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Role of Information Technology in Solving Environmental Problems in Lagos, Nigeria.

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Abstract
Apart from technology causing some environmental problems, it is also one of the best tools we have available to the human race to help us understand how we can fix these problems. Computers and other information systems are available to man in the prediction of natural and technological events that affect the environment. The paper is an assessment of how efficiently information technology (IT) is used in the Nigerian physical environment. It outlines mainly the procedures of environmental management in Lagos Nigeria in relation to the use and application of geo informatics, computer models and scientific techniques in environmental management. Environmental management bodies in Lagos Nigeria served as the study population and results obtained, formed the criteria from which conclusions were drawn. The study employed the use of questionnaire survey and the method for data analysis is descriptive. The study promotes an objective evaluation of how well environmental organization, management and equipment are performing, with the aim of safeguarding the environment.
Keywords: Environmental organizations, Management, Physical Environment, Problems and Information technology.

1. Introduction

Nigeria has a total land area of 983,213 km2 occupied by about 140 Million people. According to Omofonmwan and Osa-Edoh (2008), the interaction of these millions of people with their environment has left indelible mark on the landscape. Human demographic growth, coupled with an advancement of economic activities in human settlements often precipitate an increase in environmental degradation (Smith, 2007). The need for man to address the problems resulting majorly as a result of his interaction with the environment is the reason behind this paper. The need for appropriate modern technology for comprehensive and effective management and planning of environmental issues is evident in the study area. The paper revealed the limited use of IT in the study area. The problem here lies in its operation and management, not in its usefulness. There is inconsistency in the research on information technology for environmental management. Inadequacy in finance to acquire adequate and up to date equipment and the problem of trained personnel to manage and manipulate environmental data efficiently are also evident in the study area.

However, IT although still rudimentary in Nigeria has been used in mitigating environmental problems. As opined by Uchegbu, (2002) and Ofomata(2001) the use of Geographical Information Systems (GIS), Geo-positioning systems (GPS), Remote sensing, and other digital data analysis systems aids the environmental manager in finding the most efficient ways to make the environment more habitable. Some instances were modern technology was used include the work on the State of Environmental Monitoring in Nigeria and ways to improve it: Case Study of Niger Delta by Okafor (2011). Also, Ishaku, Yakubu and Haruna(2011), applied Geographic Information System (GIS) on the Control of Floods in Jalingo Metropolis Taraba State Nigeria.

Environmental management is a dynamic subject and its methodology is also dynamic. The importance of information technology to environmental monitoring cannot be over emphasized as this has proven to be one of the most effective ways of solving environmental problems (Babalola, Akinola and Okhale, 2010). The paper reveals the interactions between the fragile ecosystem of the region and human activities and then sharpen the response mechanisms in dealing with the problems. The efficiency of the urban authorities whose statutory responsibility includes efficient environmental management in Lagos Nigeria was interviewed in relationship to their use of IT in addressing environmentally related issues.

The paper is focused on enhancing awareness on the threats environmental degradation poses and updating environmental management authorities on emerging best practices in information technology, by working out a framework that need to be implemented to achieve a safe and healthy physical environment. Despite the problems associated with the application of information technology to environmental management, the power of information technology in solving environmental problems is outstanding, and as such people should be encouraged to be IT literate and governments and agencies should provide the facilities and enabling environment for IT application to environmental management.

2. Literature Review

There is no doubt that technological advances in agriculture, industry, and transportation greatly improved man's

way of life. However, these activities, while providing the raw materials for production of goods and services have also resulted in pollution of land, atmosphere, vegetation and rivers (Okojie, 1991). Various literatures as [Omofonmwan, (2008) Ofomata (2001)] pointed out, environmental problems – desertification, urbanization, deforestation, overpopulation and pollution – has become important paradigms in Nigeria in the last three decades. Every state of the federation suffers from one form of environmental problem or the other in varying degrees. The northern part of the country is being literally cleared out by wind erosion while the southern part is being washed away into the ocean (Ikporukpo, 1988). Urban cities and town in Nigeria are increasingly threatened by pollution of air and water and improper disposal of solid wastes while the rural areas are plagued by soil erosion, deforestation, and bush burning (NEST, 1991).

The need to protect the physical environment is pertinent. In spite of the remarkable progress made in providing environmental information, there are still substantial constraints to the effective management and development of the environment (Omofonmwan, 2008). Urbanization, deforestation, desertification and pollution are now more remarkable than ever before. In Nigeria, uncoordinated policies and legal instruments, weak data base, inadequate enforcement, institutional conflicts, inadequate and untimely funding, and lack of public awareness are evident in the environmental management process.

Information Technology offers a potential to solve many problems by providing a means of generating information, regular monitoring and analysis to predict and visualize future scenarios Ofomata (2001) and Uchegbu, (2002). It can be used to define the association between variables on the earth surface and help environmental managers in taken informed decisions. Modeling can analyze trends, identify problems, reveal alternative paths to solving the given problem, and indicate the implications or consequences of decisions. GIS can be used to integrate data enabling professionals in various disciplines to analyze and visualize spatial relationships. Information technology can be used to evaluate changes in the physical environment; it can be used for trend analysis in spatial features throughout time.

Ogunsanya (2007) emphasized the need of Information technology in Environmental management. For instance, the use of internet can help identify users of recyclable materials and provide information about solar energy, low cost pumps and building materials. Users of computer can watch presentations on deforestation, pollution, loss of wildlife and habitat and then learn about ways to care for the environment (Atu, 2008). According to Rosen, et al, (1998), IT has a significant role in providing the public access to timely, accurate and understandable environmental information which has been a major issue with environmental monitoring. Access to the data collected by Environmental monitoring (EM) systems is crucial to support public participation within any environmental decision making process. Schloss (2002) noted that, environmental data collected by citizens have been used to keep communities, elected officials and government agencies informed about the problems that need to be addressed thereby increasing public awareness.

The urban planners concern is on the environment to monitor events and changes that take place in the environment. In other to do this, the urban planner works with data that relate to space (Uchegbu, 1998). Some case studies in Nigeria documents the application of information technology in environmental management. An example is the study carried out by Puegeren et al (2001), geo-informatics was applied in pipeline routing and environmental management at the shell petroleum Development Company's (SPDC), in collaboration with the geo-matics departments, Warri, Nigeria.

GIS was used to integrate satellite image, and topographic database in other to produce a combined sensitivity factor image layer by layer. The gas pipeline case study revealed the use of geoinformatics approaches in environmental impact assessment and management.

Some other works include; Environmental Monitoring, Mapping and Protection of Erosion Site in Parts of South Eastern Nigeria in Umuahia, Abia State by; Sunday and Onyemachi (2009) Use of Remote Sensing and GIS techniques in the selection of Solid Waste Disposal Sites in Lagos Island Local Government Area of Lagos State by Saeed (2009) and the project by Twumasi and Merem (2006) explored the applications of GIS and remote sensing in a tropical coastal zone environment with emphasis on the environmental impacts of development in the Niger Delta region of Southern Nigeria.

3. Study Objectives

- Identify the environmental problems dominant in the area;
- identify the information technologies in use by the environmental management agencies in the study area;
- access the effect of IT on environmental management in Lagos state;
- encourage all interested environmental stakeholders on emerging best practices on IT for environmental management.

4. Research Questions

- What are the major environmental problems in Lagos Nigeria, its Causes and Effects?
- What IT tools are in use by the environmental management agencies in the study area in solving environmental problems?
- How efficient is IT on environmental management in Lagos state?

5. Study Area

The area under investigation is Lagos Nigeria. It shares an international boundary with the Republic of Benin to the South West and has an interstate boundary with Ogun State to South East, North East and North West, the Gulf of Guinea is to its South (Federal Republic of Nigeria, 2004a), and its capital is Ikeja. It covers an area of 3,671 sq kilometers. It has a population of 9,013, 534. It is the most populated state in Nigeria and therefore faces a lot of environmental problems as an implication of population pressure.

6. Research Methodology

The study was conducted in the environmental management related agencies in Lagos State. The agencies under interviewed include; Lagos State Environmental Protection Agency(ASEPA), Ministry of Mining and Energy Resources, Ministry of Housing, Ministry of Rural Development, Lagos Waste Management Authority (LAWMA), Ministry of Transport, and Ministry of Environment. The method of acquiring data was through the administration of questionnaires and interview questions. The issues investigated covered major aspects as; waste, pollution, housing, transport, industrial emissions, mining, and other environmentally related problems. Descriptive summary measures were used to represent outcomes of the variables investigated. Data obtained from the respondents relate to the management of the environment, and the use of information technology in solving environmental problems.

The questionnaire obtained was analyzed in two parts; the environmental problems in the study area, and how far the environmental management agencies have used information technology to mitigate environmental problems.

7. Data Presentation and Discussions

Table 1: Major Environmental Problems in Lagos Nigeria, its Causes and Effects.

Problems	Cause	Environmental effects
Solid waste	• Urbanization • Public attitude	• Filthy environment • Health problems • Drainage blockages/erosion • Contamination of soil water and air
Noise pollution	• Population • Urbanization • Industrialization	• Reduction in property value • Health disorder • Accidents
Land degradation due to Mining	• Urbanization • Lack of mechanization • Engineering works • Lawlessness	• Coastal erosion • Accidents • Loss of soil fertility • General loss of organic nutrients of the soil • Reduces the usefulness of land either for road construction or building
Traffic	• Ignorance • Population pressure • Poor road construction • Too many vehicles on the road • Poor transportation facilities	• Air pollution from emissions • Accidents • Congestion • Destruction 0f neighborhood and wildlife habitats • Death
Air pollution	• Burning of refuse fumigation co^2 from petrol, engines • Smokes and Particulate matter • Release of combustion gas	• Ozone layer depletion • Global warming
Water pollution	• Discharge of solid or liquid substances into water bodies. • Seepages and overland flows of land pollutants • Organic & inorganic industrial effluents • Cultural beliefs	• Contamination of surface and underground water • Flooding and erosion • Public nuisance • Adverse effects on marine biodiversity
Poor housing condition	• Rural–urban migration, • Rapid rate of uncontrolled and unplanned urbanization	• Competition for land • Acute housing shortage, • Rapid growth of slums

Table 1 above represents the major environmental problems existent in Lagos Nigeria. The table has highlighted that most of the environmental problems are rooted in anthropogenic factors as; population pressure and urbanization. These two factors among others have aggravated the environmental problems in the study area, and have therefore threatened the ability of the environment to regenerate itself. Resultant effects of these problems are key elements of environmental damage, and this has become a challenge to man.

The area is plagued with large scale industrialization, massive migration from the rural population, and inadequate shelter, water and sewage as well as the inefficiency of transport and other public services. This has created serious social and environmental problems in the study area. Major environmental problems as represented in table 1 include; hazardous emission from industries, pollution from traffic, inadequate housing, congestion, coastal erosion and, poor sanitary conditions and waste. These are some of the resultant effects of man's interaction with his environment. These changes occur as the people attempt to acquire their seemingly endless desire for food, shelter, recreation and infrastructural facilities. However, as Ofomata (2002) opined, rising to this challenge will require that the society adopt a mix of technologies, policies and practices that explicitly recognize the inextricable linkages among environmental systems and basic human needs.

Table 2: Major IT tools available to policy makers in solving environmental problems in Lagos Nigeria

Environmental management body	**IT tools available**	**Uses**	**Remark on Efficiency**
Lagos State Environmental Protection Agency (air and water pollution department)	Automated air monitoring stations	Used to monitor the ambient air quality in remote stations thereby giving an idea as to what mitigation measures to apply as need be	Helpful in proffering solutions to environmental issues i.e. data base creation. Making predictions in air monitoring, climate change etc. based on studies and results gathered over time. Helps sensitize people on the inherent dangers of such problems before they arise, helping to prepare against eventualities.
Lagos State Environmental Protection Agency (Noise pollution)	Noise and air meter Digital camera	The introduction of noise meter has helped in maintaining the required noise level of 55db during the day and 45db during the night	Has been very efficient in detecting the noise level and air emitted respectively
Ministry of mining and energy resources (sand)	Internet, GIS, GPS, map digitization and AUTOCAD	Effective determination of mine sites. Adequate for information dissemination	Efficient in its use, but the absence of personnel trained to manage the sand mines.
Ministry of housing	GIS, Internet, SPSS	Internet aids easy research SPSS for easy data analysis GIS is used by the surveyors to help determine the statistics of the population, and their housing needs	There is more that can be achieved with the use of these modern technologies that will help in solving the housing needs of the Lagos population.
Ministry of mining and energy resources (water)	GPS, Establishment of seismographic stations	Geodynamic centre underground to monitor tremor, sea surges sending signals to the radio station	Recent in Lagos but efficient in curtailing environmental hazard
Ministry of rural development (water)	GPS	Assists in getting actual points of the water and aids in the determination of water schemes and location	Has helped to enhance the quality of life, human capacity and productivity of rural populace in Lagos state for even and sustainable development
Lagos Waste Management Agency (solid waste)	GPS	Tracking of vehicles Design of receptacles used by tenements Monitoring and surveillance	Used for tracking waste and operational trucks. Timely collection& transportation of waste in Lagos Vehicles work efficiently without diverting away from route
Ministry of transport	Digital cameras and traffic lights	Data gathering	Effective for management, planning and restructuring
Ministry of Environment (climate change)	Internet SPSS	In the aspect of climate change the Internet has been used by the ministry to create awareness on environmental degradation. SPSS has aided in the analysis of survey studies	Its efficiency is very low. So much more can be achieved

The table above shows the various environmental management agencies in Lagos and the modern technology that is being used to meet the environmental problems. The efficiency of each tool was assessed and it was

determined that**;** there is more that can be achieved with the use of these modern technologies in other to achieve a healthy environment. The practical use of a mix scale approach involving GIS and GPS tools for the assessment of environmental change has been effective for the determination of mine site, by the ministry of mining and energy resources. However, as Saeed (2009), pointed out, using remotely sensed satellite imagery and GIS modeling will quicken the analysis of the spatial distribution of environmental change involving land use, land cover classification, forest and hydrology and demographic issues facing Lagos State.

Information technology can be applied to various aspects of the environment. Having the potential to solve many problems by providing a means of generating information, regular monitoring and analysis to predict and visualize future scenarios and help managers in making informed decisions. It is used to evaluate changes through the study of trends in spatial features through time (Omofonmwa and Osa-Edoh, 2008).

From the analysis in Table 2, it is clear that information technology has not been efficiently used to meet environmental problems. Most activities like environmental management in Nigeria, does not make optimum use and application of information technology. As Uchegbu(2002) noted, the scale of operation of IT in environmental management is marginal as majority of the departments do not have asses to it. The research on IT is inconsistent and the problem of trained personnel to adequately operate the technology is the reason for its limited use in environmental management in Nigeria.

8. Conclusion

Environmental management is a dynamic subject and its methodology is also dynamic. The importance of information technology to environmental monitoring cannot be over emphasized as this has proven to be one of the most effective ways of solving environmental problems.

Environmental management agencies in Lagos Nigeria are beginning to look towards that direction but with less fire-power. Some outstanding impact of IT in the study area include; The design of traffic lights with digital cameras; this has served as a regional environmental information system and a decision support tool for policy makers in transportation management, and for the control and regulation of traffic. The GPS has also been used to track and monitor waste trucks and receptacles thereby improving waste management.

The use of information technology in environmental management in Lagos Nigeria was discussed in the paper. The expectation is that such an information system will help in displaying the interactions between the fragile ecosystem of the region and human activities and then sharpen the response mechanisms in dealing with the problems. Inadequate and competent manpower has been identified as one of the factors impeding effective environmental management and monitoring of the Nigeria. Therefore, it is important that attention is paid towards the enhancement of manpower competency of environmental regulatory agencies. Government is urged to invest more in the training of staff of these agencies both locally and internationally on a regular or on a periodical basis. This will enable them to stay in touch with the modern ways of environmental management and also how to be effective in the discharge of their responsibilities.

References

Atu, A. (2008): An Assessment of the impact of Information Technology on Environmental Management. A case study of the Environmental Management Agencies in Umuahia , Abia State. *Bsc, Project*. Abia State University Uturu.

Babalola. Y.T, Akinola D.B, Okhale, F.O (2010): Awareness and Accessibility of environmental Information in Nigeria: Evidence from Delta State. Department of Information Resource Management Babcock University, Ogun State, Nigeria

Dung-gwom, J. Y. (1999): Partnership in Planning and Environmental Management in Nigeria: Some Case Studies. Journal of Environmental Science 3(1), 1999, pp 34-45.

Federal Republic of Nigeria (2004a), *National Policy on Population for Sustainable Development*, Abuja, Federal Government Press.

Ikporukpo, B. C. O. (1988). Managing oil pollution in Nigeria. In P. 0. Sada & F O. Odemerho (Eds.), Environmental issues and management in Nigerian development (pp. 224-229). Ibadan, Nigeria: Evans Brothers Ltd.

Ishaku,H.T, Yakubu .N. & Haruna. A. (2011): Applied Geographic Information System (GIS) on the Control of Floods in Jalingo Metropolis Taraba State Nigeria. *http://Www.researchgate.net/publication/215800626*

NEST (1991). Nigeria's Threatened Environment: A National Profile. Nigerian Environmental study/Action. Team NEST Publication. Ibadan, Nigeria. INYEC Printers Ltd.

Ofomata, G. E. K (2001): Geographic Perspective on Environmental Problems and Management in Nigeria. Jamoe Enterprises, Nigeria.

Okafor. O. (2011): The State of Environmental Monitoring in Nigeria and ways to Improve It: Case Study of Niger Delta. *A Thesis Report* Submitted to the Environmental Policy Group environmental Sciences wageningen

University.
Okojie, J.A (1991). Misuse of Renewable Natural Resources and Environmental Degradation. A Paper presented at the symposium to mark the *African Year of the Environment* in Ogun state, Abeokuta, June, 25.
Omofonmwa, I.S. & Osa-Edoh, G. I. (2008): The Challenges of Environmental Problems in Nigeria. *Geography and Planning and Educational Foundation,* Ambrose Ali University Ekpoma, Nigeria Kamla-Raj J. Hum. Ecol., 23(1): 53-57 (2008)
Omofonmwan, I. S (2008): Problems of food crops production in Nigeria. Pp.184-194. *Proceedings of the National Conferences on Population Growth and the Environment.* S. O. Osuide (Ed.). Rasjel Publishers, Iruekpen-Ekpoma.
Puegeren, J.V. E., Ibanga, A. J. & Benebe, T. E. T (2001): "Site Selection and Environmental Issues for proposed Igbokoado-Ore Gas pipeline route Project", *Technical Report at the Environmental Assessment Department.* Shell Petroleum Development Company, Warri, Nigeria.
Saeed .O. (2009): Use of Remote Sensing and GIS Techniques in the Selection of Solid Waste Disposal Sites in Lagos Island Local Government Area of Lagos State. *http://www.academic.edu/2009*
Smith, Zachary A., (2004): The Environmental Policy Paradox - 4th ed, Pearson Education Inc., Upper Saddle River, New Jersey.
Twumasi Y. A. & Merem E. D (2006): GIS and Remote Sensing Applications in the Assessment of Change within a Coastal Environment in the Niger Delta Region of Nigeria. *Journal of Environmental Research and Public Health* ISSN 1661-7827 www.ijerph.org © 2006 by MDPI
Uchegbu, S.N (1998): Environmental Management and Protection. Enugu. Precision Printers and Publishers. Nigeria
Uchegbu, S.N (2002): Issues and Strategies in Environmental planning and management Enugu. Precision Printers and Publishers. Nigeria
Victor .S. & Onyemachi .P. (2009): Environmental Monitoring, Mapping and Protection of Erosion Site in parts of South Eastern Nigeria: A Case Study of Umuahia in Abia State. *http://Www.earthzine.org/2009/03/30/*