and the protection of environment and biodiversity (Chizea, 2007).

Nigeria is faced with a number of problems that can be adequately addressed with remote sensing technology, examples are : coastal erosion and flooding of villages and towns in the coastal areas, gully and bad land erosion of the eastern region, Sand dune migration and desert encroachment from the north, human activities like deforestation for fuel wood, overgrazing, annual river and reservoir flooding with associated devastation, environmental degradation of the Niger Delta area due to oil pollution and the mining devastated areas of Jos Plateau.

To achieve these requirements, there is a need for satellite remote sensing value- added service providers. Foreign companies can set up partnerships with indigenous service providers to utilize their links and experience. Several earth observation value added companies with foreign links have established businesses in Nigeria for several years and have made reasonable profit over the years.

REFERENCES

British National Space Center (BNSC) 2002. *Earth Observation applications*. [Online]. [Assessed on 20th January 2010]. Available from World Wide Web: www.bnsc.gov.uk

CIA world fact book, 2008. [Online]. [Assessed on 20th January 2008]. Available on World Wide Web: https://www.cia.gov/library/publications/the-world-factbook/geos/

Ebizguides 2005. *NIGERIA.* Ebizguides.

ERA-STAR, 2006. ERA-STAR Regions [online]. Available from: http://www.era-star.net/ShowPage.aspx?HighlightTabId=1&tabId=285&chosenMenuItem=276 [Accessed 15 June 2010].

Environmental Resources Management LTD, erml, [online]. [Assessed on 20th January 2010]. Available on World Wide Web: http://www.erml.net

F.D Chizea, *Deploying Space Science and Technology for Sustainable Development in Africa; the Nigerian Experience*, 2007.lecture notes, ISU.

NASRDA news 2006. *Synthetic Aperture Radar for Nigeria: the Infoterra Options*, 2006. Volume 2 issue 3, NARSDA News.

National Bureau of Statistics, 2007. *The Nigerian Statistical Fact Sheet on Socio Economic & Social Development*. Federal republic of Nigeria.

Nick B., Robert N. & Jim H., 2006. *Sea Level Rise Coastal Impacts and Responses*. [Online] Berlin: WBGU (Published 2006). Available at: http://www.wbgu.de/wbgu_sn2006.html [Assessed 18 march 2010].

OGBA, C.O. & UTANG P.B., 2007. *Vulnerability And Adaptations Of Nigeria's Niger Delta Coast Settlements to climate change induced sea Level Rise*. [Online]: FIG (Published 2007). Available at: www.fig.net/pub/fig2007/papers/ts_7b/ts07b_06_ogba_utang_1342.pdf [Assessed 11 march 2010].

Polaris Consulting Ltd. [online]. [assessed 13 sep.2010]. Available on World Wide Web: http://polarisconsultingcompany.com/

Reid Crowther Ltd. [online].[Assessed 14 sep.2010]. Available on World Wide Web: http://www.reidcrowther.co.uk

Udofa, I. M. and Fajemirokun, F. A., 1978. *On a height datum for Nigeria.* In, Akinro, A.O., Opeyemi, D.A, & Ologunagba, I.B., 2008. *Climate change and environmental degradation in the Niger delta region of Nigeria: its vulnerability, impacts and possible mitigation*. Research Journal of Applied Sciences [Online]: Medwell Journals (Published 2008) Available at: www.medwelljournals.com/fulltext/rjas/2008/167-173.pdf [Assessed 15 March 2010].

Zephyrgold Nigeria. [online]. [Assessed on 23rd January 2010]. Available on World Wide Web: http://www.zephyrgold.co.uk

---

Google images:
www.dusteye.files.wordpress.com, (www.geog.leeds.ac.uk), (www.philadelphiareflections.com