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Analysis of Environment Impact Factors That Constrain Successful Delivery of Rural Road Construction Projects

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Abstract
This study identifies and examines various Environmental Impact (EI) factors that mitigate against the successful delivery of Rural Road Construction Project (RRCP) in the South Eastern region of Nigeria. The policy thrust of development of rural areas has been threatened as these factors negate the articulated policy objectives of government with respect to RRCP. The survey technique was employed with area and judgmental sampling procedures. The primary data used in the study was captured from the opinion of environmental experts, using questionnaire method and measured with the instrument of questionnaire modeled in likert five point scales. The method of factor analysis was used as the analytical tool for the data obtained in the course of the study. The result of the factor analysis generated five principal components for EI factors which may be likened to five steps of constraints or stresses on the environment. The result of the analysis also indicates that the most critical constraining EI factors in the first priority group and their significant ranking are land and soil characteristics; water ways, river system and flood; rugged geographical terrain and road accessibility; and amount and frequency of annual rainfall. Recommendation were made for forecasting and integration of seasonal variation of weather conditions in scheduling the project completion dates, fast tracking the implementation phase during the dry seasons and contingency mitigation measures to address adverse significant EI on RRCP as they occur.
Keywords: Environmental impacts, factor analysis, mitigation measures, rural development

INTRDOUCTION:

Concerted efforts are being directed to the development of rural areas in Nigeria in order to address some of the socioeconomic problems such as rural-urban migration, unemployment, poor road network and social vices. Rural areas have been neglected for a long time until recently. The developmental efforts are being challenged as a result of severe stresses on the environment. Chandra (2006) posits that Environmentalists have identified four types of different stresses or pressures that are being continuously inflicted on the environment. It has been argued in some quarters that these stresses are more severe on Rural Road Construction project (RRCP) than highway and urban roads construction projects because of lack of town planning and drainage system. The environmental stresses and pressures are classified as follow:

i. Eutrophic stress: Refers to the release of various kinds of waste into the river and other water bodies and their consequent drying.
ii. Exploitative stress: Refers to the exploitation of natural resources endowment for production and consumption purposes through agriculture, industry, extraction, fishing etc.
iii. Disruptive stress: Refers to the physical alteration in nature, resulting from such activities like forest clearance, highways, railways, factory buildings etc. These physical changes disturb the environmental and ecological balance.
iv. Chemical and industrial stress: These result mainly from the development in science and technology and their applied fields like industry, warfare and agriculture. These comprise mainly the pollutants and effluents of all types, radiation, etc.

These stresses or pressures which could be attribution to Environmental Impact (EI) factors severely inflict on the environmental components of RRCP. The categories of environmental components include; physical environment- soil and geological, human beings, landscape, cultural heritage; socio-economic activities, environment and housing, economic benefits (direct and indirect), local services, demography and socio-cultural lifestyle. Legislation through regulatory bodies usually advocate for Environmental Impact Assessment (EIA) to address the menace of these stresses and pressures which are inflicted on the component of the environment through these EI factors. Road construction and other projects suffer much of these stresses especially during the rainy season, and therefore necessitate the institution of EIA prior to project implementation. EIA is a policy and management tool for both planning and decision making. EIA assists to identify, predict and evaluate the foreseeable environmental consequences for proposed developmental projects, plan and policies. EI factors on the other hand, are causing most of the devastating environmental impact on the on-going and completed RRCP. Though the devastating and constraining effects on the on-going RRCP cannot be ruled out, there is an opinion of thought which holds that EIA should usually examine or look into the possible negative consequences of a

project on the environment. Any positive issues emerging from the development actions are taken as stated by the project proponent or the developer. However, EIA is not restricted or biased to the examination and mitigation of negative impacts alone, but also looks into the possible positive issues due to the developmental projects and explore or suggest ways of enhancing them further by carrying out mitigation actions on the projects.

Though, many on-going and completed RRCP are naturally prone to ravaging environmental degradation and devastations, EI factors aggravated the impacts to an alarming proportion. The study considers both the completed and on-going RRCP, which link to urban areas, rural schools, health centres, small scale industries, agricultural development centres etc. The Southern States of Nigeria are prone to environmental degradation as a result of EI factors. EIA could serve as a necessary tool which could be used, together with the project feasibility study to predict and ensure that the project plans optimally address the problems of economic-cum-environmental impacts on the RRCP. The plan should be environmentally compatible as well as economically sound and thus represents the best approach to planning for developmental projects so that continuing economic development will be sustained. It could be on this premise that Glasson, et al, (1999) observe that "planners have traditionally assessed the impact of construction on the environmental, but invariably not in the systematic, holistic, multi-disciplinary way required by EIA. Naturally, EI factors constrain the RRCP and other developmental projects in the rural areas.

The need to avert adverse environmental consequences of human activities or even natural process has brought the issue of EIA to the fore. The inevitability of EIA is further strengthened by the fact that most construction projects do have significant deteriorating consequences on the environment, because of their direct intervention into the environment, but EI factors naturally constrain the realization of construction projects delivery. It has been predicted that South East States of Nigeria will record the heaviest and the highest number of rainfall in the year 2012, which could result to ravaging environmental degradation with multiplier effects on RRCP which could be attributed to EI factors. The consequences to a large extent could promote or ruin the objective of RRCP, irrespective of the amount of capital sunk in the projects. EI factors have therefore become an important constraints and responsibility of project management and therefore, must be an integral part of project formulation and appraisal. These should be an afterthought so as to create a conducive environment for successful delivery of RRCP. Since EIA is a critical appraisal of the possible consequences of any developmental project, the effects of the environmental impact factors should not be undermined, as they naturally constrain the successful delivery of RRCP.

The South Eastern States of Nigeria have recorded unprecedented environmental degradation in the recent years. For instance, many rural roads being developed by the Imo State governor in line with his government rescue mission agenda are being washed away by ravaging flood and other EI factors. The noble objectives of massive development of rural roads are being challenged by innumerable environmental impact factors, and therefore the need to identify and examine the critical factors for institution of mitigation and remedial actions. Development of rural roads and infrastructural facilities are sine qua non for rapid socioeconomic growth. Good motorable roads in the rural areas result to lower time spent in moving output resources from one point to another, and for social and economic activities. However, RRCP are usually characterized by cost and time overruns due to challenges and constraints posed by EI factors which; are unpredicted, not properly addressed, lacks effective remedial actions and contingency plan for their mitigations. The EIA are either poorly conducted or in many cases neglected as many completed and on-going RRCP are devastated by EI factors and threatened by rapid environmentally induced degradation of the aesthetic features and roads. Movement of construction materials such as sand, stone, chippings and steel from source to the RRCP sites are difficult and sometime impossible because of devastation of rural roads by EI factors. It could be due to the reasons that EI factors are not properly identified and their level of probable impacts on the environment are not meticulously predicted and determined with certainty prior to implementation of RRCP. Also, the Environmental Impact Statement (EIS) with the EIA results are not reliable as they are characterized by skeptism and doubt due to care-free perusal of the reports by the regulatory body.

These have resulted to project failure and financial loss, loss of land use/resources, vegetation damage resulting in habitat fragmentation and loss of biodiversity. The environmental disturbances emanating from these EI factors during implementation stage of RRCP impact negatively on the performance objectives of on going projects, public health and safety of the rural dwellers living in the immediate vicinity of the projects. Many researchers have delved in the study of EIA of developmental action or projects, without recourse to the constraints and stress on the on-going and completed projects due to EI factors, hence research gap exists. The central objective of the study is therefore to examine the effects of EI factors on the RRCP in South Eastern State Nigeria with Imo State as a study background The specific objectives are to:

- Identify and explore the critical EI factors so as to be able to examine and predict the level of significance of impacts and proffer feasible mitigation measures prior to implementation of RRCP.
- Classify and collapse the identified EI factors constraining the RRCP into priority groups for logical assessment and qualitative reasoning so as to provide basis for mitigation measures.
- To assess the overall effects of EI factors on RRCP and make recommendation based on the findings in

order to assist decision makers and regulatory agencies in prevention and mitigation of the significant adverse EI on the RRCP.

REVIEW OF RELATED LITERATURE

It could be note worthy that "development projects do impact positively and negatively on man's bio-physical and socio-economic environment". Similarly stresses and pressures can be naturally inflicted on the RRCP and the environment by EI factors. EIA is a flexible procedure, which can vary in breadth, depth, and type of analysis, depending on the project. It can be carried out at one point in time, stretched over a year to account for seasonal variations, or done in discrete stages. Thus EIA, which results are usually influenced by EI factors is a systematic identification and evaluation of the effects of projects plans, programs or legislative actions relative to the physical, chemical, biological, cultural, and socio-economic components of the total environment. EI factors adversely impact on completed or on-going RRCP, though it could be attributed to poorly conducted and lack of comprehensive EIA of the affected projects. The World Bank Group (2007) states that EIA identifies ways of improving projects environmentally, and minimizing, mitigating or compensating for adverse impacts, by alerting project designers, implementing agencies and project sponsors to issues early. EIA also; enables them to address environmental issues in a timely and practical fashion, reduces the need for project conditionality because appropriate steps can be taken in advance or incorporated into project design, and help avoid cost and delays in implementation due to unanticipated environmental problems.

Projects until recently were often formulated, designed, and assessed based on technical, economical and political criteria, and the potential environmental, health and social impacts of projects were rarely considered in a rigorous manner. Even when considered, such assessment usually takes the form of Cost Benefit Analysis (CBA), which crudely attempts to place a monetary value upon non economic variables such as the destruction of marine ecosystems, the socioeconomic and health impacts, and air pollution as typical cases. As a consequence of such restricted assessment, many developments have resulted in unforeseen harmful impacts, which reduced predicted benefits. However, in recent years, there has been a remarkable growth in environmental issues in sustainability and better management of projects in harmony with the environment. Associated with this growth of interest has been the introduction of new legislations that seek to influence the relationship between development (construction projects) and environment. In Nigeria, such legislation was cited by Federal Environmental Protection Agency (1992) as "Environmental Impact Assessment, Decree 86, 1995 of Nigeria", which specified the procedural guidelines for conducting environmental impact assessment. It also listed the projects that required Environmental Impact Assessment.

EIA is a process with several important purposes. It is an aid to decision making. For decision-making purpose, for example, in a local authority, it provides a systematic examination of the environmental implications of a proposed action and sometimes alternatives, before a decision is taken. One of the important purposes of an EIA is "to determine the potential environmental, impact factors, and their social and health effects of a proposed development. It attempts to define and assess the physical, biological and socio-economical effects in a form that permits a logical and rational decision to be made. Attempts can be made to reduce potential adverse effects through the identification of possible alternative sites and/or processes. The World Bank (1989) notes that EIA.

i. Enables them to address environmental issues in a timely and practical fashion,
ii. Reduces the need for project conditionality because appropriate steps can be taken in advance or incorporated into project design and
iii. Help avoid costs and delays in project implementation due to unanticipated environmental problems.

As an aid to the formulation of construction or developmental projects, many developers no doubt see EIA as another set of hurdle to jump before they can proceed with their various activities. The process can be seen as yet another costly and time consuming exercise.

Evaluation of EI factors and tackling their constraints head on would provide preventive measures and contingency plans for mitigation, because environmental impacts are usually proceeded by different types of mitigation measures. According to Glasson, et al, (1998), mitigations is defined as "measures envisaged in order to avoid, reduce and, if possible remedy significant adverse effects" of EI. Where significant adverse effects are identified, the measures to be take to avoid, reduce or remedy those effects, could be;

(a) Site planning
(b) Technical measures, e.g: process selection, recycling, pollution control and treatment, containment e.g. building a storage, reservoir, pit or valley.
(c) Aesthetic and ecological measure e.g: mounding, design, colour etc, landscaping, tree planting, measures to preserve particular habit or to create alternative habits, recording of archaeological sites, measure to safeguard historical buildings or sites.

METHODOLOGY

Survey technique of research design was used. Judgmental sampling, a non-probability technique was

adopted because of difficulty in estimating the probability of selecting any element of the study population in the sample. The choice of Imo State of Nigeria was made purely on judgmental sampling and also because of high concentration RRCP going on in the state coupled with the availability of relevant information for the successful execution of the research. The study focused on the constraints imposed by EI factors on the activities of RRCP in the three zones of Imo State representing South East geopolitical zone of Nigeria. The data obtained from the field survey were presented, and analysed with factor analysis model. The results generated from the analyses were discussed with deductions and inferences. The data generated were based on the subjective assessment of experts opinion in the areas of EIA, due to the fact that EI factors constrain RRCP. Since EIA has become a pre-requisite for the execution of major rural development road construction projects, there is need to explore the causative EI factors so as address the subject matter. In Nigeria, it is mandatory and with government directives to carry-out EIA prior to developmental projects in line with environmental laws and regulations. Factor analysis which is used in the study is a quantitative multivariate analysis with the goal of representing the linear interrelationship among a set of continuously measured variables, represented by interrelationships with a number of underlying linearly independent reference variables called factors. For the purpose of the study, a factor analytical technique was adopted to assess the significance of fourteen identified EI factors most considered by EIA experts because they constrain the performance objectives of RRCP. Furthermore, factor analysis seeks to collapse the numerous operating factors into fewer dimensions of interrelated attributes called principal components. The eigenvalue determines the principal components, which is varimax, rotated to obtain more evenly distributed factor loading with each components. A data structure of n x n matrix, "A" has eigenvalue λ if there is a non zero X called eigenvector associated with λ, and for which $AX = \lambda X$, it follows that the matrix $A - \lambda_1 = 0$ is a singular and therefore the determinant $(A - \lambda 1) = 0$.

The RRCP are justified for this study considering the facts that rural roads are vulnerable to severe environmental impacts due to lack of; drainages, water channels, culverts, gutters, master plan and EIA. They are also prone to wind and rain storms, overgrazing and devastating effects of agricultural activities. The identified 14 EI factors that hypothetically, have potentials of inflicting stresses on the RRCP are;

X_1 = Water ways, river system and flood
X_2 = Youth restiveness and employment level
X_3 = Noise and vibration
X_4 = Amount and frequency of rainfall
X_5 = Rugged geographical terrain and road a accessibility
X_6 = Land and soil characteristics
X_7 = Community cultural heritage and life style
X_8 = Socio-economic interest to the host community
X_9 = Wind and thunder storm
X_{10} = Health and safety
X_{11} = Pollution
X_{12} = Refuse dumps and environmental sanitation
X_{13} = Ecology
X_{14} = Land ownership and compensation

The structured questionnaire based on the 14 identified EI factors cited from Glasson, et al, (1998) and Chandara (2006) were administered to experts environmentalists, construction managers and rural development experts in the three senatorial zones of Imo State of Nigeria; Owerri, Orlu, and Okigwe. Each zone received 20 copies of the questionnaire. The numbers of copies of questionnaire returned were as follow, 16, 14 and 11 for Owerri, Orlu and Okigwe zones respectively. The captured data from the opinion poll were subjected to factor analysis as shown below:

Table: Weighted Scores of EI Factors Constraining RRCP as posited by Experts

Respondents	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}
1	1	4	4	1	1	1	4	4	1	4	2	5	4	4
2	5	4	4	4	4	5	5	4	5	5	4	4	5	5
3	5	4	3	3	2	4	3	2	3	4	4	4	4	4
4	4	3	3	4	2	4	3	3	4	5	3	5	4	4
5	4	3	3	4	1	3	2	2	4	4	2	4	3	3
6	4	4	4	3	2	3	2	2	1	2	1	4	3	3
7	4	5	4	3	0	2	2	2	5	4	2	5	3	3
8	5	3	4	2	2	3	3	2	4	4	4	5	2	2
9	4	4	2	3	2	3	4	3	4	3	3	3	2	2
10	5	5	4	4	3	4	2	3	4	4	4	5	4	4
11	5	5	3	4	2	4	3	3	4	5	5	2	5	5
12	5	4	4	3	2	4	4	3	5	5	3	5	5	5
13	5	4	3	2	2	4	3	3	4	5	2	4	4	4
14	5	5	4	4	3	4	2	2	3	4	1	2	4	4
15	5	4	3	3	1	2	1	2	2	2	1	4	2	2
16	2	3	1	2	1	2	2	3	2	2	1	4	2	2
17	4	4	4	4	2	4	4	2	2	3	2	4	4	4
18	1	5	4	2	2	2	2	4	4	3	2	4	4	4
19	5	3	3	2	2	3	2	1	5	4	1	5	4	4
20	1	4	4	1	1	1	4	4	1	4	4	3	4	4
21	5	4	4	4	4	5	5	4	5	5	3	3	5	5
22	5	4	3	3	2	4	3	2	3	4	4	5	4	4
23	4	3	3	4	2	4	3	3	4	5	2	4	4	4
24	4	3	3	4	1	3	2	2	4	4	4	5	3	3
25	4	4	4	3	2	3	2	2	1	2	1	2	3	3
26	4	5	4	3	0	2	2	2	5	4	1	5	3	3
27	5	3	4	2	2	3	3	2	4	4	2	3	2	2
28	4	4	2	3	2	3	4	3	4	3	2	2	2	2
29	5	5	4	4	3	4	2	3	4	4	3	4	4	4
30	5	5	3	4	2	4	3	3	4	5	4	2	5	5
31	5	4	4	3	2	4	4	3	5	5	5	4	5	5
32	5	4	3	2	2	4	3	3	4	5	2	5	4	4
33	5	5	4	4	3	4	2	2	3	4	5	4	4	4
34	5	4	3	3	1	2	1	2	2	2	2	1	2	2
35	2	3	1	2	1	2	2	3	2	2	4	5	2	2
36	4	4	4	4	2	4	4	2	2	3	5	2	4	4
37	1	5	4	2	2	2	2	4	4	3	4	4	4	4
38	5	3	3	2	2	3	2	1	5	4	2	4	4	4
39	5	4	3	3	2	4	3	2	3	4	1	4	3	3
40	4	3	3	4	2	4	3	3	4	5	4	4	2	2
41	4	3	3	4	1	3	2	2	4	4	1	5	2	2

In order to ensure that the respondents actually understood each of the fourteen EI factors as distinct from the others, correlation test was carried out where the correlation coefficient is the decision parameter. If a correlation coefficient between two EI factors is very close to unity (1.0) it means that the two factors are so close to one another and that they cannot be statistically regarded as distinct from one another, hence they cannot be statistically independent.

Table 2: Correlation Matrix

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}
Correlation X_1	1.000	.128	.116	.475	.442	.750	.005	-.37	.492	.380	.242	-.141	.233	.233
X_2	.128	1.000	.338	.213	.145	.089	-.098	.184	.078	.071	.120	-.267	.406	.406
X_3	.116	.338	1.000	.050	.222	.084	.068	.036	.082	.244	.093	.162	.391	.391
X_4	.475	.213	.050	1.00	.377	.605	-.072	-.09	.329	.216	.285	-.263	.271	.271
X_5	.442	.145	.222	.377	1.00	.771	.420	.359	.196	.289	.339	-.232	.451	.451
X_6	.750	.089	.084	.605	.771	1.00	.352	.097	.457	.572	.443	-.127	.565	.565
X_7	.005	-.098	.068	-.072	.420	.352	1.00	.606	.234	.446	.400	-.064	.395	.395
X_8	.374	.184	.036	-.090	.359	.097	.606	1.0	.085	.335	.269	-.001	.421	.421
X_9	.492	.078	.082	.329	.196	.457	.234	.085	1.0	.638	.305	.180	.275	.275
X_{10}	.380	.071	.244	.216	.289	.572	.446	.335	.638	1.00	.442	.217	.069	.069
X_{11}	.242	.120	.093	.285	.339	.443	.400	.269	.305	.442	1.000	-001	.485	.485
X_{12}	.141	-.267	.162	-.263	-.232	-.127	-.064	.00	.180	.217	-.001	1.000	.019	.019
X_{13}	.233	.406	.391	.271	.451	.565	.395	.421	.275	.690	.485	.019	1.000	1.000
X_{14}	.233	.406	.391	.271	.451	.565	.395	.421	.275	.690	.485	.019	1.000	1.000
Sig. (1-tailed) X_2	.096													
X_3	.120	.000												
X_4	.000	.015	.306											
X_5	.000	.070	.012	.000										
X_6	.000	.185	.196	.000	.000									
X_7	.478	.159	.247	.234	.000	.000								
X_8	.000	.030	.359	.181	.000	.161	.000							
X_9	.000	.216	.202	.000	.023	.000	.008	.195						
X_{10}	.000	.235	.006	.014	.001	.000	.000	.000	.000					
X_{11}	.006	.112	.173	.002	.000	.000	.000	.003	.001	.000				
X_{12}	.076	.003	.049	.003	.009	.099	.258	.496	.033	.013	.497			
X_{13}	.008	.000	.000	.003	.000	.000	.000	.000	.002	.000	.000	.422		
X_{14}	.008	.000	.000	.003	.000	.000	.000	.000	.002	.000	.000	.422	.000	

Sources: Result of Computer Analysis with SPSS for windows ver. 15.

Optimal Grouping of EI Factors in rural development construction projects having established that respondents actually believed that each of the factors is important in inflicting stresses and pressures on RRCP, thereby constraining the realization of performance objectives. The study could as well determine the severity of each of them through the mechanism of varimax rotation factor loading based on minimum eigenvalue of 1.0. This generates principal components as follows:

Table 2: Rotated Component Matrix

	Component				
	1	2	3	4	5
X_6	.858	.265	.345	.028	.099
X_1	.817	-.258	.341	-.001	.094
X_5	.752	.494	-.095	.009	.226
X_4	.656	-.125	.235	.373	-.153
X_8	-.193	.869	.056	.165	.000
X_7	.145	.841	.144	-.198	.009
X_{14}	.231	.509	.419	.441	.445
X_{13}	.231	.509	.419	.441	.445
X_9	.279	.011	.802	-.017	-.058
X_{10}	.212	.376	.772	.038	.242
X_{12}	-.404	-.112	.478	-.460	.399
X_{11}	.254	.430	.450	.189	-.060
X_2	.037	-.002	.003	.873	.228
X_3	.071	.000	.013	.171	.882

Extraction method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 14 iterations.

The above result shows that five stages are necessary for assessing EI factors that constrain successful delivery of RRCP due to their incessant stresses and pressures on the environment.

DISCUSSION OF RESULTS

The result indicates that the EI factors in the first principal component in order of significance are X_6, X_1, X_5, and X_4. They are the most critical EI factors that affect RRCP. It follows that this set of factors are the most critical of all EI factors constraining RRCP and therefore, concerted efforts should be directed towards their mitigation. In component 2, the factors that load maximally are X_8, X_7, X_{14}, and X_{13} in that order of significance, and they are the second group of critical EI factors affecting the successful delivery of RRCP. Similarly, in component 3, the factors that load maximally are X_9, X_{10}, X_{12} and X_{11}. In components 4 and 5, X_2 and X_3 respectively loaded maximally as EI factors constraining the successful delivery of RRCP.

The result of the factor analysis based on the first principal component factors vis-à-vis the most critical EI factors constraining successful delivery of RRCP could be adduced to the following reasons: South East region of Nigeria is located in the rain forest geographical zone with heavy rainfall approximately 8 months in a year. The frequency and intensity of rainfall cause excessive flood and devastating environmental impacts due to lack of gullies, drainage system and waterways. The zone is also characterized by clayed soil which makes it difficult for water to percolate easily, thus resulting to ravaging flood, and erosion that always threaten or wash away RRCP. Also mash land, mud and chain potholes resulting from EI factors hinder both the operations and movement of construction logistics, and performance of construction work progress. RRCP are usually put to a temporary stop as a result of devastating effects of these EI factors. The resultant effects include time and cost overruns with shoddy completion of RRCP.

Table 4: Summary of order ranking of EI factors that constrain RRCP

Code	Name of factor	Priority group	Rank
X_6	Land and soil characteristics	1	1
X_1	Water ways, rive system and flood	1	2
X_5	Rugged geographical terrain and road accessibility	1	3
X_4	Amount and frequency of rainfall	1	4
X_8	Socio economic interest to the host community	2	5
X_7	Community cultural heritage and life style	2	6
X_{14}	Land ownership and compensation	2	7
X_{13}	Ecology	3	8
X_9	Wind and thunder storm	3	9
X_{10}	Health and safety	3	10
X_{12}	Refuse dumps and environmental sanitation	3	11
X_{11}	Pollution	3	12
X_2	Youth restiveness and unemployment level	4	13
X_3	Noise and vibration	5	14

Based on the results of the analysis, weather forecasting and metrological report should be explored and taken into consideration prior to project planning, scheduling of completion dates and implementation. In-depth feasibility analysis (especially geo feasibility studies) and soil test should be carried out as that would help to provide information for soil characteristics necessary for structural design of project, appropriate tendering, scheduling of completion date and meeting up with the quality specification at budgeted cost. Contingency plans should be put in place for technical mitigation measures to address significant environmental impacts. Such measures should include containment vis-à-vis building of channels to water storage valleys or dams, flood diversion, construction of culverts, bridges, gullies and water channel prior to or along side with the implementation stage of RRCP. These remedial actions are imperative for successful delivery of rural road projects.

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