

Full Length Research Paper

Liquefied natural gas (LNG), environment and the society

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The environmental impact of the Liquefied Natural Gas (LNG) Company for the environment and social conditions using the Nigeria Liquefied Natural Gas (NLNG) in Rivers State, Niger Delta area of Nigeria as a case study is analysed in this paper. Specifically, the paper analyses the environment and social consequences of the operations of NLNG on the immediate environment. Data were collected from both the secondary and primary sources. The paper reveals that air borne diseases are the common ailments. Loss of potable water as well as farmland/wildlife is prevalent while societal values are shown to have broken down. However, NLNG has put some measures in place in order to mitigate some of these negative impacts of its operations on the environment.

Keywords: Liquefied Natural Gas, environment impact, Bonny Island, Niger Delta, Nigeria.

INTRODUCTION

Liquefied Natural Gas (LNG) company operations generally have both positive and negative effects on the environment and society. They provide an important commodity for domestic and industrial use. As a country industrializes and its economy becomes more sophisticated, the demand for gas for industrial and domestic use increases. These demands are met by the products from LNG plant the world over. LNG company operations also create benefits for local economies through job creation and service provision. The operation of LNG plants involves the extraction and transformation of natural resource with consequences for the environment and social conditions.

They sometimes affect heritage and cultural resources and livelihoods in ways that generate conflicts, sometimes leading to violence. Thus, the location, design and operation of an LNG project are often the subject of government regulation worldwide (see Haley and Aldrich Inc., 2002; Hightower *et al*, 2004; Hightower, 2004; Parfomak and Vann, 2009 for details). In virtually all countries where LNG companies operate a plant or storage facility, there are legislations to ensure that the location, design and operation of such companies are

done in a manner that results in minimal adverse impact to the natural and socioeconomic environment. These regulations normally would require a pre-operation impact assessment on the critical habitats of any endangered or at-risk species, and on human and institutional services.

One precondition for a smooth operation of LNG therefore is to embark on an Environmental Impact Assessment (EIA). The environmental impact assessment usually involves detailed and extensive information pertaining to and characterizing the natural resources and environment of the project area, covering topography and climate, oceanographic conditions, land use, geology, hydrology; aquatic and terrestrial biology, air quality, noise, parks, marine reserves and protected areas, and cultural resources (Hightower *et al*, 2004; Parfomak and Vann, 2009).

These companies are expected not only to take precautionary measures; they are also expected to provide measures to mitigate some of the adverse effects of their operations. They are expected to address some of the dislocations and disruptions that may result thereof by direct intervention in the development of their host or affected communities. There is a broad range of interventions programmes undertaken by LNG companies worldwide, reflecting the various peculiarities of the contexts from the Balhaf LNG in Yemen, AES

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Ocean Ltd in the Bahamas, the Darwin LNG plant and Queensland Curtis LNG in Australia and the Tangguh LNG project in Indonesia. Storage facilities are not left out of these requirements for adequate assessment of the likely impact and possible measures to mitigate the negative impact while promoting the positive impact on the environment and society (Haley and Aldrich Inc., 2002; Hightower, 2004). Loan granting organizations like the World Bank require companies to demonstrate commitment to responsible behaviour by outlining plans to develop their host communities in addition to providing EIAs.

These plans and EIAs are not once-for-all events. The companies are expected to periodically evaluate their operations and intervention programmes in order to improve on the ways their operations are carried out. Such periodic evaluations are expected to take into account new developments in technology and comparative experience in community engagement and development activities. Given the setting, it is to be expected that Nigeria Liquefied Natural Gas (NLNG) Company will have various forms of impact on the surrounding areas.

This paper therefore specifically analyses the operations of NLNG vis-à-vis the environment within which it operates in the Niger Delta. Apart from this introduction, the second section presents the setting, while section three deals with the data collection procedure. The result of the analysis of the impact of NLNG on the environment and society is the focus of section four, while the suggested mitigation measures on the effects of NLNG operations is presented in section five. The summary and conclusion are given in the last section.

The Setting

The Niger Delta area which houses the Nigeria's natural gas reserves in large quantity, and also the main source of petroleum often regarded as 'a gas province dotted with oil fields' provides the study area for this paper (see Figure 1). The NLNG project located in Bonny is made up of an industrial zone and a residential area with associated ancillary facilities.

The natural gas used in the production process is collected from gas fields several kilometres to the north of Bonny. Inevitably, gas transmission pipelines traverse the areas between these fields and the firm site. The plant and ancillary facilities necessitated the relocation of a settlement-Finima-to some kilometres away from its original site.

The NLNG like all such projects impacts the social and physical environment of its operations. The area is largely made up of Kalabari Ijaw, Igbani Ijaw, Okrika Ijaw, Ekpeye, Engenni, Ikwerre, and Ogba cultural groups each with its distinct socio-cultural system. In spite of

these cultural diversities, a general socio-cultural pattern is discernable.

These cultural patterns are in constant interface with the various activities and operations of the NLNG. Amadi-ama is Okrika while Ogbunabali is Ikwerre speaking people in some parts of Port Harcourt. Rumuji belongs to a cultural group different from Bonny and Finima. The people are Ikwerre and speak Ikwerre language. Ekpeye is the cultural identity of the Ubeta people. A common feature of these communities is that there is hierarchical structure in the socio-cultural organization, and land ownership is the communal type.

Data Collection Procedure

The data used in this paper were obtained from both secondary and primary sources. The secondary data were collected from NLNG published and unpublished documents from the company's offices in Lagos, Port-Harcourt and Bonny. They provided information on company policy covering various aspects of NLNG activities and achievements. These documents include several issues of NLNG: The Magazine (in house magazine); Host: A Nigeria LNG Community Magazine; Community Project Status; NLNG: Facts and Figures; NLNG: Common Questions and Answers; and NLG: Sustainable Development Reports. Data from these documents relate to community relations/projects. Formal meetings were also held at various contact points with NLNG officials to obtain permission to access various officers, documents and communities. Such meetings held in Lagos, Bonny and Port Harcourt.

Two broad types of key in-depth interviews, marked by unstructured and unpredetermined questions and associated responses, were also carried out with a number of officials of NLNG and some opinion leaders in the host communities. Other officers of NLNG were also interviewed to ensure a full coverage of all the officials. Apart from the foregoing, the collection of data from the primary source involved questionnaire field survey conducted between November and December, 2010. The questionnaire was successfully administered in six communities within the study area as reflected in Table 1. The choice of these communities was based on the information provided by NLNG officials. Three types of host communities were identified. These are: NLNG *plant site communities*, *nodes junction communities* and *pipeline communities*. Although, the NLNG's community relations activities cover three types of communities, in terms of actual impact of the company, the first two types are the active host communities, with the first type being the key. Bonny, Finima, Amadi-ama, Ogbun-abali belong to the first type while Rumuji and Ubeta are of the second type. There is no visible indication of NLNG activities in the pipeline communities. The questionnaire focused on the socioeconomic characteristic of the

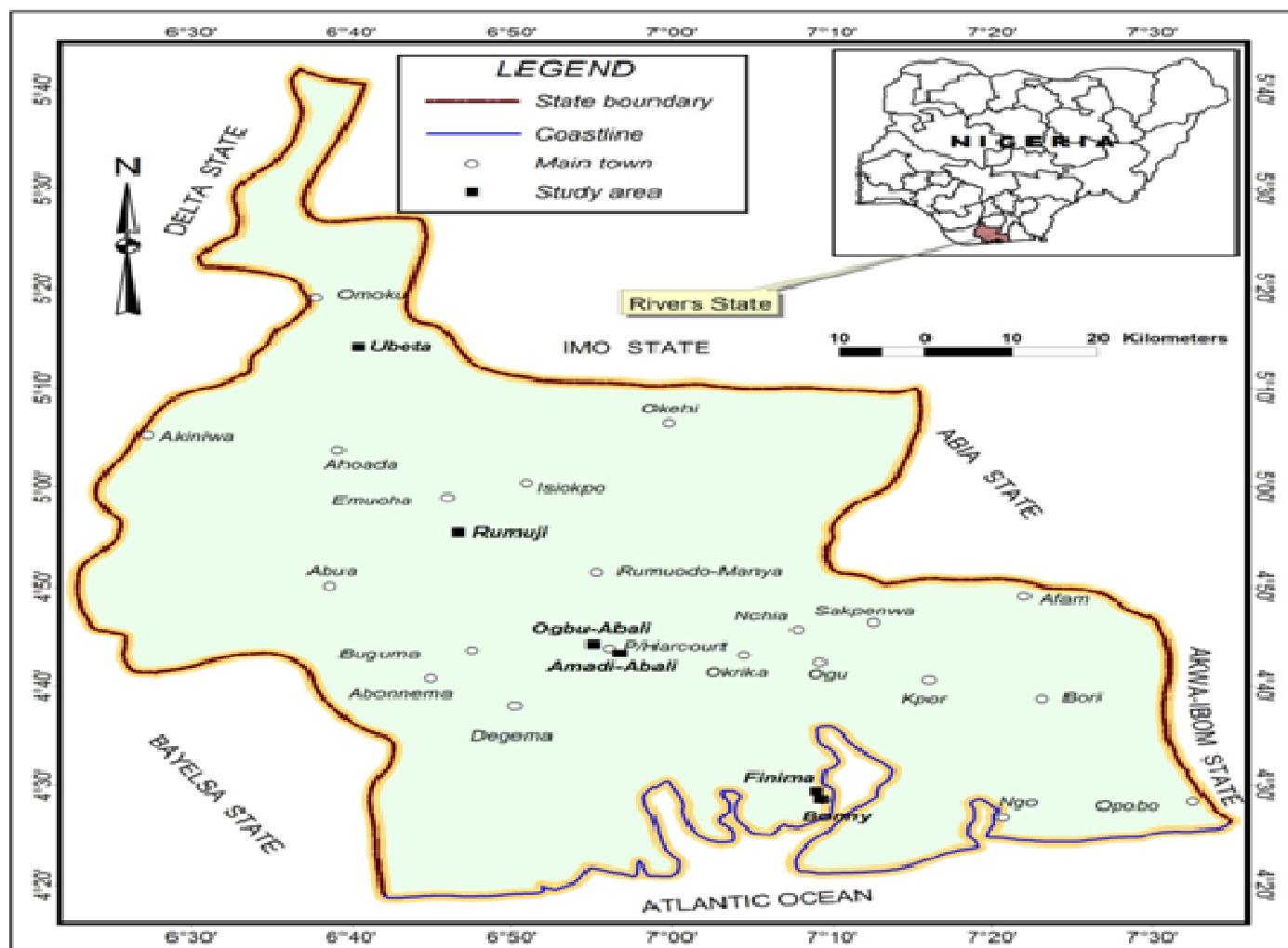


Figure 1: The Setting

Table 1: Distribution of Respondents

S/No	Settlement	No of Respondents	Percentage
1	Bonny	51	18.0
2	Finima	47	16.6
3	Amadi-ama	49	17.3
4	Ogbun-abali	48	17.0
5	Rumuji	51	18.0
6	Ubeta	37	13.1
Total		283	100.0

Source: Fieldwork, 2010

respondents and the environmental effects of NLNG operations on the environment and society in

general. Given that these communities are small, the initial plan was to administer the questionnaire to 50

Table 2: Common Ailments Suffered as a Result of NLNG Operations

Location	a	(%)	b	(%)	c	(%)	d	(%)	e	(%)	Total	%
Bonny	0	0.0	20	39.2	31	60.8	0	0.0	0	0.0	51	100.0
Finima	0	0.0	0	0.0	0	0.0	47	100.0	0	0.0	47	100.0
Amadi-ama	49	100	0	0.0	0	0.0	0	0.0	0	0.0	49	100.0
Ogbun-abali	15	31.3	29	60.4	0	0.0	4	8.3	0	0.0	48	100.0
Rumuji	4	7.8	5	9.8	38	74.5	0	0.0	4	7.8	51	100.0
Ubeta	35	97.2	0	0.0	0	0.0	1	2.8	0	0.0	36	100.0

respondents in each of the communities. A systematic random sampling procedure was adopted in the choice of the respondents. The basis for the choice of this sampling technique is its relative ease of application, given the basically linear structure of these settlements. Each community was divided into four zones while the questionnaire was administered equally in each zone.

This was to ensure that all parts of the communities were covered in the questionnaire survey. In each of the major streets identified in each of the zones, every fourth house from the beginning of the street was identified while the questionnaire was administered to the head of a household in each of the houses. Focus Group Discussions (FGDs) were conducted across the sampled communities while direct field observation was used for areal-based facilities.

Impact of NLNG on the Environment and Society

The impact of NLNG on the environment and society covers a range of issues from health, water supply, population, environment, and cultural heritage.

Health

Highly concentrated industrial activities in a location are likely to be accompanied by some diseases and ailments. This has been medically proven. Table 2 indicates that almost all the respondents in Amadi-Ama and Ubeta indicated that cough and catarrh are among the common ailments suffered in these communities as a result of the NLNG operations.

Note

- a—cough and catarrh;
- b—skin related diseases;
- c—malaria fever, typhoid, cholera, eye problem;
- d—respiratory problems;
- e—stomach disorder.
- *Source: Author's Analysis.*

In Ogbun-Abali and Rumuji, 31.3 per cent and 7.8 per cent of the respondents respectively indicated that the aforementioned ailment is common to their communities

due to the NLNG operations. However, none of the respondents in Bonny and Finima agreed that cough and catarrh suffered in their communities were as a result of the NLNG operations. Some 60.4 per cent, 39.2 per cent and 9.8 per cent of the respondents in Ogbun-abali, Bonny and Rumuji respectively consented that the common ailment associated with the NLNG operation in their community are skin related diseases. In another development, the result shows that 74.5 per cent in Rumuji and 60.8 per cent in Bonny indicated that malaria fever, typhoid, cholera and eye problems are the common ailments suffered in these two communities. All the respondents in Finima attributed their respiratory problems to the operation of the NLNG. This is understandable giving the close proximity of the community to the plant site. Only 8.3 per cent in Ogbun-abali and 2.8 per cent in Ubeta agreed that respiratory problems suffered in their communities are as a result of the NLNG operation. Evidently, the various diseases and ailments in these communities are associated with several factors. These include the high environmental problems such as gas flaring, air pollution, noise pollution and oil spillage as well as lack of potable water.

Water Supply

Water is central to life; hence, we sought to know the situation of water supply to residents of the host communities from NLNG. In relation to loss of potable water, four communities stood out (see Figure 2). These are Bonny (78.3%), Finima (74.5%) and Rumuji (83.7%) and Ubeta (100%) where respondents submitted that there is no potable water in their communities.

In Amadi-ama community, it was observed that marginal loss of potable water was reported by about 22 per cent of the respondents. These submissions are in contrast with the data provided by the NLNG on the provision of water in the host communities. This can be attributed to the high level of expectations of the people viz-a-viz what the NLNG is currently able to provide.

Population

The opinion of residents was also sought on the issue of population in the communities.

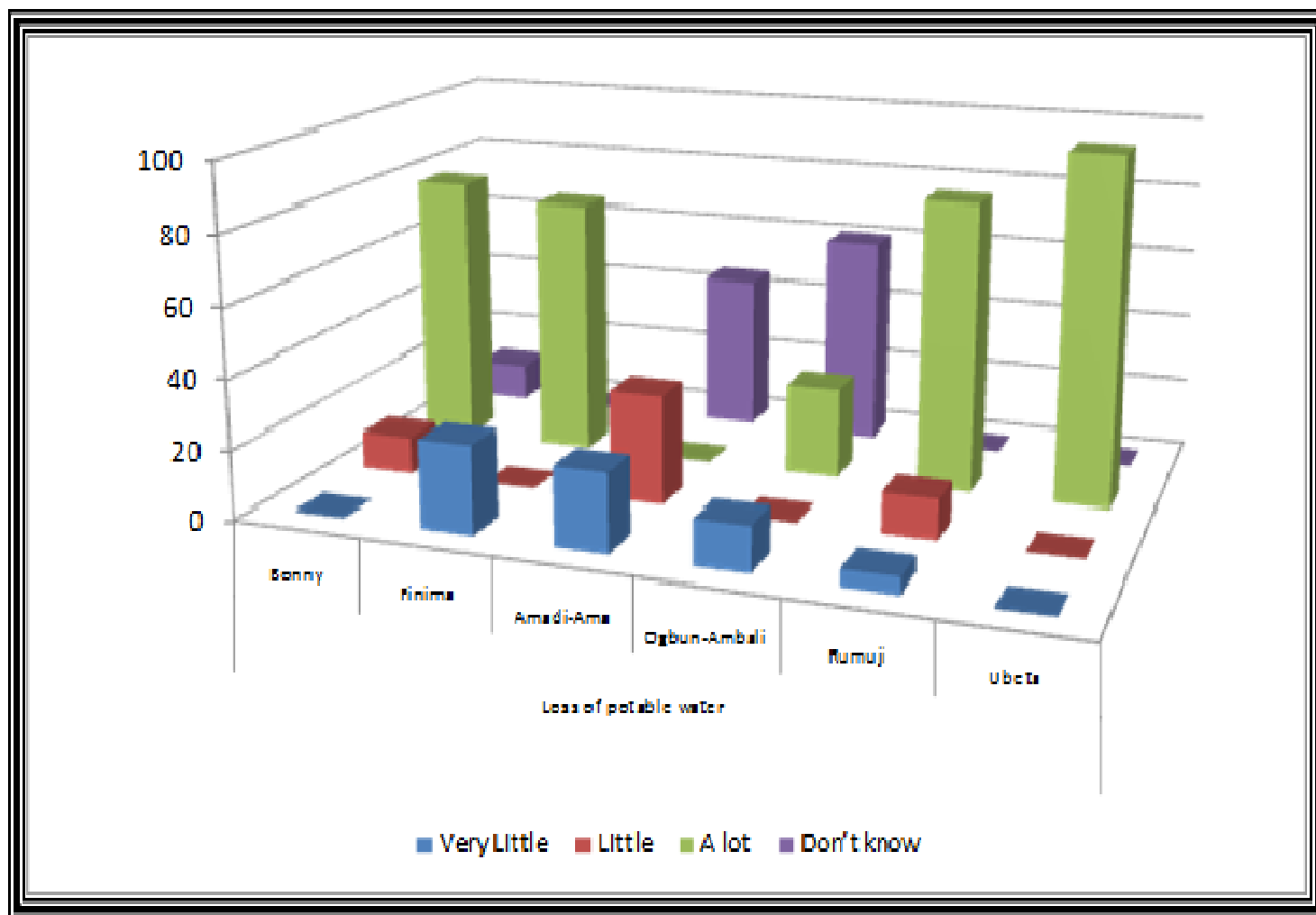


Figure 2: Perception of Respondents on Loss of Potable water

Expectedly, over 65 per cent of the respondents in both Bonny and Finima contended that there is overpopulation in their communities. This submission is supportive of the fact that the plant site of NLNG is located in the two communities. Thus, the expectation is that inflow of workers to the communities will precipitate population rise relative to other communities considered in this study. In Amadi-ama, more than 75 per cent of the respondents agreed that the population of their community has increased inconsequentially whereas in Ogbun-abali those who acceded to the fact that the community population is growing a lot are less than 13 per cent (see Figure 3).

Environment

In continuation of the assessment of the impact of NLNG operations on host communities, this subsection focuses on environment issues. The main elements considered

include land encroachment, loss of farmlands and wildlife, and deforestation.

Land Encroachment

The import of land as a resource for production is nowhere better confirmed than in location of industry. The NLNG case is not different. The host communities offered their land to enable the development of the plant and some other components of the industry especially as it concerns pipes and nodal points. It was perceived that the communities are extremely reserved about the issue of land encroachment. During the FGD, most of the speakers did not clearly express resentment. The reason is not farfetched; the people of Finima and Bonny were adequately compensated and resettled by NLNG. However, the people made submissions in the case of loss of farmlands.

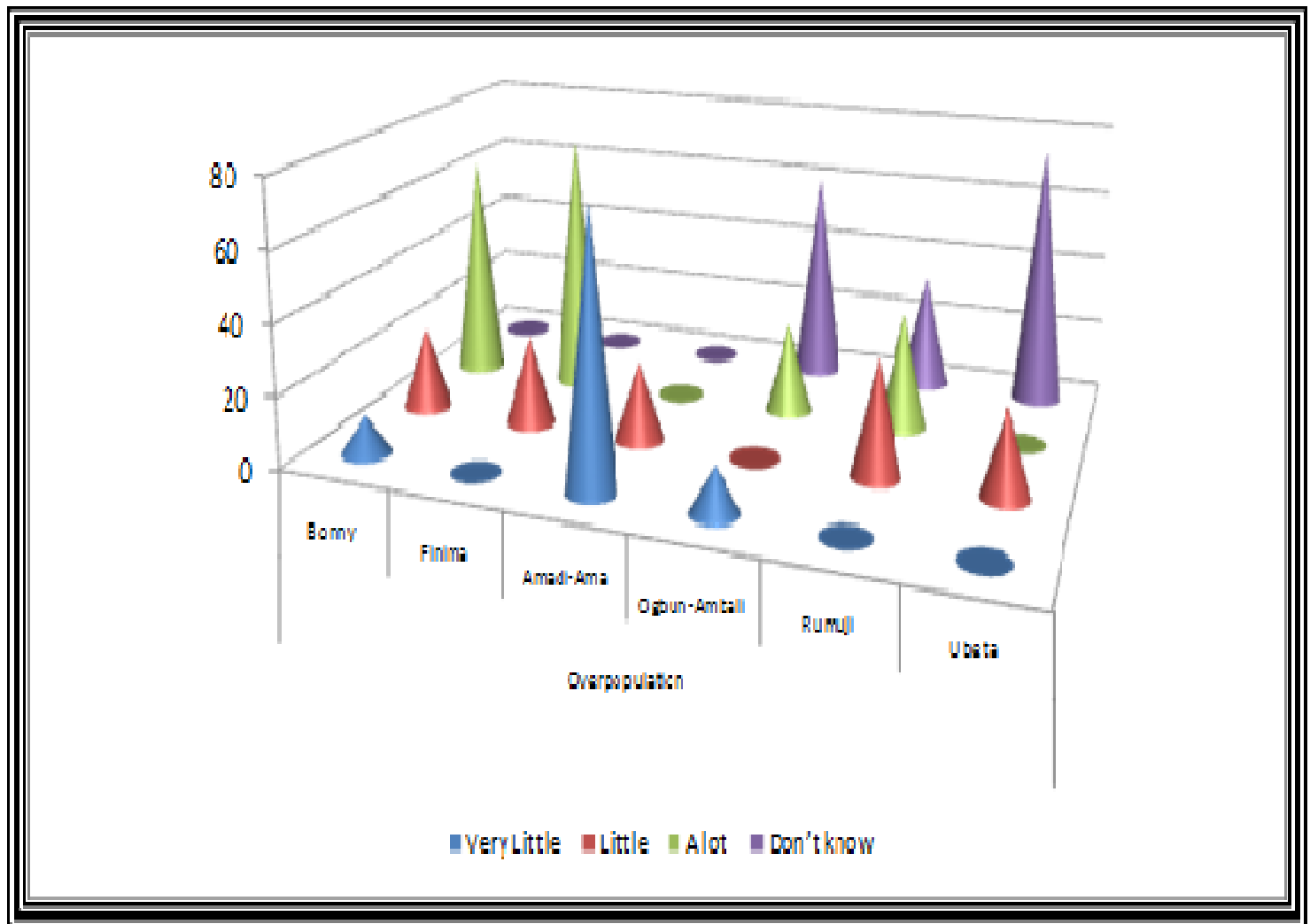


Figure 3: Perception on Overpopulation

Loss of Farmlands

It is clearly evident from Figure 4 that Ubeta (100%) and Rumuji (95.2%) felt the loss of farmland 'a lot' in while about 4 per cent of the people of Rumuji felt it marginally. The two are followed by those from Finima (76.6%). However, 24 per cent of the respondents in Finima do not know if they feel it.

Analysis of this loss of farmlands in Bonny shows a similar trend with Finima, where 76 per cent of the respondents indicated that they lost their farmlands 'a lot'. The remaining 24 per cent agreed they do not know. The loss of farmlands in Amadi-ama and Ogbun-abali shows a different drift. In Amadi-ama, 54 per cent of the respondents stated that very little farmlands were lost, 23

per cent of the respondents believe it was little while the remaining 23 per cent are not aware of the loss of farmlands. Still on the same analysis, in Ogbun-abali community, 60 per cent respondent do not know about loss of farmlands, while 25 per cent indicated a little loss of farmlands and 15 per cent indicated very little loss of farmlands. The resettlement factor can be held accountable for the loss of farmland by people of Bonny and Finima because they are the core hosts for NLNG. The perceived loss of farmland can be linked with the view of the people in the area of reduced agricultural production.

Loss of Wildlife

Attention is shifted to the issue of loss of wildlife attendant on or resulting from various constructions

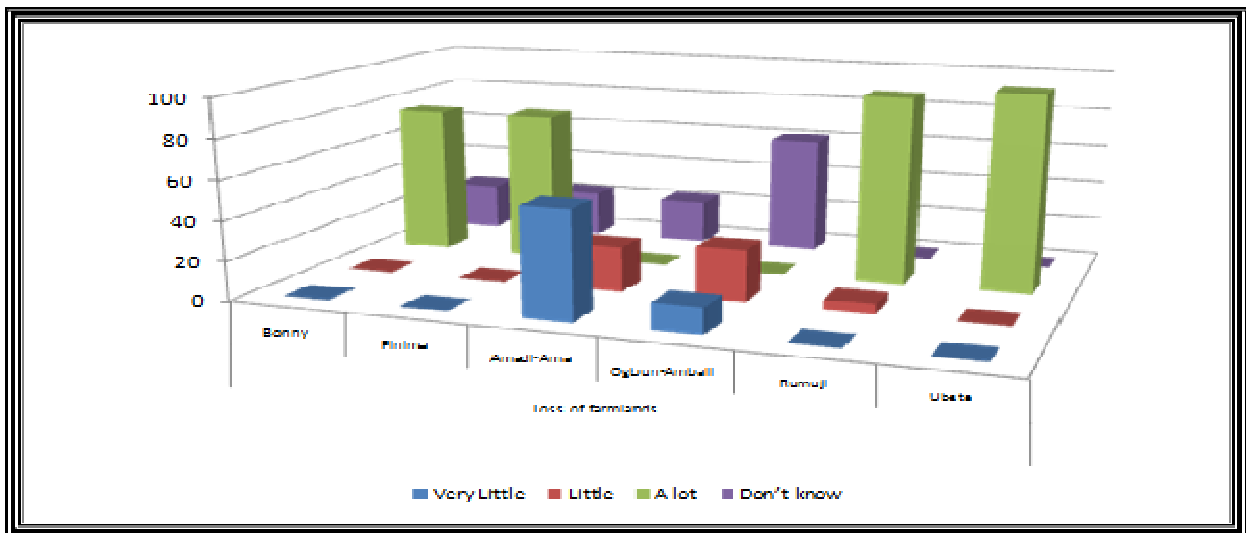


Figure 4: Perception of Residents on Loss of Farmlands

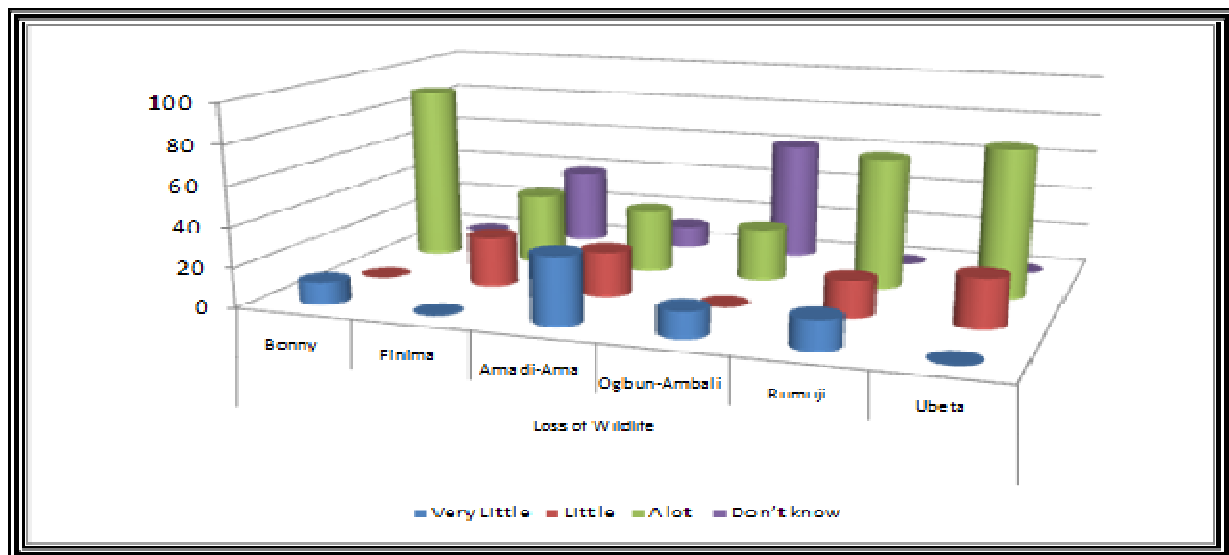


Figure 5: Perception on the Loss of Wildlife

which include residences for the ever-increasing staff of NLNG. Bonny community recorded almost 90 per cent of the respondents that affirm that they have lost wildlife “a lot” while about 10 per cent stated they only lost very little wildlife (see Figure 5).

The results for Rumuji and Ubeta are also striking in the sense that, 68 per cent and 74 per cent respectively agreed that they have lost ‘a lot’ of wildlife. About 36 per cent in Finima, 32 per cent in Amadi-ama and 27 per cent in Ogbun-abali experienced the loss of wildlife in a great measure. Opinions are representative of the fact that the largest portion of land to accommodate NLNG came from Bonny which tops the list on ‘a lot’ of loss of wildlife.

Cultural Resources

Specifically, the discussion here covers cultural festivals, societal values and sexual laxity. The ongoing processes in NLNG areas of operation are normal, for any change in process and any growing urban context, heterogeneity, fluidity and transition should be expected.

Most often, tradition is usually called to question and its norms and values are always vulnerable to changes. There was a general feeling that societal values are breaking down with 37.2 per cent mean submission. Community variations put the odds on Bonny (about 65.2%) and Finima (almost 62%). These two epicenters are unfolding changes. This is to be expected as the

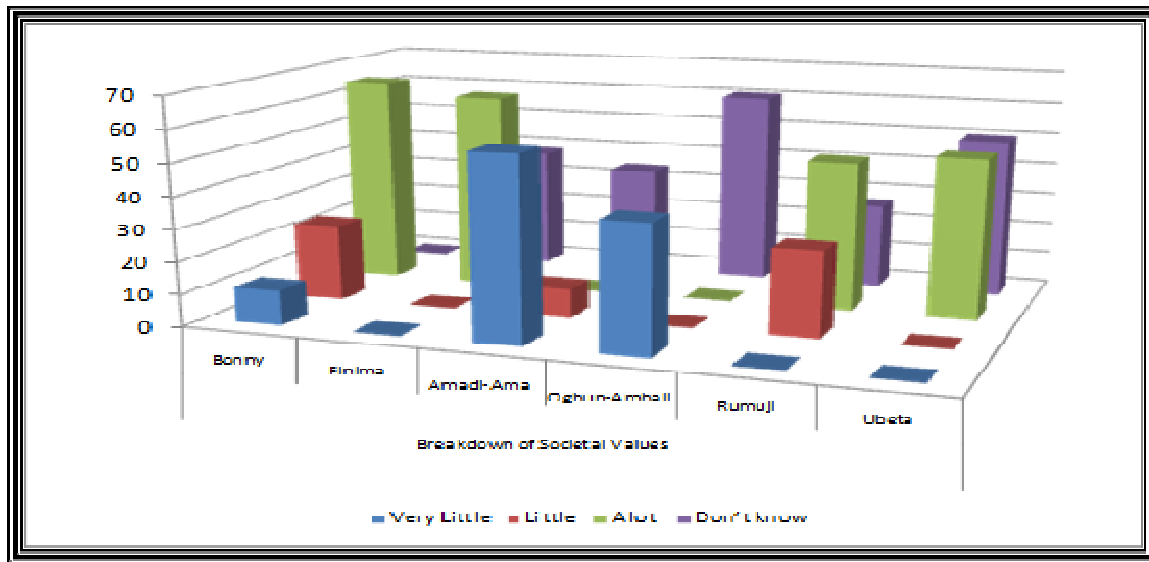


Figure 6: Perception on Breakdown of Societal Values

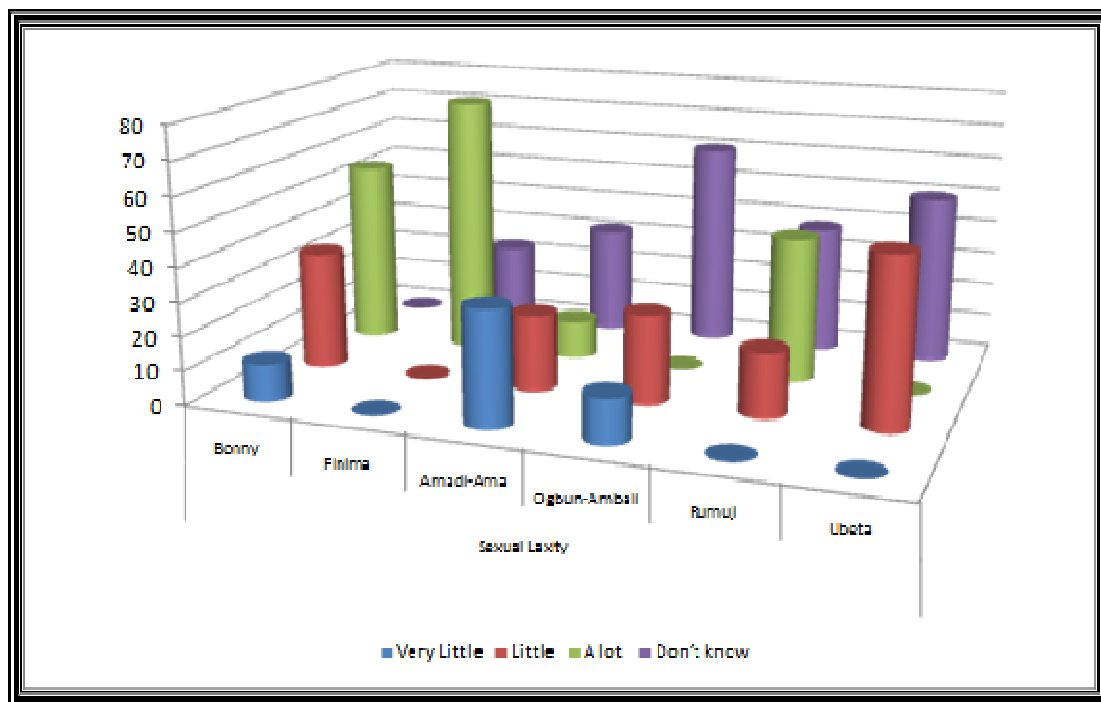


Figure 7: Perception on Sexual Laxity

change from these two locations is likely to diffuse into surrounding communities as time goes on. Following the results in other communities, 47 per cent of the respondents in Rumuji stated that 'a lot' of their societal values have broken down. In Ubeta, about 50 per cent of the respondents agreed that the rate of dilapidation of societal values is huge.

In Amadi-ama, 57 per cent of the respondents believe that their societal values have been destroyed. However, about 60 per cent of the respondents in Ogbun-abali consented that they do not know if their societal values have been adversely affected. The trend as reported in Figure 6 is replicated in the responses on sexual laxity in the communities (Figure 7).

It is evident that Finima (about 80%) took the lead in the area of sexual laxity. This is followed by Bonny with about 60 per cent. Figures like these are indicative of the pressure of population (mostly from in-migration) on the two settlements.

A high male population has encouraged inflow of commercial sex workers (CSWs) into these communities, thus eroding cultural norms and values on sexual relationship.

NLNG Intervention Programme

The specific intervention programmes of NLNG on host communities among which include health, environmental and cultural resources, infrastructural facilities are discussed in this section.

Health Services

NLNG has taken health and safety seriously. Within its plant and operational sites, efforts are made to prevent injuries to workers and surrounding communities. In order to improve access to clean water in the operational environs, the company sunk water borehole in Ubeta, provided solar powered water schemes in Rumuche, Lighom and Elok.

Further, it built staff quarters for doctors in Isaka, Bakana and Finima. Several primary health care centres have been built in several communities in Rivers State. The company carries out regular health awareness campaigns. Also, immunisation and roll back malaria campaigns were sponsored. During the latter campaigns, mosquito and insecticide treated nets were provided for over 4,000 adults and children. NLNG donated an electrocardiogram (ECG) machine to the Bonny General Hospital. Other items supplied to hospitals include mattresses and pillows.

Environment and Cultural Resources

NLNG has a robust policy and framework for protecting the environment. It plans its work to prevent damage to assets and minimise negative impact on the environment. It also takes measures to eliminate or avoid future liabilities. One of such policies is to carry out regular environmental impact assessments (EIAs), enforcing due diligence over its operations in terms of water discharges, sewage treatment and disposal and solid waste management. Its solid waste management is based on the 3R philosophy of *Reduce, Reuse and Recycle*. For emissions into the air, it adopts the principle of abatement at source. NLNG is the biggest gas consumer and exporter in Nigeria, connoting it is a major source of eliminating gas flaring in Nigeria.

As part of its direct line of business, between 1999 and 2008, it converted 57bcm or 2tcf of Associated Gas (AG)

to export LNG/NGL products. Their continued operation is a major guarantee that Nigeria would meet its target of ending gas flaring. In addressing the impact of its operations on community life and the ecosystem, NLNG has established a nature reserve to ensure that floral and natural heritage of Bonny Island are conserved in their natural state.

There is also a park, *The Finima Nature Park*, established for conservation of natural resources and recreational activities. The park is also a resource for research on the fauna, floral and cultural heritage of the Bonny kingdom. Managed by a non-governmental organisation (NGO), Niger Delta Wetlands Centre (NDWC), the park covers about 700 hectares of virgin area of rainforests, mangrove swamps, sandy soil and freshwater ponds. This area is home to a variety of mammals, bird species and reptiles, including crocodiles.

Apart from paying attention to and working towards conserving the environment, the company has carried the local community along in measures to mitigate environmental problems. It is involved in public consultations and enlightenment campaigns on EIA mitigation measures. It has also put up a number of billboards, urging the preservation of forests. It is also exploring the possibility of preserving Ibani language which seemed threatened. Some of these measures have been carried out in partnership with the Bonny Environmental Consultants' Committee. The company has helped with land reclamation in Bonny and Finima and shore protection in the former.

Infrastructure

The NLNG project development includes a Nigerian content plan. This includes a community relations component and an indigenous sub-contractor plan. Several community development projects were implemented alongside the construction of the various trains.

Train three was accompanied by the following road rehabilitation projects:

- The construction of the Coal Beach Roundabout;
- Road to Finima;
- Court Road;
- Lecox/Isowari Road;
- New Layout and King Jaja Road;
- Road to Vocational Training School;
- Park Road;
- King Perekule Road;
- The following infrastructural development projects, dubbed NLNG Plus, accompanied the trains four and five.
- Construction of the Bonny sandy road;
- Finima soccer field upgrade;
- General road repairs in Finima.
- Train six came with the following community infrastructural development projects:
- Jerusalem Road Construction;
- Bonny Truck Park; and
- Finima Road Repairs.

Table 3: Suggested Mitigation Measures on the Adverse Effects of NLNG Operations

Location	a	(%)	b	(%)	c	(%)	d	(%)	e	(%)
Bonny	0	0.0	5	9.8	16	31.4	0	0.0	30	58.8
Finima	0	0.0	0	0.0	0	0.0	0	0.0	47	100.0
Amadi-ama	0	0.0	0	0.0	39	79.6	5	10.2	5	10.2
Ogbun-abali	0	0.0	0	0.0	0	0.0	0	0.0	48	100.0
Rumuji	6	11.8	0	0.0	2	3.9	0	0.0	43	84.3
Ubeta	0	0.0	0	0.0	0	0.0	0	0.0	36	100.0

a–Maintenance of Law and Order; b–Manpower Development and Skills Acquisition; c–Provision of Potable Water and Electricity; d–Youth Employment and Scholarship; e–No Response. *Source: Fieldwork, 2010*

Suggested Mitigation Measures On The Adverse Effects Of NLNG Operations

Given the negative perceptions of the effect of the operations of the NLNG by the respondents, this section focuses on the measures continuously being put in place by the company to mitigate the inevitable consequences of her operations in the host communities. For example, NLNG has the shared value in relation to environment in her areas of operations:

“to ensure adherence to EIA requirements, Environmental Management Plan with the major objective of ensuring compliance with legislations and NLNG HSE policy set up and regularly updated. Its implementation is regularly evaluated by regulators”.

As part of the fulfilment of this pledge and recognizing that unchecked increase in industrial activities on Bonny Island is bound to increase pressure on most aspects of community life as well as the ecosystem (through increased exploration of natural resources), NLNG has established a natural reserve (Finima Nature Park) on Bonny Island. This is in recognition of the importance of the fauna and flora, the sacrifices of the Bonny people and their aspiration and commitment to develop a record of their culture and heritage.

Premised on the need to improve the living standards of the host communities, field observations have shown that NLNG provided drainages and waste management programmes that should positively impact on the environment. However, community members tend to show reservations as to the efficiency of some environmental hazards measures put in place. They were quick to point to the stunted growth of crops and the golden nature of cash crops.

Undoubtedly, it is expected that the operations of NLNG will have adverse effects on both living and non-living things in the host communities.

Note:

Table 3 clearly indicates that 79.6 per cent of the respondents in Amadi-ama community prefer the provision of potable water and electricity as the best

mitigation measure to combat the negative impacts of NLNG operations on their surroundings. Youth employment and scholarship were also conceived by 10.2% of the people as a means of reducing the adverse effects of NLNG operations in their community.

The remaining 10.2 per cent were indifferent. The choice of the respondents in Bonny is similar to that of Amadi-ama, as 31.4 per cent of the respondents' ranked provision of potable water and electricity as the best option for mitigating the effects of the NLNG operations on their environment. Also, in Bonny, 9.8 per cent agreed that manpower development and skills acquisition should be given priority in terms of mitigating the adverse effects of the operations of NLNG in the community. About 59 per cent of the respondents are not disposed to any of the mitigating measures and option.

The story is different in Rumuji where 11.8 per cent of the people believed in the maintenance of law and order as the surest way of mitigating the environmental impact of the activities of the NLNG on their community. About 4 per cent of the respondents also chose the provision of potable water and electricity as the measure to be taken to mitigate the adverse effects of the operation of NLNG.

The respondents in Finima and Ubeta did not respond to this question. It was observed in all the three communities that respondents believe that provision of potable water and electricity are the most plausible measures to be taken in order to mitigate the adverse effects of NLNG operations on their communities. It is pertinent, therefore, to recommend that NLNG should provide some of these amenities/facilities, for example potable water and electricity supply, scholarship and youth employment programmes as a way of compensating these communities in order to facilitate the good neighbourliness policy and create enabling environment for the operation and sustainability of NLNG.

SUMMARY AND CONCLUSION

This paper has shown that cough, catarrh, and skin related diseases are among the common ailments suffered in these communities as a result of the NLNG operations. In another development, malaria fever,

typhoid, cholera and eye problems are the common ailments suffered by Rummuji and Bonny residents. Finima respondents attributed their respiratory problems to the operation of the NLNG. This is understandable giving the close proximity of the community to the plant site. Evidently, the various diseases and ailments in these communities are associated with several factors. These include the high environmental problems such as gas flaring, air pollution, noise pollution and oil spillage as well as lack of potable water.

Respondents in most of these communities are agreed to lack potable water supply in spite of NLNG efforts at the provision of water in the host communities. This can be attributed to the high level of expectations of the people viz-a-viz what the NLNG is currently able to provide. There has been population increase in both Bonny and Finima largely due to the fact that the plant site of NLNG is located in the two communities. This has precipitated population rise relative to other communities. This is in sharp contrast to the situation in Amadi-ama, and Ogbun-abali where population is said to have increased inconsequentially.

The import of land as a resource for production is no where better confirmed than in location of industry. The NLNG case is not different. The host communities offered their land to enable the development of the plant and some other components of the industry especially as it concerns pipes and nodal points. It was perceived that the communities are extremely reserved about the issue of land encroachment. During the FGD, most of the speakers did not clearly express resentment. The reason is not farfetched; the people of Finima and Bonny were adequately compensated and resettled by NLNG. However, the people made to varying degrees submissions in the case of loss of farmland linked to reduced agricultural production, and the loss of wildlife.

There is a general feeling that societal values breaking down as reflected on sexual laxity in the communities occasioned by the inflow of commercial sex workers (CSWs), thus eroding cultural norms and values on sexual relationship. NLNG has provided specific intervention programmes for the host communities among which include health, environmental and cultural resources, and infrastructural facilities. The company also carries out regular health awareness campaign, immunisation and roll back malaria campaigns sponsored while hospitals items are also supplied.

NLNG has a robust policy and framework for protecting the environment.

It plans its work to prevent damage to assets and minimise negative impact on the environment.

It also takes measures to eliminate or avoid future liabilities. One of such policies is to carry out regular environmental impact assessments (EIAs), enforcing due diligence over its operations in terms of water discharges, sewage treatment and disposal and solid waste management. Its solid waste management is based on

the 3R philosophy of *Reduce, Reuse and Recycle*.

For emissions into the air, it adopts the principle of abatement at source. NLNG is the biggest gas consumer and exporter in Nigeria, connoting it is a major source of eliminating gas flaring in Nigeria. The continued operation of NLNG is a major guarantee that Nigeria would meet its target of eliminating gas flaring in no distant time.

In addressing the impact of its operations on community life and the ecosystem, NLNG has established a nature reserve to ensure that floral and natural heritage of Bonny Island are conserved in their natural state. There is also a park, *the Finima Nature Park*, established for conservation of natural resources and recreational activities. The park is also a resource for research on the fauna, floral and cultural heritage of the Bonny kingdom.

Apart from paying attention to and working towards conserving the environment, the company has carried the local community along in measures to mitigate environmental problems. It is involved in public consultations and enlightenment campaigns on EIA mitigation measures. It has also put up a number of billboards, urging the preservation of forests. It is also exploring the possibility of preserving Ibani language which seemed threatened. Some of these measures have been carried out in partnership with the Bonny Environmental Consultants' Committee.

The company has helped with land reclamation in Bonny and Finima and shore protection in the former.

The NLNG project development includes a Nigerian content plan. Several community development projects were implemented alongside the construction of the various trains. Given the negative perceptions of the effect of its operations, NLNG continuously put measures in place to mitigate the inevitable consequences of her operations in the host communities.

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REFERENCES

- Haley, Aldrich Inc (2002), Environmental Impact Assessment Ocean Cay and The Biminis, The Bahamas, Bahamas: AES Ocean LNG, Ltd. September, 399pp.
- Hightower, ML Gritzo, A Luketa-Hanlin, J Covan, S Tieszen, G Wellman, M Irwin, M Kaneshige, B Melof, C Morrow, D Ragland (2004), *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water*, 167 pages.
- Parfomak PW, A Vann (2009), Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation, Congressional Research Service, 7-5700 www.gov RL32205 December 14.
- Worley, Parsons (2010). Australia Pacific LNG Project Supplemental information to the EIS Social Impact Management Plan LNG Facility.