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DEVELOPING COST- BENEFIT MODEL FOR NATIONAL CONTENT EMPHASIS OF ECONOMIC VENTURES

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ABSTRACT

In this paper, a model is proposed for evaluating the benefit of equitable participation of the citizenry in the economic and technological activities in Nigeria with a paradigm of conscious and limited engagement of foreign partnership. With the current emphasis on the development of national content in our body polity, it has become pertinent to evolve models for any activity (economic and industrial) to serve as index-watch for assessing qualities of national content and foreign partners' contribution within Nigeria. The key approach in this work is the development of iterative processes, which employ Discrete Fourier Transform (DFT) and Regression Techniques for solution. Deductions have been made to the fact that the indices predicted by the model developed would be useful in determining the impact of the level of local contribution on the performance of the national economy. The higher the index the greater is the inducement indicating the need for policy makers to shift from undue emphasis on foreign participation to focus on accelerated indigenous participation in the economy.

KEY WORDS: Benefit-Cost Model, Local Content, Economic Ventures.

INTRODUCTION

In this age of high technology and strides in modern methods of production, manufacturing, design, construction and management of resources, there is the tendency to admire and therefore embrace everything foreign to the neglect of local input into the economy. The recent local content initiative has generated a lot of interest for which various expressions and opinions have been made (Bassey, 2004). However the task now confronting researchers is that of translating various statements of fact into mathematical models so that the multi-dimensional economic activities and their social impacts can easily be read in the context of the quality of local and foreign contributions in the economy. Specifically the objective of the work is to evolve iterative processes by which it is possible to analyze the benefit of local participation in terms of personnel, supply of materials, local manufacture of equipment and spares, home grown products and technologies in conjunction with conscious limited foreign participation.

It is expected that such models will give a lead on how deliberate shift towards internal or over-reliance on external participation in the economy can be related to the degree of boost or degradation of key economic indices.

Theory

Studying the development of Natural Gas market in Nigeria a thermo economic model was proposed (Bassey, 2003) to boost local participation in the industry by relating Natural gas pricing regime to social and environmental factors.

The impact of Liquefied Natural Gas (LNG) projects on the economy was studied by establishing "devotonic" models (Adiele, 1989) relating local and foreign cost contributions to the projects. It was found that the structure of such participation was a key factor when using the models to access the effect of exchange rate , inflation etc on the economic indices of the country.

In our study we employ two discrete non-stationary stochastic event series X (t) and Y (t), where each may be expressed as the sum of non-random and random components (Hall, 1994):

$$X(t) = x(t) + \varepsilon_x(t) \quad (1)$$

$$Y(t) = y(t) + \varepsilon_y(t) \quad (2)$$

Where:

x(t) and y(t) are non-random activities of Local Content and Foreign participation series and $\varepsilon_x(t)$ and $\varepsilon_y(t)$ are random fluctuations or shock factors.

The fluctuations or shocks may be in the form of poverty created as a result of unfavorable structure of participation in the economy such as the killing of initiatives, self esteem, public and spirit of patriotism, promoting sense of neglect, abandonment and devaluation of patented certificates of training /education at all levels on the part of the citizens.

With respect to foreign participation the shock might be in the form of economic risks, brought about by deregulation, change in policies etc. Because of the multifaceted nature of the shocks or fluctuations, it is not easy to express any particular situation as a direct mathematical link with the participation structure. Rather, a more feasible approach is to express them as probabilistic factors or functions.

Suppose the activities are divided into sub activities over a certain period of time n, so the Discrete Fourier Transform (DFT) (ASCE, 1988) of any such activity of X (t) is given by:

$$E_x(\omega_j) = \frac{P}{n} \sum_{t=0}^{n-1} X(t) \exp(-i\,\omega_j t) \quad (3)$$

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where:

ω_j is the Fourier activity frequency and volume, that is:

$$\omega_j = \frac{2}{n}\pi j, \text{ and } j = 1, \frac{n-(-1)^n}{2} \quad (4)$$

The DFT of Y (t) may similarly be defined as follows:

$$F_y(\omega_j) = \frac{1}{n}\sum_{t=0}^{n-1} Y(t)\exp(-i\omega_j t) \quad (5)$$

Taking the Fourier transforms of Equations *(1)* and *(2)* yields:

$$E_x(\omega_j) = E_x(\omega_j) + E\varepsilon_x(\omega_j) \quad (6)$$

$$F_y(\omega_j) = F_y(\omega_j) + F\varepsilon_y(\omega_j) \quad (7)$$

The random component have variances, $\sigma^2_{\varepsilon x}$ and $\sigma^2_{\varepsilon y}$, and co variances $\sigma_{\varepsilon x, \varepsilon y}$ are given by :

$$\sigma^2_{\varepsilon x} = \sum_{j=1}^{k} |E\varepsilon_x(\omega_j)|^2 \quad (8)$$

$$\sigma_{\varepsilon y}{}^2 = \sum_{j=1}^{k} |F\varepsilon_y(\omega_j)|^2 \quad (9)$$

$$\sigma\varepsilon_x\varepsilon_y{}^2 = \sum_{j=1}^{k} E_{\varepsilon y}(\omega_j) F_{\varepsilon y}(\omega_j) \quad (10)$$

Where: $k = (n-1)/2$

The quantities $E\varepsilon_x$ (wj) and $F\varepsilon_y$ (ω_j) may easily be estimated if the random fluctuations or shocks are normally distributed. In such a case, the power spectra of the random components have distribution given by $P\varepsilon_x X^2_{1,2,\alpha/2}$ and $P\varepsilon_y X^2_{1,2,\alpha/2}$;

Where:

$X^2_{1,2\alpha}$ is the chi-square variate, with two degrees of freedom and confidence limit α; and $P\varepsilon_x$ and $P\varepsilon_y$ are the average power in the random component at all occurrences or events/economic activities of local contenders and foreign participators respectively , so we have:

$$P_{\varepsilon x} = \frac{2!}{n-1}\sum_{j=1}^{m} |E_{\varepsilon x}(\omega_j)|^2 \quad (11)$$

$$P_{\varepsilon y} = \frac{2!}{n-1}\sum_{j=1}^{m} |F_{\varepsilon y}(\omega_j|^2 \quad (12)$$

Where: $m = \left[n-(-1)^n\right]/2$

Consider the power spectrum of X(t), then Equation (6) shows this characteristics:

$$|E_X(\omega_j)|^2 = |E_x(_ij)|^2 + 2\,Re[E_x(\omega_j j)\,E_{\varepsilon x}(\omega_j)] + |E_{\varepsilon x}\,\omega_j|^2 \quad (13)$$

Where, *Re* denotes random spectrum component.

From the Equation *(13)* it is found that $|E_{\varepsilon x}(\omega_j)|^2$ is the non-zero component of the power spectrum at higher level of economic activities. The probability that a particular set of Professionals or individual or trained personnel is rendered poor as a result of abandonment or abscondment for any reason on doing any earned jobs is the random distribution of the spectrum given by $P_{\varepsilon x} X^2_{2,\alpha/2}$ (for an unsmoothed spectrum) then we may find the maximum value r for which none of the following inequalities is violated more than *0.05 [(n- 1)/2 – r + 1]* times.

$$P^{(r)}{}_{\varepsilon x} X^2{}_2 \cdot \frac{0.95}{2} > |E_{\varepsilon x}(\omega_j)|^2, j = r, \frac{n-1}{2} \quad (14)$$

$$P^{(r)}{}_{\varepsilon x} X^2{}_2 \cdot \frac{0.05}{2} < |E_{\varepsilon x}(\omega_j)|^2 \; j = r, \frac{n-1}{2} \quad (15)$$

Where:

$$P^{(r)}{}_{\varepsilon x} = \frac{1}{N_p} \sum_{x}^{k} |E\varepsilon_x(\omega_j)|^2 \quad (16)$$

and

$$N_p = k + r - 1 \text{ and } k = (n-1)/2 \quad (17)$$

where, N_p equals the number of personnel rendered poor as a result of jobs being thrown outside to foreign economic participants which satisfy the power spectrum distribution associated with random sampling.
For large values of Np we may infer that,

$$P^{(r)}\varepsilon_x \propto P\varepsilon_x \quad (18)$$

Hence, for a very large number of people floating in the labour market as a result of this inelastic turn out, then the assumption of only low frequency random components is verified. Based on the above algorithm, the Fourier Transform of the random sampling of floating personnel is given by:

$$E_{\varepsilon x} \quad (\omega_j) = \begin{cases} E_x(\omega_j), \; j = r, k \\ P^{(r)}{}_{\varepsilon x} \underline{E_x}(\omega_j) / |E_x(\omega_j|, \; j = 1, r-1 \end{cases} \quad (19)$$

Where: k = (n-1)/2
For the component of *Y(t)* which relates to the effect of the job rationing attitude to the foreign participation the operation would have been the same as described above, but the effect of denying a local personnel a job and engaging a foreign partner, is not the same. Hence in this case the approach of minimizing foreign participation so as to give such opportunity to equivalent local personnel. The problem of minimization is a well known exercise in mathematical programming system, so Equation (2) may be further analyzed by adding simple constraint equation.

For the purpose of simplifying this problem let the result of minimization may be represented by F_{y^*} If we define a complex quantity $A(\omega_j)$ whose magnitude equals the gain and whose argument equals the phase shift between *x(t)* and *y(t)*, then:

$$A(\omega_j) = F_{y^*} \underline{E_x}(\omega_j) / |E_x(\omega_j)|^2 \quad (20)$$

Based on the number of job activities over a certain period of time, one may calculate the average gain in local content exercise as $U(w_j)$ and interaction shift $\varphi(\omega_j)$ by the relations;

$$U(\omega_j) = |A(\omega_j)| \quad (21)$$

$$\varphi \Omega j = \arg. A(\omega_j j) \quad (22)$$

Hence the coherence, $C_{(wj)}$, between *X (t)* and *Y (t)* at job existence (ω_j) is

$$\frac{C(\omega_j) = E_x((\omega_j) F_Y^*}{[|E_x(\omega_j)|^2]^{1/2} [|F_y(\omega_j)|^2]^{1/2}} \quad (23)$$

$$F_Y(\omega_j) = A(\omega_j) F_X(\omega_j j) \quad (24)$$

Where, $F_Y(\omega_j)$, $F_X(\omega_j)$, are the distributions (apportioning) of resources to Foreign partnership and Local contenders, respectively

For zero poverty line of the contenders, $r_o = \left(1 + \frac{m-1}{F_{a,\,b,\,(m-1)}}\right)^{1/2}$ (25)

a and *b* is the degree of freedom and m the number of activities at the disposal of the government, agencies etc. If C $((\omega_j)$ is less than or equal to r_o, then the situation is that:

$$Fx(\omega j) = Fy(\omega_j) \quad (26)$$

Thus for $C(\omega_j) \leq r_o$ then:

$$F_x(\omega_j) = F_y(\omega_j) \quad (27)$$

MODEL APPLICATION AND ANALYSIS OF RESULT

The model was applied to assess the effect of the structure of internal and external participation in the production of petroleum in Nigeria- which is reported to contribute about 90% to foreign exchange earnings at present (Arowolo, 2006). In order to explore the analytical potential of the models expressed in Equations (1) and (2) it has to be understood in its simplified form that is:

$$X(t) + Y(t) = 1 \quad (28)$$

The structure of internal and external participation in the production of petroleum can be demonstrated using the data in Table1.

Table 1 : Annualized cost of stages of Petroleum Production in Nigeria *(1988)*

Description	Amount	
	Dollars	Naira
Exploration	463	470
Drilling & Completion	7,305.6	5,099.2
Construction	2,929.5	1486.2
Operating & Maintenance	10,057	7,183

Source: Adiele (1989)

From the above data it is found that at exchange rate of Naira, ₦5.5 = Dollars $1 (1988 value) the weighted average values of the internal and external contributions is as follows:

$$X(t) = 0.115 \quad \text{and} \quad Y(t) = 0.885. \quad (29)$$

Then Equation (28) gives the model for 1988 participation structure as:

$$0.115\,[X(t)] + 0.885[Y(t)] = 1$$

Analysis of Economic Impact

The structure of the internal and external participation in the oil production as expressed by the model was used to evaluate some economic indices such as Income level, devaluation and growth. The analysis follows closely the methods proposed by Adiele (1989).

Income

It should be noted that the internal participation in the production of any kind represents the share in the economy which in turn accounts for its purchasing power. By virtue of its huge contribution to the economy, if it is assumed that oil production is the only income indicator, and then based on daily production of C (t) barrels the real daily income of the economy, E_i can be estimated for the year 2005 as follows:

$$E_i = X(t) * C(t) * P \quad (30)$$

Where the structure for 2005 is:

$$0.15[X(t)] + 0.85[Y(t)] = 1 \quad (31)$$

and $X(t) = 0.15$ (estimated from 1988 value with 3% annual growth in internal participation)

$C(t) = 2.45$ million barrels per day (Siddigi, 2006)

P = *$ 54.2* per barrel (Siddigi, 2006).

The Income to the economy may be found as $20b or ₦3 trillion approximately at the exchange rate of ₦ 132: $1. Thus for every $15 earned from the oil production there is an associated $85 cost to the nation. With such a structure the nation faces a high risk of maintaining the current balance of payment regime especially when either the price of oil falls or there is problem with the production output. When this happens the purchasing power of the economy drops causing induced increase in the poverty level.

Devaluation of the National Currency

It has always been argued that the balance of payment of a nation can be improved by devaluation the exchange rate. Of local currency, analysis of the participation model using the case of Naira devaluation between 1988 and 2005 shows that without improving the internal participation in the economy a further deterioration of the economy results instead of improving the balance of payment.

The model found for 1988 at the exchange rate of ₦ 5.5 to $1 as reported earlier and shown in Equation (29) is as follows:

$$0.115[X(t)] + 0.885[X(t)] = 1$$

In 2005 the rate of exchange was ₦132 to $1 which gives the present devaluation of ₦2400. Thus for every ₦100 in 1988 there is an equivalent of ₦ 2500 in 2005:

The model for participation in oil production in 2005 now becomes:

$$0.115*100/100 + 0.885*2500/100$$
$$0.115[X(t)] + 0.885*25[Y(t)]$$
$$0.115[X(t)] + 22.125[Y(t)] = 22.24 \quad (32)$$

Thus $$0.005[X(t)] + 0.995[Y(t)] = 1 \quad (33)$$

By comparing the 1988 and the 2005 structures thus within space of time (1988 and 2005) Equation (33) shows that :
$X(t) = 0.115$, $Y(t) = 0.995$ and $\epsilon x(t) = -0.11$ and $\epsilon y(t) = +0.11$

It is obvious that in real terms there is approximately a 96 percent loss in the internal capacity to contribute to the economy and which has resulted in an increased cost of production to the nation by foreign participation of some 12 percent, the direct consequence of the loss in the capacity to participate in the economy and therefore an increased reliance on foreign resources is evident in deterioration in national infrastructure and services. Low level of manufacturing activities and application of technology, unemployment, lay-offs, falling standards of living etc are evident while at the same time the foreigners are smiling to the banks with high rate of capital exploit. In Engineering related operations in the oil sector recent reports (9) have indicated that the annual capital earning is about $8b (₦1.2 trillion).

Improving Internal Participation

From the analysis of the model so far, it is clear that economic growth and therefore the well being of the citizens can only occur in line with deliberate measures put in place to increase productivity. As this happens the model will also show an improved structure of participation with respect to local content drive in the Nigerian economy.

Local Content Initiatives

In the light of the participation models we have assessed the effect of the Local Content initiatives of the oil sector and how they affect the economic projections into the future, Siddigi (2006) has reported on the economic performance for Nigeria up to year 2008. In line with projections, it is planned that by the year 2010 about 70% of the capital flight in the oil sector will be retained and the Local Participation with respect to engineering design, equipment, spares, materials and services should be increased to about 45%.

In order to realize these plans, it is also proposed that (Lawal, 2004) an annual budget of $5.7b (₦741b) to increase oil production to about 4.5million barrels per day and a reserve of 40 billion by the year 2010 of particular note is that 57% of this annual budget is to be internally funded while the balance will be externally sourced. In addition local expertise and production facilities are mobilized for increased engineering and technology. Thus on achieving the planned 45% internal participation in the local oil production repetition the model structure is:

$$0.45[X(t)] + 0.55[Y(t)] = 1 \quad (34)$$

And when compared with the 2005 structure Equation (31) there should be a 200% increase over the current level with some 35% reduction in foreign funds intervention in the production. This improved participation structure will surely translate into improved standard of living, improved infrastructure and other growth indices, more stable exchange rate and better balance of payment regime as envisaged in the projected performance indices. This model can be applied to other activities in the economy and the analysis can yield results which when brought together can greatly predict the impact of the level of internal and external participation in the overall economy.

CONCLUSION

The proposed models and the analysis have been shown to be capable of giving a guide on the level of internal participation and the corresponding acceptable foreign contribution to the economy. From the study it is clear that undue dependence on foreign inputs without effective participation of the citizens in production activities is damaging. The true answer to economic well being is the strengthening of the internal mobilization of resources for economic ventures.

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