RECLAIMING POLLUTED ENVIRONMENT THROUGH TECHNOLOGICAL INNOVATION: CHALLENGES AND PROSPECTS. (A CASE STUDY OF KPEAN IN KHANA L.G.A).

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Abstract

The topic of the study was carefully chosen to reflect the reality of what oil pollution has caused to the land and water of the Khana people since drilling activities commenced in the area. The aim of the research is to find the appropriate technological innovation that can return the polluted land to its natural status. The methodology adopted by the researchers was comprehensive by projecting the population given in 2006-2020 using one of best methods. The sample size gotten became the accessible population on the strength at which questionnaires were distributed to the respondents in the study area. Secondary data was also consulted to ensure speedy completion of the work. The returned questionnaires were analyzed using the tabular method while the chi square was used to test the hypothesis formulated in the work. The study finds out that oil spillage actually impacted negatively on the health and ecosystem of the people. The study also recommends that periodic environmental awareness campaign be organized by stakeholders in the environment to enable the people understand the dangers of oil spills and the need to protect oil facilities entrusted to them, and concluded that the oil companies and the people should see that environmental protection is key to our survival on earth.

Keywords: Reclamation, Pollution, Environment, Technology, Innovation.

Introduction

The environment is the sum total of water, air and land, inter-relationship among themselves and the human beings, other living organism and property. Man's need for economic growth and survival led to his foraging of the environment. In his attempt to maximize production of any kind, alters his natural environment. This productive activity impacts positively or negatively on both man, animal and the physical environment or ecosystem (Omodu, 2011). Over the years since the creation

of the world, the earth as the home of man has been changing. From a beautiful garden created by God in which our first parents Adam and Eve lived, to a hard land that the Israelites sojourned unto their present abode; from a fragile environment where animals of all kind and plants of all species flourished, to a land torn by environmental degradation in the nature of soil pollution, water pollution, depleted ozone, air pollution, oil spills, carbon emissions and the rest (Oladejo and okoronkwo, 2018).

The researchers are aware that man thinks less about the negative impacts when he is extracting the treasures of the earth, but technology and science have shown man to realize that he has been making a mistake and that is the reason man started getting worried about the environment and thinking of sustaining the land.

Statement of the Research Problem:
The study area is a community called **"Kpean"** in Khana Local Government Area of Rivers State. The Yorla flow station is situated in this community. During and within the period that this oil well was discovered and drilled by Shell Petroleum Development Company. The people taught that their prayers had been answered, because it was an opportunity that every member of the community embraced. Owing to the fact that new things can be seen provided by the company, such as good road networks, hospital or clinic, schools, electricity, portable drinking water, reconstruction of the old market to a new one, awarding scholarships to interested children and having a clean environment. But today, the reverse is the case where productive land turns unproductive, because of oil exploitation and exploration by multi-national companies operating in the area.

Don't forget the people of kpean are full time farmers and fishermen and so they guide their lands with jealousy. The people are confronted with major environmental problem, the most important of which are; deforestation, desertification, water pollution, oil pollution, loss of biodiversity and oil waste management. It is on this background that the researchers are willing to proffer the best approach to reclaiming or restoring the oil impacted site using the most preferable technological innovation.

Aim and Objectives of the Study.
The aim of the study is to bring back to life polluted land through modern technological developments.
The few objectives that be considered are;
- To identify the causes of oil spillage
- To identify the nature of the spill
- To identify the impact of polluted land on the health of the people
- To identify the technological or innovative method in reclaiming the polluted land
- To identify the challenges and prospects of reclaiming polluted land

Research Questions
a.   What are the causes of oil spillage in the area?
b.   What are the nature of the spill?
c.   What are the impact of polluted land on the health of the people?
d.   What are the best technological method for the reclamation of polluted land.
e.   What are the challenges and prospects of reclaiming polluted land.

Research Hypothesis.
H_O: There is no significant relationship between technological innovation and reclaiming of polluted environment.

The Study Area

Khana Local Government Area is the largest and among the 23 LGAs of Rivers State. The geographical coordinates are located on latitude $4^0 42'$N and longitude $7^0 21'$E. The headquarters of the Local Government Area is Bori. Accordingly, the National Population Commission (NPC) 2006 fixed its population at 294,217 final result. The Local Government Area has three main districts namely; Nyokhana, Kekhana and Babbe. Khana LGA is bounded by Tai LGA on the North, Andoni and Opobo LGAs on the South, Gokana LGA on the West and Oyigbo LGA on the East. Khana LGA found itself in the heart of the Niger Delta Region which falls under the third zone of the peak of rainy season between March – September equally the dry season falls between November and February, that does not mean there is no intermittent rainfall during the dry season. Another characteristic feature of rainfall distribution is that it is remarkably spatial in magnitude determined by proximity to the coast and also by elevation.

The temperature in the study are range from 27^0C – 32^0C. Vegetation zones include mangrove swamp forest, fresh water swamp forest and tropical rainforest. The vegetation types are parts of the Delta of Rivers Niger which is one of the world's largest wetlands encompassing over 20,000 sq km. The soil types includes; sandy, loam, clay and alluvial soils. The economic activities in the area are to many, for example, the Ken Saro – Wiwa Polytechnic that attracted many investors into the place, the modern motor parks, banks, hospitals and clinics, modern market, police station for security, post office, super markets, filling stations, schools, fire service station, and above all the people are hospitable and accommodating.

Literature Review

The term technology can be seen as the application of scientific knowledge for practical purposes especially in industry dealing essentially with engineering and science. This is a clear manifestation that for reclaiming polluted land, special skill and man power must be employed or involved which is what this paper stands to address. Reclamation is a process of creating new land from oceans, riverbeds, oil impacted area and lake beds. It is also the gaining of land from the sea, wetlands or other water bodies and the restoration of productivity or use of lands that have been degraded by human activities or impaired by natural phenomena (Smriti, 2008). Oil spillage is the release of a liquid petroleum hydrocarbon into the environment due to human activity (Akpofure, 2009).

Causes of Environmental Pollution (Oil spills).
1) Accidents involving tankers carrying petroleum products.
2) Oil barges, drilling rigs, and storage facilities.
3) Equipment failures, sabotage and burst pipelines.
4) Age of facilities and lack of proper monitoring along pipelines (Onuoha, 2001).

Challenges of Land Reclamation.
❖ Accelerated run off.
❖ Poor vegetation covers (Ede, 2009).
❖ Erosion and poor soil structure.
❖ Flooding and soil liquefaction (Sulphey, 2013).
❖ Capital intensive to restore polluted land.
❖ Local community crisis.
❖ Changing shoreline evolution and wetland hydrology.
❖ Impaire ecosystem functioning and services (Wiwa, 1992)

Prospects of Land Declamation
- Land improvement for agriculture and housing construction.
- Increasing land fertility and ecological conditions.
- It helps to stimulate tourism industry and job creation.
- For the beautification of the natural landscape.
- The restoration of the polluted land to its natural state.

Effects of Oil Spills on the Environment and Humanity.
- It causes deforestation.
- Loss of biodiversity.
- Development of skin rashes, headaches, vomiting and diarrhea.
- Land degradation.
- Reduces soil productivity.
- Contaminate ground water.
- Defacing landscape architecture.

Mitigating strategies for oil spilled polluted site.
- Containing the spill by using boom and spill berms.
- Use spill kits, sorbent pads and granular oil sorbets to clean up the spill.
- Using skimmers.
- Burning insitu.
- Bioremediation.
- Dispersants.

Methodology

The population of Khana Local Government Area given by the National Population Commission (NPC) 2006 is 294, 217 which will be projected to year 2020 by the researchers, to know the increased number of persons in the study area. Furthermore, the Taro Yamene's formula will be employed to extract the sample size from the projected population, which will determine the number of questionnaire to be distributed in the study area. Apart from the questionnaire, personal interview will be conducted.

Secondary information will be utilized to complement the primary source of information. Preferably the descriptive statistics will be adopted for a simple understanding. The Chi Square will be used to test the reliability and validity of the hypothesis.

$$P_n = Pt \left(\frac{I+r}{100}\right)^n$$

Pt = Projected population.
P = Existing population (294,217)
r = Growth rate (3.5)
n = Number of projected years (14)
Substituting the figure in the formula

$$P_n = 294,217 \left(\frac{1+3.5}{100}\right)^{14}$$
$$= 294,217 \left(1 + 0.035\right)^{14}$$
$$= 294,217 \left(1.035\right)^{14}$$
$$= 294,217 \left(1.619\right)$$
$$= 476, 337$$
$$\therefore pt = 476,337.$$

The projected population of khana LGA from 2006 is 294,217 to 476,337 in the year 2020. The sample size was gotten through the formula below.

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

$$= \frac{476,337}{1+476,337(0.05)^2}$$

$$= \frac{476,337}{1+476,337\ (0.0025)}$$

$$= \frac{476,337}{1+1190.843}$$

$$= \frac{476,337}{1191.844}$$

= 399.67

= 400

Results and Analysis
Table 1: Questionnaire Distribution and Retrieval

Category of respondents	Quest Dist.	Quest Retried	% Response
Hyprep staff	100	60	28.6
Elites in the community	130	71	33.8
Contractors	10	10	4.8
Staff of R/S MOENV	140	54	25.7
NOSDRA Staff	20	15	7.1
Total	400	210	100

Source: Author's Field Work, 2021.

The title is self-explanatory, it shows the respondents interviewed in the study area. Hyprep staff represents 28.6%, the community elites represents 33.8%, contractors represents 4.8%, Rivers State Ministry of Environment Staff representing 25.7% while National Oil Spill Detection and response agency staff represents 7.1%. the staff of Hyprep Ministry of Environment and Community elites responded that technology is the best means of reclaiming polluted sites.

Table 2: Causes of Oil Spills in the area

Causes	(O)	(E)	$(O-E)$	$(O-E)^2$	$\left(\frac{O-E}{E}\right)^2$
Storage facilities	46	42	4	16	0.381
Equipment failures	63	42	21	441	10.5
Burst pipelines	51	42	9	81	1.929
Age of facilities	30	42	12	144	3.429
No proper monitoring or pipelines	20	42	22	484	11.524
					x^2 = 27.76

H_o: oil spill does not have any significant impact on the ecosystem where it occurred.
H_I: Oil spill does have significant impact on the ecosystem where it occurred.
X^2 cal = 27.76

X^2 tab at 5% degree of freedom
$(n - 1) (5 - 1) = 4$
$(4, 0.05) = 9.49$

        Since the calculated value is greater than the tabulated value 27.76 > 9.49, H_I is accepted that oil spill have significant impact on the ecosystem where it occurred.

Table 3: The nature of the spill in the area

Nature	Frequency	% Response
Severe	80	38.1
Very severe	119	56.7
Not severe	11	5.2
Total	**210**	**100**

Source: Author's Field Work, 2021.

        From the options on the table, severe representing 38.1%, very severe representing 56.7%, while not severe got 5.2%. This represents the opinions of the respondents in the study area.

Table 4: The impact of polluted land on the health of the people

Impact	(O)	(E)	$(O - E)$	$(O - E)^2$	$\left(\dfrac{O - E}{E}\right)^2$
Headaches	65	52.5	12.5	156.3	2.98
Skin cancer	6	52.5	46.5	2162.3	41.19
Reduction in soil fertility	71	52.5	18.5	342.3	6.52
Vomiting	68	52.5	15.5	240.3	4.58
					$X^2 = 55.27$

H_o: Polluted land does not have any significant impact on the health of the people.
H_I: Polluted land has significant impact on the health of the people.
X^2 cal = 55.27
X^2 tab at 5% degree of freedom
$(n - 1) (4 - 1) = 3$
$(3, 0.05) = 7.82$

        Since the calculated value is greater than tabulated value 55.27 > 7.82, H_1 is accepted that polluted land have significant impact on the health of the people.

Table 5: The best technological method for the reclamation of polluted land.

Methods	(O)	(E)	$(O - E)$	$(O - E)^2$	$\left(\dfrac{O - E}{E}\right)^2$
Bioremediation	63	42	21	441	10.5
Containing the spill through booms	30	42	12	144	3.4
Using sorbent	40	42	2	4	0.1
Mechanical approach	70	42	30	900	21.4
Burning insitu	7	42	35	1225	29.2
					$X^2 = 64.6$

H_o: There is no significant relationship between technology and polluted land.
H_I: There is significant relationship between technology and polluted land.
X^2 cal = 64.6
X^2 tab at 5% degree of freedom
$(n - 1) (5 - 1) = 4$

$(4,0.05) = 9.49$

Since the calculated value is greater than tabulated value 64.6 > 9.49, H_1 is accepted that there is significant relationship between technology and polluted land.

Table 6: Challenges of reclaiming polluted land

Challenges	(O)	(E)	$(O-E)$	$(O-E)^2$	$\left(\dfrac{O-E}{E}\right)^2$
Poor veg. cover	20	35	15	225	6.43
Erosion and poor soil structure	41	35	6	36	1.03
Capital intensive	48	35	13	169	4.83
Community crisis	30	35	5	25	0.71
Impair ecosystem functioning and services	39	35	4	16	0.46
Changing wetland hydrology	32	35	3	9	0.23
					X^2 = 13.69

H_o: There is no significant challenges to reclaiming polluted land.
H_1: There is significant challenges to reclaiming polluted land.
X^2 cal = 13.69
X^2 tab at 5% degree of freedom
$(n-1)(6-1) = 5$
$(5,0.05) = 11.07$

Since the calculated value is greater than the tabulated value 13.69 > 11.07, H_1 is accepted that there are significant challenges to reclaiming polluted land.

Table 7: Prospects of reclaiming polluted land

Prospects	(O)	(E)	$(O-E)$	$(O-E)^2$	$\left(\dfrac{O-E}{E}\right)^2$
Land improvement for agric. And housing construction	70	52.5	17.5	306.3	5.83
Increasing land fertility and ecological conditions	81	52.5	28.5	812.3	15.47
Stimulating tourism industry and job creation	9	52.5	43.5	1892.3	36.04
Beautification of the natural landscape	50	52.5	2.5	6.3	0.12
					X^2 = 57.46

H_o: There is no prospect for reclaiming polluted land.
H_1: There is prospect for reclaiming polluted land.
X^2 cal = 57.46
X^2 tab at 5% degree of freedom
$(n-1)(4-1) = 3$
$(3,0.05) = 7.82$

Since the calculated value is greater than the tabulated value 57.46 > 7.82, H_1 is accepted that there are prospects for reclaiming polluted land.

Discussion of Findings

The researchers comprehensively carried out this research in order to find lasting solution to the problem ravaging the land of the Khana people. We visited the site to ascertain the level of devastation by oil spill.

1.   Questionnaire was distributed by the researchers to five (5) classes of respondents in the study area, the Hyprep staff, elites in the community and staff of Rivers State Ministry of Environment responses was favourable.

2.   Looking at the causes of oil pollution that warranted reclamation, all the options contributed to it, where the calculated Chi Square is greater than the tabulated 27.76 > 9.49.

3.   The nature of oil spill in the area was very severe according to respondent's views representing 38.1% and 56.7% respectively.

4.   The impact of polluted land on the health of the people was also tested and found out that it has a negative effect. Calculated figure higher than the table value 55.27 > 7.82.

5.   That if all these technological approaches are applied in solving the problem, the land will be restored quickly. Though tested and confirmed.

6.   The researchers also discovered that reclaiming polluted land have some challenges and prospects, see table 6 and 7.

Conclusion

From the period of oil discovery, drilling and installation of facilities, the host community never anticipated that one day the facility could spilled volumes of oil into the land and water as seen today. The damage has been done which renders the soil and water unimportant to the people. The solution is to implement measures recommended in this study, since the land is everything that supports life on earth.

Recommendations

(1)   The Khana people are predominantly farmers and fishermen, and oil spillage had taken over their land and water. Compensation should be paid to them adequately and a central water project provided to enable them has access to good drinking water.

(2)   Because of the usefulness of land to man, periodic environmental awareness such as seminars, workshops and conferences be organized by environmental experts, regulatory bodies and operators of multinational companies including professional organizations to acquaint the populace on the dangers of oil spillages and waste disposal on the soil.

(3)   Environmental hazards natural or man-made should be quickly attended to since its negative impact on the soil, water, air including human is known to be detrimental.

(4)   Oil companies should be not neglect or undermine the strength of host communities in terms of protecting and reporting any act of sabotage by intruders to the appropriate bodies. There should be partnership in security provision against internal or external forces.

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