Climate Change and Labour Output of Primary Sector in The Niger Delta Region of Nigeria

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ABSTRACT

This study examines empirically the temporal changes in labour output of primary sector as a resultant impact of environmental dynamics induced by climate change in the Niger Delta Region, Nigeria. Its specific objective is to analyse the temporal dynamics of the labour output in the main economic activities in the primary sector as a result of climate change between 2008 and 2012. It utilised data from both primary and secondary sources. Primary data were obtained from a survey of selected settlements using a questionnaire. Multi-stage sampling technique was employed in the selection of the sample. This involves a systematic random sampling of 450 household heads from a total of 4,578 households enumerated in five rural settlements drawn randomly from a representative state in the study area. The questionnaire covered impact of climate change on the environment and labour output, measured in monetary terms, of primary sector between 2008 and 2012.The paired sample t-test was used to analyse the data collected for the study. The result showed that climate change is manifested in excessive heat and off-season rainfall. There were significant dynamics in labour output over the two-time period. The study, therefore recommends environmental education of the population and adoption of coping strategies such as introduction of modern technology and improvement in quality of inputs into primary activities
Keywords: *Primary sector, Climate change, Environmental dynamics, Labour output, Niger Delta Region*

INTRODUCTION

The labour output of primary sector refers to income or earnings accruing to that segment of the labour force that is engaged in 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. Since the economic activities of the sector are dependent on the natural environment, they are affected by any phenomenon that can cause changes in any component of the environment namely, atmosphere, lithosphere, hydrosphere and biosphere. One of such phenomena of environmental dynamism is climate change. The United Nations for Climate Change Convention (UNFCCC) (2000) defines Climate Change as a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which in addition to natural climate variability observed over comparable time periods. Climate change refers to dynamics in the average condition of

the atmosphere as a result of global warming, a condition of a noticeable or measurable increase in the average temperatures of the earth's atmosphere, oceans, and landmasses. The increased temperature is caused by rising levels of heat-trapping gases, also known as greenhouse, in the atmosphere as a result of human activities. The human activities that can cause climate change include agriculture, mining, industrialization and urbanization. Though the issue of climate change has long become a global issue, it was brought to limelight a few decades ago in Nigeria and since then there has been a plethora of studies and comments on different aspects of the phenomenon. Some studies have focused on causes of climate change (NEST, 2003; Ayoade, 2004, National Geographic, 2008), and others have dwelled on its adverse effects on the physical environment such as persistent drought and flooding, off-season rains and dry spells, reduction in river flow in arid and semi-arid areas, drying up of rivers and lakes, water resources and rising sea levels (Khile, 2007; Medugu, 2009; Odjugo, 2010). Yet others consider its effect on the human population, particularly on the health of the people and agricultural activities (Odjugo, 2000; Olanrewaju, 2006; Adejuwon, 2004; Apata, Ogunyinka, Sanusi and Ogunwande, 2010; Ayinde, 2010; Mohammed and Abdusalam, 2010; Bello *et al*, 2012; Efe and Ojoh, 2013). For instance, Efe and Ojoh's (2013) study of climate variability and malaria prevalence in Warri metropolis revealed that there is significant relationship between malaria and climatic parameters of temperature and humidity.

Furthermore, Bello *et al.* (2012) assert that climate change has resulted in reduction of arable lands for cultivation in Nigeria in addition to shortening of growing seasons; thereby causing crop failures and food shortage. In a similar vein, Mohammed and Abdusalam (2010) assert that increases in temperature, reduced rainfall and irregular humidity as a result of climate change will have numerous effects on agricultural production. They contended that the phenomenon may affect the physical availability of food production by shift in temperature and rainfall: people access to food by lowering their income from coastal fishing because of rising sea levels. Commenting on the impact of climate change on the human population, Oladipo (2010) is of the view that climate change is a serious threat to efforts at poverty eradication and sustainable development in Nigeria because the country has a large rural population directly depending on climate sensitive economy and development sectors (agriculture and fisheries). In sum, climate change leads to dynamics of the physical environment which is very crucial to the existence of the population including the primary sector, in terms of carrying out economic activities; hence the adverse effects of the phenomenon on the labour output of the primary sector.

In spite of the tremendous impact of climate change on the environment and population in the study area, a critical review of the literature shows that the dynamics of labour output in the primary sector that relies solely on the physical environment for livelihood, as a resultant impact of climate change on the physical environment, has not been studied. Moreover, most of these previous studies are qualitative. In the light of the foregoing, this study empirically examines the temporal dynamics of labour output in the primary sector, as measures of the indirect impact of climate change on the physical environment of the Niger Delta Region, Nigeria. Its specific objective, therefore, is to analyse the temporal

dynamics of the labour output in the main economic activities in the primary sector as a result of climate change between 2008 and 2012. A modification of the Pressure-State-Response (PSR) Model proposed by Harrison sand Pearce (2001) is adopted for this study. The PSR model is an alternative to both the Malthusian crisis model and the economic adaptation models. The model, in its original version, postulates that population pressure on the physical environment, which may be in form of a particular human activity, such as exploration and exploitation of resources, causing impact. The level of pressure is determined by population, consumption and level of resource use and waste output these generate. The pressures lead to environmental degradation and depletion. The responses to this state of the environment are scarcity, loss of amenities and hazards, which are in forms of feedbacks. Filters, which include science, monitoring, political, legal, market and property systems set the overall conditions for the operation of other parameters.

Lastly, the societal response to these consequences of population pressure and subsequent degradation of the physical environment are in forms of price shift, changes in behaviour, culture and technology and resource management. Other responses are policy measures, regulations, taxation subsidy and so on. In relation to this study, the model indicates that population pressure on the physical environment, which may be in form of human activities, such agriculture, mining, urbanization, industrialization lead to climate change, which manifest in form of environmental dynamics: changes in atmosphere, biosphere, lithosphere and hydrosphere. The result or feedback of this state of the environment is declining output of labour, increasing poverty and food insecurity in the primary sector which depends solely on the physical environment. Filters, which include socio-economic and political systems, set the overall conditions for the operation of other parameters. Lastly, the sector's response to these consequences of population pressure and subsequent dynamics of the physical environment are in forms of changes in economic activities. The model is schematically represented in Figure 1.

THE STUDY AREA

The Niger Delta Region lies roughly between Latitudes 4^000' and 7^030' north and Longitudes 4^000' and 7^030' east, over an area of 112,100 square kilometres, about 12 per cent of the total land area of Nigeria. The region is bordered in the south by the Atlantic Ocean and to the east by the Republic of Cameroun. To the west, the region is bordered by the southwestern states of Lagos, Ogun and Osun. The states of Benue, Kogi, Enugu, Ebonyi and Anambra border the region to the north. What constituted the Niger Delta region from the colonial days is more or less synonymous with the administrative divisions of Ahoada, Brass, Degema, Opobo, Ogoni, Western Ijaw and Warri. These administrative divisions are in the present day Rivers, Bayelsa and Delta States. The definition of the region nowadays has been made quite elastic to include any geo-political state with an appreciable quantity of petroleum resource. Based on such definition, the region covers nine states, namely, Abia, Akwa Ibom, Bayelsa, Edo, Cross River, Delta, Imo, Ondo, and Rivers States. The 2006 provisional national population census put the population of the nine States that make up the region at 31,244,577 persons, made up of 16,092,796 males and 15,131,781

females (NPC, 2006). However, the region has a projected population of 33, 616,000 persons in 2010 spread across 13,329 settlements, with about 99% having a population of less than 20,000 persons. Settlements with less than 5,000 inhabitants constitute nearly 94% and only 98 settlements, that is less than 1%, can pass as truly urban centres according to their population sizes (NDDC, 2004). Consequently, the region is predominantly rural and there is the preponderance of primary occupations. The people of the region engage in a wide range of economic activities which are land intensive and dependent upon the ecological zones. These zones were classified by Ikporukpo (1996) into two, namely, the outer Delta; which comprise muddy sheltered creeks, Deltas, brackish and or strong tidal waters characterized by mangrove (*Rhizophora race mosa)* as the most common plant. Associated with this zone are occupations such as fishing and trading. The inner Delta, is made up predominantly of swamp rainforest which is not as wet. The zone comprises wet lowland evergreen rainforest in the north and mangrove forests in the south. The main occupations in this zone are land based and they include farming (arable and animal husbandry), fishing, and hunting, tapping of rubber, and raffia palm, mining, trading and manufacturing.

MATERIALS AND METHOD

The Research 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) point 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, enabled the researcher to collect and compare data at two-time periods.

The target population for this study is anyone, male or female who is economically active in the primary sector of the study area. 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 multi-stage sampling technique was used to select sample for this study. The first stage involved a purposive selection of one from nine States in the region. The selected state is Delta. The choice of Delta State is premised on the fact that the geographical terrain of the region makes it almost impossible to cover the whole region given the manpower and financial implication of such project. Furthermore, there are also similarities in the physical and socio-economic characteristics of the States in the region and the different ecological zones are present in the chosen State; hence the choice of Delta State, as the representative State. The second stage involved the systematic selection of 5 LGAs representing 25 per cent of 25 LGAs in the State. The third stage involved the random selection of one rural settlement each from five Local Government Areas (LGAs). The settlements selected for the study were Oleri (Udu LGA), Beneku (Ndokwa East LGA), Oviri-Olomu (Ughell South LGA), Ugborodo (Warri South West LGA) and Ovade (Ethiope West LGA). The

five settlements cut across the different ecological zones of the study area. The fourth 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 few cases, actual counting of households was carried out with the help of village heads or representatives. This was further made easier because of the existing sub-divisions 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 4,578 households were enumerated in the five 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 425 households representing 10 per cent of the total households were interviewed in the five settlements.

Questionnaire used for the study was designed to covered impact of climate change on the physical environment and occupational characteristics of the respondents as well as the changes in output over the study period. Each question was brief and carefully worded so that it was comprehended by the respondents in a way desired by the researcher. The questions were also presented in a systematic manner so that responses could be related to one or other 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 and percentages were worked out and presented in 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 resultant impact of climate change was tested using the paired sample t-test. In doing this, average labour output, computed in monetary terms on occupational or activity basis in the primary sector for 2008 and 2012 were compared.

RESULTS AND DISCUSSION

Temporal Dynamics of Labour Output in the Primary Sector: Of the 425 respondents who were interviewed during the study, 396 respondents representing 92.9% were workers in the primary sector engaged in the listed occupation shown on table 1. Out of this number, 104 households or 26.3 per cent were in arable farming growing crops, such as cassava, yam, cocoyam, potato, maize, sugar cane and vegetables. The next important activity is lumbering with 21.4 per cent of the total size; followed by fishing (17.2%) and palm nut collection (12.9%). Other primary activities include rubber tapping which employed 41 households (10.4%), animal husbandry employed 15 households or 3.9%, raffia palm tapping which employed 7 households (1.7%). Only 4 (1%) and 5 households (1.2%) were engaged in fuel wood collection and other occupations such as, collection of non-timber forest products like bamboo, palm nuts, screw pines and thatches, snails, fruits and herbs for medicinal purposes respectively. A factor which might be

responsible for the high percentage of people in the primary sector of the study area is the geographical nature, which is mostly rural and the over dependence of people on land for survival. Moreover, 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 2008 and 2012 were assessed using the 'going price' in the market in 2012 for the products. This was done to enable comparison to be made in spite of inflationary trend. Output from primary occupations changed between 2008 and 2012 in the study area as indicated on table 2. Table 2 also reveals an over-all output of ₦376,300.00 in 2008 and ₦286,600.00 in 2012. However, there were variations in the output among the different activities. For arable farming, output decreased from an average of ₦382300.00 to ₦360,000.00 per annum in 2008 and in 2012. Moreover, income from fishing and animal husbandry decreased from ₦270,000.00 to ₦232,700.00 and from ₦501,900.00 to ₦420,000.00 within the same period respectively. Similarly, income from hunting also decreased from ₦ 532,600.00 to ₦320, 000.00 during the same period. The decline was sequel to the decrease in catch. Income from lumbering and rubber tapping also decreased from ₦246,800.00 to ₦240,600.00 and ₦237,300.00 to ₦200,000.00 per annum respectively between 2008 and 2012.

Similarly, income from palm nut collection and raffia palm tapping decreased from ₦433,400.00 to ₦340,000.00and N312,600.00 to ₦301,500.00 per annum respectively, between 2008 and 2012. In addition, income from fuel wood gathering decreased from ₦330,000.00 to ₦290,000.00, while income from other primary activities such as collection of non-timber forest products, snail picking, and herbal collections decreased from ₦210,000.00 to ₦115,000.00 respectively in 2008 and 2012. Thus there were decreases in the output of primary sector workers. To test the significance of the temporal dynamics of labour output of the primary sector between 2008 and 2012, the paired-sample t-test was used. The result indicated that the t value of 3.914 is significant at 0.05 levels of confidence as depicted on table 3. Consequently, the temporal dynamics of labour output in the primary sector as a result of climate change is significant.

Table 1: Occupational Composition of Labour Force in Primary Sector

Primary Occupations	Frequency	%
1.Arable Farming	104	26.3
2.Animal Husbandry	15	3.9
3. Fishing	68	17.2
4. Hunting	16	4.0
5. Lumbering	85	21.4
6. Rubber Tapping	41	10.4
7. Palm nut Collection	51	12.9
8. Raffia Palm Tapping	7	1.7
9. Fuel wood Gathering	4	1.0
10. Others	5	1.2
Total	**396**	**100.0**

Source: Fieldwork, 2012

Table 2: Temporal Dynamics of Total Output/Income of Primary Sector

Primary Activities		Average Output (₦'000)	
		2008	**2012**
1.	Arable Farming	382.3	160.0
2.	Animal Husbandry	501.9	420.0
3.	Fishing	270.0	232.7
4.	Hunting	532.6	320.0
5.	Lumbering	250.4	210.0
6.	Rubber Tapping	540.0	476.7
7.	Palm nut Collection	433.4	340.0
8.	Raffia Palm Tapping	312.6	301.5
9.	Fuel wood Gathering	330.0	290.0
10.	Others	210.0	115.0
Over-all Average Output		**376.3**	**286.6**

Source: Fieldwork, 2012

Table 3: Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				Sig.
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	(2-tailed)
Pair 1	Labour Output 2008- Labour Output 2012	89.73000	72.50367	22.92767	37.86400	141.59600	3.914	9	.004

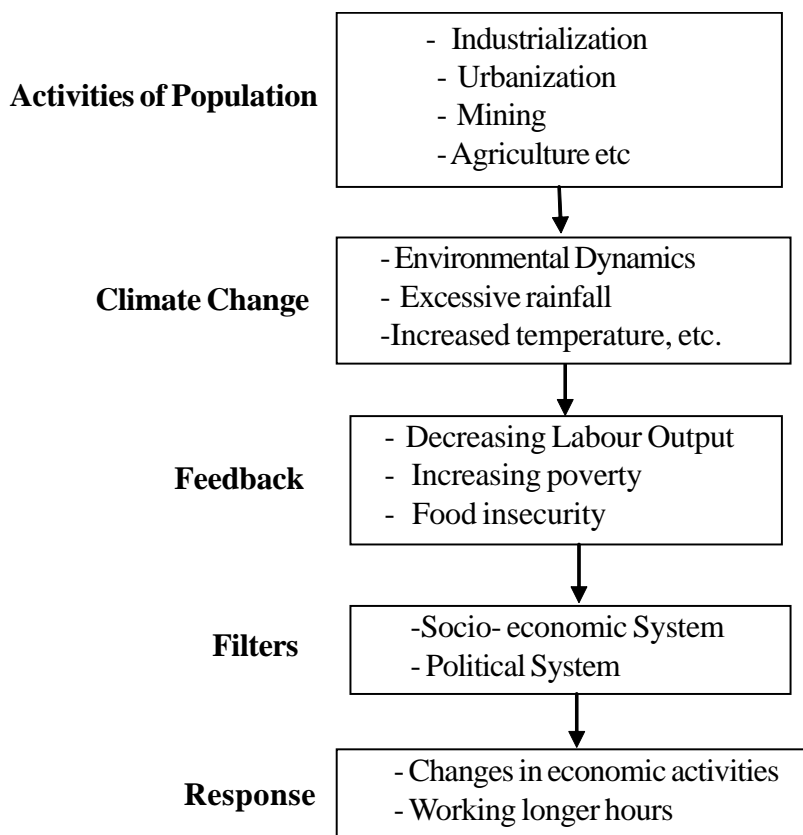|	
Activities of Population	- Industrialization - Urbanization - Mining -Agriculture etc
Climate Change	- Environmental Dynamics - Excessive rainfall -Increased temperature, etc.
Feedback	- Decreasing Labour Output - Increasing poverty - Food insecurity
Filters	-Socio- economic System - Political System
Response	- Changes in economic activities - Working longer hours

Figure1: Impact of Climate Change on Labour Output of Primary Sector. Adapted from Harrison sand Pearce (2001) The Pressure–State–Response Model

CONCLUSION AND RECOMMENDATIONS

There were temporal dynamics in labour output of primary occupations in the study area between 2008 and 2012 as a result of climate change. The implication of the above findings is that the people in the primary sector have to leave the sector or work longer hours to increase income. This development in the study area is in line with the economic adaptation theories postulated by Boserup (1965, 1981), Simon (1982) and Davis (1963). These theories argue that a decline in the resources base of the population as a result of environmental deterioration increase pressure on available resources. The population, in response to pressure would devise alternative ways of survival. Working longer hours, embarking on second occupation and even changing occupations are some of the ways (Davis, 1963). The physical environment is very crucial to the operations of the primary sector, which produces food for the population and raw materials for industrial production; hence, any alterations in the operations of the sector due to the effects of climate change on dynamics of the environment will adversely affect food security of the population. Since the dynamics of labour output is the resultant impact of climate change in the study area, measures that will reduce the adverse effects of climate on the physical environment would have considerable improvement on labour output in the study area. Consequently, the study recommends that the population should be educated on the reason for the phenomenon and the need to promote sustainable development of the environment; thereby, ameliorating the adverse effects of climate change on the primary sector. In addition, workers in the primary sector should be advised to formulate strategies in line with the economic adaptation theories to cope with the decline in labour output. Such strategies include adoption of modern technology in the operation of the sector and improvement in quality of input into primary activities.

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