INVESTIGATION OF THE EFFECTS OF SCIENCE AND TECHNOLOGY ON ENVIRONMENTAL IMPACT ASSESSMENT

BY

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A THESIS SUBMITTED TO THE POST GRADUATE SCHOOL

DEPARTMENT OF MANAGEMENT TECHNOLOGY

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTER OF SCIENCE (MSc) DEGREE IN PROJECT MANAGEMENT TECHNOLOGY.

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI

NOVEMBER, 2022

CERTIFICATION

This is to certify that this thesis work is the original work of **Ibe Raymond Obinna** (Reg. No.20054567028) of the Department of Project Management Technology , carried out as a partial fulfillment of the requirements for the Msc Degree in Project Management Technology and is hereby presented for acceptance as a contribution to knowledge and learning.

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DEDICATION

This work is dedicated to my wife, Lady Rhoda Obinna Ibe and my children, Akobundu, Anyaehie and Yagazie for all their love and support.

ACKNOWLEDGEMENTS

This project turned out a success as a result of inputs made by several people. I therefore use this medium to acknowledge my indebtedness to them. I wish to give the greatest thanks to Almighty God who started this and ended it well. Most sincere appreciation to my first supervisor, Professor F. N. Ukwuoma for his constructive criticism, patience, understanding and encouragement all through the research period. Great thanks also to my present supervisor Ass. Prof. C.I Anyanwu who painstakingly guided me in the principles of presenting my research.

I also wish to extend my thanks to the Head of my department, Dr. I.I Echeme who worked so hard to ensure that this project defense became a success and the Dean of my School, Prof. O T Ebiringa whose wealth of experience and management of the school spurred me into continuous desire for academic success. To all my lecturers who guided me through the years of study, I am grateful.

This acknowledgement will be incomplete if I fail to appreciate the encouragement and support I received from my wife Lady Rhoda Obinna Ibe. In all these, to God be the Glory.

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ABSTRACT

This research work deals on the effects of Science and Technology on Environmental Impact Assessment (EIA). Principally EIA is a predictive tool. Different professionals are involved in EIA and each and everyone has his own view about what should be done or not to ensure that the original aim of EIA as a predictive and decision making tool is achieved. The issue of Science and Technology input in EIA, its effectiveness stimulated this research. The conventional response in this area has been to place emphasis on strengthening existing EIA practice and procedure. It is revealed that the effectiveness of EIA is influenced mainly by six (6) key factors namely, Method and quality of data collection, Research time, legislative backing, information management, laboratory/research results and project funding. Factors like Capacity Building, Education for Participants, Guidance and Procedure for the Conduct of EIA, Continuous Research Training for Project Managers and Technical Staff and Follow up Mechanism have also been implicated for the improved quality and precision of an EIA . Non-probability convention was applied to select the respondents. The researcher self – administered copies of questionnaire to 115 respondents.A Five – Point Likert summated type scale was used to collect primary data and Regression analysis to analyze the data. The researcher also used Analysis of variance table (ANOVA) to establish differences between groups. Finally Spearman Rank Correlation coefficient was applied to test the hypothesis. The results show that there is a significant relationship between Science and Technology and the effectiveness of EIA. Based on the findings The researcher emphasized that substantial improvements can be made with the contribution of science and technology to environmental Impact assessment. It is recognized that analysis within impact assessments will always be limited by the knowledge base either already established or obtainable in the appropriate period. In conclusion of the study, the researcher recommended the upgrading of EIA practice through effort at conceptualization, more effective study, planning and a common realistic expectation through a focused applied Science and Technology Research Programme.

Keywords: Environmental Impact Assessment, Science and technology, Education of Participants, Research Programme.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Environmental impact assessment (EIA) brings together a broad raft of professionals, including environmental policy-makers, administrators, decision-makers, government agencies, planners, engineers, scientists, social scientist, business and project managers as well as the public.

From the diversity of these practitioners it can be anticipated that people from different background will have different expectations of how the process should function in practice (IAIA 2001).

Many countries of the world have experienced untold environmental degradation and ecological deterioration in the past, with little or no real solution to alleviate many of these concerns. Poorly managed human interference has been a major cause. The process of Environmental Impact Assessment (EIA) was developed as an effective planning tool to manage the interference into the environment.

Before the introduction of modern science and technology tools in conducting EIA, some limitations plagued the effectiveness of EIA as a planning tool. They range from Inaccurate baseline information, Loss of time, Quality of data collected, techniques/methods of processing information, Speed necessary to complete the study, Research cost, Defective equipments, Precision of results, legislative support etc.

Adequate information and appropriate technology were limiting factors for effective environmental Impact assessment (Brude et al, 2004).

Efforts were made to improve, conserve and protect the environment in the conduct of EIA by including not only the resolution of political policies but also the application of a state-of-the-art scientific approach to planning and implementation.

The evolution of science and technology and its application to natural resource issues has made it possible for researchers, agencies, local communities and others to save cost, time to compile inventories of resources, assess threats to those resources and apply such findings

to planning efforts. In fact, researchers are beginning to use modern technologies to perform more complex analytical functions that reach beyond inventorying natural resources such as identifying land suitability for certain types of projects.

However, because of the dynamic characteristics and multivariate nature of the environment, even with the use of science and technology equipment, researchers still run into some difficulties. These difficulties include methods, especially as it relates to collating, analyzing and interpreting data sets, Land use and entry Laws, Access to basic information for input into computer-based technology and some environmental laws. For instance, species and other biodiversity components are not equally likely to be successfully modelled, for reasons such as differences in habitat specificity and in how well remotely sensed data match habitat needs. Further, there is a lack of knowledge on the actual response of biodiversity components to infrastructure and other developments (Piepers et al, 2002).Biotic interactions, disturbance,

events and ecological processes may not yet be addressed properly by current methods.

This great complexity can be overcome with innovations in science and technology.

In fact for modern science and technology tools used in conducting EIA to cope with the dynamic and multivariate nature of the environment, it is important to ensure high quality and accuracy of data sets and /or data layers; compatibility with other information used in the environmental impact assessment; and avoidance of other potential limitations such as time dependent data or inaccurate projection and scale.

1.2 Problem Statement:

A great deal has been written about the role of science and technology in environmental impact assessment (EIA) over the last three decades and all aims at improved predictive abilities and assessing environmental impacts of proposed projects by EIA practitioners, which in this context means improved understanding of technological dynamics.

Thus this research is focused on practitioners perception and expectations of modern science and technology to achieve accurate predictions and assess environmental impacts of proposed projects in the conduct of environmental impact assessment.

1.3 Objectives of the Study:

The major objective of this project is to evaluate how science and technology can increase the effectiveness of EIA.

The specific objectives are:

i. Identify what has been done wrongly or neglected by the EIA practitioners.
ii. Review what modern technology has brought to improve the situation, its consequences with respect to economic, social, political etc factors.
iii. What action needs to be taken to facilitate improved predictive ability and assessing environmental impacts of proposed projects.
iv. Examine the existing institutional frameworks for EIA and relate their mandates in terms of the importance of science and technology.

v. Make specific recommendations regarding the effects of results in related programmes and activities including environmental baseline studies and post-project monitoring requirements.

1.4 Research Questions:

Based on the objectives of the study the following research questions were asked to help provide answers for the research work:

i. Does the predictive capacity of EIA practitioners depend on six key constraints of Research time, Method and quality of data collection, information management technology ,laboratory/Research result, Research cost and Legislative support.

ii. What should be considered as a guide to predictive precision for planning and assessment for proposed projects.

iii. What is the rate of incidence of predictive failure by EIA practitioners when science and technology tools are used.

iv. Is there any significant relationship between project implementation/monitoring and precise prediction for planning.

1.5 Research Hypothesis

The following research hypothesis have been formulated to guide this research work:

HO_1: The effectiveness of EIA is not influenced by Research time, Method and quality of data collection, information management technology ,laboratory/Research result, project funding , and Legislative support.

HO_2:There is no significant relationship between science / technology and the effectiveness of environmental impact assessment.

1.6 Justification of the Study:

The significance of the project can be seen from its aims and objectives;

1. Beyond the introduction and subsequent refinement of assessment policies and procedures, this project will be major efforts to examine the technical requirements from the perspective of the applied scientist.

2. Through the project, numerous people active in designing, directing, conducting and evaluating impact assessments will have the opportunity to review their collective experience and recommend ways of incorporating a more rigorous scientific approach into their future efforts.

3. The result will consequently increase society's appreciation and understanding of the role science and technology plays in EIA.

4. The understanding of the extent to which the implementation of these policies is carried out by the stakeholders will have far-reaching implications and influences on project management both in the area of agriculture, health, environment and industrial development.

5. Although studies have been conducted in the country on the importance of modern technological tools in conducting EIA and the various constraints limiting commercialization of EIA, not much has been done in the area of science and technology policy and its impact on EIA, (Ogbu O. 2003).

This study therefore, attempts to relate science and technology impact on EIA, the nature of the policies, its awareness and appreciation by the society, its application in guiding project development as well as the overall level of Science and Technology literacy.

1. It is expected that the study will reveal the potentials of Science and Technology and make valid suggestions on what could be done to further improve on its effectiveness so as to further impact on EIA.
2. The findings of the study will be of immense benefits to all stakeholders in the science and technology sector and more importantly, to the environmental stakeholders. Since government is the major stakeholders and financier of Science and Technology programmes and activities, the study will provide a framework for government to begin its reform process in the field of Science and Technology making it more market-driven and private sector led.

3. it will provide a guide towards formulating measures to promote Science and Technology in the country. The findings shall provide the background information to assess the effectiveness of S&T structure and the overall performance of its institutional frameworks. Part of the overall expectation from this study is the development of national indicators for the assessment of the impact of S&T on EIA.

4. The study shall emphasize on the need for development of S&T infrastructure and total utilization of S&T capacity in pursuance of EIA projects aimed at socio-economic development.

5. The organized private sector will find the outcome of the study quite useful in shaping opinion on the need for government to foster effective and unbroken linkage sector in order to ensure that the private sector benefit from indigenous research efforts and promote technology acquisition and transfer from developed and developing countries. It is therefore, anticipated,

that the ideas emerging from the study could be used by voluntary and non-governmental agencies when implementing policies relating to science and technology. It could also be used by educational (universities), training and R&D institutions as bases for planning new programmes and research strategies and evolving appropriate support systems for application of S&T to EIA.

6. Finally, it is hoped that the research findings from this study will generate diverse interests in the field of Science and Technology policy formulation and implementation, especially EIA study in Nigeria.

1.7 Scope and limitations of the Study:

By design, the project will involve the active contribution of environmental scientists who conduct impact assessment studies and those who are responsible for the administration of assessment procedures in Nigeria. Also Participants in environmental impact assessment studies,

representatives of industrial proponents, consultants and members of the university community.

The study will examine among other issues, how science and technology has affected research time, information/data management. Laboratory/research results, research funding and government support towards the conduct of EIA. The researcher experienced some delay from some respondents, however enough materials were available to continue with the research.

CHAPTER TWO
Literature Review

2.1: Conceptional Review

Nigeria lies between 4°16' and 13°53' north latitude and between 2°40' and 14°41' east longitude and has a land area of 924,000 sq. km, one of the largest in Africa. The geography varies greatly from tropical rainforest in the South to dry savannah in the North which is flat and sparsely vegetated. Nigeria is hilly and mountainous in the South East, along the border with Cameroon and also in the centre where the Jos Plateau rises to 5,000 feet above sea level. Nigeria is bordered to the West by the Republic of Benin, to the North by the Republic of Niger, to the North East by the Republic of Chad, to the East by the Republic of Cameroon, and to the South by the Atlantic Ocean. The average rainfall ranges from about 500 mm/year in the North to over 2,000 mm/year in the South. The country is blessed with
mineral, physical, biological and energy resources. The mineral wealth of the country is vast and should enable it to establish a firm industrial base for rapid economic development. From the mangrove and rain forests of the south, through the various savannahs, and semi-arid ecosystems of the north, the nation is richly endowed with fishery resources, wildlife, timber, medicinal plants,

mineral resources, water, ornamental and food crops. In general, the environment provides all life support systems in the air, on water and on land as well as the materials for fulfilling all developmental aspirations. However, the Nigerian environment today is faced with many problems, arising from the impacts of human activities and natural phenomenon.

2.2 History of Environmental Protection in Nigeria

As a consequence of the illegal dumping of toxic wastes in Koko, in the former Bendel State, in 1987, the Nigerian Government promulgated the Harmful Wastes Decree which provides the legal framework for the effective control of the disposal of toxic and hazardous waste into any environment within the confines of Nigeria. This was immediately followed by the creation of a regulatory body, the Federal Environmental Protection Agency (FEPA) in 1988. FEPA is charged with the overall responsibility of protecting and developing the Nigerian environment. To put this into action a National Policy on the Environment was developed. This is the main working document for the preservation and protection of the Nigerian environment. States and Local Government Councils were also encouraged to establish their own environmental regulatory bodies for the purpose of maintaining good environmental quality as it applies to their particular terrain. The EIA Decree No. 86 of 1992 is an additional

document with the same aim of protecting the Nigerian environment. It is particularly directed at regulating the industrialization process with due regard to the environment.

By this Decree, no industrial plan/development/activity falling under the FEPA's mandatory list can be executed without prior consideration of the environmental consequences of such a proposed action, in the form of an environmental impact assessment.

The Department of Petroleum Resources (DPR), an arm of the Ministry of Petroleum Resources, recognizing the national importance of the oil and gas industry sector to the continued growth of the Nigerian economy and realizing that the continued exploitation, exploration and production of the oil resources has serious environmental impacts, also decided to set out comprehensive standards and guidelines to direct the execution of projects with proper consideration for the environment. The DPR Environmental Guidelines and Standards (EGAS) of 1991 for the petroleum industry is a comprehensive working document with serious consideration for the preservation and protection of the Niger Delta, and thus the Nigerian case study.

2.3 Environmental Impact Assessment in Nigeria

Environmental impact assessment (EIA) came into being in Nigeria with promulgation of the Act establishing three

independent EIA systems—the EIA Decree 86 (1992), the Town and Country Planning Decree 88 (1992) and the Petroleum Act (1969). Despite a sound legal basis and comprehensive guidelines, evidence suggests that EIA has not yet evolved satisfactorily in Nigeria, as the current system amounts to duplication of efforts and cost. An evaluation of the EIA system against systematic evaluation criteria, based on interviews with EIA approval authorities, consulting firms and experts, reveals various shortcomings of the EIA system. These mainly include inadequate capacity of EIA approval authorities, deficiencies in screening and scoping, poor EIA quality, inadequate public participation and weak monitoring. Overall, most EIA study rarely meets the objective of being a project planning tool to contribute to achieving sustainable development and mitigate impact from development project.

2.4 EIA concept and legal basis in Nigeria

Globally, Environmental Impact Assessment (EIA) is recognized as a tool for achieving sustainable development.

The main objective of the EIA is to ensure that potential environmental impacts are foreseen at the appropriate stage of project design and addressed before any decision is taken on the project. The EIA involves a systematic process for identifying, predicting and evaluating potential

impacts associated with a development project. The EIA process must proffer mitigation measures to avoid, reduce or minimize the negative impacts on the environment, public health and property and may highlight the foreseeable positive impacts. The mitigation measures entail identifying possible alternative site, project, process design, including that of not proceeding with the project. The EIA is not a one-off process which terminates in the production of a report on the effects of the project and associated mitigation measures. It also deals with monitoring the construction and operational phases, and this continues till the project is decommissioned. The post-closure care is also an integral part of the EIA process.EIA legislations and the required procedural guidelines for carrying out the EIA process became effective since the 1970s in developed countries. Nigeria took a giant leap when she promulgated her main EIA legislation (i.e.EIA Act No.86) in 1992. EIA is proclaimed in Principle 17 of 'Agenda 21' (Agenda for the 21st century) of the United Nations Conference on Environment and Development (UNCED), which was held on the 3rd to14th of June, 1992, in Rio de Janeiro, Brazil. It states that: "Environmental Impact Assessment as a national instrument shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and subject to a decision of a competent authority**."**

The EIA Act No. 86 of 1992 makes the EIA mandatory for development projects likely to have adverse impacts on the environment prior to implementation. Prior to the enactment of the EIA Act in Nigeria, project appraisals were limited predominantly to feasibility studies and economic-cost-benefit analysis. Most of these appraisals did not take environmental costs, public opinion, and social and environmental impacts of development projects into consideration.

Currently, EIA is practiced in over 100 countries of the world (Jay et al., 2007). While its effectiveness has been explored to a certain extent in some developed countries, the research in developing countries such as Nigeria requires concerted effort. Even if most of the scholars generally agree that EIA plays an important role in environmental decision-making, the effectiveness, accessibility and influence of EIA, and specifically the accuracy and the methods of the assessment can be openly questioned and criticized. The field scholars attempt measuring the EIA effectiveness either through the quality of EIA report and EIA procedural implementation or relate it to the viability and the role of EIA in factual development planning (Bailey, 1997; Baker and Wood, 1999; Simpson, 2001; Ogunba, 2004; Sakalauskiene et al., 2004; Pinho et al., 2006; Pölönen, 2006).The paper described current practice of EIA in Nigeria, the main strengths and weaknesses of the system

and also provided the recommendations for further improvements.

2.5 The role of science in EIA

Scientists began to register concern about the performance of the EIA process shortly after US National Environmental Policy Act (NEPA) was introduced (Morgan, 1998). For example, Schindler(1976), in an editorial of the eminent journal Science, identified a series of significant failures in the practice of EIA. Critical attention in much of the early research focused on the relationship between science and EIA, and this subject continues to receive considerable attention in the contemporary literature. Nevertheless, Beanlands and Duinker (1983) suggest that the EIA community remains divided on the fundamental question of the purposes of EIA and the role of science within it. As is illustrated in this article, these two concepts are intimately interrelated: the purposes of EIA may, in part, define the role of science therein, while, vice versa, epistemological beliefs place constraints on the purposes of EIA (e.g. in terms of the types of questions, information and participants that are acceptable in environmental decision-making (Hajer and Wagenaar, 2003). The division between purpose(s) and the role of science, in consequence, is somewhat indistinct.

Five distinct models of the role of science in EIA are identified based primarily on an analysis of the EIA literature, but drawing also on other disciplines within the

environmental sciences. The models are conflated into two broad and overlapping paradigms: EIA as applied science and EIA as civic science. Although use is made of literature on the environmental assessment of strategic decisions (i.e. policies, plans and programmes) throughout the discussion, the analysis focuses on the role of science in the assessment of projects. There are evident similarities between elements of these models and the six models of EIA proposed by Bartlett and Kurian (1999). Whereas Bartlett and Kurian's models are based primarily on how EIA is perceived to influence decision processes, this study focuses on advancing theory concerning the role of science in effecting such influences. The typology suggested here is intended to reflect the plurality and heterogeneity of perceptions evident in the EIA
literature and the multifaceted nature of the subject: for example, Bartlett and Kurian note their models are not mutually exclusive and it could be suggested that EIA is intended to promote emancipation (their pluralist politics model), internal reform (the institutionalist model, the organisational politics model and, to a degree, the symbolic politics model), market reform (the political economy model), and the provision of credible information (the information processing model). It is arguably more relevant and accurate to represent the reality of extant EIA theory and practice as a series of somewhat nebulous

models operating along a broad spectrum of philosophical beliefs and values. In this analysis, it is suggested that the spectrum for the role of science runs from the conceptions of logical positivists at one end to the epistemological anarchy of conventionalism (also often referred to as relativism) at the other extreme (Schrader-Frechette, 1991). This approach to characterising EIA theory on the role of science might not satisfy the academic purist (and is not exclusive), but it is suggested that EIA has been successful precisely because it is flexible and can be adapted to accommodate different biophysical, socio-economic and geopolitical realties (see, for instance,(Bond et al., 2001).

2.6 Some Science and Technology tools for EIA

2.6.1.Geographic Information Systems (GIS)

The potential use of GIS in EIA in general (João and Fonseca 1996) and for ecological assessment in particular (Treweek and Veitch 1996; Geneletti 2002) has been recognized and advocated. However, in today's EIA reports, the use of GIS within ecological assessment is often limited to its display functions and seldom used for its analytical capacities. A broad definition of GIS is a computer system made up of hardware, software, data and applications for managing spatial data in the form of

maps, digital images and tables of geocoded data items (Bonham-Carter 1994).

In the research arena, there has been a fast development and acceptance for GIS technologies (Goodchild 2002) and its use in environmental modelling. The combination of GIS and environmental modelling offers new perspectives in integrated science (Clarke, Parks and Crane 2000).One main function of a GIS is to gather data that will result in the creation of a database. This database can then be the starting point for further manipulation and analysis of the data. For ecological assessment, such a database could consist of a land-cover map, a topographical map (digital elevation model), a conservation or protected-areas map, a soil map, a geology map and a climate map depending on the availability of these data. Data on climatic variables could also be relevant to perform the assessment further. The quality and accuracy of the land-cover map will be the limiting factor for the rest of the ecological assessment. At the baseline level of the EIA process, the display functions of a GIS can be used to produce background ecological maps. In addition, a wide range of functions is usually built into GIS software and directly available. Some of these functions such as the *buffer* command can find some relevance in ecological assessment. For example, to buffer protected areas can be very relevant in order to look at potential impacts from noise or air emissions on

sensitive species. This buffer could also take into consideration the influence of the wind pattern or topographical parameters in order to improve its accuracy.

While GIS offers many advantages as a tool in impact studies , there are some limitations. Three examples are (Joao, 1994);

1. GIS modelling technology has not yet been developed sufficiently to achieve certain complex environmental modelling;
2. Links to the other software packages or to special purpose programs may need to be developed especially for an EIA application; and
3. Very little of the information required for EIA studies is also available in a form which may be loaded directly into GIS.

2.6.2 EXPERT SYSTEMS:

Expert systems are computer programs that encode the knowledge and reasoning used by specialists to solve difficult problems in narrowly defined domains. They rely more on heuristic rules- of- the thumb and pattern matching to achieve their results , rather than numerical models and algorithms. Reasons why the EIA field lends itself to application of expert systems include;

1. It is a multidisciplinary field whose impacts and associated problems can require specialized fields.

2. It includes many different substantive areas such as engineering, chemistry, biology, planning, geography, statistics, geology, economics, toxicology, epidemiology and law. Individual EIA professionals will not always be well versed in all of these areas. Therefore , expert systems can assist in providing solution-directed knowledge on unfamiliar subjects.

2.6.3 Economic evaluation technic

Researchers discuss the current usefullness and limitations of the joint usage of EIA and Environmental cost benefit analysis ECBA, Cost benefit analysis CBA as inputs to project appraisal and decision making. While benefits acrue from expanding CBA to include economic valuation of environmental impacts , concerns remain about the scope of these tools and related uncertainties.Specifically, there are content and method inconsistencies both within and between EIA and CBA. These inconsistencies can arise from ;

1. Differences in scope of EIA and CBA and from double counting problems,
2. Conflicts between the market valuation methods used in CBA and the methods used for determining the significance of environmental impacts within EIA.
3. Differences between the single criterion (NPV- or net present value.) appraisal approach of CBA and the

more disagregated and multi –criteria approaches commonly used in EIA;and

4. Differences between EIA and CBA in approaches to time preference and discounting, the handling of uncertainty and the treatment of distributional issues.

2.6.4 Ecological Modeling.

Ecological modelling has found its core developments and applications in both conservation biology and landscape ecology, where the latter tends both to integrate knowledge and to orientate itself toward a problem-solving discipline (Tress andTress 2002).

Ecological modelling is not restricted to GIS applications but its usefulness and potential implementation in physical planning almost make some form of spatially referenced system a requirement. The development of predictive habitat distribution models and other predictive models in ecology have rapidly increased, and many of them could theoretically be relevant for ecological assessment within the EIA or SEA processes(Guisan and Zimmermann 2000).

From an ecology perspective, a model for biodiversity assessment would ideally be precise, ecologically sensible, interpretable, general and fully data-defined and should be expressed in a spatial framework (Lehmann, Overton and Austin 2002). Within ecological modelling, prediction models try to establish a relation between species occurrences and environmental variables in an attempt to

characterize the habitats suitable for specific species (Mörtberg 2004). Even though the development of new models and modelling techniques often reflects the needs of society the contribution of ecological modelling to the EIA and SEA processes remains in practice insignificant(Scott et al. 2002).

To gain an overview on the different streams of development within predictive modelling and the existing models, methods and areas of application is somewhat of a challenge suggested a classification based on the potential use of the models that would distinguish between screening, research and assessment models. (Decoursey 1992)

Even though many 'research-orientated' models have great relevance for the topic, their potential implementation will require more experience of their use in practice. Here follow a few examples of methods, models and software that have tried to go a step further towards practical application in physical planning and which are therefore relevant for EIA and SEA processes. Although a classification of the different models and methods may be difficult, a distinction can, however, be made between expert based models and empirical models (even though combinations of these two also exist).

2.6.5 Spatial Decision Support Systems (SDSS)

Despite the fact that Spatial Decision Support Systems and technologies have been successfully applied to "real-world" problem solving, relatively novel full-featured SDSS have been developed, implemented, and evaluated in Sicily. Rapid growth of these systems has occurred in the past decade; however, the field of SDSS is far from mature. Continued changes in computer hardware, software technology and geomatic applications are fundamentally altering the way that decision makers, stakeholders, policy makers, and analysts interact with Spatial data analysis. In a systematic way the complex topics and techniques can be assembled under Geomatics namely, Geodesy, Cartography, Photogrammetry, Remote Sensing (RS), Informatics, Acquisition Systems, Global Positioning Systems (GPS), Digital Image Processing (DIP), Geographic Information Systems (GIS), Decision Support Systems, and WebGIS and more Telecommunications, Geo-spatial Information, Information Technologies. This field of research is mainly influenced by an interdisciplinary approach (geoscientists and geographers, engineers, architects, computer scientists, urban planners, specialists in GIS, remote sensing, forestry, agricultural science, soil science geometry, environmental scientists, civil protection scientists and managers). Spatial analysis and EIAapplications are moving to a more exploratory, interactive emphasis with new decision analysis tools; at the same time GIS

prototypes are moving to a *wide* range of spatial decision support with exciting new applications.

On large projects, this labour intensive effort of EIA analysis is timely and costly. If novel GIS models are used at this stage (e.g. open sources and low cost wireless applications), the project can get a feeling for sensitive areas associated with a modification and select a preferred modification without costly, large-scale analysis.

2.7 Problems and limitations to implementation of GIS and ecological modelling

The accuracy, resolution and the size of GIS databases and the hardware necessary to handle or combine such data were previously limiting issues that have been substantially improved through technological advances in recent years (e.g. Lehmann,Overton and Austin 2002; Krisp 2004). However, access to data remains a major barrier to the use of GIS and modelling tools. Efforts need to be made to provide a more open and technically easier access to existing data such as species inventories that would assist the implementation of ecological models. More generally, the harmonization of databases at the national and international level (for transboundary projects) is a key issue to the successful use of such methodologies. In Europe the development of the Corine Land Cover (CLC) database is an example of such harmonization. The complexity of ecological modelling and

problems related to its reproducibility and robustness remain the main obstacles (Goodchild 2002) for its further implementation in EIA and SEA. Although GIS analyses and ecological models are now recognized as powerful tools for predicting the impacts of developments, the results need to be interpreted with a full understanding of their limitations. The fact that some of these methods have been used and tested for many years but are still seldom applied in an EIA or SEA context shows the need for further capacity building outside research environments.

2.8 Major Problems in the application of Science in EIA

Significant improvements in the scientific quality of assessment studies might be achieved if several major constraints can be reduced. Five main constraints were identified as having an important bearing on the adoption of a more scientific approach to impact assessment:

(a)The need for a common standard-A clarification of what is an acceptable scientific basis for impact assessment studies would benefit everyone involved. The current state of confusion and differing expectations in this regard is counterproductive.

(b) The need for early agreement given the limitations imposed on impact assessment studies, it is important that those people conducting and review- ing

assessments discuss as early as possible the basic approach to be adopted. The emphasis must be on maximizing the quality of work at the outset rather than unduly relying on a confrontational review at the end of the process.

(c)The need for continuity of study - All of the participants in environmental impact assessment must break out of the 'EIS syndrome'. The rationale for baseline studies and predictions of impact becomes rather tenuous without some follow-up monitoring to the project.

(d) The need for information transfer - Improving the scientific basis for environmental impact assessment would be greatly facilitated if everyone in the Nigerian assessment community were aware of the most recent concepts, techniques and approaches as developed by imaginative practitioners and by the research community.

(e) The need for better communications — A forum for productive discussion and the exchange of ideas among those administering, conducting, reviewing and paying for impact assessment studies must be established. Resolution of the principal difficulties will be slow unless the major participants are aware of more than just the problems inherent in their own responsibilities.

2.9 Science, Values and Decisions

Environmental impact assessment is grounded in the perceptions and values of society which find expression at the political level through administrative procedures of governments. Scientists are called upon to explain the relationship between contemplated actions and these environmental perceptions and values. Although the views of the general public may not be supported by the findings of scientific investigations, their collective aspirations cannot be ignored. Therefore, it must be recognized that decisions resulting from environmental impact assessments may be based as much on subjective judgments involving values, feelings and beliefs, as on the results of scientific studies. Based on the workshop discussions it is evident that in Nigeria this relationship between social values and the scientific focus of assessment studies is generally recognized and accepted. The problems to be overcome seem less related to the importance of social values than their early identification and translation into appropriate environmental studies. There emerged from workshops a number of ideas concerning the public perception of environmental values and their influence in the environmental impact assessment process. These included concern for:

recreationally

(i) human health and safety, (ii) potential losses of commercially or recreationally important resources, (iii) loss of endangered species and (iv) potential loss

of habitat. Some workshop participants suggested that the importance of environmental impacts should be based on ecological considerations. This was the most difficult interpretation of impact significance on which to develop a consensus. Eventually there was general agreement that impacts which resulted in the irretrievable loss of ecosystem components (e.g., gene pools) or functions (e.g., primary production) should be considered significant, although the ultimate concern could almost always be traced to human values.

It was amply demonstrated in workshops and supported by the literature that environmental impacts of any magnitude can be deemed insignificant if they are not considered in project-related decisions. Fundamental to this concept is that one of the prime purposes of environmental impact assessment is to present relevant ecological information for consideration in project planning. We might consider this project perspective of impact significance to be most important in environmental assessment.

The following statement attempts to capture the essence of various perspectives on what constitutes a significant environmental impact:

Within specified time and space boundaries, a significant impact is a predicted or measured change in an environmental attribute which should be

considered in project decisions, depending on the reliability and accuracy of the prediction and the magnitude of the change.

2.10 The Recognition of Scientific Requirements

For some time, members of the scientific community have been stressing the need to clarify the scientific basis for assessment studies. The main scientific and technical requirements are outlined below.

Boundaries- The establishment of time and space boundaries is a critical first step in impact assessment, although these are often assumed rather than stated. Like many other aspects of impact assessment, the setting of boundaries represents a trade-off, in this case involving: (i) the constraints imposed by political, social and economic realities (administrative boundaries), (ii) the spatial and temporal extent of the project (project boundaries), (iii) the time and space scales over which natural systems operate

(ecological boundaries), and (iv) the limited state-of-the-art in predicting or measuring ecological changes (technical boundaries). It is important to distinguish between these categories since some are under the control of the investigators while others are relatively fixed.

Quantification- From a scientific point of view, if environmental impact assessment is to be

substantially improved, the present preoccupation with descriptive studies must largely be replaced with a quantitative approach. Quantitative predictions cannot normally be made, nor hypotheses tested, without a firm foundation in measurement. The overriding constraint appears to be the high natural variability in many physical and biological phenomena. The problems posed by natural variation permeate nearly all scientific aspects of impact assessment and the limitations thereby imposed must be openly recognized. For example, within the time and resources available it may not be possible to establish true experimental controls under field conditions, nor to undertake the sampling programs required to meet normally accepted confidence limits in statistical analyses.

Modelling — There was widespread agreement among workshop participants that conceptual and quantitative modelling are very useful and appropriate scientific tools for impact assessment studies. Yet, they have received some- what sporadic use in the past. Conceptual modelling in particular was regarded as having an important early role in planning an impact assessment since it can assist in providing some much-needed direction and focus for subsequent studies. There has been considerable controversy over the application and utility of quantitative modelling, mainly with respect to its predictive capability. Quantitative

modelling, especially computer simulation modelling, appears to be used on a somewhat regular basis in certain aspects of environmental impact assessment such as those related to physical transport mechanisms in the atmosphere or water bodies. However, ecological effects modelling is generally considered to be unreliable for the purpose of predicting impacts

Prediction — For most workshop participants, and as generally reflected in the literature, environmental impact assessment is equivalent to impact prediction — prediction of changes from baseline conditions as demonstrated by the results of monitoring. In spite of this, prediction in impact assessment reports usually has amounted to generalized or vague statements about the possibility of certain conditions occurring. The lack of confidence in our predictions generally increases with expanding time scales and greater distances from the source of the impact. Added to these difficulties is the overriding constraint posed by stochastic events which by definition cannot be predicted, although their influence can be incorporated into simulation models. Assessment reports should clearly distinguish between reasonably firm predictions, forecasts based on experience or professional judgment, and outright guesses.

Study Design — One of the most obvious shortcomings in impact assessment is the lack of clear direction in

the form of a study strategy or framework for investigations. There are a number of tactical field and laboratory options available ranging from studies of controlled ecosystems (microcosms) to on site pilot-scale perturbations. Although the classic experimental design can seldom be adopted for impact assessment studies, much greater use should be made of hypotheses and statistically-based designs. Another recommended approach is to evaluate the environmental effects of similar developments previously completed (e.g., hydroelectric projects). Finally, in reorganization of our limited capabilities to predict ecological events, it may be necessary to consider the entire development project in an experimental context and design baseline studies, predictions and monitoring programmes around the need to verify hypotheses.

Developing a Scientific Perspective: It can be argued that the notion of impact assessment equates to applied science. In other words, the ranking of required environmental studies by priority should reflect, in part, the extent to which science has developed a conceptual or theoretical knowledge base for the particular phenomena of interest. The result should be a more limited and focused study effort based on a compromise between the information needs of the decision-makers and what a sound, short-term, applied

science program can provide.

Lessons From Experience- Some generalities need to be considered in the adoption of a more scientific approach to the design and conduct of environmental impact assessments. These include:

(A) Always strive to develop a study design which assumes an opportunity to measure changes after project initiation.

(B) Strike a compromise between studying the valued ecosystem components and the nearest surrogate components for which useful predictions are possible; use professional judgment to extrapolate from the predictions to the valued ecosystem components.

(C) Take maximum advantage of the information which can be obtained from natural or man-made occurrences and natural records.

(D) Focus numerical data collection programs around a statistical definition of natural variation in space and time.

(E) Refine a hunch concerning a potential impact until it can be stated as a specific question for which a numerical answer is possible, or stated as a hypothesis which can be tested.

(F) First attempt to predict project-induced changes in physical and chemical components and their direct impacts on organisms. Then focus attention on indirect

effects operating through changes in habitat or food.

(G) It may be as important to consider the long-term potential of the ecosystem (or components of it) to recover from an expected impact, as it is to predict the initial outcome of the perturbation. An interdisciplinary approach (geoscientists and geographers, engineers, architects, computer scientists, urban planners, specialists in GIS, remote sensing, forestry, agricultural science, soil science geometry, environmental scientists, civil protection scientists and managers).

CHAPTER THREE

METHODOLOGY

3.1: Research Design

The aim of this chapter is to explain the method used in obtaining relevant data for this research. The subsequent data analysis. Environmental impact statements and method used in selecting stakeholders and the data collection instrument are also discussed.

The chapter highlights the methods that have been chosen to organize and analyze data collected , and finally the statistical method used in answering the research questions in chapter four.

Research design is a framework or plan that is used as a guide in collecting and analyzing data of study, (Zar 1978).The researcher utilized the Likert summated scale. Secondary data was collected from published materials while questionnaire and interview were employed to source primary data. One hundred and fifteen copies of questionnaire in all were administered.

The project included a critical evaluation of the extent to which science and technology principles have been applied to environmental impact Assessments and its impact. An ongoing review of writing pertinent to scientific and ecological inputs to

environmental impact assessments was obtained at the beginning of the project. From various sources including scientific journals, limited-distribution symposium proceedings, government and consultant reports, standard textbooks, a collection of a few hundred items was established. Publications addressing the specific objectives of the project are relatively scarce, and it was necessary to search printed material that is rather peripheral to the project focus.

3.2 Pre-Testing of Questionnaire

In spite of the care taken in its design as outlined above, the first draft of the questionnaire was administered by a selected few of the targeted groups as a pre-text. This measure was designed to ensure that possible error/omission was conclusively addressed before the final draft is administered. The key tests are

i) Privacy test –it sought to investigate how probing the questions will be into privacy of the respondents.

ii) Ambiguity test-it investigates the extent to which questions could have more than one interpretation.

The questions were made simple enough to avoid all trace of ambiguity

1. Attempts were made to avoid either too personal or irrelevant questions
2. The layout of the questions was designed in such a way that they followed a logical sequence so that the respondent may be more encouraged to give his best co-operation.

3.3. Population of the Study

The groups involved in this study include government/statutory agencies, university/research scientists, consultants, industrialists and workshop/seminar participants. They serve as a major source of information for environmental impact studies. An accessible one hundred and fifteen people spread over the above named groups in Nigeria were arrived at using non probability convention. The following criteria was used to determine the members of these groups.

1. Government (Federal State, LGA, International) bodies with statutory duty to monitor and regulate environmental impact assessment (FMenv, FEPA, SEPA, etc).
2. University/research scientists involved in science and technology studies at it related to EIA.
3. Industrialist/contractors whose activities affects the ecosystem and the environment generally.

4. Consultants who are accredited and whose services are contracted and retained to carry out environmental impact assessment.
5. Workshop participants is limited to professionals in the physical and biological sciences who are reasonably close to field responsibilities and who had experience in, or a good working knowledge of environmental impact assessment as it is practiced in Nigeria.

Research methodology for this project is fully explained in the following heading.

- Description of date analysis
- Questionnaire design
- Statistical treatment and data analysis

3.4 Questionnaire Design:

The questionnaire contained information section where the respondents indicated the extent to which they agree or disagree with the stated statements therein that describes the six variables referred to as the explanatory or independent 'X' variables and factors that influence the application of science and technology in EIA ($x_1..x_2$).

- Method and quality of data collection

- Research time,
- Legislative backing,
- Information management,
- Laboratory/research results,
- Project funding.

While ‘y’ is the dependent factor, the impact of science and technology on E.I.A.

3.5 Method of Data Analysis;

Regression analysis method is used to analyze data in this research. This statistical technique is adopted to measure the quantitative functional relationship between associated variables called techniques of regression and correlation.

In regression analysis attempt is made to determine how given changes in certain variable “y” affect other variables “x”. The variables involved are assumed to be quantitative and continuous. In this case study, it is the impact of science and technology on E.I.A a function of variables called independent, explanatory, predicator, or predetermined variables. For example, Research time, legislative backing, method of collecting and analyzing data, information management, laboratory/research results, project funding. The values of the dependent variables are determined by the values of independent variables. The hypothesis that the

impact of science and technology on E.I.A is a function of the mentioned constraints can be translated into a mathematical function as, Y = a +bx.

The relationship can be written as;

Y= $Y = \beta_0 X_{io} + \beta_1 X_{i1} + \ldots + \beta_{p-1} X_{i,p-1} + \varepsilon_I$ The impact of science and technology on EIA. (The dependent variable)

X_1, X_2 = known constraints e.g. research time etc (The independent variables). $\beta_0, \beta_1, \ldots, \beta_{p-1}$, are parameters.

a = the constant “a” is the intercept it gives to the degree of success of environmental impact assessment without the constraints e.g. when x = 0

b = coefficient of “Y” in relation to x.

it gives the measure of increase in the success due to certain increase in (proper time for research) the constraints

e = “error term” refer to deviation from the regression line.

In the above equation, the main concern of the researcher is how “Y” relates to more than one variable “X”. A hypothesis stated verbally can only be estimated quantitatively by translating it in an estimable function or mathematical function.

Analysis of Variance (ANOVA) table.

The purpose of this is to see if there is any difference between groups in some variables. This is used when there is a difference between two groups. What ANOVA looks at is the way groups differ internally versus what the difference is between them. The following will be observed from ANOVA table;

1. It calculates the mean for each of the final grading groups of the variables – the group means
2. It calculates, within each group, the total deviation of each individual score from the group mean within group variation.
3. It calculates the deviation of each group mean from the overall mean between group variation.
4. Finally, it produces the f-statistics which is the ratio between group variations to that within group variation.

The analysis of the significance of the variation in the dependent variable due to cumulative variables of the independent variables is known as analysis of variance (ANOVA). The table below summarizes the steps involved in the analysis of variance by the computer.

Table 3.4.1 Steps involved in Analysis of Variance

Anova Table		Monova Table		
Source of variance	**Sum of squares**	**Degree of freedom**	**Mean of sq**	**F.ratio**
Regression	$SSR = R^2\Sigma Y^2$	K	$\frac{MSR-SSR}{K}$	$F^A=\frac{MSR}{MSR}$
Error	$SSE=\Sigma Y^2-R^2\Sigma Y^2$	n-k -1	$MSE=\frac{SSE}{n-k-1}$	
Total	$SST=\Sigma Y^2-\frac{(\Sigma Y)2}{N}$	n-1		

Source:(Nworuh, 2001)

Where;

N = Sample size

K = Number of independent variables.

SST = Total sum of squares

SSR = Sum of squares due to regression

SSE = Sum of squares due to error

MSR = Mean of squares due to regression

MSE = Mean of squares due to error

Coefficient Table

Regression line:

Let;

Y = Impact of Science and technology on EIA.

X = Constraints, variables research time, legislative backing etc.

a and b = constants

a = intercept

It gives the impact of science and technology on environmental impact assessment without the constraints.

x=0

b=the slope of the regression line.

It is the coefficient of Y in relations to x that measure the impact of science and technology on environmental impact assessment due to certain variables – research time, funding, government support etc.

Regression equation of best fit translated into mathematical function as:

y-a+bx=0

Research time

Y=11.327 + .921x substituted with values of constraints.

Laboratory/research results

Y=11.327 + .921x

Constant b = .921 gives the slope of the regression line. It means that an increase in the research time will bring increase of .921% science and technology input in EIA.

The value of coefficient of correlation .921 which is close also indicate that there is a very strong association or correlation between research time and success of employing science and technology in conducting EIA. 0.246 is the standard error of coefficient accounting for the standard deviation of the estimated value. To find how reliable the estimated value of the b coefficient or how well does the estimated regression line to the observed data. The technique that is used to answer this question is called **Test of statistical significance**. The level of significance is determined on the basis of the standard error and t-ratio to statistics.

Mathematical function is shown as;

T=b/sb = .921/.246 = 3.744

T calculated =3.744

The first hypothesis will be tested using regression analysis. The second hypothesis will be tested using a nonparametric test;

The Spearman Rank correlation co-efficient is given as.

$$r_{spearman} = 1 - \frac{6\sum_{i-1}^{n} d_i^2}{n(n^2-1)}$$

To test the significance of r_{sr}, we compute the test statistics

$$t = r_s \frac{\sqrt{n-2}}{1-r^2}$$

Here we accept the null hypothesis if t- calculated is greater than t-tabulated.

CHAPTER FOUR
RESULT AND DISCUSSION

4.0 DATA PRESENTATION

This chapter deals with the presentation and analysis of data collected. Statistics data presentation is the scientific process of collecting, organizing, and interpreting data with the view of providing useful concise information for decision making (Nworuh G.E 2006). The researcher devised descriptive statistics in the data presentation. Data presentation means accurate collection of all analysis, questionnaire etc collected from various stakeholders, personal advice that help interpretation would then be made on the outcome of presentation and results of data gathered.

4.1. ANALYSIS OF DATA

Tables, scores and percentages were used to analyze the data collected from respondents. The hypothesis will be tested using five point scale technique. 115 structured questionnaire designed on the likert five point scale were distributed, 105 were returned. Out of the lot distributed five was discarded due to errors such as incomplete answers and inconsistencies. 100 questionnaire were found sufficient for analysis which is 95%.

4.2. RESPONSE RATE TABLES.

4.2.1 Characteristics of Respondents in three towns of Nigeria (Representing south, West and North)

The characteristics of the respondents selected in the three towns is based on their environmental impact assessment activities.

TABLE 4.2.1 DISTRIBUTION OF RESPONDENTS

	Portharcourt		Lagos		Abuja		Total	
Respondents	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Govt./Stat.	**5**	**15.6**	**7**	**21.2**	**8**	**22.9**	**20**	**20**
Univ/Res.	**8**	**25**	**5**	**15.2**	**6**	**17.1**	**19**	**19**
Ind/Contr.	**10**	**31.3**	**9**	**27.3**	**5**	**14.3**	**24**	**24**
Consultants	**4**	**12.5**	**4**	**12.1**	**6**	**17.1**	**14**	**14**
Wkshp. Part	**5**	**15.6**	**8**	**24.2**	**10**	**28.5**	**23**	**23**
Total	**32**	**100**	**100**	**35**	**35**	**100**	**100**	**100**

SOURCE: FIELD SURVEY 2012

The above table shows that in Port Harcourt 15.6% of the respondents were selected from govt./statutory bodies agencies who regulate EIA, 25% were university/research institutes who support the researches on science and technology, 31.3% as industrialist/contractors who are compelled by law and standard to carry out EIA, 12.5% were engaged as consultants who are in the field of EIA, 15.6% were workshop participants who come from diverse fields involved in EIA. In Lagos, 21.2% were engaged as Govt/statutory agencies, 15.2% were University/Research institutes, 27.3% were engaged industrialists/contractors, 12.1% are contractors while 24.2% are workshop participant. In Abuja 22.9% were engaged as g government/statutory agency,17.1% were university/research institutes, 14.3%were industrialists/contractors, 17.1% were consultants, while 28.5% are workshop participants.

We can observe in general of the govt/statutory agencies, 19% were university/research institutes, 24% were industrialists/contractors, 14% were consultant, while 23% were workshop participant.

TABLE 4.2.2. LEVEL OF AWARENESS OF PRACTITIONERS OF E.I.A

S/N	Responses	No. of Respondents	%
1.	Strongly Disagree (SD)	2	2%
2.	Disagree (D)	8	8%
3.	Neutral (N)	10	10%
4.	Agree (A)	30	30%
5.	Strongly Agree (SA)	50	50%
	Total	**100**	**100%**

SOURCE: FIELD SURVEY 2012

In section 'A' awareness no 4, we can observe from the table above strongly agree have the highest score showing that all that were listed are conversant with E.I.A, signifying 50% of the respondents.

The researcher agree with their view. This depicts a high level of awareness and involvement in E.I.A among them.

TABLE 4.2.3 Views of Different E.I.A practitioners from science and technology areas.

TABLE 4.3

S/N	Responses	No. of Respondents	%
1.	Strongly Disagree (SD)	2	2%
2.	Disagree (D)	8	8%
3.	Neutral (N)		%
4.	Agree (A)	20	20%
5.	Strongly Agree (SA)	70	60%
	Total	**100**	**100%**

SOURCE: ANALYSIS OF FIELD SURVEY DATA 2012

From the table above 70 of the respondents which is 60% strongly agree to be involved in the numerated E.I.A projects therein.

TABLE 4.2.4 REQUIREMENT FOR THE SUCCESS OF E.I.A PROJECTS.

S/N	Responses	No. of Respondents	%
1.	Strongly Disagree (SD)	-	-
2.	Disagree (D)	10	10%
3.	Neutral l (N)	5	5%
4.	Agree (A)	20	20%
5.	Strongly Agree (SA)	75	75%
	Total	**100**	**100%**

SOURCE: ANALYSIS OF FIELD SURVEY DATA 2012

The table above reveals that 75% of the respondents strongly agree that research time, legislative backing, government support, etc are important to the success of environmental impact assessment in Nigeria. 20% of the respondents Agree, 5% of the respondent took the neutral position to the question asked in the questionnaire. 10% of the respondents disagree totally that Research time legislative backing, government support, etc. are important to the success of E.I.A .

4.2.5 X-RAY OF RESPONDENTS GENERAL OPINION OF THINGS NEEDED FOR SUCCESSFUL E.I.A

From test II of the questionnaire generally almost all the respondents chose strongly agree from the list of options given to them in the structured question to determine requirements for successful E.I.A. They are numerated as follows:-

- An environment of consistent government policies and favorable regulatory activities.
- Good and timely information.
- Application of E.I.A managed planning techniques and implementation.
- Adequate and timely funding.
- Proper definition of functions and job specifications.

- Qualified scientists and technologist to carry out E.I.A

TABLE 4.2.6 RANKING MAJOR CONSTRAINT OF E.I.A

CONSTRAINT	**S 1 Total**	**C**	**O 2**	**R 3**	**E 4**	**S 5**
1. Short Research time.	130	65	50	70	73	390
2. Non supportive bills.	85	77	65	45	24	296
3. Frequent change in govt. policies.	135	70	55	70	80	410
4. Unavailability of Information.	46	93	104	40	15	268
5. Poor Project Funding	120	64	45	64	22	297

SOURCE: ANALYSIS OF FIELD DATA 2012.

From the table above drawn from section B question 1, the most critical constraint of E.I.A frequent change in government policies with total scores of 410. Followed by sort research time with 390 points. This scores for respondent one just to show sample.

TABLE 4.2.7 SUMMARY RANKING VARIABLES THAT CONTRIBUTE TO SUCCESSFUL EIA PROJECT (SECTION B QUESTION 3)

Variables	**S Total**	**C**	**O**	**R**	**E**	**S**
1. Enough time for carrying out research	245	80	30	17	40	412
2. Good bills to support Sci/Tech in E.I.A	45	80	114	45	10	294

3. Consistent government policies	33	77	55	80	20	275
4. Availability of existing information	31	72	54	78	20	254
5. Reasonable funds for projects execution	140	48	33	22	44	283

SOURCE: ANALYSIS OF FIELD SURVEY DATA 2012

Table 4.2.7 above, one hundred respondents that contribute to successful selected enough time for carrying out Sci/Tech. research 412 as the most important factor. Availability of existing information 294, ranked second while availability of existing information 254 points was regarded as the important.

TABLE 4.2.8 SUMMARY RANKING CRITERIA WHICH DETERMINE A SUCCESSFUL E.I.A PROJECTS (SECTION B QUESTION)

Criteria	**S 1**	**C 2**	**O 3**	**R 4**	**E 5**	**S Total**
1. Completion of E.I.A within budget.	190	115	50	20	10	385
2. Completion of E.I.A within time	185	112	46	27	6	375
3. Completion of E.I.A meets Sci/Tech standard	36	70	145	45	4	300
4. E.I.A outcome acceptable to client	55	45	32	90	25	247

5. Acceptance by the Govt/Statutory bodies	200	120	40	10	10	380

SOURCE: FIELD SURVEY DATA 2012.

Table 4.2.8.above reveals the respondents ranking in descending order of importance, five key criteria from measuring a successful E.I.A project. Completion of E.I.A project within budget is ranked the most important 385 scores while outcome acceptable top client is ranked least important 247 scores aggregate.

The x-ray of this vital points will help to ensure a successful E.I.A

TABLE 4.2.9 DETERMINATION WHETHER GOVERNMENT SPONSORED EIA ARE MORE PRONE TO BE UNSUCCESSFUL. (FOR RESPONDENT 1)

INDEPENDENT VARIABLES	**Questions/scores**					**Total**
	1	2	3	4	5	
X	5	1	4	2	4	16

From the table, one will observe that the respondent scored 5 mark, strongly supported that non government owned firms are not separated in the decision making in the maintenance of their project focus. Aggregate of his total scores for the questions asked

16 marks indicating that government owned EIA projects are more prone to be unsuccessful.

4.2.10 TOLL OF UNSUCCESSFUL EIA PROJECTS IN NIGERIA (FOR RESPONDENT 1.)

INDEPENDENT VARIABLES	Questions/scores					Total
	1	2	3	4	5	
X	4	5	5	4	4	22

The above selected respondent from the table scored 4 marks from financial toll of unsuccessful EIA in Nigeria: he scored 5 marks for rate of EIA project unsuccessful in Nigeria and 5 marks again for the characteristics of unsuccessful EIA projects consequences: all manifest itself in Nigeria. In aggregate, he scored 22 marks indicating that the toll of no success of EIA projects in Nigeria is very high. **CONTINGENCY TABLE 1**

4.2.11 SUCCESSFUL EIA PROJECT (SCORES FOR RESPONDENT 1.)

INDEPENDENT VARIABLES	Questions/scores										Total
	1	2	3	4	5	6	7	8	9	10	
Y	5	5	4	3	5	5	4	5	3	5	44

Source: analysis of field survey data 2012

Table 4.2.11 above is also based on the likert scale, it has a maximum score of 50 and a minimum score of 10. This is referred to as a dependable variable. Its value depends on the value of explanatory or undependable variable in table 4.2.8 above.

These question from where the scores were derived are contained in questionnaire test II.

The method was employed to show another way the likert questions can be designed, there are 100 respondents but the rest test were treated due to time constraints. Ten questions/statements on criteria for successful EIA project in Nigeria were considered adequate by the researcher.

CONTINGENCY TABLE 2

4.2.12 DETERMINATION OF EIA SUCCESS WHEN SCIENCE AND TECHNOLOGY IS APPLIED. (SCORES FOR RESPONDENT 1.)

INDEPENDENT VARIABLES	**Questions/scores**										**Total**
	1	2	3	4	5	6	7	8	9	10	
Y	2	4	3	3	4	5	4	5	4	5	40

SOURCE: ANALYSIS OF FIELD SURVEY

The above table is dependent variable used for the second hypothesis were derived.

This table is also based on the scale which has a maximum score of 50 and a minimum score of 10. The enumerated were

answers from test III chosen from one respondent from ten question listed in the questionnaire.

According to the respondent above, 5 point from the scale gave a total of 40 points aggregate.

4.2.13 an illustration that shows how table 4.2.14 which summaries the scores of respondents. Table 4.2.14 below is the explanatory or independent variable, while 4.2.11 are dependent variables

QS/N		1	2	3	4	5	Total
	Constraints 'x' (factors)						
1	Research time x_1	5	4	4	4	4	21
2	Legislative backing x2	4	4	4	5	4	20
3	Method& quality of data collection x_3	4	5	4	4	4	21
4	Information management x_4	4	4	5	4	5	23
5	Laboratory/Research Result x_5	4	2	3	4	5	18
6	Project Funding x_6	4	4	2	3	4	17

SOURCE: ANALYSIS OF FIELD DATA 2012.

The questionnaire attached to each respondent was to indicate the degree of agreement with five statements related independent variables eg. 'Research time'x_1. The first respondent scored 5 for each of the five statements giving a total scores of 22. Table 4.2.13, above scoring is based on the Likert summated scale in

which the maximum score for each independent factor is 25 and the minimum score is 5.

LE 4.2.14 RELATIONSHIP OF RESEARCH TIME, LEGISLATIVE BACKING,METHOD AND QUALITY OF DATA COLLECTION , INFORMATION MANAGEMENT, LABORATORY/RESEARCH RESULT, PROJECT FUNDING TO APPLICATION OF SCI/TECH IN EIA (100 RESPONDENTS) 1ST Hypothesis}

Respondents	Research Time X_1	Legis. Backing X_2	Method &quality of data, X_3	Information Mgt. X_4	Lab/Res. Result X^5	Project Fundingx_6	Y
1	22	20	21	23	18	17	44
2	25	19	18	25	18	16	40
3	24	20	18	24	17	18	40
4	22	20	20	24	18	20	49
5	21	19	23	25	16	17	35
6	22	18	21	23	18	16	35
7	25	16	21	22	17	16	38
8	25	16	21	25	17	16	49
9	24	16	21	25	18	16	30
10	23	16	22	25	10	17	31
11	24	17	22	23	20	18	32
12	25	18	20	24	17	17	40
13	25	17	20	20	17	16	143

14	**24**	**16**	**20**	**25**	**18**	**17**	**44**
15	**22**	**17**	**20**	**22**	**18**	**18**	**44**
16	**22**	**20**	**21**	**22**	**19**	**18**	**45**
17	**21**	**20**	**22**	**23**	**20**	**19**	**46**
18	**20**	**20**	**21**	**24**	**17**	**16**	**47**
19	**23**	**20**	**20**	**23**	**18**	**15**	**48**
20	**22**	**21**	**21**	**24**	**18**	**15**	**49**
21	**22**	**22**	**18**	**22**	**16**	**15**	**43**
23	**24**	**21**	**18**	**24**	**16**	**16**	**43**
24	**25**	**21**	**17**	**25**	**17**	**18**	**40**
25	**24**	**22**	**18**	**25**	**18**	**17**	**40**
26	**22**	**19**	**19**	**25**	**17**	**17**	**41**
27	**22**	**18**	**19**	**24**	**18**	**17**	**42**
28	**21**	**17**	**20**	**23**	**18**	**17**	**42**
29	**22**	**16**	**21**	**22**	**19**	**17**	**40**
30	**25**	**22**	**21**	**25**	**18**	**16**	**40**
31	**25**	**21**	**21**	**25**	**18**	**16**	**49**
32	**25**	**21**	**22**	**25**	**20**	**18**	**45**
33	**16**	**20**	**22**	**24**	**18**	**18**	**46**
34	**20**	**18**	**23**	**24**	**20**	**16**	**46**
35	**21**	**16**	**24**	**24**	**18**	**18**	**47**
36	**24**	**18**	**20**	**20**	**22**	**18**	**48**
37	**23**	**18**	**17**	**24**	**18**	**20**	**49**
38	**23**	**18**	**17**	**24**	**18**	**20**	**35**
39	**23**	**18**	**18**	**25**	**18**	**16**	**35**

40	**24**	**18**	**20**	**25**	**16**	**18**	**36**
41	**23**	**19**	**20**	**25**	**16**	**18**	**36**
42	**22**	**20**	**18**	**25**	**16**	**20**	**37**
43	**20**	**21**	**18**	**24**	**18**	**18**	**38**
44	**20**	**21**	**21**	**20**	**20**	**16**	**39**
45	**21**	**22**	**20**	**21**	**20**	**16**	**40**
46	**21**	**23**	**21**	**22**	**20**	**18**	**49**
47	**21**	**20**	**22**	**22**	**21**	**18**	**42**
48	**21**	**16**	**18**	**22**	**22**	**18**	**43**
49	**23**	**16**	**18**	**23**	**18**	**16**	**44**
50	**23**	**16**	**18**	**23**	**18**	**16**	**45**
51	**24**	**16**	**18**	**25**	**18**	**21**	**49**
52	**25**	**18**	**18**	**25**	**20**	**21**	**40**
53	**25**	**18**	**21**	**24**	**21**	**22**	**49**
54	**25**	**18**	**22**	**24**	**22**	**20**	**42**
55	**24**	**20**	**21**	**23**	**20**	**20**	**43**
56	**23**	**16**	**22**	**22**	**20**	**18**	**44**
57	**22**	**16**	**21**	**23**	**21**	**18**	**45**
58	**22**	**18**	**20**	**24**	**18**	**18**	**40**
59	**23**	**18**	**20**	**24**	**18**	**20**	**36**
60	**23**	**18**	**20**	**25**	**21**	**21**	**36**
61	**25**	**20**	**21**	**25**	**16**	**16**	**30**
62	**25**	**20**	**21**	**50**	**16**	**16**	**32**
63	**24**	**21**	**23**	**25**	**20**	**18**	**44**
64	**25**	**22**	**22**	**25**	**20**	**18**	**43**
65	**25**	**16**	**23**	**25**	**22**	**18**	**44**

66	**24**	**18**	**22**	**24**	**20**	**18**	**45**
67	**20**	**18**	**23**	**25**	**20**	**20**	**44**
68	**21**	**18**	**22**	**24**	**20**	**21**	**47**
69	**22**	**20**	**24**	**20**	**18**	**22**	**46**
70	**23**	**20**	**25**	**22**	**18**	**23**	**48**
71	**24**	**21**	**20**	**23**	**20**	**20**	**48**
72	**25**	**22**	**20**	**25**	**22**	**20**	**49**
73	**24**	**22**	**20**	**25**	**20**	**18**	**42**
74	**25**	**21**	**20**	**25**	**29**	**18**	**40**
75	**24**	**23**	**16**	**25**	**29**	**16**	**37**
76	**24**	**23**	**16**	**25**	**29**	**16**	**38**
77	**25**	**23**	**16**	**24**	**18**	**16**	**39**
78	**25**	**23**	**16**	**21**	**16**	**18**	**30**
79	**24**	**20**	**18**	**22**	**16**	**18**	**32**
80	**22**	**20**	**18**	**22**	**16**	**18**	**34**
81	**20**	**20**	**20**	**22**	**18**	**18**	**35**
82	**20**	**18**	**20**	**22**	**18**	**20**	**36**
83	**16**	**18**	**22**	**23**	**18**	**22**	**37**
84	**16**	**20**	**21**	**24**	**21**	**22**	**40**
85	**19**	**17**	**18**	**25**	**20**	**23**	**44**
86	**20**	**17**	**18**	**25**	**20**	**24**	**45**
87	**22**	**18**	**18**	**24**	**21**	**23**	**46**
88	**23**	**17**	**20**	**24**	**20**	**21**	**47**
89	**24**	**16**	**21**	**24**	**20**	**21**	**48**
90	**25**	**18**	**21**	**22**	**20**	**16**	**48**
91	**25**	**17**	**22**	**23**	**22**	**16**	**49**

92	**22**	**20**	**21**	**24**	**22**	**5**	**45**
93	**20**	**20**	**21**	**24**	**22**	**5**	**46**
94	**20**	**19**	**22**	**25**	**20**	**11**	**47**
95	**20**	**16**	**23**	**25**	**21**	**18**	**48**
96	**21**	**18**	**23**	**25**	**16**	**19**	**49**
97	**24**	**18**	**21**	**25**	**126**	**20**	**48**
98	**20**	**18**	**20**	**25**	**19**	**17**	**47**
99	**24**	**19**	**21**	**24**	**18**	**14**	**44**

100	**25**	**18**	**20**	**25**	**18**	**14**	**44**
TOTAL	**2269**	**1893**	**2022**	**2373**	**1883**	**1771**	**4219**

SOURCE: ANALYSIS OF FIELD SURVEY DATA 2012

Table 4.2.14 Above presented the summary of the scores of the one hundred respondents, on their assessment of the impact of the major constraints (X_1 to X_6), applicable of science and technology in EIA.

4.3 TEST OF HYPOTHESIS

4.3.1 Using STATA 11.0 software, The fitted regression of Y on X1,X2,X3,X4,X5 and X6 based on the table 4.2.14 is given below;

Regress y x 1 x2 x3 x4 x5 x6

Source | SS df MS Number of obs = 100

```
-------------------+------------------------------          F(6, 93) =       3.09
         Model |   44.6844183   6  74.4740305          Prob > F  =     0.0083
      Residual |  2238.54582   93  24.0703851          R-squared =
0.1664
-------------------+------------------------------          Adj R-squared = 0.1126
         Total |   2685.3999  27.1251515                 Root   MSE          =
4.9062

------------------------------------------------------------------------------
         y |    Coef.          Std. Err.       t       p>|t|    [95% Conf. Interval]
-----------------------+------------------------------------------------------------------
        X1 |    - .1597204    .2541813     -0.63   0.531    -.6644741    .3450334
        X2 |    -. 2281434    .2563273     -0.89   0.376    -.7371587    .2808719
        X3 |      .7058291    .2664488      2.65   0.009     .1767146    1.234944
        X4 |      .2786016     .354738      0.79   0.434     -.4258378     .983041
        X5 |      .5481116    .1964897      2.79   0.006     .1579922    .9383011
        X6 |      .0636347    .1717433      0.37   0.712    -.2774135    .4046828
        _cons | 17.7393      14.78914      1.20   0.233    -11.62901    47.10761
```

$Y=17.7393-0.1597X_1-0.2281X_2+0.7058X_3+0.2786X_4+0.5481X_5+0.6363X_6$

The Analysis of Variance (ANOVA) table is presented below:

Table: ANOVA TABLE

Source	SS	df	MS	Number of obs = 100
				F(.95,6, 93,0.05) = 3.09
Model	446.844183	6	74.4740305	Prob > F = 0.0083
Residual	2238.54582	93	24.0703851	R-squared = 0.1664
				Adj R-squared = 0.1126
Total	2685.39	99	27.1251515	Root MSE = 4.9062

4.3.2 Hypothesis One;

The Impact of science and technology on EIA is dependent on six key constraints namely Research time, legislative backing, Method and quality of data collection , information management, Laboratory/research results, Project funding.

From the table 4.2.14, the STATA software of Regression analysis and ANOVA table calculation, Since F_{cal} =47.961 > F(0.95,6,93)=3.09, we have sufficient evidence to reject the null hypothesis and conclude that application of science and technology in environmental impact assessment is dependent on Research time, Legislative backing, Method and quality of Data collection, information management, Laboratory/Research results, Project funding. The probability value 0.0083 is less than 0.05 which is in line with our conclusion above. When the six predictor variables are considered, the variation in application of science and technology in environmental impact assessment is reduced by 16.64 percent as shown by the coefficient of multiple determination R^2=0.1664 with the coefficient of multiple correlation R=0.4079 and the adjusted coefficient of multiple determination, R^2a=0.1126 showing that adjusting for the number of predictor variables in the model had only small effect on R^2.

TABLE 4.2.15 RELATIONSHIP BETWEEN SCIENCE/TECHNOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT {(100 RESPONDENTS) 2ND HYPOTHESIS]

RESPONDENTS	SCIENCE/TECHN.	CONSTRAINT
1	25	40
2	25	40
3	25	40
4	25	40
5	25	40
6	25	40
7	25	40
8	25	40
9	25	40
10	25	40
11	24	35
12	24	35
13	24	35
14	24	35
15	24	35
16	24	35
17	24	35
18	24	35
19	24	35
20	24	35
21	20	32
23	20	32
24	20	32

25	**20**	**32**
26	**20**	**32**
27	**20**	**32**
28	**20**	**32**
29	**20**	**32**
30	**20**	**32**
31	**23**	**30**
32	**23**	**30**
33	**23**	**30**
34	**22**	**46**
35	**22**	**46**
36	**22**	**46**
37	**22**	**46**
38	**22**	**46**
39	**22**	**46**
40	**22**	**46**
41	**22**	**46**
42	**22**	**46**
43	**22**	**46**
44	**23**	**44**

45	**23**	**44**
46	**23**	**44**
47	**23**	**44**
48	**23**	**44**
49	**23**	**44**
50	**23**	**44**

51	**23**	**44**
52	**23**	**44**
53	**23**	**44**
54	**25**	**45**
55	**25**	**45**
56	**25**	**45**
57	**25**	**45**
58	**25**	**45**
59	**25**	**45**
60	**25**	**45**
61	**25**	**45**
62	**25**	**45**
63	**25**	**45**
64	**24**	**37**
65	**24**	**37**
66	**24**	**37**
67	**25**	**42**
68	**25**	**42**

69	**25**	**42**
70	**25**	**42**
71	**25**	**42**
72	**25**	**42**
73	**25**	**42**
74	**25**	**42**

75	**25**	**42**
76	**25**	**42**
77	**24**	**44**
78	**24**	**44**
79	**24**	**44**
80	**24**	**44**
81	**24**	**44**
82	**24**	**44**
83	**24**	**44**
84	**24**	**44**
85	**24**	**44**
86	**24**	**44**
87	**22**	**40**
88	**22**	**40**
89	**22**	**40**
90	**22**	**40**
91	**22**	**40**
92	**22**	**40**
93	**22**	**40**
94	**22**	**40**
95	**22**	**40**
95	**22**	**32**
96	**22**	**32**
97	**23**	**32**
98	**23**	**32**
99	**23**	**32**
100	**23**	**32**

SOURCE: ANALYSIS OF FIELD DATA 2012

Hypothesis Two:

There is no significant relationship between science/technology and environmental impact assessment.

From the table 4.2.15 and Using the spearman rank correlation coefficient;

Spearman cSpearmen x1 x2, stats(rho obs p)

Number of obs = 100

Spearman's rho = 0.1706

The r_s=0.1706 shows that science/technology principles and environmental impact assessment are correlated and in a positive manner.

To test the significance r_s we compute the test statistics

$$t = r_s \frac{\sqrt{n-2}}{\sqrt{1-r^2}} = 0.1706 \frac{\sqrt{100 - 2}}{\sqrt{1 - 0.1706^2}} = 1.714$$

T(0.95,98)=1.662 which is less than t_{cal}=1.714, the null hypothesis is rejected. We therefore conclude that science and technology and environmental impact assessment have significant relationship.

CHAPTER FIVE

SUMMARY CONCLUSION & RECOMMENDATIONS

5.1 SUMMARY

It can be argued that the notion of impact assessment equates to science and technology. In other words, the ranking of required environmental studies by priority should reflect, in part, the extent to which the science and technology has developed a conceptual or theoretical knowledge base for the particular phenomena of interest. The result should be a more limited and focused study effort based on a compromise between the information needs of the decision-makers and what a sound, short-term, applied programme can provide. In addition to the Requirements for Organizing and Conducting Environmental impact Studies, the research project has identified several other initiatives which would facilitate and encourage a more scientific approach to environmental impact assessment. The following recommendations pertain to the administrative and institutional aspects of impact assessment.

5.2 CONCLUSION

The project has demonstrated the interest and willingness of most people directly involved in impact assessment activities to upgrade the quality of their work through the adoption of some commonly accepted performance standards. The degree of commitment and level of support demonstrated by the agencies supporting the project is another important positive aspect. Furthermore, there are enough examples from across Nigeria to demonstrate the capability of the community of applied scientists to undertake more rigorous scientists studies as part of environmental impact assessment. The challenge is to modify existing administrative procedures and develop the necessary motivation to ensure a much broader application of this potential. In this regard, the recommendations in the report are directed both to the practicing scientist as well as to those administering assessment procedures.

The researcher has emphasized also that substantial improvements can be made in the contribution of science and technology to environmental assessment. It is recognized that analysis within impact assessments will always be limited by the knowledge base either already established or obtainable in the appropriate period, (Ojeshina 1998). Nonetheless, we have noted that much of the upgrading can be realized through effort at conceptualization, more effective study planning, and a common, realistic expectation of what can be accomplished through a focused, applied research programme. The case studies have substantiated these views. Technical limitations, whatever their form or magnitude, are universal and will continue to apply. Practitioners must be aware of these when planning study

programmes, as they bear directly on what can be achieved in the laboratory or broader scientific concepts to environmental assessment field. Despite these limitations, the forgoing analysis has identified some key opportunities where overcoming the non technical barriers can lead to upgrading of the scientific integrity of impact assessment. In conclusion the project have demonstrated the great improvements in the application of science and technology to environmental impact assessment are within the means of those who plan, undertake, and review assessment. As well they have shown that constraints posed by attitude and perception of the persons and organizations involved may be equally, if not more important than the technical and logistic limitation that may apply.

5.3 RECOMMENDATION

1. Adoption of the Requirements

Implementation of the Requirements for Organizing and Conducting Environmental Impact Studies if expected to occur mainly through assessment guidelines or terms of reference. However, successful application of the requirements will not occur unless they are endorsed by all the parties associated with the environmental assessment process, especially the review agencies, proponents, consultants, and professional organizations. The requirements must be widely accepted and must be seen to contribute to an improved scientific basis for impact assessment.

It is recommended that all groups involved in environmental impact assessment adopt the requirement for organizing and conducting environmental impact studies.

A. Agencies that administer impact assessment procedures should incorporate the requirements into their policy documents and into assessment guidelines which they issue. As well, technical advisors should request to take the requirements into account when reviewing assessment studies.

B. Project proponents should advise their environmental staff and consultants to adhere to ‘the requirements when planning and undertaking assessment studies.

C. Professional organizations and industrial associations should advocate the requirements as performance standards for their members involved in assessment studies and should encourage their use as a basis for further study and elaboration by the professional community.

D. Environmental consultants could use the requirements when preparing proposals to undertake assessment studies, and should adhere to them when designing and conducting such studies.

2. **Agency Advisory Committees**

Most successful nations in EIA benefited from the contributions of a scientific advisory committee composed of individuals from university, industry, government and the consulting community. The committee periodically reviews the results of the project and advised on future activities.

Agencies that administer assessment procedures often do not have the expertise needed to deal with scientific matters related to environmental assessment. The concept of a scientific advisory committee should be of interest to such agencies. The committee

could provide unbiased advice on numerous matters related to scientific practice in impact assessment, and other matters in general support of the assessment process.

It is recommended that agencies administering environmental impact assessment procedures in Nigeria each establish a small committee of experts to provide general advice on scientific matters related to environmental assessment.

A. The committee should review the policies and procedures under which the organization operates, and should advice on changes required to support a more scientific to assessment studies.
B. The committee should assist the agency in making priorities for impact assessment research needs. Such ranking could include soliciting the opinions of proponents, consultants and research scientists, reviewing major research programmes relevant to environmental assessment, and informing research agencies of the main areas of knowledge deficiencies.
C. The committee should encourage regular, non-adversarial meetings with representatives of the agency, proponents, consultants, research scientists and resource managers. Such meetings should address the current state of affairs in environmental assessment, should attempt to resolve outstanding issues, and should recommend changes in procedures and requirements to continually refine the process.

D. The committee should agenizing and other relevant organizations to co-operate in organizing and conducting impact assessment training activities including technical workshops and short courses.

E. The committee should advice the agency on initiatives to be taken in developing in depth studies on several major problem areas in impact assessment including socioeconomic aspects, the cumulative effects of several projects in one area, regional environment assessment, risk analysis, impact prediction and mitigation, and others. Such research efforts should involve broad based support and participation.

F. The committee should advise the agency on initiatives to promote information transfer and dissemination. Initiatives of particular utility to scientific practice within impact assessment include a central storage and retrieval system for all environmental assessment reports and documents prepared under the agency's procedures, and up-to-date annotated bibliography of relevant research, and case studies of impact assessments which may serve as model approaches for certain scientific aspects of environ mental assessment.

3. Monitoring as Part of the Assessment Process

In spite of the widely recognized importance of monitoring in environmental assessment, the assessment processes as administered in Nigeria generally are terminated in a formal sense after impact statements have been reviewed and project decisions are made, (Usman 2001). The requirements for Organizing and

Conducting Environmental Impact Studies include a requirement for the monitoring of project effects. While the successful implementation of this requirement (and the others) depends on its acceptance by the assessment community, it must also be acknowledged by fundamental changes in assessment procedures the following recommendation recognizes the special procedural attention needed to translate the concept of monitoring into application.

It is recommended that EIA Agencies undertake whatever procedural changes that are necessary to have monitoring recognized as a integral component of assessment process.

(a) Guidelines or terms should place emphasis on monitoring of effects as an integral part of design of impact studies.
(b) Environmental impact statements should provide as much rationale and technical detail for monitoring studies as for pre-project studies.
(c) Agencies should clearly establish for each environment impact assessment the responsibilities of government agencies and proponents for conducting and reviewing monitoring programmes.

4. Professional Involvement in Environmental Assessment:

There has been a widespread conviction within the scientific community in Nigeria that environmental assessment studies are largely pseudo-scientist and are to be avoided, (IPAC 2001). However, the scientific basis for impact assessment is improving, and the general adoption of the Requirements for Organizing and Conducting Ecological Impact Studies will see a substantial

upgrading of the scientific quality of assessment studies. As the practice of environmental assessment improves, the involvement of research scientists and natural resource experts should be fostered in every way possible.

It is recommended that organizations and institutions which employ research scientist and natural resources experts actively encourage their involvement in environmental impact assessment.

A. The organizations and institutions should stress the importance of cooperative research and study programmes as supportive activities for impact assessment.
B. The contributions of research scientists and experts to environmental assessment should be recognized in performance appraisals and career advancements.
C. Increased opportunities should be provided for employees to engage in short-term transfers of work or leaves of absence related to environmental impact assessment.

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APPENDIX I

QUESTIONNAIRE SAMPLE

SCHOOL OF MANAGEMENT TECHNOLOGY

DEPARTMENT OF PROJECT MANAGEMENT TECHNOLOGY,

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI IMO STATE

DEAR SIR/MADAM

A SCIENCE AND TECHNOLOGY FRAMEWORK FOR ENVIRONMENTAL IMPACT ASSESSMENT IN NIGERIA

I am a Project Management Student, the School of Project Management Technology, Federal University of Technology Owerri. I am carrying out a research on the above topic in partial fulfillment of the requirement for the award of Masters of Science (M.Sc.) degree.

I am sincerely soliciting your assistance in completing this questionnaire which will help me in collecting relevant information for the survey. All information supplied by you will be treated in absolute confidence as the work will be used for the purpose of academics.

Please answer the following questions according to the instructions provided. They are structured questions, closed (fixed) questions and response categorized.

Thanks and God bless

Yours faithfully

Ibe Raymond Obinna

08034096223

INSTRUCTIONS

A TYPICAL QUESTIONNAIRE WAS CONSTRUCTED FOR