

# The Economic, Environmental and Safety impacts of COVID-19 pandemic and the coping strategies for the petroleum industry

Franklin Okoro<sup>1\*</sup>, Nwamaka Linda Okoli<sup>2</sup>, Mary Frank-Okoro<sup>3</sup>, Ambrose Onne Okpu<sup>4</sup>, Cynthia Ehialeta<sup>5</sup>

<sup>1\*</sup>*Clean Script Group, Nigeria*

*\*Corresponding author*

**Abstract:** This study assessed the economic, environmental and safety impacts of COVID-19 pandemic and coping strategies for the petroleum industry using the descriptive survey design approach. Eighty (80) oil companies that operate in Port Harcourt, Nigeria, constituted the population of the study. Random sampling method was applied in choosing the sample for assessment and in getting the respondents to answer the questionnaire. The random sample size was derived utilizing Yamane Taro's statistical technique to arrive at a sample size of 70. The study made use of questionnaires of both structured and semi-structured nature. Data from the answered questionnaires were analyzed both qualitatively using percentages. From the findings, the environmental impacts identified were both negative and positive. The result revealed that the safety impacts of COVID-19 pandemic across selected petroleum companies in Port Harcourt are in two (2) folds (positive and negative). The positive impacts included: improved air quality, reduction in water pollution, drop in Greenhouse gases (GHGs) emissions, reduction in noise pollutions. Whereas the negative impacts identified were clogging in water ways, increased land filling and environmental pollutants worldwide. The Positive Safety Impacts are increased level of awareness of threat to health globally and increased level of safety measures practiced. The Negative Safety Impacts include increased risk of getting infections and increased risk of disease transmission from one person to another. From the results, the economic impact felt was a reduction in the barrel price of oil. Finally, the result revealed that some of the possible coping strategies are Rigid travel policies permitting essential duties workers only should be formulated and implemented for the short period of time and reduction of working days for offshore staff.

**Keywords:** COVID-19; Economic impact; Environmental impact; Safety impact; Coping strategies; Petroleum industry.

## I. INTRODUCTION

What began as a health crisis - with grave impact on populations, within days became an economic and fiscal crisis with a high risk of negative social implications. National and international authorities and experts suggest the use of non-pharmaceutical measures like wearing face masks and hand gloves, washing hands with soap, frequent use of antiseptic solution and maintaining social distancing (Hui *et al.*, 2020; Sajed and Amgain, 2020; WHO, 2020). To control the spread of the virus and reduce the death rate, government of most of the affected countries initiated to restrict the movement of people. Except emergency services (e.g., medical, fire, police, food supply etc.), all other organizations including the oil

companies were closed to encourage people to stay at home. All the public transport services (e.g., bus, truck, train, airplanes, etc.) were suspended, with exceptions of the transportation of essential goods and emergency services (Tripathi, 2020).

Oil and gas activities are generally considered essential activities by governments and have been mostly exempt from the lockdown measures. However, continued operations became increasingly difficult due to workforce shortages as employees are infected by the coronavirus and the practical difficulties in many cases of social distancing. Companies were forced to operate skeleton crews to continue operations, with disruptions expected for the maintenance, inspection, repair and replacement of equipment and drilling activities. Operators were forced to seal off wells because of the reduced number of personnel on drilling rigs falling below the level required by health and safety regulations and the reasonable and prudent operator standard. As the situation deteriorates, many industry participants are reaching for the force majeure (FM) provisions in their key contracts to excuse failure to perform or to exit. Whilst these are typically designed to cover a situation where contractual performance is impossible, difficult, or onerous to perform because of exceptional events outside either party's control (for example a global pandemic), relying on a FM clause is very heavily dependent on the factual circumstances and the drafting of the specific clause.

As of April 7, 2020, World Economic Forum reported, nearly 3 billion people were faced with some form of lockdown globally, and movement (WEF, 2020). Overall, the pandemic caused huge global socio-economic disruption, which directly or indirectly affected the environment like improvement of air and water quality, reduction of noise and restoration of ecology (Chakraborty and Maity, 2020; Somani *et al.*, 2020; Saadat *et al.*, 2020). Moreover, the increased use of personal protective equipment (PPE) (e.g., face mask, hand gloves, gowns, goggles, face shield etc.), and their haphazard disposal created environmental burden (Fadare and Okoffo, 2020; Nghiem *et al.*, 2020; Singh *et al.*, 2020). The COVID-19 pandemic brought a lot of changes to the workplace and challenged established norms about how employees can deliver on their employment obligations. In these circumstances, this study explored the environmental and safety consequences of the

COVID-19 pandemic in the oil industry and proposed possible strategies as future guideline for environmental sustainability.

The following research questions guided study:

- i. What are the environmental impacts of COVID-19 pandemic across selected petroleum companies in Port Harcourt?
- ii. What are the safety impacts of COVID-19 pandemic across selected petroleum companies in Port Harcourt?
- iii. What are the economic impacts of COVID-19 pandemic across selected petroleum companies in Port Harcourt?
- iv. What are the COVID-19 coping strategies across selected petroleum companies in Port Harcourt?

## II. METHODOLOGY

The study used the descriptive survey design approach. According to Orodho (2003, 2012), the descriptive survey design is effective, and easy to conduct, and it also ensures ease of accessing information. The descriptive survey design allowed the researcher to gather information, summarize and interpret data for purposes of clarification. The descriptive survey design is useful in collecting information about people's attitudes, opinions, habits, or perceptions about issues under investigation (Orodho & Kombo, 2002). Eighty (80) oil companies that operate in Port Harcourt, Nigeria, made up the population and were targeted for the data collection, with an acceptable response rate of above fifty percent (50%).

Random sampling method was applied in choosing the sample for assessment. Creswell (2005) characterized random sampling as a subset of people that are arbitrarily chosen from a population. The objective is to get a set that represents the bigger population. Kothari (2004) stated that this sampling technique is utilized on the grounds that it ensures the needed representation of the pertinent subgroups.

The random sample size for the present study was derived utilizing Yamane Taro's statistical technique. This technique for sample size population was defined by statistician Taro Yamane in 1967 to ascertain the sample size from a given population utilizing a certainty level of 95% and 5% margin error. With a target population of 80, the size of random sampling was determined using Taro Yamane (1967) formula as below:

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

where;

n = sample size

N = population size

e = marginal error (0.05) (assuming a confidence level of 95%). Using this formula and substituting N = 80, 70 questionnaires were distributed randomly to respondents (workers of the petroleum companies in Port Harcourt). To collect data that will be a representative of the whole Port Harcourt oil industry, companies were randomly chosen from within Port Harcourt.

Questionnaire was adopted for the data collection, where the respondents selected for this study answered questions on their own and brought back to the researchers. Both structured and semi structured questions were used in helping the researchers to get answers and relevant information from respondents. The questionnaire was developed by the researchers based on the research questions. The first part of the questionnaire collected demographic data from the respondents while the other parts comprised of the item statements they responded to. The instrument was given to experts to ascertain the validity. Their suggestions and corrections were integrated before they were given to respondents. The research instrument included instructions on how to fill the questionnaire. The preamble to the questionnaire had explanations on the purpose and nature of the study and assured all the respondents of their confidentiality. This ensured that the participants could make informed decisions on whether to participate in the study or not. To ensure anonymity, the participants were not required to write their names on the questionnaires.

Reliability of data were assured through information collected from relevant respondents with specific attention to proper wording of instructions, logical arrangement of questions that were asked and key issues related to the effect of COVID-19 on the environmental, safety and economies of selected oil companies in Port Harcourt, and possible coping strategies. In addition, to establish the reliability of the instrument, the split-half method was used. In the split-half method, the total number of items was divided into two halves (odd and even), and a correlation taken between the two halves using a correlation coefficient. A correlation co-efficient of about 0.88 was judged high enough for the instrument to be assumed reliable.

The questionnaires were either emailed, or hand delivered to the respondents by the researcher. Once completed, the researcher collected the filled questionnaires from them almost immediately or at an agreed time and venue. Some respondents opted to have the completed questionnaires scanned to the researchers via email. Data from the answered questionnaires were analyzed qualitatively using percentages. All questionnaires were coded before analysis. Data were coded by identifying themes that are related to the research questions and analyzed using descriptive statistics to obtain frequencies and percentages. Percentages of 50% and above were accepted while below 50% were rejected. The results were presented in tables. The software used for analysis of the findings was Statistical Package for Social Sciences (SPSS).

## III. RESULTS AND DISCUSSION

All 70 questionnaires were retrieved successfully and upon a cross check to ascertain the usage of the filled questionnaire, it was discovered that all 70 retrieved questionnaires were properly filled and that ensured a 100% retrieval rate.

Table 1 presents all demographics information about the participants, which include their age, gender, and their working experience. The result shows that over 40% of the study participants were within the age grade of 31-40 years while 21

percent were within 21-30 years. This is followed by 20% who are in the age group of 41-50. Also, the result showed that most of the study participants were male, constituting 61% of the study sample size whereas the other 39% were females. And lastly, the result showed that about 64% of the participants have had between 1-5 years working experience while the other 36% have had between 6-10 years working experience.

Table 1: Demography of the respondents

Variables	No. of Respondent	Percentage (%)
<b>Age Distribution</b>		
21-30 years	15	21.4%
31-40 years	29	41.4%
41-50 years	14	20%
51 years and above	12	17.1%
<b>Total</b>	<b>70</b>	<b>100%</b>
<b>Gender</b>		
Male	43	61.4%
Female	27	38.5%
<b>Total</b>	<b>70</b>	<b>100%</b>
<b>Working Experience</b>		
1-5 years	45	64.3%
6-10 years	25	35.7%
<b>Total</b>	<b>70</b>	<b>100%</b>

Source: Field Survey

*The environmental impact of COVID-19 pandemic across selected petroleum companies in Port Harcourt*

Eight (8) questionnaire items were developed for used in meeting this research objective. Participants’ responses to this questionnaire items are presented in Table 2 and the outcome is used in ascertaining the environmental impact of Covid-19 pandemic across selected petroleum companies in Port Harcourt.

Table 2: Responses to ascertain the environmental impact of COVID-19 pandemic across selected petroleum companies in Port Harcourt

Items	Negative			Positive		
	SD	D	N	A	SA	
Due to movement restriction and a significant slowdown of social and economic activities, air quality improved with a reduction in water pollution in different parts of the world.	-	18	8	31	13	
As industries, transportation and companies closed down, it brought a sudden drop of greenhouse gases (GHGs) emissions.	2	17	10	29	12	
During the lockdown period, the major industrial sources of pollution shrunk or completely stopped, which helped to reduce the pollution.	-	13	-	41	16	
COVID-19 lockdown, and lessens of economic activities reduced the noise pollution around the globe.	6	17	-	33	14	
Due to travel restrictions, the number of flights and vehicular movements drastically reduced around the world, which ultimately reduced the level of noise pollution.	7	15	4	30	14	
Haphazard dumping of trashes creates clogging in water ways and worsens environmental pollution.	2	17	12	26	13	

Disruption of routine municipal waste management, waste recovery and recycling activities, led to increased land filling and environmental pollutants worldwide.	-	18	13	32	7
Huge number of disinfectants applied into roads, commercial, and residential areas to exterminate SARS-CoV-2 virus may have killed non-targeted beneficial species, which may create ecological imbalance.	-	9	2	44	15

Source: Field Survey

[SD – Strongly Disagree; D – Disagree; N – Neutral; A – Agree; SA – Strongly Agree].

The responses statistically presented above (Table 2) revealed that the environmental impacts identified were both negative and positive. As highlighted, the positive impacts were:

- Improved air quality
- Reduction in water pollution
- Drop of Greenhouse gases (GHGs) emissions
- Reduction in noise pollutions

Meanwhile the negative impacts identified were:

- i. Clogging in water ways
- ii. Increased land filling and environmental pollutants worldwide
- iii. Possible deaths of non-targeted beneficial species, which may create ecological imbalance.

*The safety impact of COVID-19 pandemic across selected petroleum companies in Port Harcourt*

Four questionnaire items were developed for achieving this objective. The participants’ responses are presented together with the analysis below (Table 3).

Table 3: Responses to ascertain the safety impact of COVID-19 pandemic across selected petroleum companies in Port Harcourt

Items	Negative			Positive	
	SD	D	N	A	SA
Since the outbreak of COVID-19, medical waste generation increased globally, which is a major threat to public health and environment.	-	21	7	29	13
To protect from the viral infection, peoples were using face mask, hand gloves and other safety equipment, which increased the amount of healthcare waste.	-	12	-	41	17
Due to lack of knowledge about infectious waste management, most people dump face mask, hand gloves etc. in open places and in some cases with household wastes.	7	19	-	33	11
Mixing up these wastes increases the risk of disease transmission, and exposure to the virus by waste workers.	-	20	9	28	13

Source: Field Survey

The result as shown in Table 3 revealed that the safety impacts of COVID-19 pandemic across selected petroleum companies in Port Harcourt are in two (2) folds (positive and negative).

Positive Safety Impacts include:

- i. Increased level of awareness of threat to health globally.
- ii. Increased level of safety measures practiced.

Negative Safety Impacts include:

- i. Increased risk of getting infections.
- ii. Increased risk of disease transmission from one person to another.

*The economic impact of COVID-19 pandemic across selected petroleum companies in Port Harcourt*

Two (2) questionnaire items were formulated for meeting this objective. Participants’ responses to these questionnaire items are presented in Table 4 and discussed accordingly.

Table 4: Responses to ascertain the economic impact of COVID-19 pandemic across selected petroleum companies in Port Harcourt

Items	Negative			Positive	
	SD	D	N	A	SA
As a result of the COVID-19 pandemic, global industrial and transport activities are reduced causing lower oil consumption that decreased the barrel price.	3	15	8	34	10
Due to the pandemic, quarantine policies were established in many countries, which led to an increased demand in online shopping for home delivery, which ultimately increase the amount of household wastes from shipped package materials.	4	20	-	38	8

Source: Field Survey

From the results in Table 4, it is evident that the economic impact felt was both negative and positive. Firstly, the negative impact was a reduction in the barrel price of oil as this affected national revenue generation and possibly weakened the nation’s economy especially because oil has been a major source of revenue generation in the country. While the positive impact observed was that there was increased online shopping and high demand for home delivery. The online transactions kept the economy running despite a shut down on offline economic activities and this created a substantial number of jobs for home delivery personnel who made monies from delivery orders made online. Though this positive impact may not particularly apply to the oil industry, and it also led to increased household wastes.

*Possible coping strategies for achieving environmental, safety and economic sustainability amidst the global COVID-19 pandemic in the petroleum industry*

The study developed eight (8) questionnaire items in meeting this objective. Responses gotten on these questionnaire items are presented in Table 5 and discussed accordingly.

Table 5: Responses for the possible coping strategies amidst the global COVID-19 pandemic in the petroleum industry

Items	SD	D	N	A	SA
In industries where many people work, proper distance and hygienic environment should be maintained to reduce the spread of any infectious communicable disease.	-	11	-	41	18
To reduce emissions, it is necessary to encourage people to use public transport, rather than private vehicles to reduce carbon emissions.	8	18	23	21	-
People should be encouraged to use bicycle in a short distance, and public bike sharing (PBS) system.	12	26	18	14	-
Use of renewable energy sources like solar, wind, hydropower, geothermal heat and biomass can contribute to meeting the energy demand and reduce the GHGs emission.	-	18	8	31	13
Industrial and municipal wastewater should be properly treated before discharge and disposal.	-	15	2	35	18
Government should implement extensive awareness campaign through different mass media, regarding the proper waste segregation, handling, and disposal.	-	-	-	55	15
Only staff who are engaged in essential duties should be permitted to travel to offshore/remote locations during the peak of the pandemic.	-	19	9	32	10
Offshore staff should work for a minimum period of twenty-eight (28) days to reduce the travel rates.	-	21	17	32	-

Source: Field Survey

The result as shown in Table 5 reveals that the study participants suggested the following possible coping strategies for achieving environmental, safety and economic sustainability amidst the global COVID-19 pandemic in the petroleum industry:

- i. Proper distancing and hygienic environment should be maintained.
- ii. Increased adoption of solar, wind, hydropower, and geothermal heat for used in energy generation.
- iii. Proper treatment of industrial and municipal wastewater.
- iv. Extensive awareness campaign on proper waste segregation, handling and disposal methods should be conducted by government.
- v. Rigid travel policies permitting essential duties workers only should be formulated and implemented for the short period of time.
- vi. Reduction of working days for offshore staff.

#### IV. DISCUSSION

The findings of this work corroborates with some of the works reported in the literature. Maijama'a *et al.* (2020) investigated the impact of coronavirus outbreak on the global energy demand by using daily data on China’s population, currency Chinese exchange rate and international crude oil prices, from 23rd January to 8th February 2020. The result revealed that the total population had a positive and significant impact on total

coronavirus infected cases while the crude oil price was negative and significantly related to the coronavirus infected cases. According to Henriques (2020), as industries, transportation and companies closed down, it brought a sudden drop of greenhouse gases (GHGs) emissions. Compared with 2019, levels of air pollution in New York reduced by nearly 50% because of measures taken to control the virus in 2020. It was also estimated that nearly 50% reduction of N<sub>2</sub>O and CO occurred due to the shutdown of heavy industries in China (Caine, 2020). The European Environmental Agency (EEA) predicted that, because of the COVID-19 lockdown, NO<sub>2</sub> emission dropped from 30-60% in many European cities including Barcelona, Madrid, Milan, Rome, and Paris (EEA, 2020). In the US NO<sub>2</sub> declined 25.5% during the COVID-19 period compared to previous years (Berman and Edisu, 2020). The level of NO<sub>2</sub> demonstrated a reduction across Ontario (Canada) and found to be reduced from 4.5 ppb to 1 ppb (Adams, 2020). Up to 54.3% decrease of NO<sub>2</sub> was observed in Sao Paulo of Brazil (Nakada and Urban, 2020). It was also stated that, the levels of NO<sub>2</sub> and PM<sub>2.5</sub> reduced by almost 70% in Delhi, the capital of India (Thiessen, 2020). Overall, 46% and 50% reduction of PM<sub>2.5</sub> and PM<sub>10</sub> respectively, was reported in India during the nationwide lockdown (IEP, 2020). Jribi *et al.* (2020) reported that, due to the COVID-19 lockdown, the amount of food waste is reduced in Tunisia, which ultimately reduces soil and water pollution. Also, the amount of industrial water consumption is also reduced, especially from the textile sector around the glove (Cooper, 2020).

According to Singh *et al.* (2020), since the outbreak of COVID-19, the production and use of plastic-based PPE is increased worldwide. For instance, China increased the daily production of medical masks to 14.8 million since from February 2020, which is much higher than before (Fadare and Okoffo, 2020). However, due to lack of knowledge about infectious waste management, most people dump these (e.g., face mask, hand gloves etc.) in open places and in some cases with household wastes (Rahman *et al.*, 2020). Such haphazard dumping of these trashes creates clogging in water ways and worsens environmental pollution (Singh *et al.*, 2020; Zambrano-Monserrate *et al.*, 2020).

Experts and responsible authorities suggest for the proper disposal and segregation of household organic waste and plastic based protective equipment (hazardous medical waste) as mixing up these wastes increases the risk of disease transmission, and exposure to the virus of waste workers (Ma *et al.*, 2020; Somani *et al.*, 2020; Singh *et al.*, 2020).

According to Somani *et al.* (2020) and Zambrano-Monserrate *et al.* (2020), due to the COVID-19 pandemic, global energy demand was reduced, which resulted in the reduction of emission and increased ambient air quality in many areas. But, to maintain the daily needs and global economic growth, it is not possible to cut-off energy demand like a pandemic situation. Hence, use of renewable energy sources like solar, wind, hydropower, geothermal heat, and biomass can meet the

energy demand and reduces the GHGs emission (Ellabban *et al.*, 2014).

## V. CONCLUSION

This study assessed the environmental and safety impact of COVID-19 pandemic and coping strategies for the petroleum industry, focusing on selected petroleum companies in Port Harcourt. From the findings, the environmental impacts identified were both negative and positive. The positive impacts included:

- Improved air quality
- Reduction in water pollution
- Drop of Greenhouse gases (GHGs) emissions
- Reduction in noise pollutions.

Whereas the negative impacts identified were:

- Clogging in water ways
- Increased land filling and environmental pollutants worldwide
- Possible deaths of non-targeted beneficial species, which may create ecological imbalance.

The result revealed that the safety impacts of COVID-19 pandemic across selected petroleum companies in Port Harcourt were in two (2) folds (positive and negative).

The Positive Safety Impacts included:

- Increased level of awareness of threat to health globally
- Increased level of safety measures practiced.

Negative Safety Impacts included:

- Increased risk of getting infections
- Increased risk of disease transmission from one person to another

From the results gotten, the economic impact felt was a reduction in the barrel price of oil as this affected national revenue generation and possibly weakens Nigeria's economy especially because oil has been a major source of revenue generation in the country.

Finally, the result revealed that the study participants suggested the following possible coping strategies for achieving environmental, safety and economic sustainability amidst the global COVID-19 pandemic in the petroleum industry:

- a) Proper distancing and hygienic environment should be maintained
- b) Increased adoption of solar, wind, hydropower, and geothermal heat for used in energy generation
- c) Proper treatment of industrial and municipal wastewater
- d) Extensive awareness campaign on proper waste segregation, handling and disposal methods should be conducted by government

- e) Rigid travel policies permitting essential duties workers only should be formulated and implemented for the short period of time
- f) Reduction of working days for offshore staff.

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