

Environmental Impact Assessment (Eia) On Project Design: An Emperical Approach

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Abstract

The concept of EIA in Nigeria, after its introduction in 1992 via EIA Act No 82, has not really been given its place as a standard enforcement tool in the areas of project development; such that lobbying is better preferred by both project proponents and environmental regulating agencies. This makes it difficult for the emergence of environmental conscious or sensitive project designs. The research work, studied and exposed the nature, concept and composition of both project design and EIA, and as such anchored centrally on the level of impacts of EIA exercise on the design stage of a project. F-test (one way ANOVA) statistical tool were used to analyze the hypotheses at 0.05 level of significance; and in the presentation of the field survey data, simple percentage were employed while considering 89 respondents out of the sample size of 100. The phases in project design were analyzed as to the impacts of EIA exercise on their different processes. Also, four key effects of EIA exercise on project design were established, such as development of design alternatives, identification of risk(s) in the design, and design recap or modification. A relationship between the cost of EIA exercise and the cost of design was established, thereby revealing that the exercise cannot for any reason create a scenario which supports project delay, due to delay in the final design (detailed design). The research work dissuades the speculations that EIA exercise is an add-on exercise (inconsequential) for project design.

Key words: EIA, Project Design, Project appraisal, baseline information

1.0 Introduction

1.1 Background of Study

In recent years, there has been a remarkable growth of interest in environmental issues, and better management of development in harmony

with the environment. EIA as an important example has done a lot positively in the assessment of developmental project as it relates to the environment.

Project design/appraisal as a stage in the project life cycle has always been influenced by EIA, which can be seen in the detailed design of mitigation measures as an aftermath of the assessment. But rarely do project proponents consider this; thus they see EIA as an add-on exercise rather than a fundamental part of project design.

Environmental mitigation as a process in EIA often result in reduced project costs and lower community costs if incorporated as dire part of project design; though for all the positive aspect of EIA, it may also have significant discouraging impacts to the project design.

Remarkably, simple designs sometimes change into a bit complex one, after an environmental assessment. This certainly helps the project proponents in proper design modification and right direction of attention and energy.

Stain attention is paid to design as it regards the project life cycle, because the level of attention to environmental issues/problems during this stage is at its peak; as deduced from the conventional approach of running a project.

Here, the need to increase the level of environmental attention during early stage of a project, is paramount, so as to increase the solution space. A proactive approach during the design stage remains the main study of adoption, owing from the impact of integrating the cumulative EIA for such design.

EIA is much more than a regulating procedure; however, good EIA's have their findings integrated into the iterative process of planning and design, making it an important part of fitting a development proposal to its environment.

1.2 Statement of the Problem

In Nigeria, it is obvious that there has been purported improvement in the practice of Environmental Impact Assessment (EIA), as it regards proper and sustainable construction of developmental projects.

However, a thorough look at the process, indicate that the majority of project proponents prefer to lobby rather than carry out the exercise, and as such in most cases, do not incorporate/integrate the mitigation measures into the design stage of the project. Their argument is such that EIA exercise has no direct effect in the project design, and also that the exercise is costly and inconsequential, thereby leads to project delay.

Due to the environmental regulatory agencies' inability most times to carry out follow-up plan (EMP) on the activities of these projects when on-going; numerous project proponents do not anymore consider the results of the exercise from onset.

Finally, most project proponents do not like to consider alternatives, since they have made up their minds on the choice of a design, even though, EIA exercise may help them develop better alternatives. They see redesign and modification cost as not in the best interest of the overall project cost and the project itself.

1.3 Aims and Objectives

The aims and objectives of this project work seeing from the definitions above are to achieve the following:-

- Ascertain the stage/phase in the project design process where EIA exercise or mechanism affects or impacts on the design. To really know the phase in the project design where redesign or modification comes into effect due to EIA.
- Assess the level or magnitude of impacts/influence by EIA on the project design, and how the design process reacts to the demands of EIA as it relates to

mitigation measures and Environmental Management Plan.

- Assess the reactions of project proponents and designers as regards EIA exercise, and its effects on their set-out plans/design (if any). This seeks to know the feelings of the owners of a proposed project and the designers, considering the expectations placed on their project by EIA exercise. To ascertain whether they see the exercise as tasking and inconsequential, judging from the cost implications of redesign or modifications.

1.4 Research Questions

The following research questions have been formulated to guide the study.

- (1) At what stage or phase of project design is EIA exercise influential?
- (2) To what extent do EIA have direct impact/effect on project design?
- (3) How far does the effect of EIA exercise on project proponents or designers set-out Plans affect their reactions?

1.5 Research Hypotheses

- H₀: EIA exercise has no direct impact on the stages/phases of a project design
- H_A: The cost of EIA exercise cannot affect the cost of design

2.0 Literature Review

2.1 The Concept Of EIA

Gradually, the environment is constantly changing, both naturally and due to man's utilization of the resources of the environment. The main focus of EIA is on man-induced changes which result from man's interference with the environment. There is no universally accepted definition of the concept of environmental impact assessment, as there are many views on it. According to Munn as cited by [1], EIA is an activity designed to identify and predict on the impact on the

bio-geophysical environment on man's health/well being of legislative proposals, policies, programmes, projects and operational procedures and to interpret and communicate about the impacts. This depicts that EIA reflects a preventive approach to environmental management.

In 1987, United Nations Environment Program (UNEP) draft guidelines for assessing industrial environmental impact and criteria for industry siting, defined EIA as an aim to identify, predict and describe in an appropriate term the pros and cons (penalties and benefits) of a proposed development. The environmental impact assessment (EIA) according to them compares alternatives which could be used to realize a project and identifies one with the best combination of economic and environmental costs and benefits. [2].

The first form of assessment was first introduced in the US which was known as the National Environmental Policy Act (NEPA), of 1969, with the mandate of publishing an environmental impact statement (EIS), describing in detail the environmental impacts likely to arise from project developments. Since then, majority of countries have adopted similar procedure; with Nigeria's first ever promulgation on EIA known as EIA Act 86 of 1992.

2.1.1 Objectives of EIA Study

EIA is important for incorporating environmental concerns at the project level. It is conventionally carried out as early as the project planning stage (pre-feasibility/feasibility), thus ensuring that the project will be environmentally feasible.

Also, EIA mechanism is a decision making tool spanning a project development lifecycle. The general objectives of the EIA study according to Federal Ministry of Environment (FMENV) EIA Act of 1992 are to provide:

- (1) Baseline information about the environmental, biophysical, socio-economic and health conditions in the project area
- (2) Information and evaluation on potential significant positive and significant negative impacts of the project, and the characteristics of the impacts, magnitude, distribution, which will be the affected group, and their duration.
- (3) Information on potential mitigation measures, proffer cost-effective mitigation measures for the negative impacts, and where possible, enhance the positive impact that will further assure the environmental and social sustainability of the project.
- (4) To assess the best alternative project at most benefits and least costs in terms of financial, social and environmental. In addition to alternative location of the project, project design or project management may also be considered.
- (5) Appropriate and cost-effective Environmental Management Plan (EMP)
- (6) Incorporate the recommendations of the EIA process into the detailed project decisions.

From the above reasons, the need for project appraisers and environmental managers to appreciate the need for EIA becomes obvious, as EIA enhances the efficiency of decision making; it throws light on areas most susceptible to adverse impacts and therefore give guide in site selection, if only appreciated in the early part of project planning and design.

2.2 Project Design

The term project design falls into the various types and categories of design. Its methodology and practice lies under the general practice involved in design, and its process follows suit with the design process.

It is better known as the design stage of a project.

Project design according to [3] is the formalization, preferably set down in writing on paper of the whole project and how it is to be carried out, which requires gathering, synthesizing and analyzing of information with enough objectivity and detail to support a program decision that makes optimum use of resources to achieve desired results.

Most literatures have argued on the stage in the project life-cycle where project design comes into existence; some indicated the second stage, while others made mention of the third stage. According to [4], the design stage of a project which they take to be the detailed design comes into inception after the project conception, pre-feasibility and feasibility stages. But to various other literatures including [5], the trio of project conception, pre-feasibility and feasibility stages is merged as one term, known as the design stage of a project. This makes the design stage an indispensable stage in the whole process of a project.

2.2.1 The Design Process/Methodology

There is no single universally acclaimed sequence of steps that leads to workable design. Different writers or designers have outlined the designing process in as few as five (5) steps or as many as 25. According to [6], models of the design process are often drawn in this flow diagram form, with the development of the design proceeding from one stage to the next, but with feedback loops showing the iterative returns to earlier stages which are frequently necessary. Example is shown below

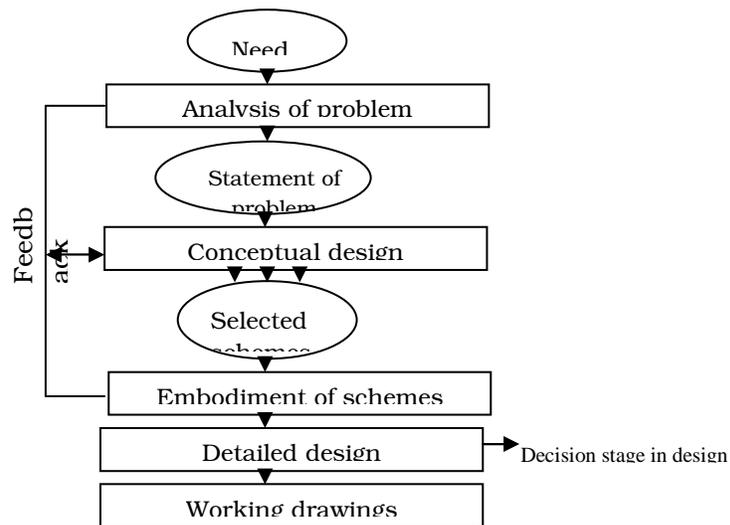


Fig. 2.1: French's Model (Adapted from [6])

The major focus for the research which is similar to every other model is based on three phases of a design process. Such as, the conceptual design phase, the embodiment/schematic design phase and the detailed design/design development phase.

3.0 Methodology and Data Collection

3.1 Population of The Study

The population referred to by the research is the totality of persons involved in the study. The population of this study is the totality of organizations or persons that have the capacity, ability and responsibility of either to carry out or conduct an EIA exercise and monitor its compliance or develop developmental design projects or the both. But for the purpose of ease and accessibility, the population has been delimited to organizations with the above characteristics, within Owerri, the capital of Imo State, (Nigeria) and as such, professionals in this research are of interest, such as civil engineers, architects, environmentalists and urban and regional/town planners.

3.2 Sample and Sampling Technique

For the purpose of this study, the researchers based on their desire to limit the population of study to organizations and professionals in Owerri Imo state, Nigeria; and also due to the fact that there are no accessible existing database to ascertain the total numbers of civil engineers, architects, town planners and environmentalist in Owerri, Imo state (Nigeria), choose a sample size of 100 persons whom would be contacted to bare their views and assertions as regards the project topic. This sample size is further divided into five (5), for the organizations. The organizations are State Ministry of Works, Housing and Transport Imo State, State Ministry of Petroleum and Environment Imo state, Owerri Capital Development Authority (OCDA) Imo state, Niger Delta Development Commission (NDDC), Owerri Area Office, Imo state and RHAS Construction Company Owerri, Imo State.

The sampling technique adopted in this work is that of the probabilistic sampling technique which gives every respondent equal opportunity to express opinion and ensures reliability of information obtained. In particular, the randomization sampling technique was utilized in obtaining

information from the sample by removing all elements of bias and favouritism for particular class or sections of people/professionals.

3.3 Instrument for Data Collection

The major instrument for data collection in this study is the questionnaire. It consists of two sections, A and B. section A is designed to give information on the personal details about the respondents, while section B contains 20 (twenty) items which focus on eliciting the various concepts, integration, and effect of environmental impact assessment (EIA) on project design, with importance and necessity of EIA for

stipulated projects. Out of the 20 items, five of them (items 1,2,3,4 and,5) elicited responses on project design phase where EIA exercise affects/ impacts on, while ten items (6,7,8,9,10,11,12,13,14,15) elicited responses on the level of magnitude of impacts by EIA on project design/mitigation measures. Another five of the items (items 16,17,18,19, and 20) elicited responses on project proponents/designers reactions on EIA's effect on their set-out plans.

The item on the questionnaire were responses on a five-point likert type scale of Strongly Agree (SA), No idea (N) Disagree (D) and Strongly Disagree (SD)

4.0 Data Presentation and Analysis

4.1 Number of Copies of Questionnaires Administered And Collected

Table 4.1 Showing Organizations Of Respondents

| Questionnaires Administered | | | Questionnaires Collected | |
|-----------------------------|----------------------|----------------|--------------------------|----------------|
| Organization | Number/ Frequency | Percentage (%) | Number/ Frequency | Percentage (%) |
| Min. of Works | 25 | 25% | 23 | 25.8 |
| Min of Pet. and Envnt. | 25 | 25% | 21 | 23.6 |
| NDDC | 15 | 15% | 12 | 13.5 |
| OCDA | 15 | 15% | 15 | 16.9 |
| RHAS | 20 | 20% | 18 | 20.2 |
| Total | 100 | 100% | 89 | 100 |

Table 4.2: Showing At The Average, The Size Of Project(S) Participated In By The Respondents

| Size of Project(s) (at the Average) | No of /Frequency | Percentage (%) |
|-------------------------------------|---------------------|----------------|
| Small-sized | 10 | 11.2 |
| Medium-sized | 33 | 37.1 |
| Large-sized/complex | 46 | 51.7 |
| Total | 89 | 100 |

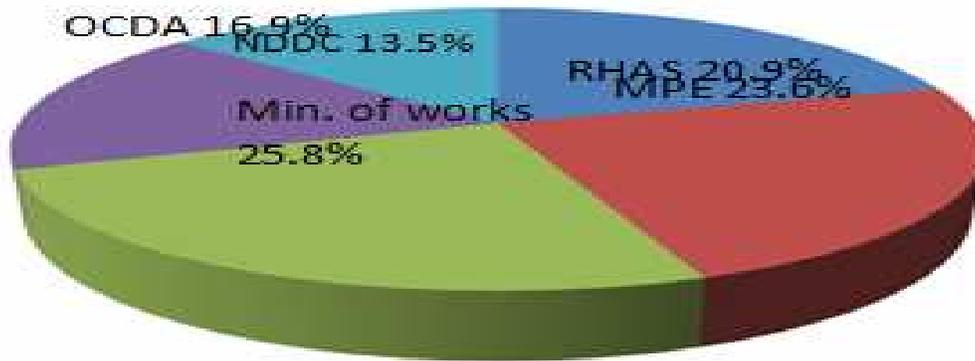


Fig. 4.1 Pie Chart for copies of questionnaire collected according to organisations

Table 4.2 reflects and shows that at the average, 11.2% (10) of the respondents have participated in small-sized projects, 37.1% (33) of them in medium-sized projects, while 51.7% (46) have participated in large-sized/complex projects.

4.2 Analysis and Presentation of Research Question

Data collected were sequentially presented and analyzed according to research question, and as such thus represented in the categorization of the questions in the questionnaire via the objective of study for this research.

4.2.1 Research Question One

At what stage or phase of project design is EIA exercise influential?

Table 4.3: Responses To Research Question One

NB: For the purpose of clarity, the responses are classified into: Strongly Agree, Agree, No idea, Disagree and Strongly Disagree as can be seen in the questionnaire, except for item 2 which was explained accordingly. Also lastly, after commenting on the responses, judgment were made based on grouping the responses into Agree (as a representation of both Agree and Disagree) and No idea on its own.

| Item No. | Questionnaire item | Responses | No. of Responses | Percentage (%) |
|----------|---|-------------------|------------------|----------------|
| 1. | Do you agree that EIA has direct impact/effect on the design stage /process of a project? | Strongly Agree | 69 | 77.5 |
| | | Agree | 20 | 22.5 |
| | | No Idea | 0 | 0 |
| | | Disagree | 0 | 0 |
| | | Strongly Disagree | 0 | 0 |
| | | Total | 89 | 100 |
| 2. | At what stage or phase of project design is EIA much influential? | A (conceptual) | 58 | 65.2 |
| | | B (schematic) | 8 | 9.0 |
| | | C (Detailed) | 18 | 20.2 |
| | | No Idea | 5 | 5.6 |
| | | Total | 89 | 100 |
| 3. | Do you agree that EIA exercise can affect the conceptual/preliminary design phase of a project? | Strongly Agree | 52 | 58.4 |
| | | Agree | 30 | 33.7 |
| | | No Idea | 7 | 7.9 |
| | | Disagree | 0 | 0 |
| | | Strongly Disagree | 0 | 0 |
| | | Total | 89 | 100 |
| 4. | Do you agree that EIA exercise can affect the embodiment/schematic design phase of a project? | Strongly Agree | 32 | 36.0 |
| | | Agree | 39 | 43.8 |
| | | No Idea | 10 | 11.2 |
| | | Disagree | 5 | 5.6 |
| | | Strongly Disagree | 3 | 3.4 |
| | | Total | 89 | 100 |
| 5. | Do you agree that EIA exercise can affect the detailed /development design phase of a project? | Strongly Agree | 29 | 32.6 |
| | | Agree | 50 | 56.2 |
| | | No Idea | 10 | 11.2 |
| | | Disagree | 0 | 0 |
| | | Strongly Disagree | 0 | 0 |
| | | Total | 89 | 100 |

Source: Field data

4.2.1.1 Explanation Of Result 1

From the table above, Item1 shows that in the areas considered, EIA exercise has direct impact/effect on the design stage of a project.

Item 2, reflects that EIA exercise is much influential at the conceptual/preliminary phase of a project design.

On item 3, This confirms that EIA exercise can affect conceptual/preliminary design phase of a project.

On item 4, in grouping the responses, 79.8% (71) of the respondents in general

agree to the item, as 11.2% (10) has no idea; while 9% (8) also in general disagreed to the item. This gives a picture that EIA exercise can affect the embodiment/schematic design phase.

On item 5, In grouping the responses, 88.8% (79) of the total respondents in general agreed to the item, as 11.2% (10) has no idea; while no respondent responded in disagreement. From the analysis, it is deductible that EIA exercise can affect the detailed design phase of a project.

4.2.2 Research Question Two

To what extent does EIA exercise has direct impact/effect on project design?

TABLE 4.4: Responses To Research Two

| Item No. | Questionnaire item | Responses | No. of Responses | Percentage (%) |
|----------|--|-------------------|------------------|----------------|
| 1. | Do you agree that the impact of EIA exercise on the design stage of a project has cumulative effect on other stages of a project life cycle (e.g. implementation, closure, e.t.c)? | Strongly Agree | 62 | 69.6 |
| | | Agree | 24 | 27.0 |
| | | No Idea | 3 | 3.4 |
| | | Disagree | 0 | 0 |
| | | Strongly Disagree | 0 | 0 |
| | | Total | 89 | 100 |
| 2. | Do you agree that EIA exercise can lead to design recap, redesign or modification for a project design? | Strongly Agree | 41 | 46.0 |
| | | Agree | 37 | 41.6 |
| | | No Idea | 8 | 9.0 |
| | | Disagree | 3 | 3.4 |
| | | Strongly Disagree | 0 | 0 |
| | | Total | 89 | 100 |
| 3. | Do you agree that every EIA exercise leads to design recap, redesign or modification for every development project? | Strongly Agree | 25 | 28.1 |
| | | Agree | 9 | 10.1 |
| | | No Idea | 8 | 9.0 |
| | | Disagree | 31 | 34.8 |
| | | Strongly Disagree | 16 | 18.0 |
| | | Total | 89 | 100 |
| 4. | Do you agree that EIA exercise can lead to cost-reduction in the design of a project? | Strongly Agree | 21 | 23.6 |
| | | Agree | 34 | 38.2 |
| | | No Idea | 4 | 4.5 |
| | | Disagree | 18 | 20.2 |
| | | Strongly Disagree | 12 | 13.5 |
| | | Total | 89 | 100 |
| 5. | Do you agree that the cost of design modification/redesign as a result of EIA exercise is worth the future benefit for the project at the long term? | Strongly Agree | 47 | 52.8 |
| | | Agree | 32 | 36.0 |
| | | No Idea | 10 | 11.2 |
| | | Disagree | 0 | 0 |
| | | Strongly Disagree | 0 | 0 |
| | | Total | 89 | 100 |
| 6. | Do you agree that EIA exercise can help in the development of better design alternative(s)? | Strongly Agree | 53 | 59.63 |
| | | Agree | 29 | 32.6 |
| | | No Idea | 2 | 2.2 |
| | | Disagree | 2 | 2.2 |
| | | Strongly Disagree | 3 | 3.7 |
| | | Total | 89 | 100 |
| 7. | Do you agree that EIA exercise can help identify risk(s) in the design stage of a project? | Strongly Agree | 35 | 39.3 |
| | | Agree | 32 | 36.0 |
| | | No Idea | 9 | 10.1 |

| | | | | |
|-----|---|-------------------|----|-------|
| | | Disagree | 7 | 7.9 |
| | | Strongly Disagree | 6 | 6.7 |
| | | Total | 89 | 100 |
| 8. | Do you agree that the cost of EIA exercise can affect the cost of design? | Strongly Agree | 44 | 49.4 |
| | | Agree | 38 | 42.7 |
| | | No Idea | 7 | 7.9 |
| | | Disagree | 0 | 0 |
| | | Strongly Disagree | 0 | 0 |
| | | Total | 89 | 100 |
| 9 | Do you agree that not all identified measures in the mitigation plan are meant to be incorporated in to the design? | Strongly Agree | 17 | 19.1 |
| | | Agree | 19 | 21.3 |
| | | No Idea | 9 | 2.2 |
| | | Disagree | 33 | 11.2 |
| | | Strongly Disagree | 11 | 12.4 |
| | | Total | 89 | 100 |
| 10. | Do you agree that EIA exercise can be a tool to enforce required standard into the design process? | Strongly Agree | 55 | 61.89 |
| | | Agree | 20 | 22.5 |
| | | No Idea | 2 | 2.2 |
| | | Disagree | 10 | 11.2 |
| | | Strongly Disagree | 2 | 2.2 |
| | | Total | 89 | 100 |

Source: Field Survey October, 2011.

4.2.2.1 Explanation of Results

On item 6, In grouping the responses, a high percentage 96.6% (86) of the respondents in general agreed to the item, 3.4% (3) had no idea, while also in general, no respondents agreed to the item. This shows that the impact of EIA exercise on the design stage of a project has cumulative effect on other stages.

On item 7, in grouping the responses, 87.6% (78) of the respondents in general agreed to the item, 9.0% (8) with no idea, while 3.4% (3) in general were in disagreement to the item. This depicts that EIA exercise can lead to design recap, redesign or modification for a project design.

On item 8, in grouping the responses, 38.2% (34) of the respondents in general agreed to the item, 9% (8) of them played neutral /has no idea, while 52.8% (47) of the respondents in general disagreed to the item.

Though somehow difficult for assertion, since the percentage for agree and disagree responses were a bit close but in conclusion, it is deductible that every EIA exercise does not lead to design recap, redesign or modification for every developmental project.

On item 9, 23.6% (21) of the respondents strongly agree that EIA exercise can lead to cost-reduction in the design of a project, 38.2% (34) agreed to the item. 4.5% (4) of the respondents played neutral/has no idea to/of the item, while disagree and strongly disagree responses has 20.2% (18) and 13.5% (12) respectively.

In grouping the responses, 61.8% (55) of the respondents in general agree to the item, 4.5% (4) of them has no idea of the item, while 33.7% (30) of the respondents disagreed to the item. This shows that EIA

exercise can lead to cost-reduction in the design of a project.

On item 10, in grouping the responses, a resounding percentage and number of responses 88.8% (79) respectively in general, agree to the item, 11.2% (10) of them played neutral/has no idea, while no respondent disagree to the item. From the analysis, it is obvious that the cost of design modification/redesign as a result of EIA exercise is worth the future benefit for the project at the long-run.

On item 11, in grouping the responses, an overwhelming percentage of 92.23% (82) was recorded in general for agreement to the item, 2.2% (2) has no idea to the item, while 5.57% (5) of the respondents disagreed to the item. From the analysis, it is deductible that EIA exercise can help in the development of better design alternatives.

On item 12, in grouping the responses, 75.3% (67) of the respondents in general agree to the item, 10.1% (9) of them has no idea, while 14.6% (13) of the respondents disagree to the item. This supports the item, which says that EIA exercise can help

identify risk(s) in the design stage of a project.

On item 13 in grouping the responses, an impressive percentage of 92.1% (8) of the respondents in general agree to the item, 7.9% (7) of them ticked the neutral /no idea box, while none of the respondents ticked neither disagree nor strongly disagree boxes for this item. From the analysis, it is deductible that the respondents in general supports that the cost of EIA exercise can affect the cost of design.

On item 14, in grouping the responses, 40.4% (36) of the respondents in general agree to the item, 10.1% (9) played neutral, while 49.5% (44) of the respondents disagree to the item. Although close, the analysis depicts that not all identified measures in the mitigation plan are meant to be incorporated into the design.

On item 15, in grouping the responses, 84.4% (75) of the respondents in general agree to the item, 2.2% (2) played neutral, while 13.4% (12) of the respondents disagree to the item. This shows that EIA exercise can be a tool to enforce required standard into the design process.

4.2.3 Research Question Three

To what degree is the project proponents'/designers' reactions on EIA's effect on their set-out plans

Table 4.4 Responses To Research Question Three

| Item No. | Questionnaire item | Responses | No. of Responses | Percentage (%) |
|----------|---|-------------------|------------------|----------------|
| 16. | Do you see EIA exercise as an add-on exercise (inconsequential) as it regards project design? | Strongly Agree | 0 | 0 |
| | | Agree | 2 | 2.2 |
| | | No Idea | 6 | 6.7 |
| | | Disagree | 32 | 36 |
| | | Strongly Disagree | 49 | 55.1 |
| | | Total | 89 | 100 |
| 17 | Do you agree that EIA exercise is a | Strongly Agree | 4 | 4.5 |

| | | | | |
|----|--|-------------------|----|-------|
| | drawback to developing a detailed design for a project, thereby leading to project delay? | Agree | 10 | 11.2 |
| | | No Idea | 3 | 3.4 |
| | | Disagree | 26 | 29.2 |
| | | Strongly Disagree | 46 | 51.7 |
| | | Total | 89 | 100 |
| 18 | Do you agree that lobbying in the bid to avoid EIA exercise is in the best interest of the design / planning stage of a developmental project? | Strongly Agree | 0 | 0 |
| | | Agree | 0 | 0 |
| | | No Idea | 9 | 10.1 |
| | | Disagree | 40 | 44.95 |
| | | Strongly Disagree | 40 | 44.95 |
| | | Total | 89 | 100 |
| 19 | Do you agree that EIA exercise brings about confusion amidst the design team, during the design review? | Strongly Agree | 1 | 1.1 |
| | | Agree | 4 | 4.5 |
| | | No Idea | 5 | 5.6 |
| | | Disagree | 50 | 56.2 |
| | | Strongly Disagree | 29 | 32.6 |
| | | Total | 89 | 100 |
| 20 | Do you agree that EIA exercise reveals the level of ignorance of the project design team as to the environmental considerations/demands to design? | Strongly Agree | 26 | 29.2 |
| | | Agree | 42 | 47.2 |
| | | No Idea | 9 | 10.1 |
| | | Disagree | 5 | 5.6 |
| | | Strongly Disagree | 7 | 7.9 |
| | | Total | 89 | 100 |

On item 16, in grouping the responses, 2.2% (2) of the respondents agree to the item, 6.7% (6) played neutral, while 91.1%

(81) of the respondents disagree to the item. This shows that EIA exercise is not an add-on exercise (inconsequential) as it regards project design.

On item 17, in grouping the responses, 15.7% (14) of the respondents in general agree to the item, 3.4% (3) played neutral, while 67.4% (60) of the respondents in general disagree to the item. This depicts that EIA exercise is not a drawback to developing a detailed design for a project, thereby leading to project delay.

On item 18, in grouping the responses, none of the respondents agree to the item,

10.1% (9) played neutral, while 89.9% (80) of them disagree to the item. From the analysis, it is deductible that lobbying in the bid to avoid EIA exercise is not in the best interest of design/planning stage of a developmental project.

On item 19, in grouping the responses, 5.6% (5) of the respondents in general agree to the item, 5.6% (5) has no idea, while 88.8% (79) of the respondents in general disagree to the item. This reflects that EIA exercise do not bring about confusion amidst the design team, during the design review.

On item 20, in grouping the responses, 76.4% (68) of the respondents in general agree to the item, 10.1% (9) played neutral, while 13.5% (12) of them in general, disagree to the item. From the analysis, it is deductible that EIA exercise reveals the

level of ignorance of the project design team as to the environmental considerations or demands to design.

4.3 Test of Hypotheses

In order to test the validity of the working hypotheses, the F-test (one-way ANOVA)

4.3.1 Restatement Of Hypothesis One

H₀: EIA exercise has no direct impact on the stages/phases of project design.

statistical test was employed. In testing hypothesis one, the researcher used questionnaire items 3,4 and 5, which represent the stages / phases in a project design

Table 4.5 Hypothesis One Result

| Replications/Questionnaire items | Responses | | | | |
|----------------------------------|----------------|----------------|----------------|----------------|----------------|
| | X ₁ | X ₂ | X ₃ | X ₄ | X ₅ |
| 3 | - | - | 7 | 30 | 52 |
| 4 | 3 | 5 | 10 | 39 | 32 |
| 5 | - | - | 10 | 50 | 29 |
| ∑X _i | 3 | 5 | 27 | 119 | 113 |
| ∑X _i ² | 9 | 25 | 249 | 4,921 | 4,569 |

Here, X₁ = Strongly Disagree, X₂ = Disagree, X₃ = Neutral/No Idea, X₄ = Agree, X₅ = Strongly Agree.

$$C.F = \frac{(\sum X)^2}{N} = \frac{(3+5+27+119+113)^2}{11} = \frac{267^2}{11}$$

$$= \frac{71,289}{11} = 6,480.8$$

$$SS_T = \sum_{i=1}^{i=n} X_i^2 - CF$$

$$\text{Where } = \sum_{i=1}^{i=n} X_i^2 = 9 + 25 + 249 + 4,921 + 4,569 = 9,773$$

$$SS_T = 9,773 - 6,480.8 = 3,292.2$$

$$SS_R = \frac{(\sum X_i)^2}{n} - C.F = \frac{3^2}{3} + \frac{5^2}{3} + \frac{27^2}{3} +$$

$$\frac{119^2}{3} + \frac{113^2}{3} - 6,480.8$$

$$SS_R = \frac{9+25+729+14,161+12,769}{3} - 6,480.8$$

$$SS_R = \frac{27,693}{3} - 6,480.8 = 9,231 - 6,480.8$$

$$= 2,750.2$$

$$SS_E = SS_T - SS_R = 3,292.2 - 2,750.2$$

$$= 542$$

$$\text{Response Mean Square (RMS)} = \frac{SS_R}{R.D.F}$$

where

$$SS_R = 2,750.2 \text{ and } R.D.F = (n-1) = 5-1 = 4$$

$$RMS = \frac{2,750.2}{4} = 687.55$$

Error mean Square (EMS) =

$$\frac{SS_E}{R.D.F}, SS_E = 542$$

$$E.D.F = (n_1 - 1) + (n_2-1) + (n_3-1) + (n_4-1) +$$

$$(n_5-1) = (1-1) + (1-1) + (3-1) + (3-1)+(3-1) = 6$$

$$EMS = \frac{542}{6} = 90.33$$

$$F_{cal} = \frac{RMS}{EMS} = \frac{687.55}{90.33} = 7.61$$

$F_{tab} =$ R.D.F against E.D.F

$F_{0.05} =$ 4 against 6 (at 0.05 level of significance)

$$F_{0.05} = 4.51$$

Decision

Since $F_{tab} < F_{cal}$, we reject null hypothesis and accept the alternative hypothesis H_A . Therefore, EIA exercise has direct impact on the stages/phases of a project design.

| Response | Mean |
|----------|--------------------|
| X_1 | 1.0 ^a |
| X_2 | 1.67 ^a |
| X_3 | 9.0 ^a |
| X_4 | 39.67 ^b |
| X_5 | 37.67 ^b |

From the table above, it shows that there is no significant difference between X_1 (SD), X_2 (D) and X_3 (N), while there is no significant difference between X_4 (A) and

4.3.2 Restatement of Hypothesis Two

H_0 : The cost of EIA exercise cannot affect the cost of design

Mean Separation

We separate the mean of each response using Fischer's Least Significant Difference (LSD)

Response

$$\begin{aligned} LSD &= t_{0.05}(E.D.F) \sqrt{\frac{2EMS}{r}} \\ &= t_{0.05}(6) \sqrt{\frac{2 \times 90.33}{3}} \\ &= 1.9432 \sqrt{\frac{180.66}{3}} \\ &= 1.9432 \sqrt{60.22} \\ &= 1.9432 \times 7.76 = 15.07 \end{aligned}$$

| | |
|---------|---|
| Group 1 | } |
| Group 2 | |

X_5 (SA), but there is significant difference between Group 1 (i.e. X_1, X_2 & X_3) and Group 2 (i.e. X_4 and X_5).

TABLE 4.6 Hypotheses Two Result

| Replications/questionnaire item | Response | | | | |
|---------------------------------|----------------|----------------|----------------|----------------|----------------|
| | X ₁ | X ₂ | X ₃ | X ₄ | X ₅ |
| 9 | 12 | 18 | 4 | 34 | 21 |
| 11 | 3 | 2 | 2 | 29 | 53 |
| 13 | - | - | 7 | 38 | 44 |
| ∑ X ₁ | 15 | 20 | 13 | 101 | 118 |
| ∑ X ₂ | 153 | 328 | 69 | 3,441 | 5,186 |

Here X₁ = Strongly Disagree, X₂ = Disagree,
X₃ = Neutral/No idea,
X₄ = Agree, X₅ = Strongly Agree

$$C.F = \left(\frac{\sum X_i}{N}\right)^2 = \frac{(15+20+13+101+118)^2}{13} = \frac{(267)^2}{13} = \frac{71,289}{13} = 5,483.8$$

$$SS_T = \sum_{i=1}^{i=n} X_i^2 - CF$$

$$\text{Where } \sum_{i=1}^{i=n} X_i^2 = 15^2 + 20^2 + 13^2 + 101^2 + 118^2 = 9,177$$

$$SS_T = 9,177 - 5,483.8 = 3,693.2$$

$$SS_R = \frac{(\sum x_i)^2}{n} - C.F = \frac{15^2}{3} + \frac{20^2}{3} + \frac{13^2}{3} + \frac{101^2}{3} + \frac{118^2}{3} -$$

$$SS_R = \frac{225 + 400 + 169 + 10,201 + 13,924}{3} = \frac{24,919}{3} - 5483.8 = 8,306.33 - 5483.8 = 2,822.5$$

$$SS_E = SS_T - SS_R = 3,693.2 - 2,822.5 = 870.7$$

$$\text{Response Mean Square (RMS)} = \frac{SS_R}{R.D.F}$$

Where $SS_R = 2,822.5$

$$R.D.F = (n - 1) = 5 - 1 = 4$$

$$\text{Error mean square (EMS)} = \frac{SS_E}{R.D.F}$$

Where $SS_E = 870.7$

$$R.D.F = (n_1 - 1) + (n_2 - 1) + (n_3 - 1) + (n_4 - 1) + (n_5 - 1)$$

$$(2 - 1) + (2 - 1) + (3 - 1) + (3 - 1) + (3 - 1) = 8$$

$$RMS = \frac{870.7}{8} = 108.8$$

$$F_{cal} = \frac{RMS}{EMS} = \frac{705.6}{108.8} = 6.49$$

$F_{cal} = R.D.F$ against $E.D.F$

$F_{0.05} = 4$ against 8

$F_{0.05} = 3.84$

Decision

Since $F_{tab} (3.84) < F_{cal} (6.49)$, we reject the null hypothesis and accept the alternative hypothesis H_A . Therefore we conclude that the cost of EIA exercise can affect the cost of design.

Mean Separation

We separate the mean of each response using Fischer's Least Significant Difference (LSD)

Response

$$\begin{aligned}
 LSD &= t_{0.05}(E.D.F) \sqrt{\frac{2Ems}{r}} \\
 &= t_{0.05}(8) \sqrt{\frac{2 \times 108.8}{3}} \\
 &= 1.8595 \sqrt{\frac{217.6}{3}} \\
 &= 1.8595 \sqrt{72.533} \\
 &= 1.8595 \times 8.52 = 15.84
 \end{aligned}$$

| Response | Mean | | |
|----------------|-------|---|---------|
| X ₁ | 5 | a | Group 1 |
| X ₂ | 6.67 | a | |
| X ₃ | 4.33 | a | |
| X ₄ | 33.67 | b | Group 2 |
| X ₅ | 39.33 | b | |

From the table above, as was mentioned earlier, it depicts that there is no significant difference between X₁ (SD), X₂ (D) and X₃ (N), while there is no significant difference between X₄(A) and X₅ (SA) but there is significant difference between Group 1 (i.e. X₁, X₂ & X₃) and Group 2 (i.e. X₄ & X₅).

4.4 Discussion Of Results/Findings

Based on the findings of this study, it was discovered that all the stages/phases of project design identified in this study were found to have strong relationship with the EIA exercise, and as such being impacted by the exercise, they include; conceptual or preliminary design phase, embodiment or schematic design phase and detailed design phase. Also between the phases of a project design; the conceptual or preliminary design

phase proves to be the major phase where EIA exercise is much influential, followed by the detailed design phase and lastly the schematic design phase.

The findings of the research proved that the impact of EIA exercise on the design stage of a project has cumulative effect on other stages of a project, such as implementation/construction etc.

The results of the research brought to lime-light the view that not every EIA exercise leads to design recap, redesign or modification for every developmental project, but can do for some projects as the case may be.

The findings also revealed that EIA exercise can lead to cost reduction in the design of a project and as such the cost of design modification/redesign as a result of the exercise is worth the future benefit for the project at long-run.

Furthermore, from the findings of the research, a high confidence is placed on EIA exercise as a tool that helps both in the development of better design alternatives and also in identifying risk(s) in the design stage of a project.

The research from its results, helps gives assertions that the cost of EIA exercise can affect the cost of design and also obviously that all identified measures in the mitigation are to be added/incorporated into the design.

The findings of the research, confirms that EIA exercise can be a tool to enforce required standard into the design process.

In the same vein, the literature reviews held that project proponents/designers see EIA exercise as an add-on exercise, as it regards project design, but it was observed that there was rather a general consensus against this postulation; and as such project proponents in the country, as from the study, see the exercise as a welcomed trend for the proper execution of developmental projects.

Findings further revealed that EIA exercise is not a drawback to the preparation

of a detailed design for projects, and as such cannot lead to project delay. On the part of the design team performance/knowledge, the findings of the research believes that EIA exercise helps reveal the level of ignorance of the project design as to the environmental considerations/demands to design.

Finally, the findings of the research do not support that lobbying in the bid to avoid EIA exercise is in the best interest of the design/planning stage of a developmental project.

Based on the findings of the study, on the ascertaining of whether EIA exercise has direct impact on the stages or phases of project design, hypothesis one was subjected to a hypothesis test using the F-Test (ANOVA) statistical analysis tool; and it was concluded that the exercise has direct impact on the stages or phase of project design.

Based on the findings on the second hypothesis, a conclusion was drawn which stated that the cost of EIA exercise can affect the cost of design.

5.0 Conclusion and Recommendation

6.1 Conclusion

This study revealed the direct impact effect of EIA on the design stage/ process of a project.

Thus, in view of this, the following conclusions were made;

(1) Lobbying in the bid to avoid EIA exercise is not in the best interest of the design/planning stage of a development project in the country.

(2) That EIA exercise has direct impact on the conceptual or preliminary, embodiment or schematic and detailed phases of a project design.

(3) That the impact of EIA on the design stage of a project, for sure, has cumulative effect on other stages of a project.

(4) That EIA exercise certainly is not a drawback to developing a detailed design for a project, and as such cannot lead to project delay.

(5) It has been ascertained that EIA exercise surely can lead to design recap, redesign or modification for a project design, but is not necessarily so for every development project. Also the exercise certainly can lead to cost reduction in the design of a project, and as such help identify risk(s) in the design stage of a project and in the development of better design alternative(s)

5.2 Recommendation

Based on the findings of the study, the following recommendations were made:

1. Project proponents/design team should not lobby to avoid EIA exercise, rather they should see it as an avenue to better their design, and as such identify possible risk (s) latent in the design/planning stage of their project.

2. To enhance effectiveness and efficiency in project development, government environmental agencies like FEPA, FMENV, ISEPA, NESREA, AGIS, Ministry of Works e.t.c. should organize seminars and workshops for project designers and other project stakeholders on the need for proactiveness in matters that pertains the environment.

3. In every step of the design review for a project design, a session should be conducted for just assessing the compliance to environmental demands, and as such an arm or a department of experts should be created like we have in value engineering consults, for the handling of the design environmental considerations in the design review. This will help reduce mistakes in design and heavy cost of modification/redesign beforehand.

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