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Assessing Environmental Impacts of newly created Earth Roads in Developing Countries: The case of Cameroon

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ABSTRACT
Newly created earth roads are fundamental facilitators for development in many developing countries. However, positive or negative environmental and human impacts accompany its construction. This study investigated the assessment of the possible environmental and human impacts of the 70 km Benakuma-Bawuro-Akwaya earth road construction project in Cameroon. The study employed qualitative and quantitative approaches. Data were collected using interviews, road observation and questionnaire. Result of the study reveals that inhabitants were not motivated from the destruction of their properties. Water pollution, the destruction of water sources, Soil and farms pollution/destruction and fauna and flora destruction were identified as major negative environmental impacts, while human damages were recorded mainly in the domains of housing and changing Socio-cultural and demographic features. The total cost of destruction accessed using the EIA was far more than the government estimation called "compensation cost". In conclusion, the implementation of Impacts Assessment prior to, during and after the construction of newly earth roads would encouraged a stronger participation of beneficiary communities to optimize positive pre and post construction benefits and minimize negative ones; while reducing possible pressure on evaluators and minimizing corruption avenues which can be very common in developing countries.
Key-words: Earth road construction, pollution, impact assessment

INTRODUCTION

Earth roads are fundamental facilitators of development in many developing countries. Africa have more than 2,982,247 km of road out of which only 18.9% is paved and the rest unpaved (earth roads) (Uwe and David, 2006, and Andy, 2014). In Cameroon out of the more than 53,261 paved and unpaved roads, just 5,182 km, less than 10% of paved road and the rest being earth road (classified and unclassified) (Andy, 2014,and MINTP, 2014). The paved and earth roads helps for transportation and communication. The earth roads helps to evacuate raw material, unfinished goods and to meet up with world food policy program which was part of the MDGs and also part of the SDGs planned for 2030.

Road construction projects are fundamental precursors of development yet they cause significant temporary and permanent impacts on the environment and human societies (Diduck and Sinclair, 2012). Conducting environmental impact assessment (EIA) can essentially reduce negative impacts, making earth road construction to be accomplished in environmentally friendly ways (Daigle, 2010). Effective implementations of such environmentally friendly earth road projects require the enactment and effective application of national and international EIA regulations and laws. This has been understood and is being implemented by governments in many developed countries (Dieudonné and Pierre, 2007).

However, in most developing countries, the absence of environmental impacts assessment experts as well as relevant regulations and laws makes the implementation of EIA recommendations and mitigation activities difficult (Rio De Janerio, Declaration 1992, World Heritage Convention, 1972). Often foreign consultants and firms with relevant expertise conduct the environmental impact assessments while the implementation of the project is carried out by local construction firms. This is problematic, as local firms who are often involved in earth; road construction may lack environmental impact assessment capacities necessary to minimize environmental damages

during implementation. In addition, most earth road constructing firms operate in contexts marred by high levels of bribery and corruption (James. 2011). Hence most road projects are often implemented with limited consideration and application of EIA strategies

It is a truism that an effective road transport system is a key catalyst for economic, social and regional development by integrating social well being, economic viability and environmental integrity (Harrington *et al*. 2010). However, if good EIA mitigative measures are not integrated in the road construction philosophy, then social and economic development is likely to be achieved by trading off the environment. It is crucial to consider EIA assessments in road projects, since its implementation has the potential to improve the total quality of life for many enclave territories in developing countries with minimal effects on existing natural resources.

The environmental and social issues of major concern in road infrastructure development and managing road use, include:- air pollution, biodiversity, cultural heritage, fire management, land use management, resource consumption, social equity, soil contamination, soil erosion and sediment management, drainage and storm water management, vegetation control and management, vehicle and traffic noise and water pollution. Admissible strategies should aim at integrating these important environmental issues into the planning and operational stages of developing road infrastructure and managing road use (Ralf *et al*. 2012). Very often however, these are not considered in road construction projects.

We revisit this issue by examining the case of a 70 km road construction project along the Benakuma-Bawuro-Akwaya road in Anglophone Cameroon. We analyses the damages done during the earth road construction to the environment and human settlement in line with the laws in force in Cameroon. This approach allows us to evaluate the challenges, and dichotomy that may exist between policy formulation and implementation within the context of road construction projects. The ultimate aim is to stimulate future interest on integrating the concept of EIA on road construction Projects.

Statement of the Problem

The Benakuma-Bawuru-Akwaya road has been exiting as a foot path for more than 60 years since the area (Akwaya) was created as an administrative zone in 1963 by the Cameroon Head of State. The inhabitants plus visitors used the foot-path and helicopter by some senior government Authorities and missionaries. The road has been abandoned for a long period and some individuals and communities have constructed houses and cultivated along the road track. The construction of the earth road on this road-path has highly affected the environments.
The global importance of Environmental impacts Assessment (EIAs) in projects that connect to the environment cannot be overemphasized. The problem is that their implementation is more frequent in developed than developing countries, where EIA capacities and interest on environmental issues is primordial. In spite of the goodwill of the Environmental impacts Assessment (EIA), the government of Cameroon, currently attracts little attention in the implementation of projects in road construction projects in particular.
This study, therefore, sought to evaluate the environmental impacts of road construction projects in Benakuma – Bawuro - Akwaya road.

The Purpose of the Study

The purpose of this study was to provide an overall assess of the effects caused to the inhabitants of the road project in Benakuma-Bawuro-Akwaya itinerary and propose to the powers concerned mitigative measures, to handle this situation. The study specifically sought to investigate the following objectives:

(i) Identify and critically assess the impacts of the construction works pre and post construction;

(ii) Establish the EIA cost and compare with the theoretical proposals found in pre-construction project.

The Significance of the Study

The study may provide important information for the Benakuma-Bawuro-Akwaya population, policy-makers, researchers and other stakeholders of Civil and Environmental Engineering. The findings from this study would

also add to the existing literature on Civil Engineering in relation to the environmental impacts in and beyond Cameroon.

LITERATURE REVIEW

A number of negative impacts have been attributed to road projects in general, and earth road construction in particular. These range for instance increasing noise from machines, water pollution, through habitat destruction/disturbance and local air quality to wider effects on climate change. The design, construction and management of roads, parking and other related facilities as well as the design and regulation of vehicles can change the impacts to varying degrees (Kathmantu, 2015). It is obvious that during any road construction serious care must be taken to overcome them.

In addition to the logging exploitation, roadkill affects the general ecology because animals are attracted to roads for a variety of reasons, often to their demise. Snakes and other ectoderms go there to bask, some birds use roadside gravel to aid their digestion of seeds, mammals go to eat de-icing salts, deer and other browsing herbivores are attracted to the dense vegetation of roadside edge, rodents proliferate in the artificial grasslands of road verges, and many large mammals find roads to be efficient travel ways. Songbirds come to dust bathe on dirt roads, where they are vulnerable to vehicles as well as predators. In fact the effects are so many, many species of animals simply refuse to cross barriers as wide as a road. For these species, a road effectively cuts the population into half. A network of roads fragments the population further. The remaining small populations are then vulnerable to all the problems associated with rarity (Daigle, 2010)

Road projects may fragment and isolate terrestrial habitats, genetic deterioration from inbreeding and random drift in gene frequencies, environmental catastrophes, fluctuations in habitat conditions, and demographic chance variation in age and sex ratios sometimes abound. Thus, roads contribute to what many conservation biologists consider the major threat to biological diversity and habitat fragmentation. Such fragmentation may be especially ominous in the face of rapid climate change. If organisms are prevented from migrating to track shifting climatic conditions, and cannot adapt quickly enough because of limited genetic variation, then extinction is inevitable (Settele *et al.* 2005).

The impacts of roads on terrestrial ecosystems include direct habitat loss; facilitated invasion of weeds, pests, and pathogens, many of which are exotic; and a variety of edge effects. Road construction also kills animals and plants directly, and may limit long-term site productivity of roadsides by exposing low nutrient sub soils, reducing soil water holding capacity, and compacting surface materials. It also makes slopes more vulnerable to landslides and erosion, which in turn remove additional terrestrial wildlife habitat and degrade aquatic habitats (Spangenberg, 2011).

Hydrological and aquatic habitats are often also affected by road projects. Road construction has been known to alter the hydrology of watersheds through changes in water quantity and quality, stream channel morphology, and ground water levels. Roads increase the amount of impervious surface in a watershed, resulting in substantial increases in peak runoff and storm discharges. That usually means flooding downstream. Reduced evapo-transpiration within roadways may also result in increased runoff and stream flows. However, increases in stream flows in forested watersheds are usually very significant, more of the forest cover is removed by road construction and associated activities such as logging, laterite pit and other material exploitation. When a road bed is raised above the surrounding land surface, as is normally the case, it will act as a dam and alter surface sheet flow patterns, restricting the amount of water reaching downstream areas or normal channel (Kakonge, 2006) found this to be a significant problem in the Big Cypress Everglades ecosystem of South Florida. Ditches dug for road drainage often drain adjacent wetlands as well.

According to Geneltti and Dawa, (2009), hydro-geological impacts are those most extensively treated. Soil and water impacts represent the direct effects, soil disturbance is considered the most important effect of road building and erosion its' most frequent consequence; so after road construction good mitigative measures must be put in place.

As mentioned before, road construction activities can cause many negative socioeconomic impacts. However, creating roads can provide many important social and economic opportunities, if planned to meet all user needs and desires; and if environmental damages are minimized (Daigle, 2010). Inadequately constructed forest roads can cause severe environmental impacts including road surface erosion and sediment yield pollution of off-site waters, slope failures and mass movement direct loss of habitat (by the conversion of the original land cover into an artificial surface) and indirect loss of habitat (by the fragmentation of an ecosystem into smaller and more isolated patches). Therefore, forest road managers should design forest roads by considering not only cost efficiency but also sustainable management of the forest environment. During the construction project of a forest road, the standard design must be carried out on the ground to achieve the desired road with minimal impact on environment. Sometimes the standard design cannot be useful for determining the clearing limit of forest roads. Large areas of forest are destroyed during road construction which does not only result in economic losses, but also changes the conditions of the environment. Forest road construction is a hazardous operation in mountainous terrain and can inflict scars on the landscape and also cause substantial damage to the forest ecosystem. One of the negative effects of road construction is the loss of forest area. The ecological balance in forests is adversely affected by rock fall and forest road construction works (Dieudonné and Pierre, 2007).

Understanding the environmental consequences of roads are becoming increasingly important in management decisions Implementing a number of policy measures during all three stages of the process (planning, construction and maintenance) can reduce the environmental impact of road building. In general, careful road selection, avoidance of unnecessary earth moving and construction of an effective drainage system yield the best results. Road-bank re-vegetation and regular road maintenance are also crucial to good environmental performance (Harrington *et al.* 2010).
Kathmamdu, (2015) work on British Columbia forest road which are used for forest, mineral, and energy development, commercial and public recreation, and in some cases for access to private land holdings. Effectiveness monitoring is also required to clarify whether measures to mitigate road impacts, such as passages for wildlife and some aquatic lives, are actually achieved (Kakonge, 2006).

MATERIAL AND METHOD

Description of study area

This research was carried out on the Benakuma-Baworu-Akwaya earth road construction project in the south west zone of the Anglophone Cameroon; located at Latitude 4^0 North of the Equator and Longitude 12^0 East of Greenwich meridian. The area has a lower middle-income population, boarded in the North by Wum central sub-division, South by Eyumujock Sub-Division, West by Ngie Sub-Division and East by Taraba State, Benue and Cross River State in Nigeria.

Research Design

The cross-sectional design was adopted for this study to enable the researchers to cover a large section of the target population. Bryman (2008,) defined a cross-sectional design as the collection of data on more than one case (usually a lot more than one) and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables (usually many more than two), which are then examined to detect patterns of associations. He further noted that a cross-sectional design has a number of advantages that make it a good design for research. The design affords researchers who are “interested in variations” to adopt it for that purpose. This was one of the reasons why a cross-sectional design was chosen for the present study.

Population of the study

The research respondents for this study were people that were affected in the construction of the earth road from the seven communities. Stratified random sampling technique was used to divide the affected area into seven zones (10km in length) label A, B, C, D, E, F and G. A total of 174 affected people formed the target population from these zones that comprises 30 from zone A, 21 zone B, 22 zone C, 20 zone D, 31 from zone E, 30 from zone F and 20 from zone G (Table 1) .

Sample and Sampling Techniques

Random sampling technique was used to select a sample size 163farmers from the strata as follows; 30 from zones A and E, 20 were selected from each of zones B, C, and G respectively; 15 from D and 28 from F. The people were those that are involved in destruction of properties during the construction of the Benakuma-Bawuro-Akwaya earth road construction project (feedback per zone in Table 1).

Table 1: General coding of questionnaire and Feedback per zone

s/n	Enumerator	Questionnaire Number	Number Administered per Zone	Distance covered	Feedback per Zone
1	A	001 – 035	30	Pk00+000 - Pk10+000	25
2	B	036 – 055	21	Pk10+000 – Pk20+000	11
3	C	056 – 078	22	Pk20+000 – Pk30+000	16
4	D	079- 104	20	Pk30+000 – Pk40+000	06
5	E	105 – 125	31	Pk40+000 – Pk50+000	28
6	F	126 – 145	30	Pk50+000 – Pk60+000	23
7	G	146- 174	20	Pk60+000 – Pk70+050	20
Total			**174**	**70.050 km**	**129**

Data Collection

The research instrument was evaluating the Environmental Impacts of Earth Road Construction Projects Questionnaire (EEIRCPQ) designed by the researchers. The questionnaire focused was on the following:- 1) Terrestrial 2) Agriculture or Farm destruction, 3) Air, Water and Soil pollution and 4) Demographics and Housing problems. Research assistants were recruited and trained by the principal investigator to collect data due to language barrier. The questionnaires were administered only to groups and people of age above 18 in which majority of them are already parents in the study area. Homes of correspondents were visited by the principal investigator or by the research assistant per day. All questionnaires were prepared from EIA baseline impacts. The questionnaires were administered to mostly famers, notables, chiefs, and government heads of services per zone of about a distance of 10km to reduce too much movement which could let to poor results due to fatigue.

Data Analysis

Data were organized according to the research objectives. Relevant themes were selected and coded. Holliday (2000) views themes as the basis upon which arguments and the data extracts are organized, providing headings for discussion and stages in the argument in data analysis. Item analysis was used in qualitative data. In quantitative data, tallies were converted into frequencies and to percentages. The spread sheets were used in plotting graphs showing variables according to the questionnaires. The hypothesis of this study was tested using chi-square (χ^2). This was to clarify the studied environmental policies applied before and after construction has no significant difference between the one, which is not study.

RESULTS AND INTERPRETATIONS

This particular project affected a land surface of 700,000 m^2 (0.7 km^2) with a respondents rate of 74.14%. The total area of terrestrial land destroyed was estimated at about five hundred thousand (500,000) square meter, which is 71.43% of the total road area affected for the project.

The results of the findings are discussed in relation to Figure 1 below.

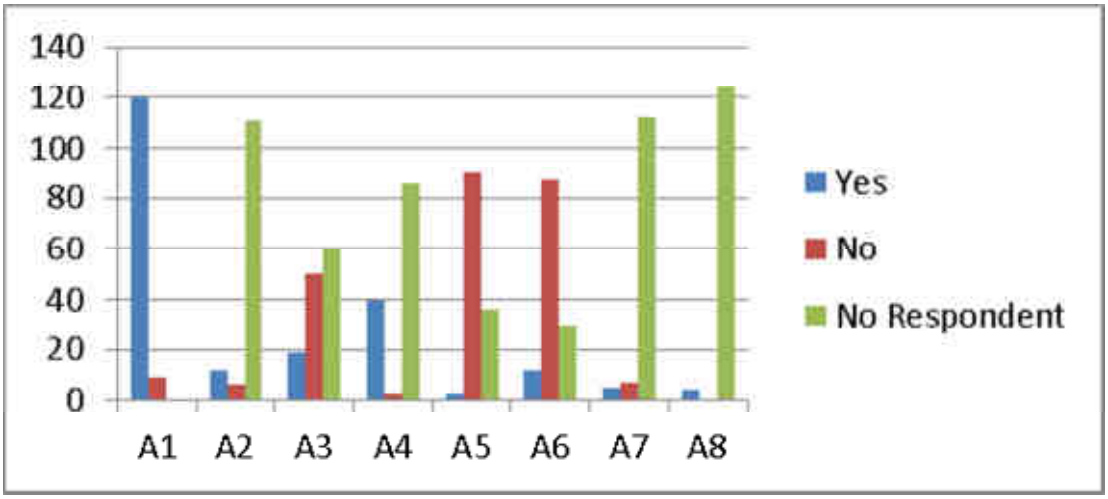

Figure 1: Terrestrial (fauna and flora**)**.

Figure 1 show the number of respondents assessed on the impacts of pre and post construction road work from Bunkum – Akwaya. Majority of the respondents in Figure 1 shows that 120 respondents responded with yes that forest or tree(s) were destroyed during the road constructed project whereas 9 responded with No; 12 respondent for yes and 6 for No while 111 respondents did not respondent for the option that they were special trees reserved for timber/medicine exploitation; 19 responded yes, 50 with No and 60 questionnaires had no respond when the respondents were asked the option to estimate the size of the forest; when the respondents were asked whether the wood cut was used for the road project or by the owner 40 responded yes, 3 No and 86 returned with no response. Figure 1 also revealed that there are 3 respondents with the yes response, 90 with no and 36 of the questionnaires had no response when they were asked that since the company left, have any tree fall to block the road whereas there are 12 responded yes 87 no and 36 questionnaires with no response when asked if they were hunter. The respondents were asked if after the road construction hunting was still possible, 5 responded yes 7 responded No and 112 questionnaires had no response whereas 4 responded yes and 125 questionnaires had no response when they were asked if the distance to see animals have increase after the construction of the road.

A number of respondents were examined on the area of agriculture or farm destruction during pre and post road construction and the responses from the questionnaires are represented in figure 2 below.

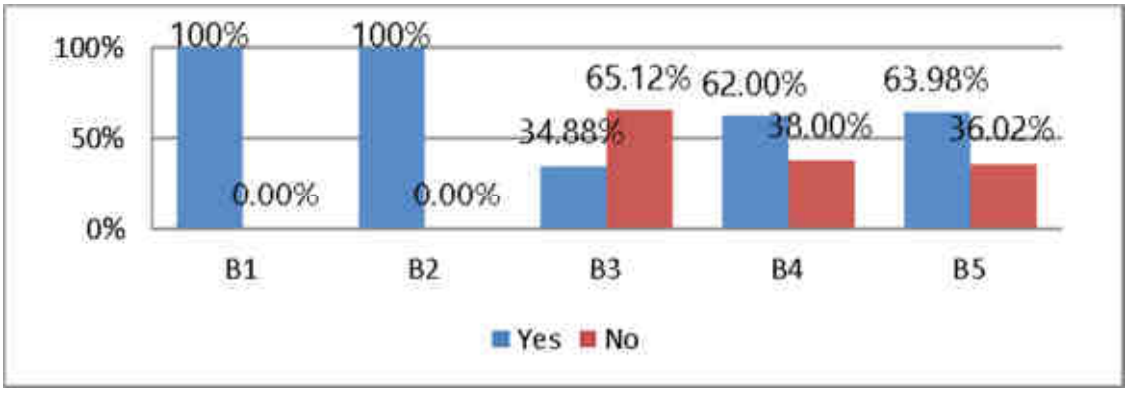

Figure 2: Magnitude of agricultural impacts above,

Results indicate that the respondents had a high number of yes responses on the fact that they were farm and locality/village area or point destroyed by the road project. The problem was found in most of the respondents (65.12%) responded yes and 34.88% responded No when asked who are the owner of the farm. It was also found that 62% are for part and 38% are for all when asked whether part or the entire farm was destroyed. The figure also shows that 63.98% are the respondents who responded yes whereas 36.02% responded No that the estimated size of the farm was estimated or given in (m2/ha) .

Figure 3 represent the response on whether the crops were harvested premature or abandoned.

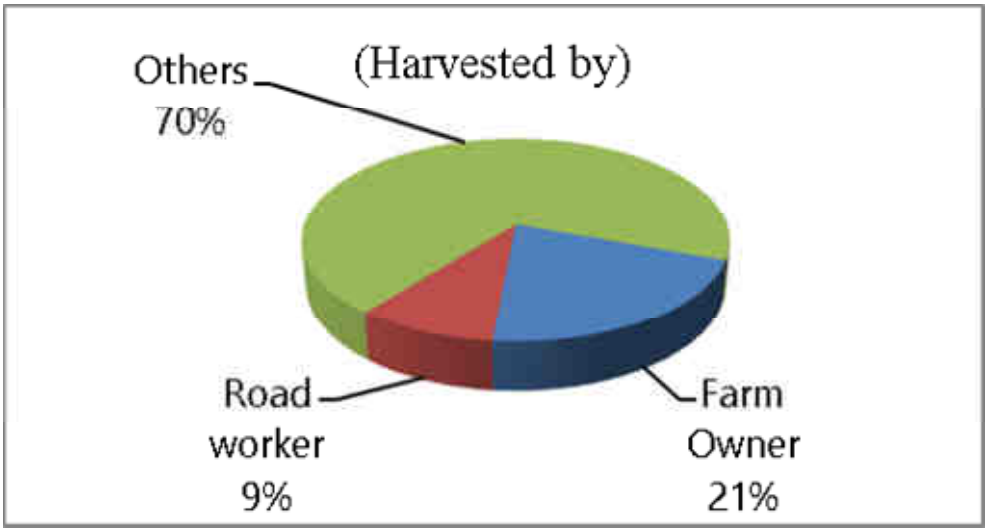

Figure 3: Nature of harvested crops,

The figure shows that 21% responded that the crops were harvested by the owners, 9% by the road workers and 70% by some other people.

A number of respondents were examined on the area of air pollution during pre and post road construction and the responses were represented in Figures 4a , 4b 4c and 4d below.

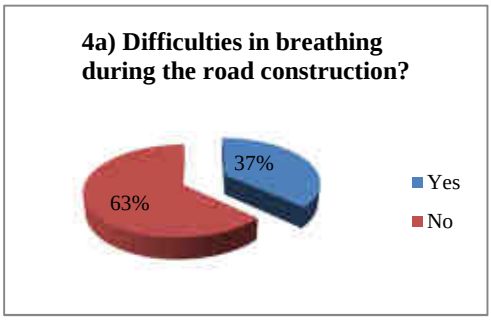

Figure 4a: Difficulties in breathing

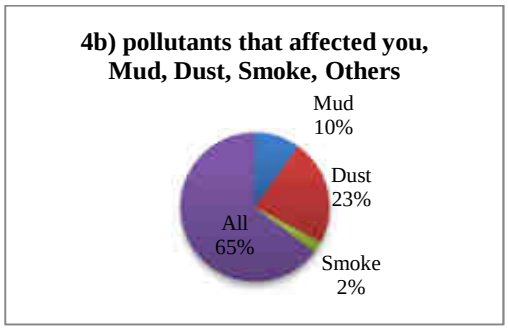

Figure 4b: Pollutants that affect

Majority of the respondents 63% responded yes that there were difficulties in breathing during the road construction period whereas 37% responded with the option No as shown in figure 4a. Also for the type(s) of pollutant that affected the inhabitants during the road construction figure 4b shows that most of the people suffered with all the pollutants, Mud, Dust, smoke and others while 23% with dust, 10% Mud and 2% suffered with smoke.

The duration period of each affected respondent varies from above one minute with 69% while 31% are for 5 minutes as shown in Figure 4c whereas Figure 3d shows that 65% of the inhabitant responded that the pollutant settled down at a particular position while 35% of the respondents were of the opinion that the pollutant moved to one direction.

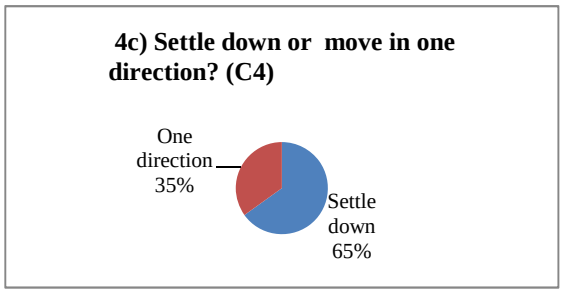

Figure 4c: Rate of direction of impacts

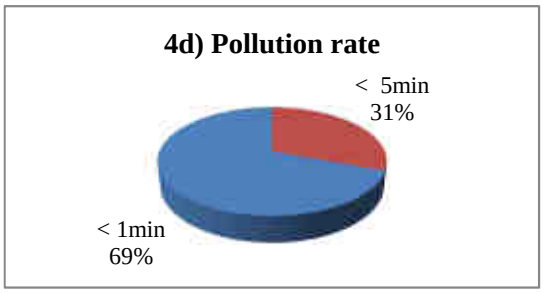

Figure 4d: Pollution rate,.

The analysis of water pollution during pre and post road construction and the responses were represented in Figure 5 below.

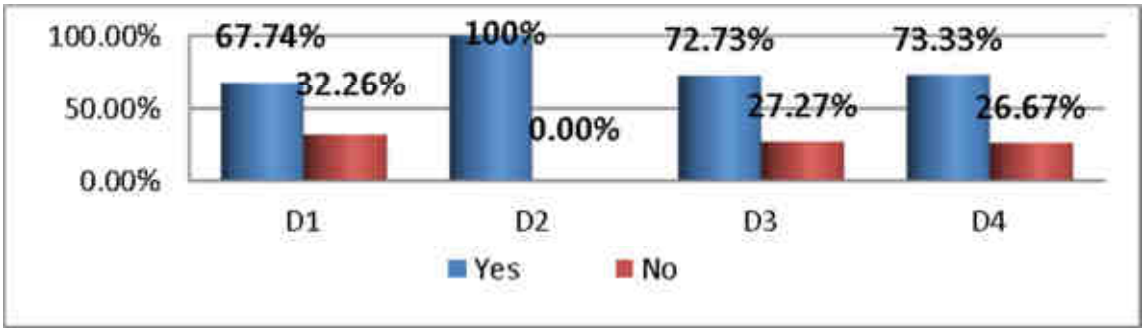

Figure 5: Magnitude of water impact

Figure 5 shows that majority of the respondents 67.7% were aware of water sources and their locality been destroyed while 32.26% were not aware, Also 72.73% of the inhabitants depend on these sources and 27.27% depend on other sources, 73.33% of them depends on fishes /tadpoles as a sources of protein . The sources of water for drinking by the inhabitants in these area are as indicated in figure 6 below.

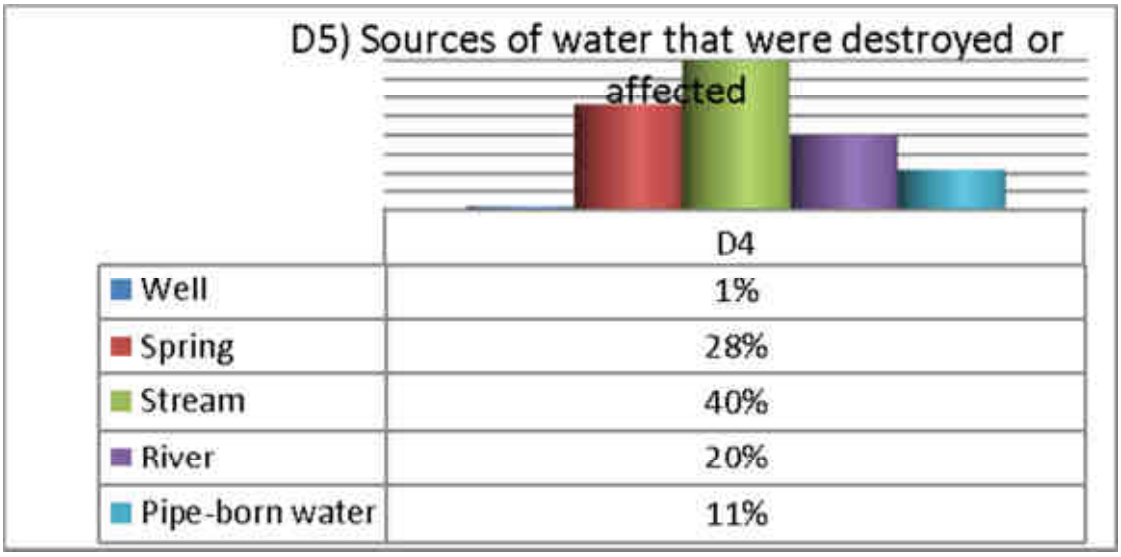

Figure 6: Water sources destroyed

Soil pollution was also examined to know whether some of the respondents were affecting during the construction of the road and the results are as in Figure 7 below.

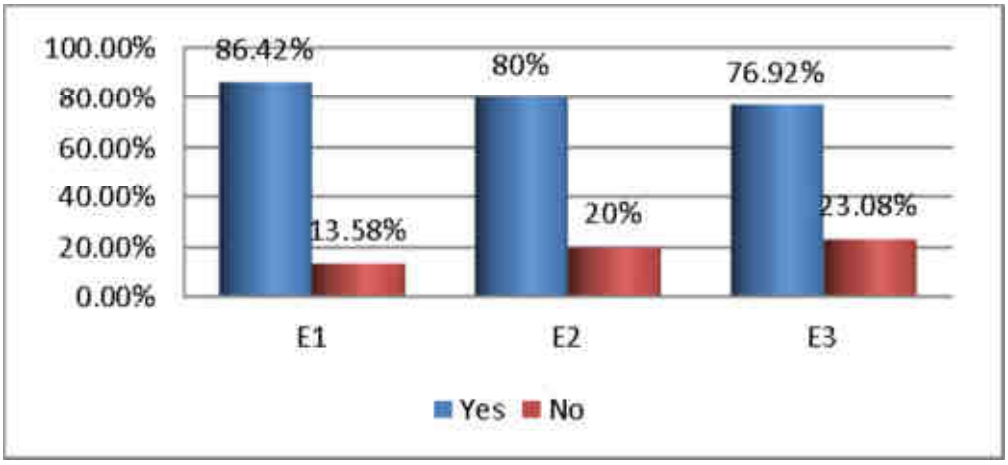

Figure 7: Magnitude of farm destruction impact

The figure above indicates that 86.4% of the respondents complained that soil was pushed into their farms and 80% of their crops were destroyed while 76.92% of the soil were abandoned in heaps.

The construction of the road also affected some of the inhabitants and the results of their responses are presented in figure 8 below;

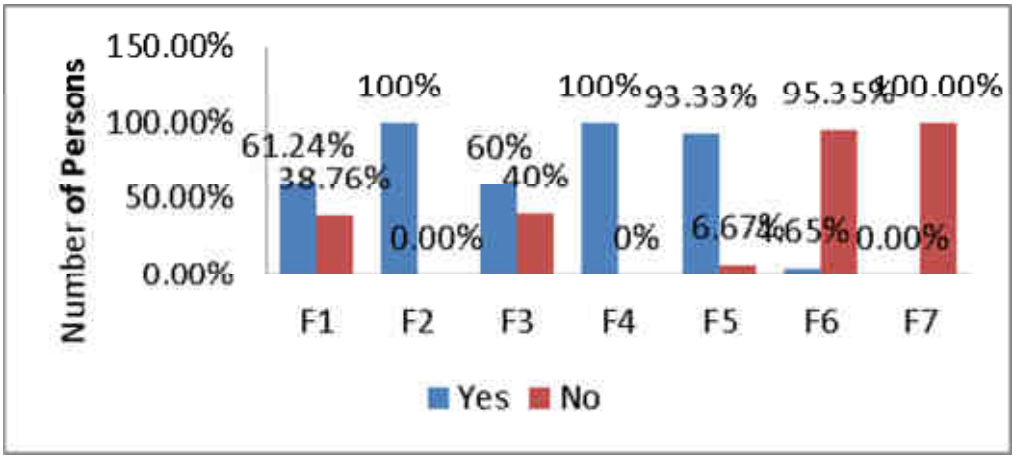

Figure 8: Magnitude of demographic and housing impact

It was revealed as shown from figure 6 that 61.24 % of houses/compounds were destroyed with all their localities known with 60% of them were newly constructed and 40% were old constructed structures. All the destroyed houses/compounds were occupied. The figure also shows that 93.33% of the displaced people are living with others while 6.67% are in their newly constructed hurts. 4.65% of the displaced persons were men while 95.35% were made up of women and children and none of the displaced families was compensated.

The EIA cost established before the road construction

The quantitative analysis was done in the following sections; Terrestrial estimates, Crops and farmland destruction and mix properties estimates. The evaluation of the properties using the EIA cost was to compare with the Government proposed estimated cost. The evaluation and estimation was done in unit (U), square metres (M^2), quantity, unit price and the total amount in FCFA. A list of the items evaluated with their estimates for terrestrial are as in table 2 below

Quantitative estimates of EIA and analysis

Table 2: Terrestrial estimates

s/n	Nature of impact	Unit	Quantity	Unit price FCFA	Amount FCFA
1	Iroko trees	U	25	75,000	1,675,000
2	Mahogany trees	U	44	75,000	3,300,000
3	Shaded trees	U	38	10,000	380,000
4	Forest land destroyed	m^2	1410	500	705,000
		m^2	930	200	186,000
5	Medicinal plants	U	4	7,500	30,000
Total cost					6,476,000
6	Labour	U	20.6% of total cost		1,334,056
Total(T1)			7,810,056 FCFA		

Source: Field work (22nd May 2011 to 10th July 2013).

The above table shows that mahogany trees was the highest terrestrial that was been destroyed at the cost of 75000FCFA per quantity given a total amount of 3,300000FCFA. This was followed by shaded trees with 33 quantities at 10,000FCFA given total amount of 380000FCFA, Iroko trees with 25 quantities at 75000FCFA per unit yielding a total amount of 1,675000FCFA and 4 Medicinal plants evaluated at 7,500FCFA per unit given an amount of 30,000FCFA. The Tale also shows that 1410 square metres of forest land was destroyed at 500FCFA per square metres given a total amount of 705000FCFA or 930 square metres at 200FCFA given a total of 186, 000 FCFA whereas labour was evaluated 20.6% of total cost given an amount of 1,224,056 FCFA. The total evaluation estimated for terrestrial items destroyed using the EIA was 7,810,056 FCFA.

Crops in the farmland destruction were also evaluated following the quantities of crops per square metre. The unit prices were obtained from the following sources:-

(i) Décret n°2014/3211/PM du 29 septembre 2014 fixant les prix minima applicables aux transactions sur les terrains relevant du domaine privé de l'Etat.

(ii) DECRET N° 2003/418 PM DU 25 FEV. 2003 fixant les tarifs des indenmités allouer au propriétaire victime de destniction pour cause d'utilité publicque de cultures et l'arbres cultivés.

The crops that were destroyed are estimated by using the number of quantities, unit price in FCFA and their total amount are as in Table 3 below.

The Table 4 shows a summary of the types of crops destroyed during the construction of the Bunkum – Akwaya road. From Table 5 it can be seen that agriculture had the highest destruction with an amount of 172,013,589 FCFA whereas air pollution occupies the least destructive position with 1,500,000FCFA.

Also, Table 4 revealed that the total cost for impacts without taxes (T3) was 286,085,615FCFA, 2,409,375,053FCFA was the total cost for project without taxes (T4), and 2,695,460,668FCFA would have been the overall total cost for the project (T3 and T4) without taxes.

The total cost allocated for project by the government as compensation for destructive properties was 25,000,000FCFA but the total cost of properties destroyed for the pre and post construction evaluated using the EIA scale was 286,085,615 FCFA. Comparing the EIA evaluation cost with of the government evaluation cost shows a different of 261,085,615 FCFA. This shows that the government evaluated cost called compensation cost is very far less than the EIA evaluation cost without taxes.

It was revealed as shown from figure eight that 61.24 % of houses/compounds were destroyed with all their localities known with 60% of them were newly constructed and 40% were old constructed structures. All the destroyed houses/compounds were occupied. The figure also shows that 93.33% of the displaced people are living with others while 6.67% are in their newly constructed hurts. 4.65% of the displaced persons were men while 95.35% were made up of women and children and none of the displaced families was compensated.

Table 3: Crops and farmland destruction,

s/n	Impact (Crop types)	unit	Quantity	Unit price (FCFA)	Amount (FCFA)
1	Maize	m^2	1325	200	265,000
2	Beans	m^2	150	200	30,000
3	Cocoyams	m^2	2505	300	751,000
4	Yams	m^2	210	300	63,000
5	Palms	u	430	10,000	4,300,000
6	Cassava	u	30350	300	9,105,000
7	Plantains/ Bananas	u	20	1520	2,280,000
8	Groundnuts	m^2	2200	200	440,000
9	General Vegetables	m^2	0	3000	0.00000
10	Egusi and Huckleberry	m^2	180	3000	540,000
11	Bush mangoes (Ogono)	u	439	50,000	21,950,000
12	Rice	m^2	4,800	250	1,200,000
13	Coco Bean	u	473	25,000	11,825,000
14	Coffee Bean	u	180	25,000	360,000
15	Coco-nuts	u	21	10,000	210,000
16	Oranges	u	435	35,000	15,225,000
17	Pineapple Farm	m^2	35	200	7,000
18	Peppers Farm	m^2	30	3000	90,000
19	Pawpaw	u	275	3000	825,000
20	Mix crops (Akwaya)	m^2	109,250	500	54,625,000
21	Mix crops (Benakuma)	m^2	69,250	200	13,850,000
22	Mangoes	u	88	35,000	3,080,000
23	Pear	u	31	35,000	1,085,000
24	Kola-nuts	u	2	50,000	100,000
25	Gavel	u	17	25,000	425,000
Total cost			142,631,500		
	Labour	20.6% of total cost			29,382,089
Total (T2)				172,013,589 FCFA	

Source: Field work (22nd May 2011 to 10th July 2013).

The table shows that the total estimation of the crops by using the EIA estimates stand as 172,013,589FCFA. An evaluation summary of the destroyed properties estimated is as in table 4.

Table 4: General Summary table including other mitigative planned measures estimates

s/n	Crop types	Unit	Quantity	Unit Price (FCFA)	Amount (FCFA)	Observation
1	Terrestrial or fauna and flora (T1)	U	1	Lump sum	7,810,056	For details see example of impact table 2 and 3.
2	Agriculture or farm destruction (T2)	U	1	Lump sum	172,013,589	
3	Air pollution	U	1	Lump sum	1,500,000	
4	Water pollution or destruction of water sources	U	1	Lump sum	44,500,000	
5	Soil pollution	U	1	Lump sum	9,511,970	
6	Demographics and housing problems	U	1	Lump sum	50,550,000	
	Total cost for impacts without taxes (T3)				286,085,615	
	Total cost for project without taxes (T4)				2,409,375,053	
	Normal total for the project (T3+T4) without taxes				2,695,460,668	

DISCUSSION AND CONCLUSION

Discussion

The study findings revealed that majority of trees were destroyed during the construction of the Bunkum – Akwaya in which many of the inhabitants did not know if some of them are for medicinal exportation. Many of the inhabitants are ignorant of the position of the animals since most of them did not practise hunting. The area of agriculture or farm destruction during pre and post road construction was examined and it was seen that only part of the farms measured in square meters/haters of the inhabitants with their localities known was destroyed and the total cost estimated.

There were difficulties in breathing during the road construction period and most of the people suffered with all the pollutants such as Mud, Dust and smoke. Occupied houses/compounds were destroyed with all their localities known most of them were women and children. Most of the water sources where the inhabitants used for drinking were destroyed. The displaced people are living with others and none of the displaced families was compensated since the money planned for the compensation mitigative aspect was too small and the government had no support to finance EIA impacts. The finding revealed that the government evaluated cost called "compensation cost" is very far less than the EIA evaluation cost without taxes this confirm the fact that developing countries do not have EIA expertise or the they pay less attention to EIA mitigative measures because of lack of funds. This implies there was a big risk in the construction of the road work from Bunkum – Akwaya. This is in conformity with a recent study by NRA, (2008) and National Environmental Laws and Decrees (Law No 96/12 of 5th August 1996 (Relating to Environmental Management law of Cameroon)) which state clearly that no work that induce harm be executed without conducting an Impact Assessment.

The study also revealed that hunting was becoming difficult due to the fact that the destruction of trees has opened the environment and force must of the animals to move further into a distance forest from road and homes, making hunting difficult because hunters has to move further into the forest in all directions. The destroyed trees could have been sold to the local population in the form of saw planks, recycled for manure and sold or given to local farmers as a form of mitigative compensation measures or transformed into wood ash to provide or be transformed into heat in any other form. In this way the local communities and the state will be gaining in sustainability.

The fact that destroyed road sides constitutes new ecosystems as a result of clearing, the reduction of soil adhesive due to the cut and fill of the embankment is resulting to general erosion and land sliding and the adjacent fauna and flora more vulnerable to the same conditions. The magnitudes of the impacts were high due to the fact that for most rural or new earth road construction, the road follows people and not the people following the road like in the case of road tarring or paved road.

The effects of air pollution is another very disturbing factor with respect to the following its magnitude, difficulties in breathing, types of pollutants like mud, dust, smoke and others (mix) pollution. Direction of movement of pollutants is a problem that only tree planting can easily reduced the effects, for now most roofs are covered all by dust especially flat roofs. The amount of dust that is raised when a vehicle pass is so high in such a way that one is tempted to ask the question as to what amount man inhale a day and so on. Many water sources were destroyed or deviated and this cause a lot of water pollution or destruction of water sources and directions with respect to localities and inhabitants directly affected of aquatic creature, well, spring, stream, river and pipe born water. The only sources left for inhabitants are big stream and the small rivers not too distance from their homes.

The evidence that there were local services and health problems like community services, health problems, worker's injury, current disease transmission and family issues, it is a very major problem that the state must look when executing earth road projects particularly in rural areas. Again, it shows that there is evidence of socio-cultural problems, due to family life, cultural belief systems affected, divorce caused by high income or company workers, community conflict at the level of both domestic animal and man for most natural (barrier made up of special small, small trees) fence , consumption of traditional foodstuffs, other multiple social

problems and their reasons, natural and traditional sacred forest, traditional temple, tomb, and shrine and there were also destroyed because of the nature of the terrain proofs very serious EIA problems.

The worst problem here is that none of the impact that merited compensation was done. The reasons been that the amount planned for both the opening of the road, construction of bridges and grading of the road was too small compared to the field realities. The question is how can a rural area of more than 70 km of road been executed without any EIA plan at this modern time.

Conclusion

From the discussion and interpretation of results, we have seen that it is very important to carry out an EIA for all projects no matter the magnitude, size and the urgency of the project. This is because population and economic pressures will continue to generate increase demand for transportation networks. Since satisfying completely local interests is never easy, and doing so within a short time frame is even difficult, EIS reports will undoubtedly continue to generate controversy.

Man is both creature and moulder of his own environment, in so doing transform and affects his environment in countless ways and in an unprecedented scale, so the protection and improvement of the human environment is a major issue which affects the well-being of peoples and economic development throughout the world, calls for a holistic EIA studies and implementation.

An environment that is not studied and policies applied before, during and after construction will have a significant difference between that which is studied and the policies applied before, during and after constructions.

Recommendations

To achieve a good EIA goal, the researchers provide the following recommendations should be taken into consideration:-

1- There is the high need of EIA studies for all major and earth road projects. For if, the road survey was done and the inhabitants or public consulted or informed most these damages would not have taken place.

2- To highly reduce cost mitigating measures policy. EIA policy should be applied at the start of any project, so as to avoid or reduce the magnitude of the impacts, Instead of damaging and compensating with difficulties if even possible. This was because the public was not informed and croups were planted as usual all over the areas.

3- Due to the difficulties the researchers encounter, the researchers highly recommend the preparation of a holistic EIA model including economic, local services and socio-cultural aspects to resolve conflicts for pre and post earth road construction.

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