



# **Assessment of Environmental and Social Impact of Benin-delta Power Transmission line Expansion Project**

**M. A. S. Horsfall <sup>a\*</sup>, A. A. Obafemi <sup>b</sup> and A. I. Hart <sup>c</sup>**

<sup>a</sup> *Institute of Natural Resources, Environment and Sustainable Development, University of Port Harcourt, Rivers State, Nigeria.*

<sup>b</sup> *Department of Geography, University of Port Harcourt, Rivers State, Nigeria.*

<sup>c</sup> *Department of Animal and Environmental Biology, University of Port Harcourt, Rivers State, Nigeria.*

## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

## **Article Information**

DOI: 10.9734/ACRI/2023/v23i8614

### **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/103732>

**Original Research Article**

**Received: 05/06/2023**  
**Accepted: 09/08/2023**  
**Published: 16/12/2023**

## **ABSTRACT**

This study examined the environmental and social impacts and household vulnerability of the 107 km Benin-Delta (Ughelli) 330 kV power transmission line (TL) expansion project right of way (ROW). Questionnaires were administered to 56 communities and 344 households to obtain information on their livelihood and the perceived environmental and social impacts of the TL expansion. Results revealed the TL on land use, community socio-cultural and health Status, employment and opportunities, community agitation and social economic status, they were found to be high, low, beneficial, medium and low in that order. Loss of land and economic trees were identified as the highest impacts of the project. All communities within the sphere of influence of the project had encroached on the existing ROW. The most vulnerable groups affected by the project are the non-indigenous elderly, widows and female-headed households, children, herdsmen, unemployed and those that have lost their lands and are now without means of

\*Corresponding author: Email:maryhorsefall@gmail.com

livelihood. The valuation of assets and losses suffered suggests the need for resettlement and compensation. Specific mitigation measures which could help ameliorate suffering of the economically vulnerable households should be put in place.

*Keywords: Impacts; environmental; social; household vulnerability; power transmission line.*

## 1. INTRODUCTION

Transmission lines are critical infrastructure for transport power to meet developmental needs. The historically grown transmission network cannot cope with the increasing regional discrepancies between generation and demand centres. In the past, power plants were built close to an area with high electricity consumption which only required limited transmission line networks. With the growing population in Nigeria, in March 2017, the Federal Government of Nigeria (FGN) approved the Power Sector Recovery Plan (PSRP) within the context of the Economic Recovery and Growth Plan (ERGP) [1]. The ERGP 2017 - 2020 builds upon the previous Strategic Implementation Plan of 2015 and has been developed for restoring economic growth. The objectives of the PSRP are to restore the power sector's financial viability on a contract-based electricity market; to improve power supply reliability to meet growing demand, and to strengthen the sector's institutional framework and increase transparency [2].

To achieve this objective, the Transmission Company of Nigeria (TCN) has developed the Transmission Rehabilitation and Expansion Programme (TREP) designed to improve the wheeling capacity from 10,000MW to about 25,000MW. The programme is expected to boost socio-economic activities through the availability of reliable power to drive commercial and industrial activities, create employment and alleviate poverty. The projects cut across 10 states and include the 107 km Benin Delta transmission power line [1].

The possibility of developing projects capable of impacting millions of people is a feature intrinsic to the power transmission system. These involve the addition of new lines for interconnectivity in electricity flows linking up emerging cities and expanding urban areas or as part of rural electrification projects. These projects come at a cost to the environment and society [3,4]. Today, those affected by the establishment or extension of transmission infrastructure want greater certainty about the process and outcomes and how their economic or domestic operations are

likely to be affected [5]. Understanding the impact is important to electricity suppliers in planning routes and determining fair compensation in cases of full or partial acquisition of private land [6].

The issues of climate change and global warming have gained a growing interest and discussion globally over the last decades. More and more people have developed environmental concerns and care deeply about the limited natural resources and developmental projects within their location [5]. Such rising concerns have led to decisions to question the siting of projects that do not put the communities into consideration. Oftentimes, this leads to disruption of the projects, and where need be, compensations and resettlement are suggested to ameliorate the suffering of the vulnerable and project-affected person. However, the practical applications of financial compensation are not trivial, including the difficulty in estimating the exact costs and benefits of the projects and the public perception of compensation as a bribe [7,8].

This study seeks to examine the environmental social impact, vulnerability assessment, and communities' encroachment within the 107 km Benin Delta (Ughelli) 330 kV power transmission line project right of way (ROW).

## 2. METHODOLOGY

### 2.1 Study Area

The study area lies within the South-south region of Nigeria. The South-south region comprises the area covered by the natural delta of the Niger River and the areas to the East and West, which also produce oil. The region is located between latitudes 4°10'N and 7°35'N and longitude 5°30'E and 9°25'E. The 107 km Benin - Delta (Ughelli) transmission line to 330 kV double circuit quad conductor cuts across Edo and Delta States.

### 2.2 Population of the Study

The South-south Region of Nigeria consists of 6 States. This work will focus on Two (2) States

along the 107 km Benin - Delta (Ughelli) Transmission line to 330 kV double circuit quad conductors. The target population shall include the communities/residents within the 107 km Benin - Delta (Ughelli) transmission line to 330 kV double circuit quad conductors right-of-way (ROW).

### **2.3 Sample, Sampling Techniques and Determination of Sampling Size**

A sample is a small group of elements or subjects obtained through a definite procedure from a specified population. Simple random sampling shall be employed in selecting the sample framework and units to which the questionnaire and interviews shall be administered across the study area. This study was limited to the communities/residents within the 107 km Benin - Delta (Ughelli) transmission line to 330 kV double circuit quad conductors right-of-way (ROW) comprising Edo and Delta States. The communities along the 107 km Benin - Delta (Ughelli) transmission line to 330 kV double circuit quad conductors which represent the footprint area, were used for the study.

Sampling size is determined by making use of the total population of the communities using Taro Yamane's formula. The questionnaire size arrived at 400. This value was distributed proportionally among the randomly selected communities and households in the two states.

Two types of questionnaires were administered – Household and community-based.

### **2.4 Assessment of Environmental and Social Impact**

Assessment of environmental and social impacts of the expansion of the TL, including transportation of men and construction materials, establishment of a temporary construction yard (utilities, borehole, lighting), preparation of transmission tower foundation, assembly of machinery and equipment (towers, conductors, transmission lines); use of natural resources (water, energy sources), maintenance of towers, conductions and disposal of operational waste materials and wastewater; and non-routine events were considered in this study.

Environmental indicators, resources or receptors considered in the impact assessment under biophysical environment were air quality; noise,

soils, water resources and terrestrial ecology. Whereas under the human environment, the receptors include aesthetic/visual amenities; community level impacts, community health, safety and security; traffic; resettlement; labour and working conditions; infrastructure, employment and economy; and cultural heritage.

The assessment of impacts involved the prediction of potential impacts and their magnitude (i.e., the consequences of the proposals on the natural and social environment and evaluation of the importance (or significance) of impacts taking the sensitivity of the environmental resources or human receptors into account.

The evaluation of impact significance was based on the criteria defined in Rossouw [9] namely environmental legislation and policy; stakeholders' concern and interest; severity of environmental and social impacts; magnitude/scale of impacts and frequency of occurrence of impacts.

## **3. RESULTS**

### **3.1 Household and Community Characteristics**

A total of 344 household questionnaires were administered and 56 community questionnaires of which 292 and 34 were retrieved representing a success rate of about 84.84% and 60.7% of the population.

Table 1 shows the respondent population's age and gender. Persons within the age bracket of (19-39) years formed the bulk of the population [98 (33.56%)] across the LGAs, while those above 65 years of age were the least [41 (14.04%)] represented in the study area. The preponderance of the respondent is male 158 (54.11%) and females constitute 45.89% (134).

Information on the gender and number of household heads in the study area is presented in Table 2. 71.2 % of household heads were male and 28.8% female. The married status of respondents in the study area of 64.73% (51.03% married and 13.70% widowed).

### **3.2 Environmental and Social Impacts of the TL**

Impacts of TL on air quality, noise, soil, ground/surface water and biodiversity

were medium, with an overall rating of 36, 28, 45, 32 and 48 respectively, where biodiversity was the most affected and noise was the least encountered environmental issue (Table 3).

The impacts of TL on land use, community socio-cultural and health Status, employment opportunities, community agitation and social economic status were high, low, beneficial, medium and low in that order (Table 4).

### 3.3 Household Information

**Household Facilities:** Several facilities were surveyed to be present in the households of the study area. These include power generators, televisions, cars/trucks, refrigerators, etc (Table 5).

**Household Roofing Materials:** Results on the roofing materials used for building construction in the study area are presented in Table 6. The majority of the houses were roofed with corrugated iron sheets (48.63%) and the least are thatch houses (2.05%), with none built with bamboo/reed.

**Household Walling Materials:** Information on household walling materials is presented in Table 7. The majority of the houses were built with

blocks (88.36%) and mud was the least used (3.08%), while none was built with wood.

**Household Flooring Materials:** Table 8 shows the flooring materials mostly used in the area. The majority of the houses used smooth cement for flooring (55.65%) and the least used flooring material was wood/plank (3.23%).

**Information on Household Size of the Communities:** Information on the household size of the communities in each of the LGAs is presented in Table 9. The dominant household sizes in the project area are those made up of 3-5 persons and 6-10 persons.

### 3.4 Vulnerable Groups in the Study Area

The most vulnerable groups include the elderly, widows and female-headed households, the unemployed and those that have lost their lands and are now without means of livelihood (Table 10). Non-indigenes were the most vulnerable (27.2%), followed by children (20.5%) and women (18.2%) and the least affected are herdsmen (3.2%). Preponderance of the vulnerable persons (20.5%) are in Ughelli North and the least (4.5%) in Udu.

**Table 1. Respondent population age and gender**

LGA	Gender	Age Bracket				Total
		1-18	19-39	40-65	>65	
Ethiope	Male (%)	4 (12.5)	6 (18.79)	5 (15.63)	2 (6.25)	17(53.13)
	Female (%)	5(15.63)	4 (12.5)	3 (9.4)	3 (9.4)	15 (46.88)
Okpe	Male (%)	4 (12.5)	4 (12.5)	3 (9.38)	1 (3.13)	12 (52.13)
	Female (%)	2 (6.26)	6 (18.75)	1 (3.13)	2 (6.26)	11 (47.83)
Sapele	Male (%)	8 (12.33)	15 (23.08)	5 (7.69)	5 (7.69)	33 (50.77)
	Female %)	6 (9.23)	11 (16.92)	7 (10.77)	8 (12.33)	32 (49.23)
Ughelli North	Male (%)	2 (12.50)	4 (25)	3 (18.75)	1 (6.25)	10 (62.5)
	Female %)	2 (12.50)	1 (6.25)	2 (12.50)	1 (6.25)	6 (37.5)
Udu	Male (%)	0	1 (20)	1 (20)	1 (20)	3 (60)
	Female (%)	0	1 (20)	1 (20)	0	2 (40)
Uvwie	Male (%)	3(12)	5 (20)	4 (16)	1(4)	13 (52)
	Female (%)	3 (12)	3 (12)	5 (20)	1 (4)	12 (48)
Ikpoba	Male (%)	17 (13.49)	22 (17.46)	21 (16.67)	10 (7.94)	70 (55.56)
Okha	Female (%)	20 (15.87)	15 (11.9)	16 (12.7)	5 (3.97)	56 (44.44)
	Total	76 (26.03)	98 (33.56)	77 (26.37)	41 (14.04)	292 (100)

**Table 2. Gender and marital status of head of household**

		<b>Ethiope West</b>	<b>Okpe</b>	<b>Sapele</b>	<b>Ughelli North</b>	<b>Udu</b>	<b>Uvwie</b>	<b>Ikpoba Okha</b>	<b>Total</b>	<b>(%)</b>
Gender	Male	19	16	45	13	4	15	96	208	71.2
	Female	13	7	20	3	1	10	30	84	28.8
	Total	32	23	65	16	5	25	126	292	100
Marital status	Single	10	6	9	3	0	9	37	74	25.34
	Married	17	13	34	10	2	14	59	149	51.03
	Widowed	4	2	12	1	2	1	18	40	13.7
	Divorced/ Separated	1	2	10	2	1	1	12	29	9.93
	Total	32	23	65	16	5	25	126	292	100
Nature of Marriage	Polygamy	7	5	9	2	0	3	29	55	36.91
	Monogamy	10	8	25	8	2	11	30	94	63.09
	Total	17	13	34	10	2	14	59	149	100

**Table 3. Impacts of TL on the environment**

<b>Impact criteria</b>	<b>Impact</b>				
	<b>Air quality</b>	<b>Noise</b>	<b>Soil</b>	<b>Ground and surface water</b>	<b>Biodiversity</b>
Legislature	3	1	1	1	3
Stakeholder concern	2	2	3	3	2
Severity	2	1	1	1	2
Scale	3	4	4	4	5
frequency	4	4	5	4	4
Overall rating	36	28	45	32	48
Impact Significance	Medium	Medium	Medium	Medium	Medium

**Table 4. Social Impacts of TL**

Impact criteria	Impact				
	Land use	Community Socio-cultural and Health Status	Impacts on Employment and Opportunities	Impacts on Community Agitation	Social Economic Status
Legislature	3	3		3	3
Stakeholder concern	2	1		2	1
Severity	3	2		3	2
Scale	3	1		2	1
frequency	5	3		5	3
Overall rating	55	21		50	21
Impact Significance	High	low	Beneficial	Medium	Low

**Table 5. Household facilities among respondents**

Facilities	Ethiope West	Okpe	Sapele	Ughelli North	Udu	Uvwie	Ikpoba Okha	Total
Power generator	24	23	45	14	3	20	89	218
Gas stove/Kerosene	32	20	65	12	5	10	126	270
Refrigerator	30	19	34	12	1	9	80	185
Television	28	22	32	14	5	8	21	130
Radio/cassette /music system	26	20	22	13	3	7	125	216
Car/Truck	16	14	8	7	1	5	40	91
Motor Cycle	8	11	8	4	3	3	29	66
Bicycle	2	1	3	0	0	2	12	20
Plough	0	0	0	0	0	0	0	0
Cart	0	0	0	0	0	0	0	0
House in town	3	3	8	2	1	2	13	32
Land in town	3	2	7	4	1	5	8	30
<b>Total</b>	172	135	232	82	23	71	543	1258

**Table 6. Roofing materials**

Material	Ethiope West	Okpe	Sapele	Ughelli North	Uvwie	Ikpoba Okha	Average (%)	
Corrugated Iron Sheets	12	12	42	6	3	13	54	48.63
Thatch	0	3	0	3	0	0	0	2.06
Asbestos	3	1	5	2	2	3	23	13.36
Bamboo/reed	0	0	0	0	0	0	0	0
Aluminium roofing	14	5	15	3	0	7	34	26.71
Nil / No roof / Not completed	3	2	3	2	0	2	15	9.25

**Table 7. Walling materials**

Walling Material Type	Ethiope West	Okpe	Sapele	Ughelli North	Udu	Uvwie	Ikpoba-Okha	Average (%)
Mud	0	2	0	1	0	0	6	3.08
Mud bricks	3	3	0	1	0	0	4	3.77
Wood	0	0	0	0	0	0	0	0
Thatch	0	1	0	1	0	0	5	2.40
Compacted (combine)	0	0	0	1	0	0	6	2.40
Concrete (blocks)	29	17	65	12	5	25	105	88.36
Others (Tarpaulin, zinc)	0	0	0	0	0	0	0	0

**Table 8. Flooring materials**

Material type	Ethiope West	Okpe	Sapele	Ughelli North	Uvwie	Ikpoba-Okha	Average (%)
Earth/sand/dirt/straw	1	2	0	2	0	2	5.65
Smoothed mud	1	2	0	1	0	1	4.03
Smooth cement	11	10	12	10	7	19	55.65
Wood/planks	1	1	0	1	0	1	3.23
Ceramic tiles	8	3	6	7	5	10	31.45

**Table 9. Household size of project area**

Numbers Per Household	Ethiope West		Okpe		Sapele		Ughelli North		Udu		Uvwie		Ikpoba Okha		Total	%
	M	F	M	F	M	F	M	F	M	F	M	F	M	F		
1-2	6	3	18	15	3	0	0	0	0	0	3	0	0	0	48	1.85
3-5	55	45	65	76	98	76	58	64	56	65	134	121	90	87	1090	42.04
6-10	87	32	60	67	78	54	78	87	98	94	73	30	102	34	974	37.56
11-15	67	62	0	3	9	6	12	217	18	21	6	0	21	33	475	18.32
>15	0	0	0	0	0	0	0	3	0	3	0	0	0	0	6	0.23
<b>Total</b>	215	142	143	161	188	136	148	371	172	183	216	151	213	154	2593	100

**Table 10. Proportion of vulnerable groups**

Vulnerable groups	Children	Land tenants	Women	Non-indigenes	Elderly	Infirmed /physically challenged	Herdsmen	Total
<b>LGAs</b>								
Ikpoba Okha	96	40	80	108	50	21	17	412
Okpe	80	53	67	140	30	13	7	390
Ughelli North	64	56	110	128	63	27	17	465
Ethiope West	80	44	51	90	55	33	16	369
Udu	20	5	23	26	16	8	3	101
Uvwie	68	40	35	56	40	17	9	265
Sapele	56	36	47	69	33	18	4	263
<b>Total</b>	464	274	413	617	287	137	73	2265



#### 4. DISCUSSION

Respondent population age and gender results revealed that persons within the age bracket of (19-39) years formed the bulk of the population (above 30%) across the LGAs, while those above 65 years of age were the least (below 15%) represented in the study area. This also implies that the communities have an able-bodied labour force that could participate actively in the various activities that will take place during the construction and operation phase of the transmission line. However, according to the National Bureau of Statistics (NBS, 2012), persons within the age bracket (0-18) form the bulk of the Nigerian population in contrast to the respondent age and sex in the study area. Kidokoro [10] attributed urban pull factors as a determining criterion in age bracket configuration.

The population of males was 158 (54.11%) and females was 134 (45.89%). However, households where males were the head was 71.2%. This is less than the Nigerian average of 85.7%, and 76.6% for South-south states implying more female house heads in the study area than the 14.3% Nigerian and south-south average [11]. Nonetheless, all areas in the line route have more male house heads.

The marital status of respondents in the study area of 64.73% (51.03% married and 13.70% widowed) is less than the Nigerian average of 77.4% but slightly less than the South-South average of 65.7% [11]. It was observed that most of the household heads that are females are widowed. In addition, there are more married and single household heads in all the LGAs.

Information on the socio-economic status of the households within the TL ROW was carried out to ascertain their current status and the likely impact of the TL expansion project and as indices of life quality. Several facilities were surveyed to be present in the households of the study area. These include power generators, televisions, cars/trucks, refrigerators, etc. Most of these facilities are meant to improve the livelihood of the households while others are income-generating.

The types of materials used in constructing household dwellings were also surveyed. These materials are used in roofing, walling and flooring. These parameters are an indirect index of life quality. The majority of the houses were roofed with corrugated iron sheets (48.63%) and

the least are thatch houses (2.05%), with none built with bamboo/reed. The majority of the houses were built with blocks (88.36%) and mud was the least used (3.08%), while none was built with wood. The majority of the houses used smooth cement for flooring (55.65%) and the least used flooring material was wood/plank (3.23%). The dominant household sizes in the project area are those made up of 3-5 persons and 6-10 persons.

The survey revealed that the TL expansion project is expected to impact air quality, biodiversity, noise, oil, ground and surface water. However, the impacts are expected to be medium. Given the findings of the impact assessment and the distance of the TL from settlements, it appears unlikely that the cumulative impact on noise and air quality will not be significant. Also, the cumulative impacts from the study area will be localized to the immediate environment. The air would become fouled from gaseous emissions. Biodiversity is expected to be lost. Noise and vibrations are expected to impact the human population in the study area of influence. Ground and surface water will be polluted by solid waste and organic waste as there is the possibility of accidental spills of hydrocarbons and indiscriminate dumping of scraps and other materials.

According to Furby [6] the environmental impacts of power grid projects may be controlled with restrictive/operational rules that must be updated regularly based on the application of principles of the projects benefits to the community, that there must be environmental limits to the installation and operation of the electrical network and that the impacts can be kept as low as reasonably achievable.

On the social impacts, the survey showed that the TL expansion would have an impact on land use, and the impact was adjudged as high. Property owner issues are often raised by individuals or communities along proposed transmission line routes. In the survey by Kinnard [12], a substantial majority of the respondents felt that transmission line rights-of-way reduced the value of the property where they intersected. The money paid to landowners for ROW easements is meant to compensate them for having a transmission line cross their property. These easement payments are not seen by some landlords as sufficient to truly compensate for the aesthetic impacts and the loss of full rights to their land.

The impact of the project on community socio-cultural and health status was adjudged as low. However, it has been established that construction activities have the potential to create new malaria vector (mosquito) habitats due to the establishment of small pit lakes. An influx of workers with no or partial immunity to the malaria parasite (*Plasmodium* sp) increases the risk of serious illness which may result in death. This impact if not managed is expected to pose a major significance characteristic. The influx of workers into the study area also increases the risks of Sexually Transmitted Diseases (STDs) and could impact adversely the spread of HIV/AIDS. This impact if left unmanaged may result in long-term health issues which may eventually lead to fatality. As reported by Kalitsi [13] the creation of a power transmission project at Volta River Ghana brought in its wake numerous negative impacts on the lives of the communities living upstream and downstream, which included insect-borne diseases like malaria, river blindness, and sleeping sickness and water-borne diseases like bilharzia.

Potential socio-economic impacts are expected to arise from socio-cultural conflicts between the construction workforce and natives due to the contrast in belief and religious systems. This may also lead to the violation of the existing traditional norms in the study area. These impacts are rated low as there is the likelihood that mitigation measures put in place by the contractors can help to reduce the impact to a negligible status.

In the event of the demolition of properties within the ROW of the TL, affected residents will suffer substantial losses. The government reserves the right to remove structures within the ROW of TL. As part of the TCN transmission expansion master plan, properties within the ROW of the proposed Benin-Ughelli TL will be demolished and no compensation would be paid for land [14]. Based on the requirements of the Land Use Act, there is no compensation for land and only assets on the land will be compensated.

The land to be used for the construction of the project is owned by the individuals and communities located in the study area. Some of the households in the study area (along with the transmission route) have economic trees. These trees will have to be cut and cannot be replanted in the area of the line. This will be a permanent loss over the years. Public consultation with the stakeholders, project communities and the census showed that the affected communities

accept the project as a means for development. By the African Development Bank's Operational Safeguards on involuntary resettlement -OS 2, the general principle adopted in the formulation of compensation valuation is that lost income and assets will be valued at their full replacement cost such that the project-affected population shall experience no net loss. The African development banks' Resettlement Policy/Guidelines require compensation for the lost assets and replacement costs to both titled and non-titled landholders and resettlement assistance for lost income and livelihoods.

There is a tendency for agitations by some groups of people or individuals over non-satisfactory engagement and compensations over land and other associated properties for ROW acquisition. This could lead to strife within communities or groups. During labour recruitment and before full construction activities, there is also potential for conflicts between neighbouring communities or individuals over employment quota systems, sub-contracting procedures or recruitment methodology. The significance of this is rated to be medium.

The economic, employment and skills development opportunities from the TL expansion will be high during the duration of the project. It should be noted that expectations regarding economic development, employment and skills development will be high amongst stakeholders in the local community. The benefit might also include the provision of electric supply to communities, which will also improve the standard of living of PAPs.

The most vulnerable groups include the elderly, widows and female-headed households, the unemployed and those that have lost their lands and are now without means of livelihood. Non-indigenes were the most vulnerable (27.2%), followed by children (20.5%) and women (18.2%) and the least affected are herdsmen (3.2%). Preponderance of the vulnerable persons (20.5%) are in Ughelli North and the least (4.5%) in Udu. The preponderance of non-indigenes in the affected area could be due to their lack of knowledge of the legal status of the land at the time of purchase, as the lands could have been sold to them unsuspectingly or it could be they are illegal occupiers. As mentioned previously, women are heads 28.8% of the impacted households. The population of the affected LGAs going to the 2006 census was 1,384,916. This puts the number of identified vulnerable PAPs at

2265 (0.2% of the population). Specific mitigation measures, such as prioritizing local people and businesses for job opportunities and procurement, participation of able members of these households to work on their land (cutting, trees, reconstruction, etc.), leaving them the use of cut trees, salvage material from displaced houses or other structures (houses, shelter, etc.), could help these economically vulnerable households increase their revenues.

Vulnerability is a dynamic situation that focuses on the probability of one's future deficiency [15]. This view further sees the relationship between 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 other profit-yielding ventures. Persons may be productive and able to secure above-average earnings, but they are dependent upon access to resources that may become inaccessible later. Consequently, anti-poverty measures alone are not likely to solve vulnerability problems. Thusly, where necessary, line route alternatives that impact minimally on persons should be explored. This is in agreement with the suggestion of Uzodinma and Agbagwa [16,17] in their studies of the environmental and socioeconomic implications and the resettlement action plan of the Alaoji-Onitsha transmission line project on project-affected persons.

## 5. CONCLUSION

The Benin-Ughelli TL expansion project will impact the socio-economic status of the residents within the project sphere of influence. The vulnerable persons that would be most affected by the project are non-indigenes, children, women, people with disabilities and the elderly. The valuation of affected assets and potential losses suggest the need for resettlement and compensation.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Power Sector Recovery Plan (PSRP). Power Sector Recovery Programme; 2017.

2. World Bank. Nigeria - Power Sector Recovery Operation; 2020. Retrieved 1<sup>st</sup> May, 2023 from: <https://www.psrp.org.ng>
3. McDonald-Wilmsen B, Webber M. Dams and displacement: Raising the standards and broadening the research agenda. *Water Alternatives*. 2010;3(2):142-161.
4. Madamombe I. Energy key to africa's prosperity: Challenges in West Africa's Quest for Electricity. *Africa Renewal*. 2005;18(4). Retrieved 2<sup>nd</sup> January, 2023 From:<http://www.un.org/ecosocdev/geninfo/afrec/vol18no4/184electric.htm>
5. Community-Based Environmental Monitoring Network (CBEMN). The Environmental Stewardship Equipment Bank; 2010. Retrieved 5<sup>th</sup> June, from:<http://www.envnetwork.smu.ca/equipment.html>.
6. Furby L, Slovic P, Fischhoff B, Gregory, R. Public perception of power transmission lines. *Journal of Environmental Psychology*. 1988; 8:19-43.
7. Marthur HM. Resettling people displaced by development projects: Some critical management issues. *Social Change*. 2006; 36:1-52.
8. Koranteng RTB, Shi G. Using informal institutions to address resettlement issues: the case of Ghana dams dialogue. *Journal of Sustainable Development*. 2018;11(4): 27-52.
9. Rossouw N. A review of methods and generic criteria for determining impact significance *AJEAM-RAGEE*. 2003; 6:44-61.
10. Kidokoro T. Community-based approach for improving vulnerable urban space', in T. Kidokoro, J. Okata, S. Matsumura and N. Shima (eds.), *Vulnerable cities: Realities, innovations and strategies*. 2008; 8:3-13.
11. National Bureau of Statistics (NBS). *Annual Abstract of Statistics 2006*. Abuja, Nigeria; 2006.
12. Kinnard WN. Tower lines and residential property values. *The Appraisal Journal*. 2000;35: 269-284.
13. Kalitsi EAK. Problems and prospects for hydropower development in Africa. Prepared for the workshop for African energy experts on operationalizing the

- NGPAD energy initiative 2 – 4 June 2003  
Novotel, Dakar, Senegal; 2003.
14. Geomatics Nigeria and PGM Nigeria. Resettlement action plan for the proposed for reconstruction of 107 km Ughelli Delta - Benin Transmission Line To 3 30 kV Double Circuit Quad Conductors. Retrieved 1<sup>st</sup> May 2023 from [www.geomaticsng.com](http://www.geomaticsng.com)
15. Fekete A, Brach K. Assessment of social vulnerability river floods in Germany: United Nations University, Institute for Environment and Human Security (UNUEHS); 2010.
16. Uzodinma BU, Agbagwa, IO. Socioeconomics implications and the resettlement action plan of Alaoji-Onitsha transmission line project on project affected persons. *Archieve of Current Research International*. 2023;23(7):1-6.
17. Uzodinma BU, Agbagwa, IO. The environmental impact of the Alaoji-Onitsha transmission line project and resettlement action plan. *Journal of energy research and review*. 2023; 14(4):22-31.

© 2023 Horsfall et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
<https://www.sdiarticle5.com/review-history/103732>