PETROLEUM EXPLOITATION AND SPATIO-TEMPORAL DYNAMICS OF LABOUR OUTPUT IN THE RURAL ECONOMY OF DELTA STATE, NIGERIA

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ABSTRACT

This study examined the impact of petroleum exploitation and the temporal and spatial dynamics of labour output in the rural economy of Delta State, Nigeria, between 2001 and 2006. The study utilized data from both primary and secondary sources. The primary source is the survey of selected settlements and heads of households in which structured questionnaire was administered. A multistage sampling technique was employed in the selection of sample. The first stage involved a random selection of 10 settlements from 40 oil-producing settlements in the study area. The second stage involved systematic selection of 560 heads of households out of 5,615 households enumerated in the sampled settlements. The data collected were analysed using the pair-wise Student's t-test and the One-way Analysis of Variance. The results show that temporal dynamics of labour output in the primary sector were significant. Also, spatial changes in labour output were influenced by distance from petroleum exploitation sites over the two-timed period. Impact evaluation of petroleum exploitation activities is recommended for sustainable development of the physical environment and labour force of the region.

Keywords: *Petroleum exploitation, Environment degradation, Labour output, Impact Evaluation, Delta State.*

INTRODUCTION

The rural economy of Delta State, Nigeria like other rural areas of the world is characterized by the predominance of primary occupations such as agriculture and allied activities, including fishing, lumbering, hunting and tapping of rubber trees and raffia palm. It also includes other occupations that are involved in the exploitation of resources from the biotic component of the ecosystem. Such activities include gathering of fuel wood, collection of non-timber forest products like bamboo, palm nuts, screw pines and thatches, snails, fruits and herbs for medicinal purposes. Consequently, these primary activities depend on the physical environment. However, petroleum exploitation in the area has devastated the physical environment and massively threatened the primary occupations, which employed over 75% of the population. The devastation is in form of severe or excessive flooding of forest and farm lands, destruction of food and forest crops, seasonal or permanent flooding of farmlands; thereby, reducing available arable farmland portions, death of foods and

economic crops and non-timber forest products, permanent flooding and pollution of lakes and creeks, reduction in games and wild life populations. All the above-mentioned forms of devastation have resulted in the declining yield from primary occupations; thereby, impoverishing and making the sector less attractive. This is so because the ecology of the study area (soil types, water, climate, physiography, plants and animals), largely determines the economic endeavours of the rural population in general and the primary sector's labour force in particular (Gabriel, 2004). People in the region's mangrove forest ecosystem engage themselves mainly in fishing and gathering of sea foods. A dense vegetation of mangrove in their marine and brackish habitat found along the numerous rivers and creeks were dependable sources of fuel wood for domestic and small-scale food processing as well as income generation. However, the mangrove vegetation is threatened by petroleum exploitation. Onuoha (1985) identifies oil as one of the major sources of pollution plaguing the Niger Delta region including Delta State, the mangrove environment. It is one of the many causes which contribute to the deterioration of the marine and brackish environment.

Similarly, the fresh water ecosystem occurring around fresh water creeks and lakes support the people's fishing activities, gathering of sea foods, fuel woods, gin distillation from raffia palm trees (Raphia hookeri), collection of African mango seeds, 'Ogbono' (Irvongia gabonesis), snails, weaving of mats and other items from screw pine (Panadus candelabrum), rattan palms and bulrushes. In the mangrove and fresh water swamp system, the people engage in farming, mainly for subsistence, and are dependent on the availability of arable farmland. In the tropical rainforest, the people's major economic activity is farming. Collection of snail and other non-timber forest products, weaving, fuel wood gathering, tapping of rubber trees and many others are economic activities which women in the state are engaged in. The devastation of environment due to oil exploitation activities, therefore, has adversely affected the people in the practice of their traditional occupations. For instance, a study by Agbogidi, Okonta and Dolor (2005) indicate that oil exploration and production in Edjeba and Kokori (Delta State) have caused damage to farmlands and water bodies as a result of oil spillage leading to decrease in agricultural output. Hence, the income-earning capacity of the people has declined appreciably.

Though the issue of petroleum exploitation vis-à-vis the population in the state has long hit the limelight, and has formed the focus or theme of numerous studies and comments, the issue of petroleum exploitation and spatio-temporal dynamics of labour output, particularly the primary sector's labour force in Delta State has not been studied empirically. Hence, this study aimed at examining the temporal and spatial dynamics of labour output in the rural economy as measures of the indirect impacts of petroleum exploitation on the physical environment of the Delta State, Nigeria.

Delta State lies roughly between Latitudes 5°00' and 6°30' north and Longitudes 5°00' and 6°45' east, over an area of 22,159 square kilometres, of which more than 60 per cent is land. The state is bordered in the north by Edo State, by Ondo State to the

northwest, Anambra State to the east and Bayelsa State to the southeast. On its southern flank is the Bight of Benin, which covers approximately 160 kilometres of the state's coastline. The state is divided into twenty-five political divisions called Local Government Areas (L.G.A), as shown in Figure 1.

The people of Delta State engage in a wide range of economic activities. These include farming, fishing and hunting, tapping of rubber and raffia palm, mining, trading and manufacturing. One of the major industrial activities in the state is prospecting for mineral resources. These resources include petroleum, lignite, coal, alluvium, silica, limestone and clay. Petroleum resource is by far, the most important of these mineral resources. The state is one of the major crude oil-bearing states in Nigeria, where a substantial amount of the country's proven reserves is located. It has 83 of 159 oil fields in Nigeria and accounts for over 25 per cent of Nigeria's crude output between 1999 and 2004 (Akpan, 2005). The landscape is dotted with numerous oil wells and is transversed by a network of oil pipelines. This development in addition to population pressure affect the traditional occupations of the people particularly farming and fishing. The traditional farming methods of shifting cultivation and bush fallowing are threatened because of the reduction of farmlands due to petroleum exploitation and production.

Fig. 1: Map of Delta State showing the study areas.

METHODOLOGY

The design adopted for the study was ex-post facto or causal-comparative. This design, accordingly to Frankfort-Nachmias and Nachmias (1996), commonly

reconstructs the past by asking retrospective questions on an earlier period and comparing it with the present situation. Peretomode and Ibeh (1995) pointed to many circumstances where causal-comparative research is appropriate. One of such circumstances, according to them, is when it is not always possible to select, control and manipulate the factors necessary to study cause and effect relationships directly. The choice of this design was therefore based on twofold. First, it enabled the researcher to collect and compare data at two-time periods. Secondly, since petroleum exploitation is the independent variable in the study, and can not be manipulated or controlled by the researcher, the ex-post facto or causal comparative design was judged appropriate.

The target population for this study is everyone who is economically active in the rural sector of the oil-producing communities of Delta State. It includes persons engaged in farming (arable and animal husbandry), fishing, lumbering, hunting, tapping of raffia palms for wine and rubber trees for latex, and other occupations in the primary sector. The multistep sampling technique was used to select sample for this study. The first stage involved selection of settlements where petroleum exploitation is carried out in the state. These are 18 out of 25 Local Government Areas (LGA) of the state, with 26 active oil fields and 40 oil-producing settlements. Ten of the settlements (25%) were selected randomly, using the table of random digits. The selected settlements are spread over nine oil fields.

The second stage involved the selection of households in the sampled settlements. In each of the selected settlements, the total number of households was estimated with the help of village head or his representative. In some cases of settlements with electricity, the registers used in the distribution of electricity bills of the Power Holdings Company of Nigeria (PHCN) were provided by the village heads. They were used to estimate and enumerate households in four of the 10 settlements of Otujeremi, Ubogo, Ovade, and Erhoike. For the remaining six settlements of Afiesere, Evwreni, Otor-Owhe, Uzere, Beneku, and Ugborodo, actual counting of households was carried out with the help of village heads or representatives. Actual counting of households was further made easier because of the existing subdivisions in each of the selected settlement called quarters. Thus, enumeration was done on the basis of quarters until the entire settlement was covered. A total of 5,615 households were enumerated in the 10 settlements.

Estimation and enumeration of households were done to eliminate sampling error because it was observed from the reconnaissance survey of the study area that official population figures were more than the actual population of these settlements. The systematic random sampling technique was employed for the selection of households in each selected settlement. This required a serial numbering of the households, after which the household was randomly picked. Subsequent ones were picked at a chosen interval until the total number of designated sample size of households in each settlement was achieved. A total of 560 households representing 10% of the total households were interviewed in the 10 settlements. The questionnaire

used for the study was designed to cover all facets of the study. Each question was brief and carefully worded so that it was comprehended by the respondents. The questions were also presented in a systematic manner so that responses could be related to one or another aspects of the study. Data collected for the study were coded and compacted into manageable size. The frequencies of occurrence of events, means, group means, mode, standard deviation and percentage were worked out and presented on tables. The process of data analysis was facilitated by the use of the Statistical Package for Social Sciences (SPSS). The temporal dynamics of labour output in the primary sector as a result of petroleum exploitation was tested using the pair-wise Student's t-test. In doing this, labour output, computed in monetary terms on individual basis for the labour force in the primary sector for 2001 and 2006 were compared. The spatial dynamics of labour output in the primary sector between 2001 and 2006 as influenced by location of petroleum exploitation activities was tested using the one-way Analysis of Variance (ANOVA). In this test, labour output in relation to the distance from petroleum exploitation sites in the sampled settlements for the two-time period was compared.

RESULTS AND DISCUSSION

As the output or yield of the labour force in the primary sector varies in types and quantity, these variations were harmonized by converting to monetary terms (Nigerian Naira). The outputs in 2001 and 2006 were assessed using the 'going price' in the market in 2006 for the products. This was done to enable comparison to be made in spite of inflationary trend. Output from primary occupations changed between 2001 and 2006 in the study area in response to changes in distances of primary activities from sites of petroleum exploitation.

Table 1 reveals an over-all output of N208,600.00 in 2001 and N166,500.00 in 2006. However, there were variations in the output among the different activities. For arable farming, output decreased from an average of N371,300.00 to N160,400.00 per annum in 2001 and in 2006. Moreover, income from fishing decreased from N211,000.00 in 2001 to N165,200.00 in 2006. Similarly, income from hunting also decreased from N195,600.00 to N157,100.00 during the same period. The decline was sequel to the decrease in catch. Income from lumbering and rubber tapping also decreased from N246,800.00 to N240,600.00 and N237,300.00 to N200,000.00 per annum respectively between 2001 and 2006. The decrease in income from rubber tapping was the consequence of petroleum exploitation activities such as oil spillages, waste dumping and crude oil transportation, which affect rubber plantations in the study area. The decrease in output from lumbering was the result of the declining number of fellable trees, and tedious and long periods of lumbering expeditions as a result of petroleum exploitation.

Similarly, income from palm nut collection and raffia palm tapping decreased from N181,000.00 to N143,300.00 and N238,000.00 to N193,300.00 per annum respectively, between 2001 and 2006. In addition, income from fuel wood gathering

decreased from N172,900.00 to N160,200.00, while income from other primary activities such as collection of non-timber forest products (snail picking, and herbal collections) remained unchanged in 2001 and 2006. Average annual income from these activities was N50,000.00. The only exception is in animal husbandry in which there was an increase in the average income from N181,800.00 in 2001 to N194,300.00 in 2006. This increase was attributed to the encouragement given to farmers by the oil-producing companies as a way of ameliorating the adverse effects of petroleum exploitation on the people.

This encouragement was in form of soft loans, organization of workshops and training on modern methods of fish farming, snail rearing and poultry by Shell Petroleum Development Company (SPDC) in Otujeremi in 2003 and Ugborodo in 2005 (SPDC, 2004; 2006) More so, this activity is not directly affected by the deteriorating environment as a result of petroleum exploitation. To test whether the temporal dynamics of labour output of the primary sector between 2001 and 2006 are not significant, the pair-wise Student's t-test' was used. The result indicated that the t value of 27.33 is significant at 0.05 levels of confidence as depicted on table 2.

Table 3 shows that there were spatial dynamics of output (measured in monetary terms) over most of the distance intervals of petroleum exploitation sites in 2001 and 2006. The average output of primary occupations carried out within 1km or less of petroleum exploitation sites decreased from N390,200.00 in 2001 to N92,800.00 in 2006. Similarly, output decreased from N468,900.00 to N194,300.00 and from N375,900.00 to N191,400.00 respectively for primary activities carried out between 1 - 1.5 km and 1.6-2.0 km. In addition, total output of primary occupations between 2.1 - 2.5 km and 2.6 - 3.0 km decreased from N279,200.00 to N156,600.00 and from N311,400.00 to N139,200.00 respectively in 2001 and 2006.

In contrast, increase in output of primary activities were recorded for distances further away from 3.0 km and above of petroleum exploitation sites in 2006 as follows; for locations 3.0km to 3.5km, the output increased from N189,700.00 to N197,200.00 and from N21,500.00 to N295,800.00 for activities located between 3.6km to 4.0km away from exploitation sites. In addition, while no primary activity was carried out at 4.1km and above away from exploitation sites in 2001, activities were carried out at these distant locations and fetched the following; N203,000.00, N118,900.00 and N60,900.00 within 4.1 - 4.5km, 4.6 - 5.0km and above 5.0 km respectively in 2006, hence, the dynamics in labour output in relation to distance from petroleum exploitation sites. To test whether the spatial dynamics of labour output of the primary sector between 2001 and 2006 are influenced by location of petroleum exploitation activities, the one-way Analysis of Variance (ANOVA) was applied. The result shows an F value of 8.45. This value is significant at 0.05 level of confidence as depicted on table 4. Therefore, the spatial dynamics of the primary sector's labour force was influenced by the location of petroleum exploitation activities. Thus, the dynamics in output of the labour force is attributable to the declining fortunes in the primary occupations as a result of environmental devastation by petroleum mining activities.

Table 1: Temporal Dynamics of Total Output/Income of Primary Sector

Primary Activities		Average Output (N'000)	
		2001	2006
1	Arable Farming	371.3	160.4
2	Animal Husbandry	181.8	194.3
3	Fishing	211.0	165.2
4	Hunting	195.6	157.1
5	Lumbering	246.8	240.6
6	Rubber Tapping	237.3	200.7
7	Palm nut Collection	181.0	143.4
8	Raffia Palm Tapping	238.0	193.3
9	Fuel wood Gathering	172.9	160.2
10	Others	50.0	50.0
Over-all Average Output		208.6	166.5

Source: Author's Fieldwork, 2007

Table 2: Temporal Dynamics of Labour Output, 2001 and 2006

	Paired Samples Test							
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	95% Confidence Interval of the Difference						
				Lower	Upper			
Pair 1 output from activity 2001 - output from activity 2006	91475.714	27.330	559	.000	98049.987	27.330	559	.000

Table 3: Spatial Dynamics of Labour Output in the Primary Sector

Distance from Exploitation Sites	Average Output in (N'000) 2001	Average Output in (N'000) 2006
<1km	390.2	92.8
1.0-1.5	468.9	194.3
1.6-2.0	375.9	191.4
2.1-2.5	279.2	156.6
2..6-3.0	311.4	139.2
3.1-3.5	189.7	197.2
3.6-4.0	21.5	295.8
4.1-4.5	-	203.0
4.6-5.0	-	118.9
>5km	-	60.9
Total	2,035.7	1,650.2

Source: Fieldwork, 2007

Table 4: Temporal Dynamics of Labour Output, 2001 and 2006

ONE-WAY ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	3.700E11	9	4.111E10	8.455	.000
Within Groups	2.674E12	550	4.862E9		
Total	3.044E12	559			

The computed F value of 8.455 is significant at 0.05 level of confidence.

CONCLUSION AND RECOMMENDATIONS

The study showed that the temporal dynamics of labour output in the primary sector is significant. Also, the spatial dynamics of the primary sector's labour force was influenced by the location of petroleum exploitation activities. Thus, the dynamics in output of the labour force is attributable to the declining fortunes in the primary occupations as a result of environmental devastation by petroleum mining activities.

Since the dynamics of labour output is the resultant impact of petroleum exploitation activities on the physical environment of the study area, measures that will reduce the adverse effects would have considerable improvement on labour output in the study area. Consequently, the study recommends that an Impact Evaluation (IE) should be carried out to determine the impact of petroleum exploitation on the environment of the study area. Such evaluation should cover all the dimensions of the environment, which are physical, social, economic and aesthetic. A good IE of the petroleum exploitation activities should, therefore, include the following; a thorough understanding of all the petroleum exploitation activities and the environmental impact of these activities, the environment in which these activities take place, in terms of dynamics of human ecosystems, the dynamic relationship between the exploitation activities, population and labour force.

In addition, the petroleum exploitation companies must adequately consult the IE, engaged in the training of the labour force on environmental education, monitor exploitation activities, and resolve environmental problems when necessary. Such efforts would promote sustainable development of the environment; thereby, ameliorating the adverse effects of petroleum exploitation on the labour force. Sustainable development, according to Diesendorf and Hamilton (1996), is aimed at meeting the needs of the present without compromising the ability of future generations. It is simply a matter of inter-generational equity. If resources are exploited in ways that are not sustainable, it would affect future generations. Applying this idea to the study, petroleum resources may have to be exploited not only to protect the present labour force, but also the future population.

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