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Socio-Environmental Implications Of The Mando (Kaduna) Rimi – Zakara (Kano) 330v DC Quad Conductors Project

Abstract

This study examined the socio-environmental Implications of the Mando (Kaduna) Rimi – Zakara (Kano) 330v DC Quad Conductors Project and suggested means of mitigating them to acceptable levels and enhancement measures for the beneficial impacts. The study was undertaken during the Fieldwork based on a review of available secondary information and primary data collected in the local communities. Primary data were collected through qualitative and quantitative methods based on key informant interviews, village-level surveys and focus group discussions. The results showed that the physical, chemical and biological characteristics and meteorological, climatic and hydrological characteristics were generally consistent with previous studies carried out within the environment with few exceptions. The result showed that a total of 63 species were observed in the study, out of which 36 phytoplankton, 20 zooplankton and 7 Microbenthos; the sampled species included the two (2) pollutant-tolerant species (Capitella sp. and Nereis sp.) were censored in sediments samples obtained in Sabaru (S3) and Gatatudu (S4). Also, parameters such as BOD, DO, and Turbidity were considered part of surface water sites while water surface Microbial species such as Escherichia species, Giardia Lamblia and Vibrio were found. An Environmental Social Management Plan (ESMP) has been developed to satisfy the long-term objectives of managing and monitoring the environmental and social impacts of the Project. The beneficial potentials of the project outweigh the conceivable adverse effects. Nevertheless, mitigation measures were developed based on the best available practices for the adverse impacts.

Keywords : Social Impact, Environmental Impact, Environmental Social Management Plan (ESMP), Mitigation, Kaduna-Kano

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Introduction

The Mando (Kaduna) - Rimi Zakara (Kano) 330kv DC Quad conductors Project is proposed by the Transmission Company of Nigeria (TCN) to ensure efficient and cost-effective transmission, system operation, and improved service delivery in the states of Kano and Kaduna. The project involves stabilising the construction grid and the reconstruction of the existing 330kV single circuit transmission line to a double circuit quad conductor of 330kV type with a total length of about 195 km between the existing TCN substation at Mando in Kaduna State and the construction of an on-going substation at Rimi- Zakara, Kano State. A study by Tourab and Babouri (2015) found that the development and expansion of power systems worldwide increase the level of electromagnetic fields and the bio-organism and human body's exposure to electromagnetic radiation. Dib and Mordjaoui (2014) found the human body as a living antenna that can absorb and re-emit power energy in the environment. The physical interaction of time-varying electric and magnetic fields (ELF, EMFs) .

with the human body results in induced electric fields and circulating electric currents associated with endogenous ones, leading to changes in the functions of cells and tissues and subtle changes in hormone levels. According to Korpinen et al. (2011), exposure to ELFs during work tasks in high-voltage substations showed that the exposure limits reviewed and published by the International Commission on non-ionizing radiations exceeded in specific work tasks from service platforms. The dispersion of pollutants is determined by many parameters, most notably atmospheric stability and wind (Kelishadi and Poursafa, 2010). According to Rajper et al. (2018), atmospheric SO2, CO, NO2 and particulate matter (PM) are the primary contributors to air pollution. The presence of these pollutants at levels beyond permissible limits causes serious health issues, such as breathing problems, allergies, cancers, cardiovascular and respiratory diseases, and even mortality (Wang et al., 2017). According to Wieser et al. (2021), air pollutants occur not only in the transport, industry, or coal combustion sectors but also in the construction sector. Pollutants have different sources of origin within the construction sector or the built environment. Outdoor sources include construction activities, which can lead to dust production, the use of construction machinery at sites, the production of building materials, or pollutant emergence at other life cycle stages of buildings, such as the end-of-life stage.

Garcia-Aleega et al. (2017) found bioaerosols, or the biological particles of aerosols, to be predominantly formed by microbial origin. Bio-aerosols are ubiquitous in the environment and are easily dispersed in the air due to their small particle size (<2.5 mm). Given the potential high concentration of bioaerosols from urban, agricultural and industrial emissions (such as composting and other bio-waste processing facilities), its impact on local air quality is a growing public health concern. It is well known that bioaerosols in the air can induce respiratory diseases and infections, including tuberculosis and asthma. Consequently, there is increased concern about the accidental or deliberate release of biological materials into the environment and the associated impacts on human and animal health and the economy, similar to the Q-fever (the resulting illness from the infection of an obligate gram-negative intracellular bacterium *Coxiella burnetii*) outbreak in the Netherlands caused by the bacteria *Coxiella burnetii*.

The transmission network faces the difficulty of evacuating and dispatching reliable and quality electricity supply and maintaining an operational security standard to prevent collapses. In all of this, nobody pays attention to the environmental and social impact of transmission substations during construction and operations on public health as long as the supply is constant. This project comes with enormous socio-economic concerns that have continued to linger without sufficiently addressing them, negatively impacting the livelihood restoration of the Project Affected Person and distorting their way of life.

There are no threshold exposure levels for air quality in Nigeria, as there is insufficient information on developing such standard (s). Environmental and social impacts are eminent in transmission substations, but there is little or no documentation of their effects on public health. The study aimed to evaluate the envisaged socio-environmental Implications of the Mando (Kaduna) Rimi – Zakara (Kano) 330v DC Quad Conductors Project. The specific objectives include to (i) identify the status of the project's environmental and social impacts (ii) assess the project monitoring process and its environmental and social impact parameters (iii) examine the cost-effective mitigation measures during mobilization construction, commissioning and operation and (iv) identify socio-environmental issues and concerns which may affect the project.

Materials and Methods

Research Design

The study was undertaken based on a review of available secondary information and primary data collected in the local communities. Primary data for this analysis was qualitative and quantitative and derived from key informant interviews, village-level surveys and focus group discussions. The study focused on identifying stakeholders and their impact on the community regarding their infrastructures and educational learning system, as well as the institutional analysis and the system for monitoring and evaluation, among others. This led to adopting a study strategy that involved the following activities:

i Conducting literature searches and reviews
ii Conducting field visits to the study area.
iii Determining target population and sample size for participatory rural appraisal and interviews;
iv Conducting consultations and socio-economic surveys (Focus Group Discussions [FGDs], General Group Discussion [GGD] and In-Depth Interviews [IDI] with various stakeholder groups and interviews with key informants in the community
v Conduct interviews with key stakeholders involved with the project;
vi Direct observations;

Collating and analysing data obtained from all the sources and coming up with the findings and results. Primary data for this analysis are qualitative and quantitative and derived from key informant interviews, village-level surveys and focus group discussions. Various samples were collected and analysed in the field. The prevailing microclimatic conditions (temperature, rainfall, humidity, wind velocity and prevailing direction and atmospheric pressure) operating in the study area were measured on the field. Measurement was carried out with the aid of Aeroqual Aerocet 531.

This equipment was calibrated and held at arm's length towards the direction of the prevailing wind for 2 minutes. The value of the climatic elements was read off-screen, and data was documented. The sampling locations for noise and air quality were the same for air quality.

Result and Discussion

Assessment of Groundwater Quality

All physicochemical parameters analysed in the water samples were within threshold values, except for iron and lead, which had concentrations above FMEnv/WHO threshold limits. The report details borehole sites where samples with elevated concentrations were obtained and possible explanations (Table 1).

Result of Hydrobiology

The study observed a total of sixty-three (63) species. The breakdown includes thirty-six (36) phytoplankton, twenty (20) zooplankton, and seven (7) macrobenthos.

Phytoplankton Study

Phytoplankton species were only observed in sampling points 1 (Tundungara), 2 (Dallawa), 3 (Sabura), 9 (Kwarinde) and 15 (Dinka). Thirty-one (31) species were recorded across all sampling points. The increased number of species and counts could be due to favourable environmental factors, including warm water temperature, nutrients from agricultural runoff and cleaning fluids (Hoppenrath and Saldarriaga, 2012). The abundance of phytoplankton usually influences the availability of nutrients and light. *Coscinodiscus cocinnus*, *Coscinodiscus eccentircus, Odontella mobilensiswere* the dominant species in the samples. Diatoms in water indicate possible pollution from anthropogenic sources, such as fertilizers and nutrient runoff, leading to eutrophication (Blinn and Bailey, 2001).

Zooplankton Result

Five (5) were observed in the samples. Ceratium species were the dominant taxa in the samples. The presence of Tintinnids in S3 and S9 indicates a water body experiencing environmental stress and anthropogenic impacts.

Benthic Study

In the Benthic study, four (4) species were censored. The Shannon index and Equitability index were 1.154 and 0.832, respectively, for the entire study area. The sampled species included two (2) pollutant-tolerant species (Capitella sp. and Nereis sp.) censored in sediment samples obtained in Sabaru (S3) and Gatatudu (S4). Their occurrence suggests water bodies are polluted by sewage, agricultural runoff, and wastes. All other samples were devoid of benthos indicator species.

Habitat Types and Flora of the Study Area

Wildfires, exploitation, and intense grazing activities are expected to contribute significantly to the sparse species recorded in the study area. Also, the relatively high species richness recorded in the Savannah compared to the other habitats could be attributed to the habitat's dominant presence in the study area.

Species Density

The relatively high ratio of species abundance to species richness in this study confirmed the inability of the habitats to support diverse species. In this study, species density was used in determining the number of plant species in the route, which in turn helps in vegetal waste quantification as shown below:

i Tree to Ton Conversion Standard (inch ft)= 24 trees at 40 ft x 7 inches (where 24= = number of tree species in one ton with an average height of 40ft and an average DBH of 7inch).
ii No of tress recorded in the project area
iii Average height of Tree (Ft)= 20
iv Average girth of Tree (inch)= 4

Estimated Ton from trees to be felled= 51,840 /6720 = 7.7 tons
Total Tons = 7.7 tons (representing sampled area x 4 = 30.8 Tons

Shannon and Evenness Indices

Shannon Wiener and the evenness index were used to evaluate species diversity for the study area. 1.069 and 0.973 Values were observed for Shannon and Equitability indices, respectively. This is indicative of a habitat under threat and continuous disturbance, such as cultivation.

Species Growth Habit

Species Growth Habit is the form in which a species exists. The censored species exhibited four (4) growth habits comprising Trees, Shrubs, Herbs and climbing species. Though the species growth habit shows a relatively high proportion of woody species in the study area compared to the non-woody species, the Diameter at Breast Height (DBH) study, on the other hand, revealed a generally low DBH value indicative of a resurging habitat inhabited by wildling tree species and an environment under disturbances. The DBH values

Table 1:Borehole Sites with Elevated Lead and Iron Concentrations

Parameter	Sampling site/Community	Possible Source	Remarks
Iron	Hauwede and Fulatan	The nature of the existing underlined bedrock in the area	Chlorination and filtration are recommended for such water
Lead	Millennium City substation, Mando substation, Hauwede and Fulatan	Nature and type of piping materials. Especially those made of lead	Distillation and filtration are recommended.

ranged from 184 cm to as low as 12 cm. *Ceiba pentandra, Adansonia digitata, Azadirachta indica, Bombax costatum* and *Mitragynainermis* were the few tree species with high DBH values of (184, 178, 157, 128 and 109) cm respectively. On the other hand, *Haematostaphisbatteri*, *Acacia Gerrard*, *Lanneaacida* and *Spondiasmombin* were the tree species with the lowest DBH values of (19, 24, 26 and 27) cm, respectively, significant of a resurging habitat.

Alien and Invasive Species

Alien species are plant resources that are inadvertently introduced into an area, while invasive species may or may not be alien except that they may out-compete other species and establish dominance. International Union for the Conservation of Natural Resources (IUCN) listed about 24 plant species aliens to Nigeria, while the global invasive database listed the occurrence of 29 invasive floras in Nigeria. A review of Nigeria's alien species database showed that two (2) species (Chromolaenaodorata and Bidenspilosa) occur in Lingel and Faru in Kano state. The presence of these alien/invasive species in the study area signifies a disturbed ecosystem with fertile loci for proliferation. Plates 6.6 are pictures of some of these species.

IUCN Status

The IUCN status of the plant resources of the studied area was evaluated using the IUCN red list version 2019 -2 criteria. Results showed that two species (Afzelia africana and Terminalia ivorensis) located at Birninyaro, Kaduna State and Yandadi in Kano State, respectively, are of conservation concern. They are both in the vulnerable category in the IUCN Red List of Threatened Species (Version 2019). They are used as Fodders for livestock during the dry season and for craft (Boat building, Artifacts), respectively.

Vulnerable Groups in the Study Area

Vulnerability is a dynamic situation that focuses on the probability of one's future deficiency. This view further sees the relationship of poverty, risks and vulnerability as a nexus of interrelated and reinforcing conditions. Poverty and vulnerability are not synonymous. However, even persons who are currently wealthy may be vulnerable if their source of income is not sustainable or if they do not invest their earnings in in other profit-yielding ventures. Persons may be productive and able to secure above-average earnings, but they depend upon access to resources that may become inaccessible later. Consequently, anti-poverty measures alone are not likely to solve vulnerability problems.

Informants and discussants reported that a number of categories of persons are likely to be more vulnerable than others. The most vulnerable groups include the elderly, widows and female-headed households, the unemployed and those who have lost their lands and are now without means of livelihood.

Conclusion

Evaluation of the proposed project has been carried out in line with statutory requirements for environmental management in Nigeria to ensure that the project's potential environmental, social and health impacts are fully appraised. This work has documented the existing environment of the area, potential and associated impacts of the proposed project, proffered cost-effective mitigation/ ameliorative measures for impacts and enhancement measures for the beneficial impacts. A management plan that would be effective throughout the project's life cycle has also been implemented to ensure the project's environmental sustainability. Respect for local residents and customs; o Non-discrimination (for example, based on family status, ethnicity, race, gender, religion, language, marital status, birth, age, disability, or political conviction)**.**

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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