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MODELLING OF OIL AND GAS MANAGEMENT AND OPERATIONS IN NIGER DELTA REGION; A CASE STUDY OF NIGERIAN NATIONAL PETROLEUM CORPORATION (NNPC)

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ABSTRACT

The problem of the Niger Delta region remains unsolved, after so many years of oil and gas exploration and production. It seems that these problems cannot be solved, since demands cannot be met based on the approaches adopted by Government in addressing the issues or demands/needs of the region. Federal Government have made several efforts to address these problems in the region, those efforts have proven unsuccessful, more especially on a long-run. Indicating that the issues of the region have not being confronted as it directly affects the people. Hence a wrong methodology or approach has being used in addressing the issues of the region which cannot provide permanent solution. This research work is on modelling of oil and gas management and operations in Niger Delta (a case study of NNPC). It analyses the relationship between NNPC (Government) and Host Communities (Oil producing areas of Niger Delta region), using developed models (M1, M2 & M3) to quantitatively arrived at its parameters. It looks at the demands of the region and how efficiently NNPC have manage their resources (oil & gas) to meet those needs/demands, which is a basic concept of management (using available scarce resources to meet needs). And the reasons for continue conflicts and agitations (unrest) in the region, and as well as the type of relationship existing with Government (G) and the Niger Delta (N); the stages and degree of conflict escalation in the region and other relevant case studies (Ken Saro Wiwa & Shell on Ogoniland). The main component of the developed model 2 (M2) is to address the concept of management (using the available scarce resources to meet the needs/demands of the people). Therefore for effective and efficient utilization of resources in the region, needs/demands must be met. Hence Resources (R) available must be directly proportional to demands (d) which is equivalent to Resources Control (R_C). But in the case where Resources available is inversely proportional to demands of the people agitations will continue, until a point where resources directly proportional equals to resources inversely proportional known as Equity Share (50% derivation). Mathematically represented as R = Ed (Equivalent to resources control), R = E/d (agitations continues) and Ed = E/d (Equity share). Where E = constant (E ≤ 100%). Therefore the analysis of the model (M2), the results shows that the actual demand (d_A) of Niger Delta region is 98.3% (oil derivation) of its total resources produced with a leftover of 1.7% (tax allowance) and tax rate of 17.93%. It is an indication of the demand for resources control (R_C) and fiscal federalism at a tax rate of 17.3% to be paid to Federal Government. But Niger Delta States gets 13% (oil derivation) while Federal Government (G) gets 87% of the total resources (oil and gas) produced in the region. Therefore it indicates that R = E/d; hence agitations will continue in the region. And the rate of deviation (between R_G and R_N) is 74%, and the rate at which resources has being diverted in the region is 64.4%. The analysis of the human relation, model 1 (M1), indicate that there is a poor mutual relationship between G and N. With 13% zone of shared power (P_S) and 87% of zone of unshared power (R_O), and the strength of the shared power is at a ratio of 11% : 2% (G:N). Where the point of intercept is 39% and the resistive intercept which oppose the mutual relationship is at 61%, indicating too many personal interests in the kind of relationship that should exist between G and N. From the analysis of model 3 (M3) and the conflict escalation chart the degree of conflict escalation (C_E) is +266.4° NNPC/OC HC/NNPC/En/OC. This means that the conflict lies on the third quadrant, and therefore could be trace to NNPC/OC as the major cause and mostly affected if there is violence, and resolution lies primarily on HC/NNPC/En/OC.

Keywords: Oil and Gas Management, NNPC, Niger Delta Region, Models

INTRODUCTION

There are many ways in which devices and behaviours can be described, we can use words, drawings or sketches, physical models, computer programs or mathematical formulas. In order words, the modelling activity can be done in several languages, often simultaneously. Modelling is a way of representing the behaviour of a situation to enable us deduces what is best to do about the system. Models are tools for representing a situation to understand it and for reasoning about it (Onwodi, 2011). In its simple form; models are the representations or abstraction of reality or situation (Migidadi 2017). Models should be made for specific goals with clear assumptions since they are only "valid" under certain conditions (Wang 2012). When dealing with models we hope to represent something that seems real and relevant to us, however they are abstractions and models, they are themselves real only as models, and they should never be confused with the reality we are trying to model. Thus, if the behaviour predicted by our models does not reflect the real world, it is the model that need to be fixed and not the world (SFU modelling chp1). Since the concept of management is how to use or utilize the available scarce resources to meet demands / needs. Though this resources may seems to be in abundance, but still referred to as scarce resources. Reason; it can never go round or be enough at any point in time.
When there is mismanagement of the Economy by our political elite (leaders), it becomes very difficult to meet demands/needs of the citizens. Therefore it is important to note that trying to meet the demands/needs of the people using the available scarce resources is also trying to make the best possible profit out of it.
The Nigerian National Petroleum Corporation (NNPC) was established on April 1977. In 1998 it was commercialized into twelve strategic business units covering the entire spectrum of oil industry operations in Nigeria, with its major exploration and production activities in Niger Delta region, representing the Federal Government of Nigeria in the entire oil spectrum and its host communities.

Oil and gas now account for about 35 per cent of Nigeria's gross domestic product (NBS annual report 2017) and petroleum export produce over 90 per cent of total export revenue (NBS). Nigeria has 37.35 billion barrels in proven crude reserves and 5,480 billion cubic meters of proven natural gas reserves (OPEC), giving the country one of the top ten natural gas endowment in the world. Due to lack of utilization infrastructures, Nigeria still flares about 40 per cent of the natural gas it produces and re-injects 12 per cent to enhance oil recovery (EIA report 2015). The World Bank estimates that Nigeria accounts for 12.4 per cent of the total gas flaring. Shell estimates that half of the 2Bcf/d of associated gas (gaseous by-products of oil extraction) is flared in Nigeria annually. According to NNPC, Nigeria is the 6th oil richest country in the world, and with its crude oil majorly produced in the Niger Delta region. The Niger Delta region of Nigeria

is one of the world's largest sources of oil and gas and plays a critical role in meeting global energy demands, providing the country with approximately 75 per cent of its foreign exchange earnings, (over 70 per cent lives in less than US $ 2.00/day (NDPI annual report 2015), which further decrease when Nigeria entered into recession in 2016 (CBN annual report 2017). Yet the region has majority of its populations living in poverty and communities in the region faces with a wide range of environmental threats and the on-going turmoil and conflicts stemming from inequitable distribution of the wealth that the region produces. Over decades the Nigerian Government has established a range of institutions and initiatives to address the poverty, conflict and under development in the region. As early 1961, the post-independence government set up the Niger Delta Basin Board, subsequent bodies include Niger Delta Basin Authority (NDBDA) in 1976, the Oil Mineral Producing Areas Development Commission (OMPADEC) in 1992, the Niger Delta Development Commission (NDDC) which replaces OMPADEC in 2000, the Ministry of Niger Delta Affairs in 2008 and recently the inauguration of the committee for the implementation of UNEP report 2011 on Ogoniland and many more, yet the problems of the region remains unsolved or unresolved, is an indication of possible mismanagement of resources (oil and gas and its operations) in the region by NNPC representing Federal Government and the entire spectrum of oil industry in Nigeria, which this research focuses on to unfold.

The facts that the people of Niger Delta region have not benefited much from the oil wealth are only part of the story. Wide spread and unchecked human rights violations related to oil and gas industry have pushed people deeper into poverty and deprivation, fuelled conflicts which leads to a pervasive sense of powerlessness and frustration, environmental pollution and demand for resources control (13% oil derivation not feasible). These are indications that the demands/needs of the region have not been met (concept of management). Oguntokin (2000) paradoxically describe the regions as the goose that lays the golden egg but most environmentally is fragile, with the primary interest of the oil companies and NNPC (Federal Government) is to maximize profit in the region at any cost, in order to achieve their objectives of subordination including livelihood of the people as well as the environment. Therefore the rationale behind this research work is about developing models that describe the behaviour or results observed, models that explain why that behaviour and results occurred as they did. The aim of this research work is to develop models of complex management decision problems in oil and gas management and its operations, in order to study NNPC and analyse the models to gain insight about possible mismanagement of resources (oil and gas) in Niger Delta region. To show that NNPC has not manage oil and gas operations in the region effectively and efficiently, which could be the reasons for unrest in the region with various

demands and agitations. And also determine the degree of conflict escalation and zone of indifference between the oil companies and their host communities.

MATERIALS AND METHODS

In order to achieve the objectives of these study, the methodology consist of three developed mathematical models (M1, M2 & M3), used quantitatively to analysed the oil and gas management and operations in Niger Delta Region; with relevant case studies and key assumptions, results, conclusion and recommendations. For this analysis secondary data's were gotten from NNPC, CBN and NBS (see appendix A &B).

Model 1 (M1): Shows the relationship between Government (G) and Niger Delta (N) with respect to their zone of indifference or acceptance. It consists of different stages (stage 1-5) which quantitatively explain the zone of indifference/acceptance (zone of shared power) between Government (G) and Niger Delta (N) and the role of External Forces (E).

Stage 1: Disjointed Relationship

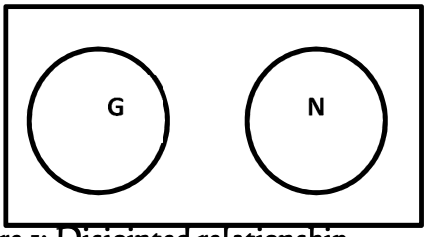


Figure 1: Disjointed relationship

This stage can occur at a neutral ground, when there is no resource available or no relationship between Government and Niger Delta region. It is also a potential starting point for any relationship to occur or when resources available have been exhausted and decommissioned. External force ($+E_1$) is always present at this stage (disjointed relationship) since it is a constant value ($+E_1 = 100$), and the presence of ($-E_2$) indicate the availability of resources. At this stage re-negotiations can also take place.

At this stage:

$$E_1 + (-E_2) = 1$$
$$E_1 - E_2 = 1 \quad (1)$$
$$E_1 = E_2 + 1$$

(At $1 = 0$)

$$E_1 = E_2$$

Stage 2: External Forces (E)

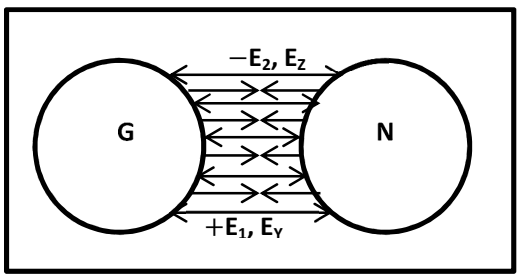


Figure 2: External force

External forces (E), which could be either, positive ($+E_1$) or negative ($-E_2$) plays critical role to determine the relationship that will exist between Government (G) and Niger Delta region (N).

At this stage:

$$G + N = E_1 - E \quad (2)$$

Where, $E_1 > E_2$ (or eliminated) to have a point of intercept (I_P) or shared power (P_S)

E_1, E_Y: positive external forces that acts as a centripetal force to bring G and N together, which involves conflict mediation for peaceful resolution, represented by opposite arrow head →←

E_2, E_Z: negative external forces that acts as a centrifugal force that tends to separate G and N further apart, which are conflict escalators, represented by double arrow head ↔

E_1 = positive external forces

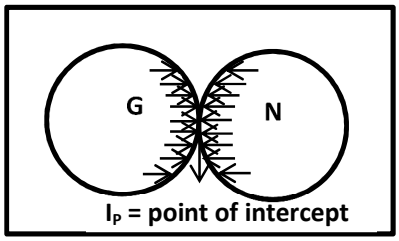
E_2 = negative external forces

E_Y = positive reserved external forces

E_Z = negative reserved external forces

$-E_2$, E_Z & $+E_1$, E_Y = reserved energies

Stage 3: Interception (I)



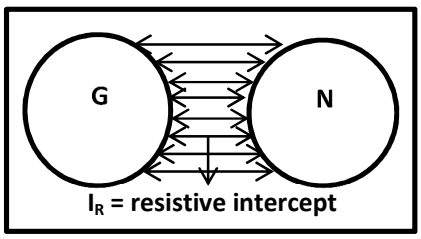


Figure 3: Point of intercept **Figure 4: Resistive intercept**

It consists of positive interception (point of intercept (I_P)) and negative intercept (resistive interception (I_R)).

At this stage:

$$I = E_1 - E_2 \quad (3)$$

Where, negative intercept ($I = I_R$) and positive intercept ($I = I_P$)

$\therefore I_R = I_P - E_1$ (4)

Hence, reserved external forces (E_Y & E_Z) are;

$E_Y = E_1 + I_P$ (at $I = I_P$), otherwise $E_Y = E_1$ (5)

$E_Z = -E_2 - I_R$ (at $I = I_R$), otherwise $E_Z = -E_2$ (6)

NB: at the point where $E_1 > E_2$ is known as point of intercept (I_P), but when $E_1 < E_2$ is known as resistive intercept (I_R) which tends to separate G and N further apart.

Stage 4: Zone of Shared Power (P_S)

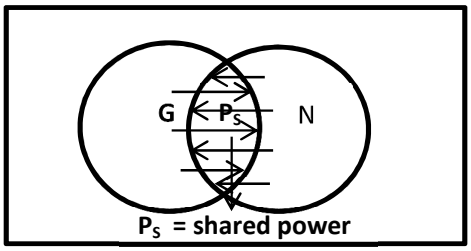


Figure 5: Zone of shared power

Zone of shared power (mutuality) is a point of intersection or mutual understanding (compromise) between G and N, and equity share (E_S) is reached at a point where G + N = 50% as the case maybe, which indicate strong mutual understanding. And total mutual understanding is at /or equivalent to resources control (R_C). Hence the strength of this relationship depends on the size of shared power (P_S), the larger the size the stronger the relationship and the smaller the size the weaker the relationship becomes.

At this stage:

$G + N = P_S$ (7)

$\therefore R_o = E_1 - P_S$ (8)

Where R_o = zone of unshared power, and P_S = zone of shared power.

Stage 5: Resources Control (R_C)

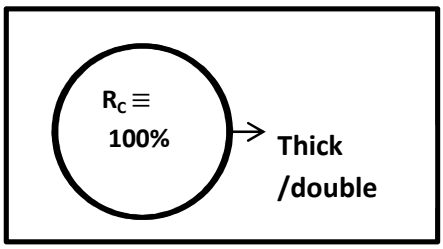


Figure 6: Resource control

At this stage zone of shared power is equivalent to 100% mutual understanding, which is total mutual understanding (M_U). It indicates that the resources (oil and

gas) utilize meets the demands/needs of the Niger Delta region, which is the basic concept of management.

There is 100% confidence and trust between G and N, and decisions are totally decentralized. This could be said to be the most suitable stage for every economy, in order to maximize productivity.

At this stage:

At resources control

$R_C \equiv 100\%$ (10)

$(R_o = 0, P_S = 100\%)$

Therefore calculate for:

Insurance $i = \sqrt{I}$ (11)

Vote of confidence or security vote $= P_S - i$ (12)

Taxation $= (i + 10)\% + I_o$ (13)

Complex Relationship

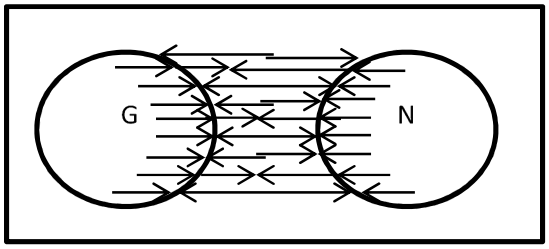


Figure 7: complex relationship

It is an imaginary or irregular relationship, which is said to be at a point of abnormality.

At this stage:

$G + N > 100$, $E_1 < E_2$ or $E_1 \ll E_2$ and or when R_o is negative

Therefore, since the aim of every relationship is to have a positive intercept; hence we calculate for the forces that will cause or regularize this relationship, known as force of conspiracy (C_p). The forces of conspiracy and re-negotiation are calculated as $P_S = \alpha$, then new P_S and R_O are determined.

Therefore Let $P_S = \alpha$

From stage 2, $(G+N = E_1 - E_2)$

$E_1 - E_2 = G+N$

$-E_2 = G+N - E_1$

Replace E_1 by E_A (where $E_A \leq 100\%$ & $E_1 = 100\%$)

$\therefore -E_2 = G+N - E_A$

$E_2 = -G-N + E_A$

$E_2 = -(G+N)+E_A$ (14)

From stage 4, $(G+N = P_S)$

$\therefore E_2 = -P_S + E_A$ (15)

Hence, if $G+N = E_1 - E_2$ (stage 2)

$\therefore P_S = E_1 - P_S + E_A$ (16)

Key Assumptions/Conditions of Model 1 (M1)

1. $E_A \leq 100\%$ (constant value, ranges from 0 – 100%)
2. $E_1 = 100\%$ (constant value)
3. At a complex relationship the actual demand is uncertain or unknown

Model 2 (M2): Shows the relationship (quantitatively) between the resources (R) utilize and the demands (d). It further studies the relationship existing at model 1(M1) with respect to resources utilization and demands to arrive at its parameters. Therefore M2 shows that for efficient utilization of resources, demands must be meet, and for demands to be met, resources (R) must be directly proportional to the demands (d) of the people (Niger delta region), which is equivalent to resources control (R_C). But in a case where resources available is inversely proportional to the demands of the people, the agitations will continue, until a particular point where resources directly proportional to demand equal to resources inversely proportional to demands at a known quantity of resources (R_Z), referred to as equity share (E_S). It can be expressed mathematical as;

$R \propto d$ (1)

$R = Ed$ (equivalent to resource control) (2)

$R \propto 1/d$ (3)

$R = E/d$ (agitations continue) (4)

Where E = constant

$Ed = E/d$ (equity share) at a known total resources (R_Z) (5)

Therefore;

$E = Ed^2$

$1 = d^2$

$d = \sqrt{1} = 1$ (6)

$\therefore P_S\% = d_o \times d$

$P_S\% = d_o$ (7)

At a constant external forces; $E_A \leq 100\%$ (Assumed external force)

Therefore; at unknown quantity of resources

$R_N = E_A d_o$ (8)

$R_G = E_A / d_o$ (9)

But at a known quantity of resources (R_Z)

$R_N = P_S \times R_Z$ (10)

$R_G = R_o \times R_Z$ (11)

Where,

R_N = resources utilized with respect to N

R_G = resources utilized with respect to G

d = constant demand at resources control
d_o = conflict demand
E_A = assumed external forces ($E_A \leq 100$).
NB: Assumed external forces must be an absolute value, since we are interested in zone of shared power (P_S) or point of intercept.
At zone of shared power
$E_2 = -(G + N) + E_A = -P_S + E_A$ (12)
Zone of unshared power
$R_o = E_1 - P_S$ (13)
At point of intercept
$I = E_1 - E_2$
(14)
$I_R = I_P - E_1$ (15)
Hence, $E_Y = E_1 + I_P$ (at $I = I_P$), otherwise $E_Y = E_1$ (16)
$E_Z = -E_2 - I_R$ (at $I = I_R$), otherwise $E_Z = -E_2$ (17)

Rate of deviation
$D_R = ((R_G/R_N \times 100) - (R_G/R_N \times 100))\ \%$ (18)
NB: D_R can either be positive (clockwise moment) or negative (anticlockwise moment).
Actual demand (d_A)
$d_1 = R_N \times d_o$ (19)
$d_2 = R_G \times d_o$ (20)
Therefore, actual demand (d_A) is the highest value between the column N and column G (see table1)
Where d_1 = assumed demand for N as a result of d_o
d_2 = assumed demand for G as a result of d_o

Table 1: Table showing how to determine the value of actual demand

N	G	R_N	R_G	R_T
d_1 (X)	A–X	A	-	-
d_1 (X)	AB–X	-	-	AB
d_2 (Y)	B – Y	-	B	-
d_2 (Y)	AB–Y	-	-	AB

Total resources diverted (R_D)
$R_D = D_R \times R_T$ (21)
Total resources un-diverted
$R_U = R_T - R_D$ (22)
Actual resources diverted (R_{AD})
$R_{AD} = R_O \times R_D$ (23)
Actual resources un-diverted (R_{AU})
$R_{AU} = R_T - R_{AD}$ (24)

Where R_T = total resources and is equal to quantity of resources R_Z
At resources control (R_C) calculate for:
Insurance $i = \sqrt{I}$ (25)
Guarantee for relative peace /Vote of confidence/ security vote = $P_S - 1$ (26)
Taxation = $(i + 10)\% + I_o$ (27)
Where I_o = tax allowance (leftover)
At complex relationship $P_S = \alpha$ (28)
At composite relationship $P_S \neq G + N$, hence $G - N = P_S$ (29)

Composite Relationship:

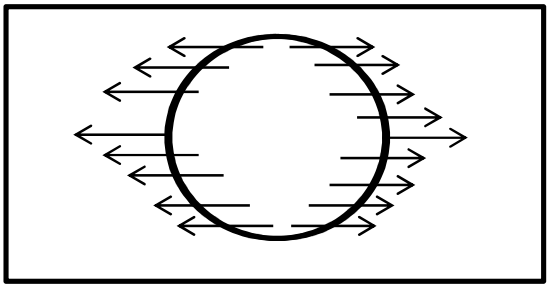


Figure 8: Composite relationship

At composite relationship $P_S \neq G + N$, it comprises of an existing relationship (mutual understanding and resources control) to a disjointed relationship. When an existing relationship is not stable and recycles its self.

At this stage:
($P_S \neq G + N$)
And the new P_S and R_O, will be calculated as $G - N = P_S$
Hence the actual relationship existing here is disjointed relationship and re-negotiation can be calculated as well.

Key Assumptions / Conditions of Model 2 (M2)

1. Equity share, $P_S = 50\%$, $R_o = 50\%$ only at a known quantity of resources (R_Z).
2. Insurance (i) is maximum at 10%
3. At a composite relationship the actual relationship is disjointed relationship.
4. Price of conspiracy is the factors that will cause $E_1 > E_2$, when $E_1 \ll E_2$.
5. Total resources diverted (R_D) is an absolute value.

Assumptions Based on Actual Demand (d_A)

1. Actual demand is the highest value between N-column and G-column e.g. if N = 0.018, 0.018, 0.200, 0.200 and G = 0.042, 0.452, 0.5269, 0.709 therefore actual demand (d_A) is 0.709 which is the highest values between N-column and G-column.

2. In a case where the values of N-column are all the same values, with two equal values and two zero on G-column, therefore the actual demand are the average values of N-column plus average values of G-column of values greater than zero. E.g. if N = 0.1, 0.1, 0.1, 0.1 and G = 0, 0.1, 0, 0.1, d_A = 0.4/4 + 0.2/2 = 0.2. If N-column = 0, 0, 0, 0 and G-column 0, α, 0 , α , actual demand = 2α/2 = α. If N-column = 0, 0, 0, 0 and G-column =0, 0, 0, 0 actual demand = 0.
3. If all values of N-column are the same and G-columns has a pair of the same and a pair of different value, then the actual demand is average values of N-column plus average values of the pair of different value e.g. If N = 8350, 8350, 8350, 8350 and G = 83500, 250500, 83500, 520500, the Actual demand = 3340000/4 + 167000/2 = 167000. Note; the actual demand would have being 250500, which is the highest value but because of equity share, the actual demand is now 167000.

Model 3 (M3): It's a model of network of mutual relationship or human relations and interdependency (entropy at work) between the Natural Environment, Host Community, NNPC/Government and Oil Companies (En/HC ↔ NNPC/OC). It indicates the nature, types and stages of conflict escalations and as well as conflict resolutions. It has three basic relationships such as vertical, horizontal and cyclic relationship, which determine the degree of conflict escalation as calculated.

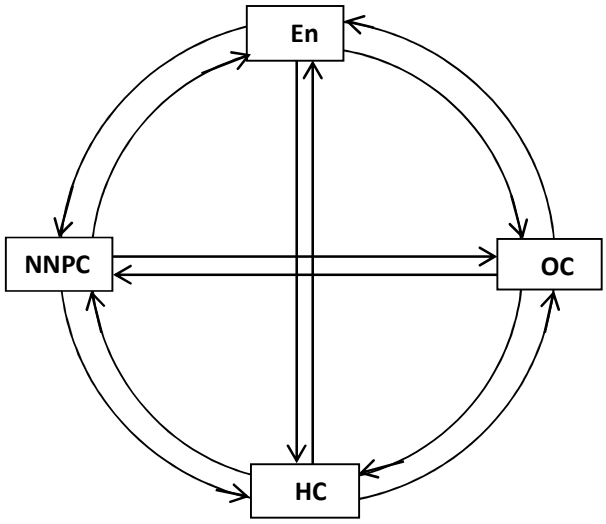


Figure 9: Network of human relations and interdependency between En, OC, HC and NNPC

Vertical Relationship

Vertical relationship is equivalent to resources control (total mutual understanding), between the Environment (En) and Host Communities (HC), where the Environment (En) gives directly to the Host community and vice versa. And the HC in turn gives to either NNPC or oil companies (OC) in a cyclic relationship.

Therefore, in vertical a relationship;

$\mathcal{R}_N = E_A d_o$

Horizontal and Cyclic Relationship

These are equivalent to mutual relationship, which can either be strong or weak.

Hence, $\mathcal{R}_G = E_A/d_o$

Degree of Conflict Escalation

At degree of conflict escalation and mitigation or resolution, the arrows indicate the chain of relationship or linkage and interdependency between En/HC/NNPC/OC. Therefore En/HC is directly linked together while NNPC/OC is directly linked together, what affects one affects the other, with the shorter arrows also indicating the network movement and relationship in both directions.

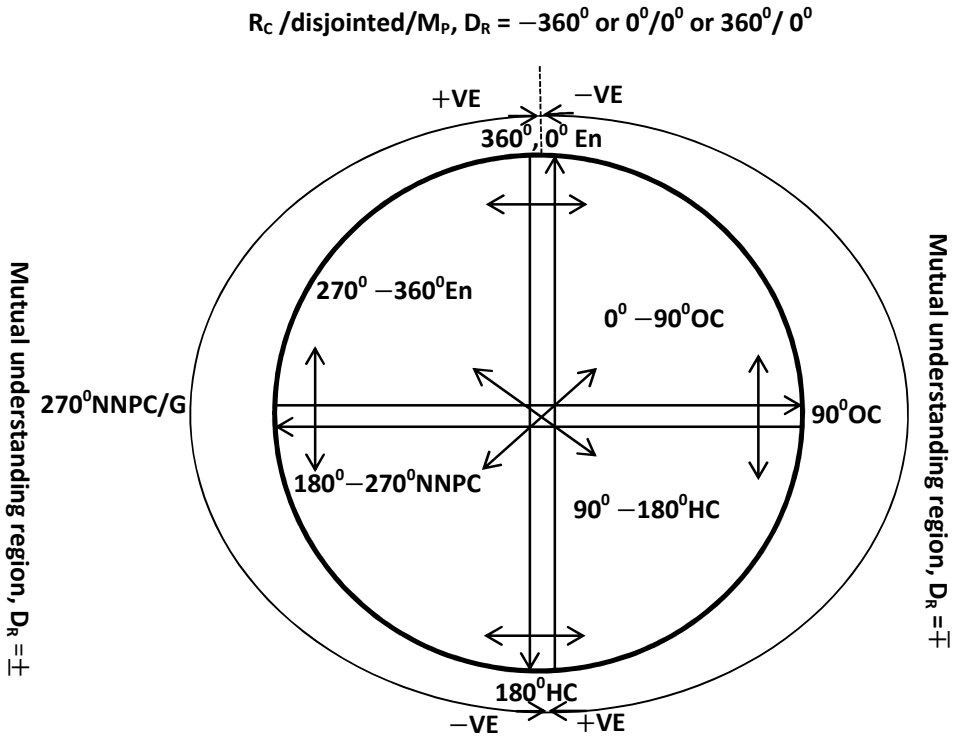


Figure 10: Degree of conflict escalation chart

The degree of conflict escalation (C_E) is either positive or negative which indicate clockwise moment or anticlockwise moment (indicating the direction of the

relationship). Hence degree of conflict escalation can be calculated using this formula; $C_E = \pm D_R \times 360°$ and indicated in the conflict escalation chart and the process of resolution determined. Where C_E = conflict escalation and D_R = rate of deviation.

Oil Company (± 0° - 90°OC)

The relationship is *± 0° - 90° OC/NNPC ↔ En/OC/HC.* It means that the conflict lies on the first quadrant (± 0° - 90°), which indicate that the conflict could be traced to OC/NNPC as the major cause of the grievance or conflict in region and mostly affected if there is violence, and the resolution is majorly centred on En/OC/HC/NNPC.

Host Community (± 90° - 180°HC)

The relationship is *± 90° - 180° HC/En ↔ OC/HC/NNPC.* The conflict lies on the second quadrant, and therefore could be trace to HC/En as the major cause or primary cause and mostly affected if there is violence, and resolutions lies on OC/HC/NNPC/En.

Nigerian National Petroleum Cooperation (NNPC) (± 180° - 270°NNPC)

The relationship is *± 180° - 270° NNPC/OC ↔ HC/NNPC/En/OC.* The conflict lies on the third quadrant, and therefore could be trace to *NNPC/OC* as the major cause and mostly affected if there is violence, and resolution lies primarily on *HC/NNPC/En/OC.*

The Natural Environment (± 270° - 360°NNPC)

The relationship *is ± 270° - 360° En/HC ↔ NNPC/En/OC/HC.* The conflict lies on the fourth quadrant, and could be traced to the En/HC as the major cause and mostly affected, if there is violence, and resolution lies on NNPC/En/OC/HC.

First Half of the Chart (± 0° - 180°oC-HC)

When degree of conflict escalation falls within this range it majorly indicates conflicts arising as a result of non-compliance to local content law and communal crisis.

Second Half of the Chart (± 180° - 360°oC-HC)

When degree of conflict escalation falls within this range it majorly indicates conflict arising as a result of the issues or demand of resource control and demand for equity share.

Key assumptions/conditions

1. Resources control/disjointed relationship/equity share, can occur at D_R = -360°or 0°/360° or 0°/0° respectively.

Case Study; Ken Saro Wiwa (Ogoniland)

The case of Ken Saro Wiwa and General Sani Abacha (military regime in Nigeria) is a practical example of conspiracy and can also be used to illustrate these models.

Where HC = host community (Ogoniland)
G = Federal Government of Nigeria
E_1 = represent Ken Saro Wiwa and kinsmen (MOSOP)
E_2 = represent Gen. Sani Abacha (military regime)/other external forces coming from shell (which made E_2 very strong and in charge or control of G).

In this case $E_1 \ll E_2$, the external forces of E_2 was very strong and powerful which makes it in charge or control of G with its influential powers. E_1 (Ken and his kinsmen) was eliminated in order to penetrate HC without hitches or obstructions and to forcefully create a high mutual relationship. The plan to create mutual relationship after eliminating Ken and his kinsmen failed, hence no existing mutual relationship between HC and G/Shell, and Shell has not return to Ogoniland since 1993.

Therefore, the conditions to cause $E_1 > E_2$, is to clean –up Ogoniland (UNEP report) which is known as the *price of conspiracy*. According to United Nations report 2011, and recommendations, the damages in Ogoniland will take 25 to 30years to repair. And an environmental restoration fund for Ogoniland should be set up with an initial capital injection of $1billion (USD) contributed by the oil companies and the Government. This is a huge price to pay in order to create a mutual relationship between Federal Government/Shell and the people of Ogoniland. Hence the kind of relationship that is exiting between Federal Government (G) /Shell and the people of Ogoniland (HC) /MOSOP is a disjointed relationship.

Therefore, the *price of conspiracy* is the factors that will cause $E_1 > E_2$, when $E_1 \ll E_2$, it is also the factors that will cause $R_o \leq 100$ when $R_o > 100$.

RESULTS AND DISCUSSION

ANALYSIS

The analysis, of the 13% oil derivation and average daily crude oil production (1920399bpd) of Niger Delta States, from first quarter 2017 to first quarter 2018 (see appendix A & B), is shown below using model (M1, M2 & M3).

R_{Σ} = 1920399bpd (known quantity of resources)
$\therefore R_N$ = 13% of 1920399bpd = 249651.87bpd
R_G = 87% of 1920399bpd = 1670747.13bpd
R_T = 249651.87 + 1670747.13 = 1920399bpd = R_{Σ}

At resources control
$Ed = E/d$
$Ed^2 = E$
$d = 1$
$d_o = d \times P_S = P_S\%$
Where $P_S = 13\%$, hence $R_O = 87\%$
$\therefore d_o = 0.13$
$d_1 = R_N\, d_o = 249651.87 \times 0.13 = 32454.7431bpd$
$d_2 = R_G\, d_o = 1670747.13 \times 0.13 = 217197.1269bpd$

Table 2: Table to derive actual demand

N	G	R_N	R_G	R_T
d_1(32454.7431)	217197.1269	249651.87	-	-
d_1(32454.7431)	**1887944.257**	-	-	1920399
d_2(217197.1269)	1453550.003	-	1670747.13	-
d_2(217197.1269)	1703201.873	-	-	1920399

$d_A = 1887944.257bpd$
$I_o = R_T - d_A = 1920399 - 1887944.257 = 32454.743bpd$ (leftover)

Rate of deviation (D_R)

$D_R = (R_G/R_T \times 100) - (R_N/R_T \times 100)$
$D_R = (1670747.13/1920399 \times 100) - (249651.87/1920399 \times 100)$
$\therefore D_R = 74\%$

Degree of conflict escalation (C_E)

$C_E = 74\% \times 360^\circ = 266.4^\circ$

Assumed resources diverted (R_D)

$R_D = D_R \times R_T$
$R_D = 74\% \times 1920399 = 1421095.26bpd$

Assumed resources un-diverted (R_U)

$R_U = R_T - R_D$
$R_U = 1920399 - 1421095.26 = 499303.74bpd$

Actual resources diverted (R_{AD})

$R_{AD} = R_O \times R_D = 87\% \times 1421095.26 = 1236352.876bpd$

Actual resources un-diverted (R_{AU})

$R_{AU} = R_T - R_{AD} = 1920399 - 1236352.87 = 684046.124bpd$

Human relations

$G = 1670747.13/1920399 \times 13\% = 11\%$
$N = 249651.87/1920399 \times 13\% = 2\%$

NB: since: $E_A \leq 100\%$, and $E_1 = 100\%$, therefore at maximum assumed external force ($E_A = E_1 = 100\%$), hence assume the value of E_A (0 -100%) or use theoretical E_A (calculated).

Theoretical E_A formula

$G + N = E_1 - E_2$
Where $G + N = P_S$, $E_2 = - P_S + E_A$
$\therefore P_S = E_1 - P_S + E_A$
$13 = 100 - 13 + E_A$
$E_A = -74\%$
$\therefore E_A = 74$ *(must be positive)*
$E_2 = -13 + 74 = 61\%$
$\therefore E_2 = -61$ *(E_2 must be always negative irrespective of the sign convection)*
$I = E_1 - E_2 = 100 - 61 = 39\% = I_P$
Where, negative intercept ($I = I_R$) and positive intercept ($I = I_P$)
$\therefore I_R = I_P - E_1 = 39 - 100 = -61\%$
Hence, actual external forces (E_Y & E_Z) are;
$E_Y = E_1 + I_P$ (at $I = I_P$), otherwise $E_Y = E_1$
$E_Z = -E_2 - I_R$ (at $I = I_R$), otherwise $E_Z = -E_2$
$\therefore E_Y = E_1 + I_P = 100 + 39 = 139\%$
$E_Z = -61\%$
Reserved energies (139 – 100 = 39%, & 61 – 61 = 0%)
NOTE: At resources control (P_S =100%) calculate for taxation, hence it's not necessary here since P_S =13%. Thus;
$i = \sqrt{39} = 6.24\%$
$P_S - i = 13 - 6.24 = 6.76\%$
Tax (T_X) = (6.24 + 10) % × 1920399 + 32454.734 = 344327.5407bpd

Human relation diagram

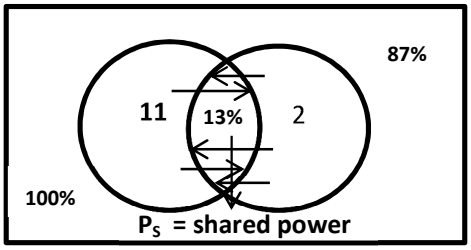


Figure 11: Zone of shared power

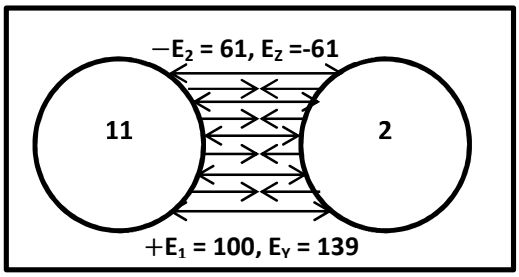
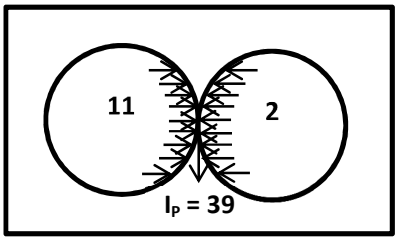


Figure 12: External forces



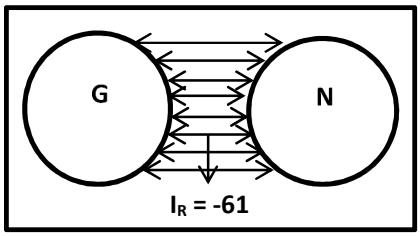


Figure 13: Point of intercept

Figure 14: Resistive intercept

Degree of conflict escalation chart

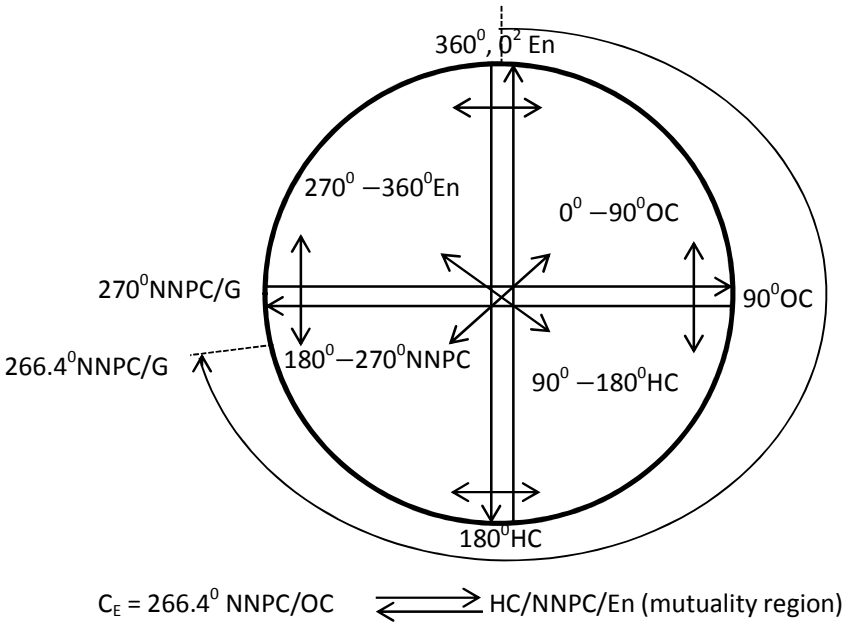


Figure 15: Degree of conflict escalation

RESULTS

Table 3: Results from analysis of Niger Delta States (1Q2017-1Q2018) using model M1, M2 & M3

S/N	PARAMETERS	RESULTS	DEFENITIONS
1	$R_Z = R_T$	1920399bpd	Total resources utilized
2	R_G	1670747.13bpd	Resources utilized by G
3	R_N	249651.87bpd	Resources utilized by N
4	d	1	Demand at resources control
5	d_o	0.13	Conflict demand
6	d_1	32454.743bpd	Assumed demand for N as a result of (d_o)
7	d_2	217197.1269bpd	Assumed demand for G as a result of (d_o)

8	d_A	1887944.257bpd	Actual demand
9	I_O	32454.7431bpd	Leftover (tax allowance)
10	D_R	74%	Rate of deviation
11	C_E	266.4°	Degree of conflict escalation
12	R_D	1421095.26bpd	Assumed resources diverted
13	R_U	499303.74bpd	Assumed resources un-diverted
14	R_{AD}	1236352.876bpd	Actual resources diverted
15	R_{AU}	684046.124bpd	Actual resources un-diverted
16	G	11%	Government
17	N	2%	Niger Delta
18	R_O	87%	Unshared power
19	P_S	13%	Zone shared power
20	E_A	74%	Assumed external force (as calculated)
21	E_1	100%	Positive external force (constant value)
22	E_2	-61%	Negative external force (must be negative)
23	I	39%	Intercept
24	I_p	39%	Point of intercept
25	I_R	-61%	Resistive intercept
26	E_Y	139%	Positive reserved external force
27	E_Z	-61%	Negative reserved external force
28	E_Y/E_1 & E_Z/E_2	39% & 0%	Reserved energies
29	$_i$	6.24%	Insurance
30	P_S-i	6.76%	Guarantee for relative peace
31	(i +10)% + I_o	344327.5407bpd	Tax

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Table 4: Results from the analysis of each of the Niger Delta States (1Q2017-1Q2018)

PARAMETERS	ABIA (1%) MBD	AKWA IBOM (26%) MBD	BAYELSA (21%) MBD	DELTA (24%) MBD	EDO (3%) MBD	IMO (1%) MBD	RIVERS (20%) MBD	ONDO (4%) MBD
$R_Z = R_T$	19203.99	499303.74	403283.79	460895.76	57611.97	19203.99	384079.8	76815.96
R_G	16707.4713	434394.2538	350856.8973	400979.3112	50122.4139	16707.4713	334149.426	66829.0748
R_N	2496.5187	64909.4862	52426.8927	59916.4488	7489.5561	2496.5187	49930.374	9986.0748
d_1	324.54743	8438.23318	6815.49603	7789.13832	973.64229	324.54743	650.9486	1298.18972
d_2	2171.971269	56471.25299	45611.39665	52127.31046	6515.913807	2171.971269	43439.42538	8687.885076
d_A	18879.44257	490865.5068	396468.294	453106.6217	56638.32771	18879.44257	377588.8514	75517.77028
I_o	324.547431	8438.233206	6815.496051	7789.138344	973.642293	324.547431	6490.94862	1298.189724
R_D	14210.9526	369484.7676	298430.0046	341062.8624	42632.8578	14210.9526	284219.052	56843.8104
R_U	4993.0374	129818.9724	104853.7854	119832.8976	14979.1122	4993.0374	99860.748	19972.1496
R_{AD}	12363.52876	321451.7478	259634.104	296724.06902	37090.58628	12363.52876	247270.5752	49454.11504
R_{AU}	6840.46124	177851.9922	143649.686	164171.0698	20521.38372	6840.46124	136809.2248	27361.84496
T_{AX}	3443.275407	89525.16058	72308.78355	82638.60977	10329.82622	3443.275407	68865.50814	13773.10163
OTHERS PARAMETERS								
d	1	1	1	1	1	1	1	1
d_o	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
D_R	74%	74%	74%	74%	74%	74%	74%	74%
C_E	266.4°	266.4°	266.4°	266.4°	266.4°	266.4°	266.4°	266.4
G	11%	11%	11%	11%	11%	11%	11%	11%
N	2%	2%	2%	2%	2%	2%	2%	2%
R_O	87%	87%	87%	87%	87%	87%	87%	87%
P_S	13%	13%	13%	13%	13%	13%	13%	13%

E_A	74%	74%	74%	74%	74%	74%	74%	74%
E_1	100%	100%	100%	100%	100%	100	100%	100%
E_2	-61%	-61%	-61%	-61%	-61%	-61%	-61%	-61%
I	39%	39%	39%	39%	39%	39%	39%	39%
I_P	39%	39%	39%	39%	39%	39%	39%	39%
I_R	-61%	-61%	-61%	-61%	-61%	-61%	-61%	-61%
E_Y	139%	139%	139%	139%	139%	139%	139%	139%
E_Z	-61%	-61%	-61%	-61%	-61%	-61%	-61%	-61%
E_Y, E_1 & E_Z, E_2	39% & 0%	39% & 0%	39% & 0%	39% & 0%	39% & 0%	39% & 0%	39% & 0%	39% & 0%
i	6.24%	6.24%	6.24%	6.24%	6.24%	6.24%	6.24%	6.24%
P_S -i	6.76%	6.76%	6.76%	6.76%	6.76%	6.76%	6.76%	6.76%

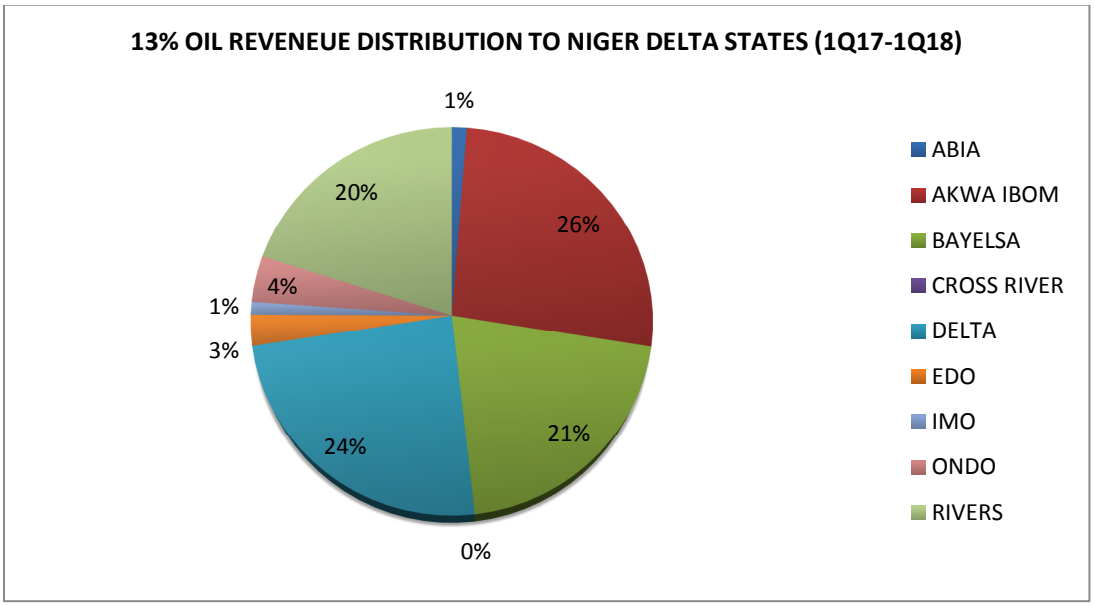

Figure 16: Percentage ratio of 13% oil revenue (derivation) distribution to Niger Delta State (1Q2017-1Q2018)

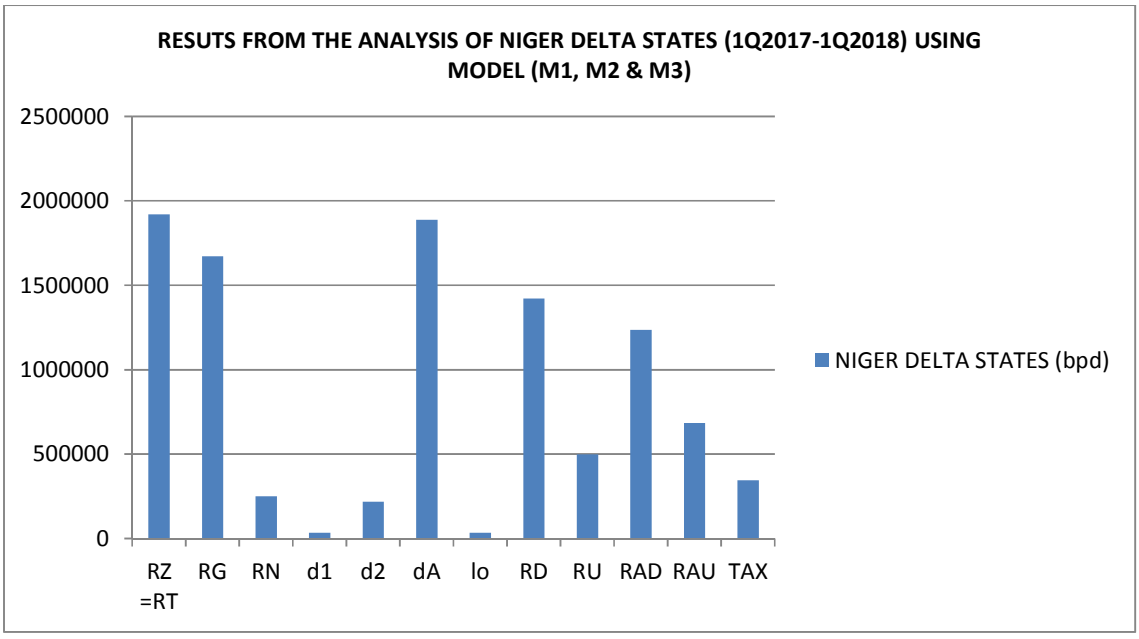

Figure 17: Results from analysis of Niger Delta States (1Q2017-1Q2018) using model M1, M2 & M3

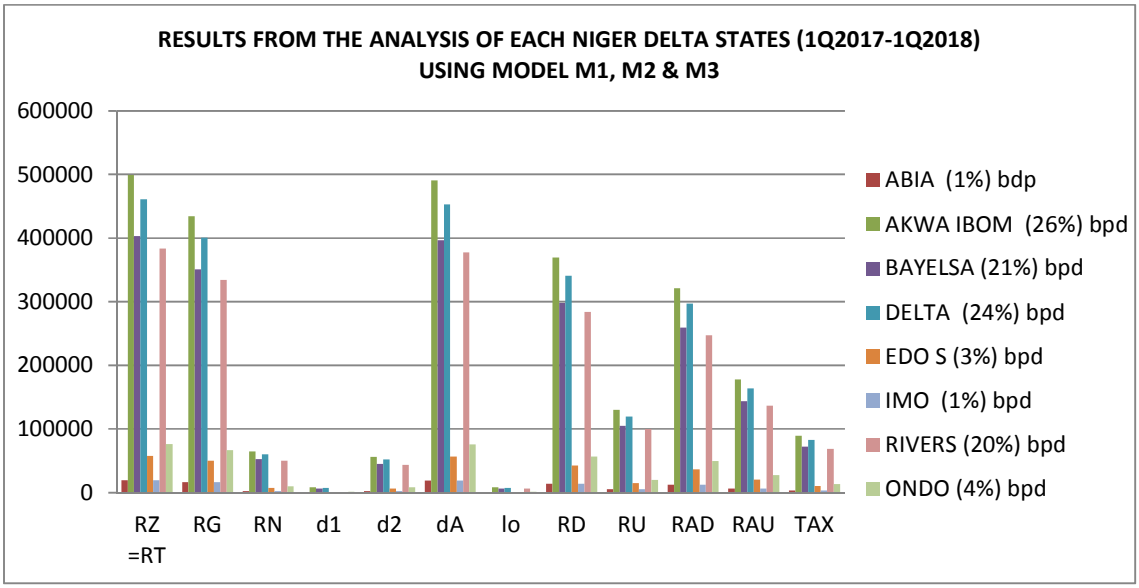

Figure 18: Results from analysis of each Niger Delta States (1Q2017-1Q2018) using model M1, M2 & M3

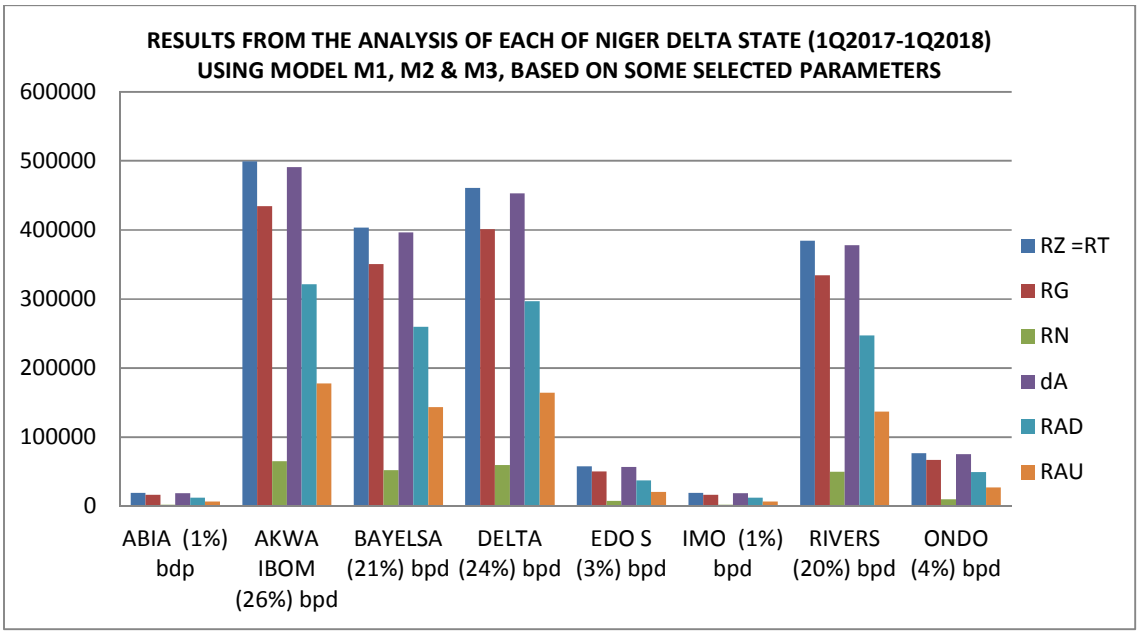

Figure 19: Results from analysis of each Niger Delta States (1Q2017-1Q2018) using model M1, M2 & M3, based on some selected parameters

DISCUSSION

From the analysis of the 13% derivation (oil revenue) distribution to Niger Delta State (see appendix A&B). The results shows that between 1Q2017-1Q2018,

Akwa Ibom received approximately (26%), been the highest. Followed by Delta (24%), Bayelsa (21%), Rivers (20%), Ondo (4%), Edo (3%), Abia and Imo (1%) each; However Abia State is higher than Imo State by a negligible difference of 0.2%.

The analysis of model2 (M2), the results shows that the actual demand (d_A) of Niger Delta Region is 98.3% of the total resources produce in the region, with a leftover of 1.7% (tax allowance) and 17.93% tax. Since the actual demand is very close or almost 100% (total demand) is an indication of the demand for resources control/fiscal federalism. Where the state controls its resources and pay tax to the Federal Government, and Federal Government generates its revenue through taxation. But from analysis, Niger Delta receives 13% of its resources produced and Federal Government receives 87% of the total resources produced in the region. Hence the rate of deviation (D_R) is 74% and the actual resources diverted are at a rate of 64.4%.

The results of the analysis of human relation (M1), shows that the zone of shared power/acceptance/indifference is 13%, therefore there is a poor mutual relationship, between Government/NNPC/ oil companies and Niger Delta (host communities). And the ratio of the strength of the 13% zone of shared power is 11% : 2% (G: N). However the zone of shared power is very small compare to the zone of unshared power (87%). Hence it makes the mutual relationship very weak and also responsible for series of conflicts and agitations (unrest) in the region. The presence of external forces (positive and negative) such as unions, environmental factors, interest groups, government policies, culture and societal values, NGO's, cabals and cartels, human activists and politics (including world politics)etc., either acts as centripetal or centrifugal forces. Therefore, positive external forces (E_Y, E_1) are 139% and 100% respectively at a reserved energy of 39%. Which suggest that there is a high potential for a wider zone of shared power against the negative external forces (E_Z, E_2) -61% and -61% respectively, at reserved energy of 0%, but the actual strength of the relationship depends on the strength of the point of intercept and resistive intercept. From analysis resistive intercept is (61%) which opposes a wider zone of mutual understanding, at (31%) point of intercept. Hence it is an indication of too many personal interests on the kind of relationship that should exist between G and N.

From the analysis of model 3 (M3) and the conflict escalation chart (see figure 15), the degree of conflict escalation (C_E) is +266.4° NNPC/OC HC/NNPC/En/OC. This means that the conflict lies on the third quadrant, and therefore could be trace to *NNPC/OC* as the major cause and mostly affected if there is violence, and resolution lies primarily on *HC/NNPC/En/OC.*

CONCLUSION

From this study, using the various models (M1, M2 &M3), shows that the concept of management have not been meet in Niger Delta region, which is the reason for continuous unrest in the region.

Therefore the following conclusion can be drawn from this research work:

1. The resources (oil and gas) produced in Niger Delta region has not being effectively and efficiently used to meet demands/needs of the region. -There are insufficient efforts by Government and oil companies to address short term and long term effects of environmental degradation in the region (i.e. the case of clean up ogoniland). - Development in the region is neglected while wealth generated from the region are misappropriated and misused to enrich few individuals in the country outside the region. - Lack of concern for agreement and MOU signed between oil companies and host communities. In order words lack of seriousness is shown by Federal Government, in dealing with the problems emanating from the activities of the oil companies in the region, hence implementing and monitoring best practices in the region is a problem.
2. The zone of indifference between Federal Government and Host Communities (oil producing areas) is very small very small (13%). Therefore there is a need for a wider zone of indifference/acceptance (increase percentage derivation).
3. The degree of conflict escalation is very high (266.4°). Hence indicating a very high conflict escalation between the Federal Government and Host Communities.
4. The potential environmental impact of these conflicts include; black-sooth (already experience in Port Harcourt metropolis), loss of alternative means of survival (fishing and farming) and increase in chronic diseases in Niger Delta region.

RECOMMENDATIONS

1. Resources control (fiscal federalism)/restructuring or equity shares (50% derivation) in the absence of fiscal federalism should be implemented. It is important to note that absolute mutual understanding does not actually exist or occur at equity shares as it implies, when compared to resources control (fiscal federalism). Because of the 50% zone of unshared power. Though there is relative peace as a result of wider zone of indifference/acceptance, resulting from the 50% derivation.
2. Implementation of best practices in operations (clean and green environment), such as stopping gas flaring in the region, reduction of oil spill etc. It is also important to note that environmental pollution generally, started most of the agitations or could be traced as the origin of agitations in Niger Delta region, i.e. the case of Ken Sairo Wiwa (environmental activist) and shell.

3. Increase in community social responsibility by all stakeholders. Such as location of Oil Company's headquarters to their area of operations, local content policies and increase in human relationship between Niger Delta region and all stakeholders benefiting from the region.

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APPENDIX A

Table 5: Crude oil and condensate production from 1Q2017 – 1Q2018

MONTHS	AV.BARRELS (MBD)	AV.OIL PRICE ($/BARREL)	EXCHANGE RATE (=N=/$)
JANUARY	1,837,229	55.38	305.2
FEBUARY	1,817,902	55.24	305.31
MARCH	1,598,963	51.91	306.4
APRIL	1,793,137	53.02	306.05
MAY	1,878,217	50.77	305.54
JUNE	1,953,436	46.92	305.72
JULY	2,014,956	48.66	305.86
AUGUST	1,994,312	51.69	305.67
SEPTEMBER	1,930,670	56.55	305.89
OCTOMBER	1,946,481	57.97	305.62
NOVEMBER	1,958,478	63.29	305.9
DECEMBER	1,956,896	64.64	306.31
JANUARY	1,996,933	69.92	305.78
FEBUARY	2,105,656	66.02	305.98
MARCH	2,022,716	64.17	305.74
AVERAGE	1,920,399	57.07644444	305.798

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Table 6: 13% oil revenue distribution to Niger Delta States from 1Q2017-1Q2018

STATE	1Q2017 (MBD)	2Q2017 (MBD)	3Q2017 (MBD)	4Q2017 (MBD)	1Q2018 (MBD)	GRAND TOTAL (MBD)
ABIA	802,353,671.27	849,140,100.75	1,142,227,716.32	1,606,349,766.71	2,060,660,721.03	6,460,731,976.09
AKWA IBOM	21,501,298,899.79	20,819,603,412.27	24,273,239,617.48	32,175,522,091.02	39,371,955,764.32	138,141,619,784.88
BAYELSA	14,185,759,634.66	16,042,176,188.17	21,173,311,509.72	25,671,151,485.21	31,176,520,724.89	108,248,919,542.66
DELTA	13,015,330,420.24	14,391,649,393.19	24,019,461,807.68	34,497,400,834.45	41,115,836,516.63	127,039,678,972.19
EDO	622,902,224.47	751,648,815.19	2,218,067,113.86	4,578,205,090.59	5,532,995,459.69	13,703,818,703.80
IMO	892,737,323.58	913,358,003.82	1,066,378,345.23	1,147,897,168.25	1,454,728,560.36	5,475,099,401.24
ONDO	3,265,899,283.37	3,837,374,728.45	4,104,309,401.65	4,313,960,862.17	4,640,985,737.50	20,162,530,013.15
RIVERS	14,651,001,475.89	15,433,229,802.05	20,598,036,301.80	23,910,519,882.63	30,434,603,350.33	105,027,390,812.70
CROSS RIVER	-	-	-	-	-	-
TOTAL	68,937,282,933.29	73,038,180,443.90	98,595,031,813.74	127,901,007,181.03	155,788,286,834.76	524,259,789,206.72
AVG.	8,617,160,366.66	9,129,772,555.49	12,324,378,976.72	15,987,625,897.63	19,473,535,854.35	65,532,473,650.84
LAGOS	87,620,856.62	109,332,655.40	-	-	130,014,623.53	326,968,135.55

APPENDIX B

Table 7: Ratio of 13% oil revenue (derivation) distribution to Niger Delta State (1Q2017-1Q2018)

STATTE	13% OIL REVENEUE DISTRIBUTION TO NIGER DELTA STATE (1Q17-1Q18) IN =N=	RATIO OF 13% OIL REVENUE DISTR. TO NDS.	AV.DAILY PRODUCTION IN (MBD)	13% OIL REVENUE DISTR. (MBD) FOR NDS.	87% OIL REVENUE DISTR. IN (MBD) FOR FGN
ABIA	N6,460,731,976.09	1.00	19203.99	2496.5187	16707.4713
AKWA IBOM	N138,141,619,784.88	26.00	499303.74	64909.4862	434394.2538
BAYELSA	N108,248,919,542.66	21.00	403283.79	52426.8927	350856.8973
CROSS RIVER	N0.00	0.00	0.00	0.00	0.00
DELTA	N127,039,678,972.19	24.00	460895.76	59916.4488	400979.3112
EDO	N13,703,818,703.80	3.00	57611.97	7489.5561	50122.4139
IMO	N5,475,099,401.24	1.00	19203.99	2496.5187	16707.4713
ONDO	N20,162,530,013.15	4.00	76815.96	9986.0748	16829.8852
RIVERS	N105,027,390,812.70	20.00	384079.8	49930.374	334149.426
TOTAL	**N524,259,789,206.72**	**100.00**	**1920399**	**249651.87**	**1620747.13**

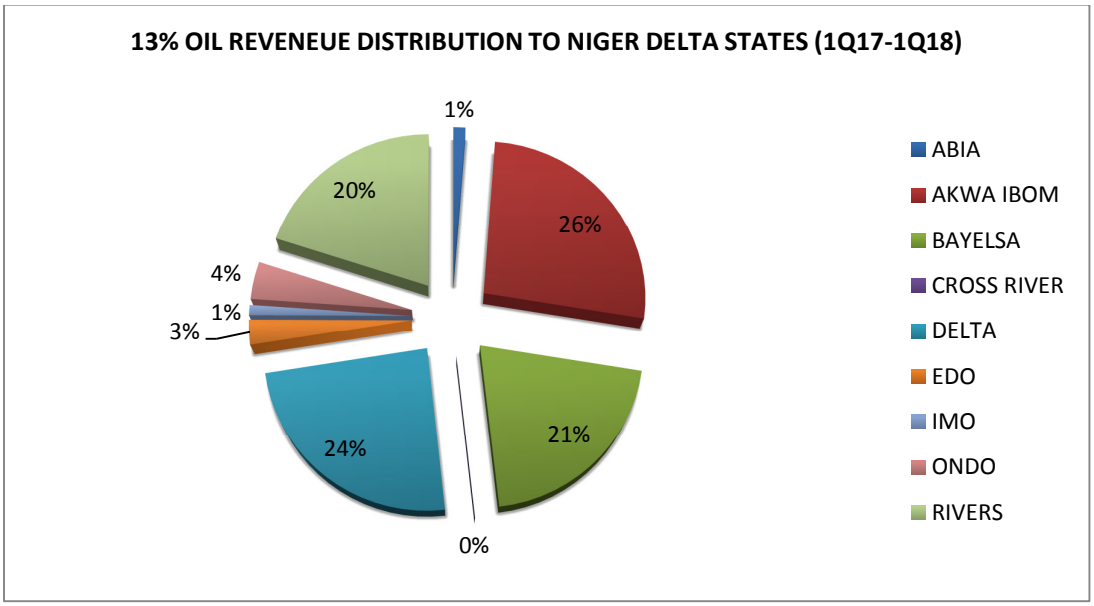

Figure 20: Ratio of crude oil production by Niger Delta States (1Q2017-1Q2018)

APPENDIX C

Glossary and Definition of Terms

R	Resources utilized
E	External forces
d	Demand at resource control
D_R	Rate of deviation
E_A	Assumed external forces
R_C	Resources control
R_Z	known quantity of resources
R_T	Total resources
P_S	Zone of shared power/acceptance/indifference
R_O	Zone of unshared power
$+E_1$	Positive external forces
$-E_2$	Negative external force
E_Y	Reserved positive external force
E_Z	Reserved negative external force
R_D	Total resources diverted
R_{AD}	Actual resources diverted
R_U	Total resources un-diverted
R_{AU}	Actual resources un-diverted
R_N	Resources utilized N
R_G	Resources utilized G
G	Government

N/ND	Niger delta
d_O	Conflict demand
d_1	Assumed demand for N as a result of d_O
d_2	Assumed demand for G as a result of d_O
I	Intercept
I_R	Resistive intercept
I_P	Point of intercept
C_E	Degree of conflict escalation
C_P	Price of conspiracy
R_C	Resources control
I_O	tax allowance (leftover)
d_A	Actual demand
α	Complex relation
i	insurance
$P_S - i$	guarantee for relative peace/vote of confidence/security vote
$(i + 10)\% + I_o$	taxation
OC	Oil Company
M_U	Total mutual understanding
E_S	Equity share
HC	Host Environment
En	Environment
NNPC	Nigerian National Petroleum Cooperation
bpd	Barrel per day
NDS	Niger Delta State

Explanatory Notes

External forces (E) include: Labor unions, Environmental factors, Personal interest group, Government policies , Cultures and societal values, NGO's, Cabals and cartels, Human activist , Politics (including world politics) etc.

Factors that can cause composite relationship include: conflict, change in administration, government policies, change of ownership and when resources has being exhausted etc.