

**UNIVERSITY OF PORT HARCOURT**

**DISCERNING THE MANAGEMENT  
OF ENVIRONMENT RESOURCES IN  
TIME AND SPACE**

**An Inaugural Lecture**

**by**

**PROFESSOR W. I. L BELL-GAM**

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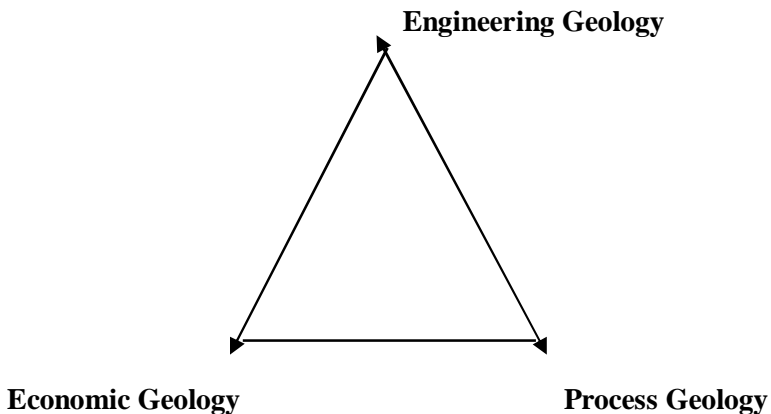
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Ladies and Gentlemen.

## **INTRODUCTION**

Environmental Geosciences offer us a great opportunity for interdisciplinary studies. Coates (1971) described environmental Geology as made up of 3 tips of a triangle labelled as Economic Geology, Engineering Geology and Process Geology.



The space defined by this triangle is the intellectual field covered by my work which became academic from 1981 and which prior to then was interspersed with opportunities for

research analysis and synthesis of ideas and vision which almost always found practical applications and in some cases, a willing or able corporate or governmental agency as sponsor.

Inside this triangle it is possible to understand with reasonable legitimacy the binding string of all scientific enquiry, the science of economics resources as physical forms of value or economic entities available to planners of the governmental or corporate delivery systems. It is in this spirit and within this contextual set up that coastal erosion, flood, land reclamation, small-scale industry and land use management may be understood. It was in 1985 that the present lecturer called for the setting up in Nigeria, a Coastal Management Zone Authority. Since the number of agencies have been established by the Federal Government for the purpose of alleviating the problems highlighted here.

The creation of an integrated coastal management zone authority could bring about better controls of the development of the Nations ports, better management of environmental hazards as well as complementary body able to assist the over stretched special area agencies, such as NDDC, The Rivers Basins, The Authority and others.

The inevitable conclusion of this essentially multidisciplinary effort is that micro level, village plans, Town plans, Local government area plans must be adopted at a national level in order to infuse into the entire nation's fabric the discipline, the possibility for accountability, the monitoring possibility and inner thought and drive to do right, to effect positive change which form the cornerstone of the planning science.

In this inaugural lecturer, I will attempt to throw up

justification of the plea as I have done since I became a professor in 1988.

## **PART -1**

### **NATIONAL RESOURCES ENDOWMENTS IN GLOBAL AND NATIONAL CONTEXTS: THE CASE OF PETROLEUM AND OTHER ENERGY SOURCES OF NIGERIA**

#### **THE GLOBAL AND NATIONAL CONTEXT**

The National Policy Development Centre (Think Tank) of Nigeria in 1978 provided me with an opportunity to articulate my vision of how the question of energy policy in the global context may be approached by developing countries. My paper was modern approaches to the analysis of the Energy Policy Question- some implications for developing countries development.

In the paper the following cross cutting issues were identified and discussed.

#### **FIRST: WHAT ARE THE MAIN AREAS OF CONCERN ASSOCIATED WITH THE ENERGY PROBLEM?**

##### **1. Insufficiency of Global Energy Resources**

The past two decades have witnessed a lot of controversies about the insufficiency of global energy resources to support the size and expected growth of industrialization in different nations of the world.

Projections of demand of various mineral resources were

Used to show that the known reserves of most of them would be exhausted in not a very long time.

In the publication entitled "Limits of Growth", the club of Rome claimed that danger was imminent if their observed trends continued. This prophecy of doom was generally not well received but the methodology employed in the club of Rome's models has survived as a great contribution to the field of National Resource Planning.

Forrester and his colleagues at M.I.T developed the concept of industrial organisations the message that all the existing components or problems should be constantly observed together and kept in balance.

The fundamental nature of this concept has enabled many model builders of national energy models not to forget to link up with the other variables of the national economy. Any successes due to these due to these models must be attributed to the underlying concept.

**(i) Implication for the Developing Countries:**

**Energy- Resources Poor Developing Countries:**

To these countries the message of industrial dynamics should be quite important if this technique is employed by their national planners, more realistic profiles of their needs and possible supply sources and at what costs to the national economy will emerge. This could be the basis of effective planning for national development.

**(ii) Energy-Resource Rich Developing countries:**

In the energy resources rich developing countries, the most popular target of planning is to ensure that

the available resources when produced and exported should be enough to earn sufficient foreign exchange to finance development projects within the country.

This valid concern of the planners could run into immense difficulties if a lopsided profile is achieved in the end. As the saying goes, 'the chain is as strong as its weakest link so no matter how unimportant an aspect of national development may be perceived, in the end it becomes very obvious that the top priority items on the plan are unable to function efficiently if unsupported by low priority projects.

A sober scrutiny of all the various components of development is therefore urged when planning the supply and use of energy in the country.

For Nigeria the following factors are easily identified as crucial to the national plan. They are grouped under two broad areas:

- Domestic Use
- Export Use

## 2. Satisfaction of National Needs

### a) Energy Resources for Domestic Use

Direct Energy Use Specific Sectors

From Internal and External Sources

Manufacturing Time Expected Growth

By Sector

Agriculture  
 Commercial Houses  
 Construction  
 Transportation  
 Utilities

**b) Energy Resources for Export Use:**

**Present Markets**

State of Homes Resources USA Planned Decrease

In Imports

**Times:** 1979, 1980, 1990

State of Technological  
 Development

UK, Japan

**c) New Markets:**

State of Home Resources: New markets with  
 planned home resource  
 or substitutes (use the  
 scheme above).

State of Technological Development: New  
 markets without  
 planned home resource  
 or substitute – i.e long  
 term dependence on  
 imports.

**3. Conserved Energy Resources:**

A. Proven Reserves

(i) Recoverable

(ii) Not Recoverable

B. Unconfirmed Resources

(i) Exploration in Progress

(ii) Exploration not in progress



**REQUIRED STUDIES IN VARIOUS AREAS:  
ENERGY RESOURCES FOR DOMESTIC USE:**

Planned development in the various sectors will determine the energy required for each sector. Obviously the form of energy required will be necessary information to have. It is important to identify for each sector present-day requirements and future requirements. The picture obtained will only represent the effect of the existing industrial policy of the government.

Certainly, a realistic energy policy should take note of differences that are likely to occur in national industrial policy.

Differences in growth rates between the sectors will unavoidably create difference between present and future profiles of energy resource distribution. One elegant way to take care of these variations is to develop a rank order of the sectoral requirements in each scenario is quite crucial as it enables the national planners to programme the total requirements in domestic demand and to satisfy them from internal and imported resources.

The formula here is simply: for Nigeria.

Domestic Energy Demand	The Sum of Internal	Imported
Or	Resources	+ Refined
The Sum of Sectoral Requirements		Products

- (a) Oil Refineries
- (b) Goal Board
- (c) Electricity
  - (i) Hydromotive (i.e. Dams)

- (ii) Oil/Gas Turbines
- (d) Other Sources

#### 4. **Developments and Efficiency of Internal Energy Resources**

The various sources that contribute to the internal energy resources should be so skilfully harnessed that the following objectives are met:

- (i) Sufficiency
- (ii) Low-cost
- (iii) Good quality

All three objectives can be enhanced - if appropriate capital investments are made - if the required manpower in consonance with the capital investment.

#### 5. **Importation of Refined Products**

The balance of domestic demand less the available internal resources need to be imported. Needless to say that this is a wasteful ploy to be energy-resource rich country and so should be severely mitigated.

#### 6. **Energy Resources for Export Use**

The objectives here most of which are complementary are:

- (i) To maximize earnings in foreign exchange.
- (ii) To have an acceptable balance of payments.
- (iii) To maximize foreign reserves.
- (iv) To minimize production costs.

In concert these objectives point to the fact that the countries preference is to sell the largest quantity of exported energy resources at the best price. It is understood that pricing is

controlled by a number of unquantifiable factors and so largely uncontrollable. For example, Nigeria belongs to OPEC and so cannot unilaterally increase the price of her crude oil at her convenience.

That leaves us with the problem of finding the buyers. As shown in the scheme above, how much she can find locally, or conserve what is already bought or buy from some cheaper source, including a different energy resource with a new technology. Since it is a well-known fact that most of the developed countries have undertaken several in-depth studies, all aimed at finding a basis for the cut down of imported crude oil, it is suggested that the Nigerian Policy making machinery should be organized to monitor the progress in these countries, institutions and international bodies.

Some of the well-known bodies involved in studies are:

- (i) The OECD – organization for Economic Development and CO-operation.
- (ii) IEA – The International Energy Agency
- (iii) The Brooking Institute
- (iv) The Trilateral Commission

The aim of these organizations is to articulate energy policy, which will ensure the survival of the member nations industries and the competitiveness of their goods in foreign markets.

The methods they employed should be clearly understood by planners of developing countries especially countries like Nigeria that are very dependent on petroleum exports.

## **7. Analysis of the Implications**

Apart from the contributions of the various specialized agencies the departments of energy or some special government commissions are actively involved with mapping out appropriate policy options for their governments.

The following results are always contained in their recommendations:

- (i) Assumptions on the growth rate of the national economy.
- (ii) Advances in the technological development of alternative sources of energy.
- (iii) The competitiveness of proposed alternatives.
- (iv) Extent of reliance on imports.
- (v) Targets for national self-reliance where possible
- (vi) Any other strategic considerations to ensure national survival in case of an emergency e.g. storage facilities, long-term supply contracts, emergency treaties.

Apart from monitoring the contents of these various national recommendations, it is useful for our national planners to be able to predict the outcomes using various mixes of the situations, which have been detailed above. Such simulation exercises that are often undertaken in order to arrive at optimal outcome in various countries can be attempted here with a view to initiate counter safeguards in order to mitigate the effect of developed country measures on the developing country's economy e.g. Nigeria.

## **8. Constant Observation and understanding of the World Trade Cycles**

Restriction on imports may be due to a slow down of

Industrialization in the developed country. It could be due to a global recession. As the economy gets out of recession more industrial production could demand more energy use. It is therefore important to understand the transient nature of some of the slumps of avert radical changes to policy here, which could be overtaken when the causative agent disappears after a short-term effect.

### **9. Data Compilation and Analysis**

No doubt, enormous amount of data will need to be assembled and analyzed before any real steps can be taken to implement the contents of this paper. The compilation and analysis of such data could be very tedious and expensive. Only the effective use of appropriate computers can facilities such an exercise.

A lot is now being written on the need for an energy policy for Nigeria. This is the time to devote some money and a lot of thoughts to making such a policy realistic and viable.

We can see from the foregoing that I had proposed a series studies required for planning a major natural resource of the nation. I received no invitation of commission but was soon to be appointed one of the pioneer consultants of the National Policy Development Agency (Think Tank), a reward I was unable to accept as a result of commitments at the Centre for Management Development (CMD); then being nurtured by the International Labour Organization for the Nigerian Government.

**PART – 2****SMALL INDUSTRY AS A STRATEGIC  
NATIONAL RESOURCE BASE****10. Small Industry as a Strategic National Resource  
Base**

Work at the Centre for Management Development (CMD) provided me unique opportunities to study the secret of the Asian tigers, in a study tour, which took me from Lagos to South Korea, Japan, the Philippines and India. The transformations of National Resources into marketable products through the articulation of National Small Scale Industry Policy's were examined. The monograph produced was later to be adopted by the CMD as its contribution to the Nations Fledging Policy for Small Scale Industries Development. Excerpts of this work were then summoned by me in the paper funding strategies:

An opportunity to study small-scale industries empirically came when the Federal Government assigned the firm Niger Trigon Konsult to study small-scale industries of the South Eastern State, including Rivers State. I as a member of the study group later undertook the locational and structural analysis of Rivers State Small Industry. The findings are reported in my book, Small Scale Industry. A Review of Strategies and Options. The basic findings and considerations were summon arised as indicated below:

The objective in the analysis is essentially to produce a consistent basis of comparison between firms and between the concentration of the firms in specific areas. The result, it

was hoped would provide a means of monitoring and a basis for policy intervention in the growth and spatial distribution of small industries. The framework of the firm level analysis would also indicate the need for small-scale industry development policy to take into account the smallest recognized administrative unit, the local government area (LGA) in this typical Nigerian example.

The inclusion of Town/Village information would make a further examination of intra LGA disparities possible to observe. Finally, the spatial information clearly illustrates an important aspect of land use planning, the use of available land as sites of small business. Similarly, the dual use of domestic housing units for industrial and commercial purposes, a natural concomitant of small industry development reveals the pressures on domestic housing. Clearly, it is a valid position that small industry development, land use management and small industry development may be taken together as elements in the policy equation of a particular area of developments.

The revised NTK-1 questionnaire on which the firm level survey is based is now presented in Appendix 3. Table 7 indicates the analysis of the distribution of variable, V7, type Manufacturing, or processing. Eight of the ten local government areas of Rivers State are represented in this data. These are coded:-

ALGA - Ahoada Local Government Area;

BALGA – Brass Local Government Area;

BOLGA – Bori Local Government Area’

DELGA – Degema Local Government Area;

KELGA – Ikwerre/Etche Local Government Area;

OTELGA – Okrika, Tai, Eleme Local Government Area;

PHALGA – Port Harcourt Local Government Area;

YELGA - Yenagoa Local Government Area.

Data on Bonny Local Government Area – OLGA, and Sagbama Local Government Area are not covered in the presents analysis.

In **Table 7**, ALGA shows a preponderance of Processing Industries (68.75%) over manufacturing industries (31.25%) by a difference of 37.50%. This should normally suggest the predominance of agricultural raw materials processed for foods and drinks. ALGA has one of the most stable terrain of farmlands in Rivers State.

In BALGA, a coastal zone area with marked limitation in farmland and severe infrastructural deficiency on fishing gear, it seems as though both manufacturing (48%) and processing (44%) thrive on imported raw materials. This is not surprising, given the relative presence of alien immigrants in Brass, which is an important oil terminal and operational base.

Ignoring sample discrepancies, it could be concluded that Brass has a higher concentration of manufacturing type of small industry while ALGA has a higher processing industry type of small industry. BOLGA indicates a preponderance of manufacturing industry (60%) over non-manufacturing (13.3%) and processing (26.6%).

The distribution between non-manufacturing and processing might seem vague. Infact the present analysis defines processing strictly as transformation of agricultural produce and non-manufacturing as others which are neither manufacturing nor processing.



DELGA displays a preponderance of processing (55.5%) over non-manufacturing (4.4%) and manufacturing (40.1%). KELGA follows the pattern of SELGA with higher concentration of processing enterprises (50%) than manufacturing (37.5%) and non-manufacturing (12.5%). The least two local government areas maintain a reasonable balance between manufacturing and non-manufacturing/processing small industry rendering agricultural land use interpretation suspect.

However, the great disparity between processing (81.48%) and Manufacturing (14.81%) and non-manufacturing (3.7%) tends to restore confidence in the land use interpretation. OTELGA has vast farmlands and produces substantial proportion of the agricultural output of Rivers State.

More metropolitan PHALGA strikes a balance between processing and manufacturing enterprises (40% each), while maintaining the highest percentage of non-manufacturing. The small number in the PHALGA sample makes any final conclusion unsafe. YELGA recorded the highest concentration of manufacturing enterprises recorded in the state (66.6%) and three times as much as processing 22.2%, and non-manufacturing by six folds (11.11).

**Table 8** indicates the result of variable V8, which sought to know whether business was registered. A large preponderance of businesses were registered over 90% in OTELGA, DELGA and BALGA. A relatively substantial number of unregistered businesses occurred in ALGA (18.75%). BOLGA (14.28%) and YELGA (22.22%). This has implication for the relative strength or efficiency of the local government areas in enforcing the requirement for businesses to register.

### **11. Financial Situation of Small Businesses**

Many obvious factors depend on the financial situation and resources of small enterprise(s). These include their ability to make new investments, ability to expand and ultimately the number of people employed. The significant contribution of small industry on the national economy are propelled through these factors. This, therefore, directly affects the land use patterns that emerge. When small business exhibits growth, more land comes under development as more business premises emerge. When small business is starved of capital and hence opportunities to grow, business premises shut down and after dereliction occurs.

Variable, V9: How is business financed and V10, size of investment enquired into the financial situation of Rivers State Small Industry. **Table 9** indicates it might be financed by:

- (1) Owner's Savings;
- (2) Co-operative Effort;
- (3) Bank Loan; and
- (4) Direct Government Credit Scheme.

The table also indicates that a large number of the enterprises have derived funds from their owners, the highest percentage being in BOLGA with 80.0% and DELGA with 71.42%. The next highest are OTELGA with 70.3%; and ALGA with 62.5%. Only YELGA with 33.3% had the owners' savings source lower than the co-operative effort source (44.4%) and lower than all the other sources combined (66.66%). In all the local government areas, the cooperative effort was the next highest source of business finance, except in YELGA where at 44.4% it was higher than the more traditional source, owners' savings.

The complete absence of bank loans in most of the sample from all the LGAs but BOLGA and DELGA where a minimal presence was observed. In BOLGA, it was 6.66% while in DELGA, it was 2.04%. Rivers State Small Industry is not adequately funded by bank loan finance, although sample bias may have exaggerated this fact. The basis of dissemination of small business by banks and other financial of collateral and other forms of security acceptable to the banks. This situation emphasizes the need for direct government intervention to bring loan finance. In chapter one, some strategies and options were reviewed and in Nigeria, government has tried to adopt some of these methods. They have in most cases been overwhelmed by administrative inefficiencies.

The extant of direct government contribution was investigated in variable, V9 option "4". Only three local government areas indicated some presence. These are BOLGA, OTELGA and YELGA. This result reveals the need for a definite government action in this respect. The Federal Ministry of Trade and Industry and the State Ministries has attempted to set up loan schemes but positive results have been dwindled by problems already reviewed in chapter one. But how much could be entrepreneurs who are largely self-financed fund? Variable 10 examined the size of investment. (See coding and categorization of investment levels – **Table 10**). The analysis presents in tune with the theme of the present volume, the regional distribution of Rivers State Small Industry investment.

The data in **Table 10** suggest a wide dispersal of the different levels of investment. In ALGA, for example 43.75%, the highest proportion of the sample is investment in the range of

₦25,000.00 and above. The next highest for this LGA are NO – ₦5,000.00 and the ₦5,000.00 - ₦10,000.00 each of which has 18.75%. ₦10,000.00 - ₦15,000.00 was recorded (6.25%), so, also, was ₦20,000.00 - ₦ 25,000.00 (12.25%). BALGA shows also a fairly well dispersed structure of investment data between the various classes where 48% were recorded under ₦25,000.00 and above. Next highest was ₦10,000.00 - ₦15,000.00 (24%) and the rest but the ₦20,000.00 - ₦25,000.00 range were represented in small percentages relatively. The preponderance of the ₦5,000.00 - ₦10,000.00 in BOLGA (42.85%) is remarkable confirming that up to 80% were self funding ventures. Significant contributions of BOLGA investment came under ₦10,000.00 - ₦15,000.00 and the ₦15,000.00 - ₦20,000.00 range each 21.42% and both similar in proportion to the ₦5,000.00 - ₦10,000.00 (42.84%). Also remarkable throughout the LGAs is the low proportion of ₦0.00 – ₦5,000.00 investment level.

It is unlikely that large numbers of efforts were not made at this level. More probably, the high rate of failure associated with poorly financed enterprises has taken place and would explain the low percentage recorded. DELGA is similar to LGAs mentioned above in its wide spread of investment levels and low ₦0.00 – ₦5,000.00 investment below ₦15,000.00. This must be some form of samples bias or loss of sampled data.

It is, however, unique that 75% recorded under N25,000.00 and above. This is highly suggestive of some biased in favour of more successful or large small enterprises. In OTELGA, the situation was not much different, as the N25,000.00 and above was the highest (30.76%). In PHALGA, 83.33%

invested at N25,000.00 and above. This is clearly indicative of better-resourced urban-based operations. The only other range represented was N10,000.00 - N15,000.00 (16.66%) and this suggests a bias in sampling or a secondary bias due to loss of data. YELGA is similar or the general trend observed above except that the proportions are different.

The leading concentration of investment is the ₦20,000.00 – ₦25,000.00 range (37.5%). This is followed by ₦10,000.00 – ₦15,000.00 and the ₦15,000.00 – ₦20,000.00 range which have the same proportion (25%). As noted in most of the other LAGs, the ₦0.00 – ₦5,000.00 range has the least number of cases in our sample (12,5%).

The data reviewed above enabled a conclusion that substantial savings of entrepreneurs have been invested in small industry and the level of funding involved tends to suggest that the middle class are the major sponsors of small industry in Rivers State. This also seems to represent the picture through out Nigeria and indeed throughout the developing countries wherever investment income depends on personal savings.

## **12. Sources of Raw Materials Utilization in Rivers State Small Industry**

Raw materials sources were categorized into: (1) Local sources; and (2) Overseas Sources. Variable 11, (V11); was then used to examine this factor. In six of the LGAs, raw materials were predominantly local. These were ALGA (60%) ; BALGA (72%); DELGA (87.5%); KELGA (75%); OTELGA (84.6%); YELGA (75%). Two of the LGAs studied showed greater import components of raw materials. These are BOLGA (69.23%); and PHALGA (66.66%). The use of local raw materials is a welcome trend in the national economy. It has a fundamental impact in the use and

development of local resource endowment and has the outcome of reduced spending in foreign exchange. This provides a healthier foreign reserve for the nation. To the extent that this finding represents the true picture, small industry will be seen as superior to medium and big industry (in Nigeria's experience) from point of view of desirable monetary consequences.

PHALGA and BOLGA traditionally more modern in terms of manufacturing capabilities, seem to represent better the way the whole country has gone, the repercussions of which are at present being felt nationally in the economic scene. By way of comparison, the southern parts of the state which are coastal marine zone areas with grave agricultural land shortages, depend largely on local inputs for the activities of their enterprises. Santo's two types of industrialization presented in the share space model provide a theoretical explanation (Bell-Gam, 1984 p.59). According to Santos, the industries, which could be set up in such environments as the Niger Delta Coastal Zone, would be the type B industries which according to his analysis, create their own economics or seek their external economics outside the country.

As pointed out by the author (Bell-Gam, 1984 p.61):

***The second contribution of Santo's analysis is the warning that Type 'B' industries do not often contribute substantially to the development of the rural communities where they are located.***

They are, therefore, not to be encouraged. Again, the foregoing suggests that small industry has developed along the more desirable paths.

### **13. The Size and Growth of Rivers State Small Industry**

Three variables were used to assess the nature of growth factors observed in Rivers State Small Industry. These are number of staff employed, (V12); estimated annual sales, (V14); and planned expansion (V15). Number of staff employed is a statistics that has been found very useful in the categorization of small business, (chapter 1). For a given level of technological set-up, it can be said that the larger the operation, the greater the number of staff employed. Another important consideration assisted by the use of this statistics is the selection of small industry when the objective is to reduce unemployment. In such a situation, the planning agency would show a preference for industries that offer maximum employment opportunities.

**Table 12** indicates that in all the LGAs most small industries employed staff who combined both technical and administrative functions in varying degrees: ALGA (46.1%); BALGA (76%); BOLGA (71.42%); DELGA (87.5%); OTELGA (79.16%); YELGA (87.5%). Of particular interest in industrial development studies is the technological component of the human resources base. Table 12 indicates that only two of the LGAs displayed a technical staff complement of greater than 20%. These are: BOLGA (21.42%); and DELGA (27.65%).

The other local government areas had considerably less technical complement - ALGA (7.69%); YELGA (12.5%), The specific examination of types of staff would help policy formulation for the purpose of desirable industrial development. Given that a large proportion of the small business studied were spontaneous creations of

Entrepreneurs from their personal savings, no specially planned outcomes may be expected. That may be achieved if adequate private or loan finance is injected into modern industry investments. In this situation, it would be possible to select an option that would lead to the enrichment of staff skills and the upgrading of the technological growth process.

One way to go is the introduction of the industrial training of entrepreneurs as skilled owner-operators. Nigeria's current NDE (National Directorate of Employment) scheme is one faltering step in the right direction, which has a good promise for stabilization in due course. DELGA (27.65%) has the highest level of technical staff component followed by BOLGA (21.42%). The targeting for large numbers of trained and financed staff remains a valid option in the view of the present author.

Annual sales records have traditionally offered one of the best measures of company size. Sales revenue is connected with market share and hence the competitive advantage of the enterprise. Also, profitability, the rewards of enterprise is linked to sales revenue.

$$P = R - C \quad \text{where:}$$

P = Profit;  
R = State's Revenue  
C = Cost

Rivers State Small Industry has been categorized as shown in **Table 14**.

This Table confirms the fact that Rivers State small businesses earn fairly good sales revenue with most of the sampled earning above ₦25,000.00. The highest among this



was KELGA where 87.5% earned ₦25,000.00 and over in sales. DELGA has 66.6% in this category. The rest were as follows:- OTELGA (53.8%); PHALGA (50%); BALGA (64%). The regional variation of sales volume by Rivers State Small Industry is now examined.

ALGA has a small proportion of enterprises in the N0.00 – ₦5,000.00 range (12.5%) of the sample and none in the second range (₦5,000.00 - ₦10,000.00). Third range (₦10,000.00 - ₦15,000.00) has a proportion in the sample similar to the first range (12.5%). The ₦15,000.00 - ₦20,000.00 is the second largest proportions in the sample (25%) accounting for one quarter of the sample size. No sample belonged to the fifth range in ALGA (₦20,000.00) - ₦25,000.00).

Sales revenue in BALGA small industry was distributed differently. None in the sample belonged to the first category as opposed to 12.5% in ALGA; 7.1% in BOLGA; 2.0% in DELGA; 3.8% IN OTELGA; 16.6% in PHALGA; and 25% in YELGA. ALGA has a marked predominance of processing industry, (68.75%), (see Table 7); second only to OTELGA which had 81.48%. But the riverine LGA, BALGA which had no firm in the low N0.00 - ₦5,000.00 range but substantially more in the other ranges has an indication of relatively better established and better funded firms. A run through BALGA Small industry profile determined in this study may produce an explanation.

BALGA is dominated by manufacturing (48%) and processing, (44%) industries. Most BALGA businesses are registered, (96.15%) showing the highest percentage of registered companies in Rivers State, an indication of proper establishment and relatively larger organizations, able to earn

higher annual revenues, Financing in BALGA come essentially from owners' savings (56%) and co-operative effort (40%) both as stated earlier would isolate BALGA's expected earnings from the barest (**Table 9**).

The size of investment variable proves this point as well, (**Table 10**). The largest concentration of firms, (48%) belong to the category ₦25,000.00 and above, while ₦10,000.00 and above cumulatively account for 80% of firms in the sample. Table indicates that BALGA has the third largest concentration of technical staff (16%) smaller than BOLGA (21.42%) and DELGA (27.65%). This additionally confirms the relative technical sophistication of BALGA small industry revenue earning companies concentrated in the highest category (₦25,000.00 and above). This accounted in the 35.7%; ₦15,000.00 and above add up to 64.1%. This shows that firms in the area earn relatively good income. The BOLGA profile suggests explanations. Table 12 indicates high proportion of technical staff (21.42%) and second largest in Rivers State. Size of investment is well spread and concentrated between second and fourth categories: 42.85% (₦5,000.00 - ₦10,000.00); 21.42% (₦10,000.00 - ₦15,000.00); and 21.42% (₦15,000.00 - ₦20,000.00). The three categories combine to give 85.69% of BOLGA small industry. The spread of firm investment suggests large number of small manufacturing firms.

**Table 7** indicate that this is 60%. Financing comes from mainly owners' savings, 80% (**Table 9**). Most firms are registered (85.7%). BOLGA's case shows a great potential. Government investment in the area has been minimal as water supply and electricity from public power supply was

gravely lacking. Addition of such infrastructure will make the area bloom with small industry with growth potential. The next local government area - DELGA may be similarly examined.

The Degema Local Government Area is set in coastal estuarine zone environment with easy access to the neighbouring landmass essentially by pontoon. Table 14 indicates that sales revenue from the firms is concentrated in the three highest categories. 66.6% represent ₦ 25,000.00 and above category, while the ₦ 15,000.00 category and above amount to 93%. Explanations similar to BALGA and BOLGA are presented by the data. 27.65% of the workforce are in technical functions, the highest recorded for the Rivers State sample. Although the size of investment variable, (**Table 10**) indicates a fairly good spread within the categories, the third category, ₦10,000.00 - ₦15,000.00, predominates (35.41%) and forms over 50% of the whole when combined with the second category. (56.24%).

The higher three categories, nonetheless, amount to a significant proportion, (₦15,000.00 and above = 39.57%). Over 96% of the DELGA firms are registered (**Table 8**). DELGA small industry is marked by a predominance of processing firms (35.55%) and 40% of manufacturing (**Table 7**). The analysis presented so far, seems to show that a majority of the small firms examined in all the local government areas (LGAs) have good potentials for growth. There are some interesting policy implications from these findings.

First, it has been demonstrated that if adequate infrastructure are provided the firms which have been shown to survive in

the existing harsh conditions are likely to bloom and so become substantial employers of labour as well as contributions to the national economy (productive output).

Second, small industry funding should not concentrate entirely on setting up new firms, older firms that indicate viability through studies such as the present, should be provided with loan finance or direct government aid.

Third, the various parts of Rivers State seem to have similar distribution of firms and resources. This indicates the universality of small industry potentials and problems in the state. Table 10 indicates that OTELGA, PHALGA and YELGA firms would present analytical results similar to those exposed for the foregoing LGAs. Nonetheless, it must be pointed out that PHALGA's 83.33% in the largest categories of investment indicates the consistency of the data accumulated for the present study, (**Table 10**).

KELGA has 87.5% of sales revenue from the largest category, N25,000.00 and above, (**Table 14**). A little over fifty-three percent for OTELGA in this category is also confirmatory of the conclusions attempted above. PHALGA and YELGA, each with 50% also confirm the consistency in the findings and conclusions. Our suggestion that government focus should include the development of existing firms is corroborated below.

Variable 15, (V15) posed the question. "does firm plan any expansion?" **Table 15** indicates that the YES answers obtained were overwhelming. ALGA (71.42%); BALGA (91.60%); BOLGA (3.84%); DELGA (72.7%); KELGA (85.7%). The only 'NO' answers came from OTELGA (75%); PHALGA (66.6%); and YELGA (60%). "NO"

response indicates saturation of stability at optimal size or frustration and lack of knowledge of other opportunities. It is suggested from this and other studies that the latter would be the more likely assemblage of causes. We may conclude, therefore, that a great need exists for financial support of tottering small industry in Rivers State. Their contributions as vehicles for land resources development and rural development in general will be reviewed in a subsequent chapter. But what assistance has been obtained so far? Variable 16 (V16) examined this issue. A larger proportion of firms in the sample has obtained no assistance. **Table 16** Indicates that YELGA (62.5%) received the most assistance. The other LGAs came behind as follows: PHALGA (50%); ALGA (31.25%); BALGA (24%); OTELGA (23.07%); DELGA (21.73%); and BOLGA (21.42%).

It is only in PHALGA and YELGA that substantial assistance seems to have been received. This shows that there is need for a change in policy thrust in favour of substantial assistance to existing small industry in Rivers State.

#### **14. Profitability and Market Potential**

Profitability is the greatest motivation for private enterprise. It is more so for small industry especially when, as was observed in Rivers State, it is mainly funded through personal savings and co-operative effort. Is small enterprise profitable? Variable 21 (V21) was employed to examine this question. In all local government areas an overwhelming 100% of the sample recorded a “YES” answer, inspite of the small number of respondents. It is quit likely that those who refrained from answering this question are potential tax avoiders who were suspicious of the motives of the researcher. They may be also assumed to be making profit. The lack of a non-response column in the present analysis

makes further investigation of this group of firms impossible.

The local government areas covered by the study are ALGA, BALGA, BOLGA, KELGA, OTELGA and YELGA. Having established that most Rivers State small enterprises make profit it becomes necessary to examine the size of profit margins obtained and the distribution of profit earning within the Rivers State. Variable 21 (V21): Average profit margin per annum was employed to investigate this factor (**Table 22**). Average profit margin per annum was divided into 6 categories:

1. ₦0 - ₦5,000.00
2. ₦5,000.00 – ₦10,000.00
3. ₦10,000.00 – ₦15,000.00
4. ₦15,000.00 – ₦20,000.00
5. ₦20,000.00 – ₦25,000.00
6. Above ₦ 25,000.00

**Table 22** indicates the size and regional distribution of the average profit margin per annum in Rivers State small enterprise. The analysis of the data shows that in general, a large proportion of the profit margins falls within the first three ranges of profit (below ₦15,000.00). When we recall that sales revenue fell within the higher revenue categories (**Table 14**), then it will be clear that the burden of cost most probably due to the lack of efficient supporting infrastructure, is responsible for large scale profit erosion in Rivers State small enterprise.

The size and distribution of average profit margin within the local government areas is now examined (**Table 22**). In

ALGA 50% of the sample had profit margins in the lowly ₦0 – ₦5,000.00 range. 12.5% fell within the second range of ₦5,000.00 – ₦10,000.00. The third range: ₦10,000.00 – ₦15,000.00 had 18.75%. The largest three profit categories above ₦15,000.00 per annum in ALGA. The distributions in BALGA were fairly similar. The largest number of firms (48%) earned within ₦0 – ₦5,000.00 category.

The second and third categories had 12% each of the sample. But an improved percentage, when compare with ALGA distributions were generally similar to the foregoing. 38.8% fell into category 1 (₦0 – ₦5,000.00). The second d and third categories had 16.6% each while percentage that earned average profit margins greater than ₦15,000.00 was 27.75%.

In DELGA a considerably different picture emerged. The second category topped in number of firms (43.75%). This is the ₦5, 000.00 - ₦10,000.00 category. A significant number still earned in the ₦0 – ₦5,000.00 category, (27.08%). The third category (₦ 10,000.00 – ₦ 5,000.00) retained 16.6% found for this category in BOLGA, while the percentage earning over ₦15,000.00 reached 27.77% marginally better than BOLGA but marginally worse than ALGA. In KELGA the supremacy of the second category first observed in DELGA was maintained (25%), but this had dropped in size very considerably. The third and fourth categories each with 12.5% combine to represent 25% while the percentage of firms above ₦15, 000.00 rose to 50%.

OTELGA showed a reversal to a situation similar to that observed in ALGA. 50% belonged to category 1, 26.9% to Category 2 while percentage earning more than ₦15,000.00

was 15.37% the lowest recorded so far in the Rivers State Local Government Areas. PHALGA revealed a fair distribution between the first three categories, 22.22% each and the highest number earning above N15,000.00 recorded so far (33.3%). YELGA produced a domination of category 1 (40%). The second to fifth categories had 10% each while the 6<sup>th</sup> (N25,000.00 and above) had 20%. The percentage greater than N15,000.00 gave 40%, the highest recorded in all the local government areas of Rivers State.

The growth potential of small firms cannot be comprehensively evaluated without a consideration of the market potential for the firm's products or services. The factor was examined by employing variable 19 (V19). Respondents were requested to indicate if their products/services were sold to:

- (1) Direct consumers;
- (2) Input to others;
- (3) All.

**Table 19** indicates that all the firms in all the local government areas sold either to Direct Consumers or to ALL. None was specifically established for "Input to Others".

In the ALGA sample 43.75% sold directly to consumers and 56.25% said they sold to "ALL". The rest of the local government areas responded as follows:

BALGA:	36% directly to consumers, 64%; ALL.
BOLGA:	39.13% directly to consumers, 60.8%; ALL
DELGA:	29.16% directly to consumers, 70.83%; ALL
KELGA:	37.5% directly to consumers, 62.5%; ALL
OTELGA:	11.53% directly to consumers, 88.46%; ALL



PHALGA: 66.66% directly to consumers, 33.33%; ALL.

YELGA: 62.5% directly to consumers; 37.5%, ALL.

If it is assumed that enterprises with a specific target in mind would be more efficient in the definition of their market and articulation of market strategies, then, the importance of the response “Direct Consumers” will be better understood. Under this assumption the consumer economy will be best serviced by the PHALGA small enterprise, followed by YELGA and the rest in declining order of the percentages that responded “Direct to Consumers”.

Another point, which may be deduced from **Table 19**, is hinged on the lack of enterprises organized specifically to provide inputs to other enterprises. To this class of firms belong component makers, cleaning services, fabrication companies and raw material processors. All these are lacking in the Rivers State sample and this is a microcosm of the generation situation in Nigeria. Small industries normally thrive very well under the patronage of bigger firms in the economy, which depend on them for specific products/services. This hiatus is one that must be addressed by government’s small industry policy. In practice, a big time can be set up with specific commitments on the number of small industry that must arise to serve it at given time scenarios. This principle, although well known, has not been efficiently implemented in Nigeria. Volkswagen of Nigeria, which imports CKD, (completely knocked down) parts into Nigeria attempts to replace imports with locally manufactured parts but this has not yielded much success as the policy has not been stringently pursued.

We have so far attempted a fairly in-depth analysis of Rivers State small enterprise. The analyses so far has covers the availability, types and location of infrastructure for small-

Scale industry in Rivers State. In addition the actual distribution of the firms, their funding and internal working have been examined on an area by area basis. But a comprehensive appraisal of small enterprise must include an examination of the management of the individual enterprise. It is a well-known fact that small businesses are slow in the adoption of modern business techniques. More often than not, the business is managed by the owner or a member of the owner's family. The small businesses studied are no exception. The beginning of modern management is the introduction of record keeping by the enterprise.

Variable 23 (V23) was used to examine whether records are kept in the enterprise. Table 23 indicates that all the businesses sampled kept records by overwhelmingly that all the percentages: ALGA (93.75%), BALGA (96.15%), BOLGA (93.33%), DELGA (97.95%), KELGA (88.88%), OTELGA (96.29%), PHALGA (83.33%), and YELGA (85.71%). An important deduction from this discovery is that most small enterprise is amenable to record keeping. The level of professionalism involved in the record keeping is also important. If accountants kept the records, it indicated a greater level of modernization from point of view of modern management although owners of managers may have substantial accounting knowledge and so could keep their own records nearly as efficiently. There was need, therefore, to investigate who kept the records.

Although no special regionally influenced attributes were contemplated at the beginning of the analysis, the format of the foregone sections was adopted. Six possibilities were indentified for variable 24. These are:

- (1) Manager
- (2) Accountant
- (3) Clerks
- (4) Manager and Clerk
- (5) Accountant and Manager
- (6) All (manager, Accountant and Clerk).

In ALGA, **Table 24** indicates, the manager kept records in (26.6%). The highest occurring situation was where the Manager and Clerk kept records, (40%). In 33.33% of the cases, Manager, Accountant and Clerk kept the records.

BALGA revealed a different picture. In 40% of the cases, Manager, Accountant and Clerk kept the records, the Manager kept records in 24% of the cases while Manager and Clerk kept the records in 36% of the cases. BOLGA revealed a high preponderance of situation where Manager and Clerk kept the records 64.28% and Manager 21.42%. DELGA is cases and the Manager being responsible for record keeping in 25% of the cases. KELGA is considerably different. The predominating situation is where All (Manager/Accountant/Clerk) kept the records (75%). In OTELGA Manager/Clerk) situation maintained the lead (69.23%). In PHALGA, the Manager topped with 58.33% while the Manager/Clerk situation which topped in the other local government areas came down to 25%. YELGA has 57.14% in the All-category, 28.57% in Manager/Clerk category and only 14.28% in Manager category.

The absence of any case, where it was Accountant or Clerk alone suggests that either this category of staff did not exist in the establishments studied or they referred to themselves as Managers in some cases.

It may also be assumed that, as may be reasonably expected the small enterprises are unable to keep Accountants on their payroll. This indicates the need for professional assistance to small enterprise through extension services or through consultants, if the latter can be provided by the government.

Both possibilities have been tried in Nigeria but not nearly as effectively in the cases reviewed in Part 1, The CMD (Centre for Management Development) set up IBAS (Indigenous Business Advisory Service) which carried out extension services for small enterprises. Currently, the National Directorate for Employment is providing consultants for the control and guidance of beneficiaries of the self-employment or entrepreneurial loan schemes. This laudable scheme has not fully taken off and so, full services required by the small enterprises are not yet forthcoming. Some commercial banks are also conducting advisory visits to their small enterprise customers.

### **RURAL DEVELOPMENT AS CONTEXT OF SMALL INDUSTRY DEVELOPMENT**

Development says Lucy Mair (1984) refers to a process and in contemporary contexts the process is a movement towards a condition that some of the world's nations are supposed to have attained. According to this analysis, the term 'development' essentially constitutes a division between rich nations and poor nations.

Several definitions have been proffered for Rural Development, (Mabogenje 1980) (Ayua) and others. Our objective in the present volume is not to rehearse the merits of the various definitional approaches but to underscore the elements of Rural Development that related to the transformation of space and the creation of a better living

Environment especially for the relatively disadvantaged members of the human community. Again, the traditional arguments of Development economics on third world development are essentially avoided in the present treatment as they have been very well elaborated upon in many places.

We Will, therefore, explore the central role land development and resources transformation play in rural development. We shall then conclude by demonstrating that small-scale industry is a useful vehicle for achieving such transformation and so for achieving integrated rural development.

Mabogenje (1980) asserts that:

*Since land is basic to the viability of rural life, it is the contention of this study that comprehensive spatial reorganization is central to the attainment of this objective and that much of the failure of past attempts at rural development has been due to the relatively scant attention paid to the spatial dimension of rural development planning, Mabogenje (1980) p.94.*

In the present study spatial perspective has been adopted in the analysis of the small-scale industrial sector of the one state as a microcosm of Nigeria and indeed developing countries in general.

This approach assumes that small industry if examined at the level of the unit firm reveals the problems and constraints, which the national economy casts on it. Although this volume does not compare the various strategies of rural development, it is inevitable to elaborate the position of some of the critiques.

First how is the process of rural development assessed?

Chambers (1983) criticizes the use by professionals of criteria that suit their own background and experience and, therefore, ignoring elements existing in the traditional system which might have, if given a chance, achieve a more effective transformation.

The professional values and preferences were divided by Chambers in:

First, the preferred situation and last the rejected situation. Some examples are selected from his list for the various issues he addressed.

**A. For Technology, Research and Projects**

<b>First</b>	<b>Last</b>
Urban	Rural
High Cost	Low Cost
Capital-Using	Labour-Using
Exotic	Indigenous

**B. For Contacts and Clients**

High Status	Low Status
Rich	Poor
Light Skinned	Dark Skinned

### C. For Place and Time

Indoors

Outdoors

Accessible

Remote

Chamber's citing Sarin (1981) p.398, uses Indian Forestry, to deliver the main message of his criticism.

*....For instance the entire orientation and thus organizational/administrative arrangements in the form of structures, systems, training of manpower, procedures, planning, etc of the forest department, appears to have been around major forestry produce, Little attention has been paid to the management of minor forestry produce.*

And yet states:

*Most of the 40 million odd tribal farmers in India, among the poorest and most despised of people, directly depend on the collection of minor forestry produce, and for many of them, it is a key source of livelihood.*

Chamber's position is only partially upheld by the present author. A similar example now operational in Nigeria is the establishment of Oil Palm Plantations. This more efficient process of bringing Oil Palm into productive cultivation seemed inevitable as national output of the product has dropped tremendously and the country had descended from being an exporter of the product to an importer.

Chamber's position will be fully valid if the local farmers were displaced and the modern big farmers superimposed.

That has not been the case at least on paper in Nigerian, as the more modern farms have tended to integrate the local producers in their programmed usually through the process of buying their products and usually of planting more productive species. The integration of the poor communities in development planning for rural areas is therefore, a welcome resource based approach.

Writing in support of small holder farms in Sri Lanka, Brohier (1975) tells the story of how big business failed as paddy farmers. The excerpt from his book *Food and the People*, p.91, is reproduced for its instructional value.

*A shortage of rice focused attention on the economic necessity for developing the Island's agricultural resources and making the country self-supporting except for such commodities as must be brought from outside. A special committee was appointed by the Governor to enquire into the question of food production and evolve a vigorous policy to encourage the opening up and development of land. Paddy was selling locally as RSA-per bushel – an inflated price caused by scarcity of the commodity abroad.*

*Capitalist and company interest were stirred by the promising investment paddy growing as a large-scale operation, held out. The dormant possibilities of the land under Minneriya thus came to be considered on a basis of food for financial returns.*

*A concession to open and develop the land*



*Under Minneriya task was granted to a company formed under the auspices of the planters association of Ceylon. It was subsequently registered under the joint stock company ordinance.*

To help the scheme, Government signed an agreement to lease 9,000 acres, free of rent for 10 years and thereafter at RS 31 – per acre each year.

The project commenced in the month of June with a European Manager and 20 labourers. The staff increased to 300 by September. But when the rain came in October, transporter difficulties in the area and malaria disease forced the exodus of the staff. Ultimately the company collapsed enabling Bohier to conclude:

*This is one of the several instances where for inert reason “big business” failed as paddy farmer. It emphasized the lesson that paddy growing as in the past, will ever be small-holder industry’*

Nigeria has a Federal Ministry of Agriculture, water resources and Rural Development. The organization of this large ministry indicates that the Government is reasonably aware of the tasks and appropriate investments are being continuously channelled to these areas.

The problems of rural development in Nigeria do not seem to be conceptual. Infact it can be categorically stated that Rural Development is taking place. Despite the fact that the Ministry seemed well organized for the purpose it was set up, traditional criticism of the bureaucratic process – its slow pace of activities, the non chalant attitudes of civil servants,

The great sense of security and lack of motivation to produce. These among other considerations have enabled the Government to push ahead with reforms and to create a performance oriented Public Service. This has led to the abolition of the post of Head of the Civil Service to whom the Federal Permanent Secretaries reported. And as it were just to ensure the problem did not come from the name Permanent Secretary, the title was abolished and the responsibility of "accounting Officer" was transferred to the Minister, who would from that time wield full executive powers.

The Permanent Secretaries were then sworn in as Director-General and Nigeria would seem to be poised for a more dynamic approach to National Progress and Development. Similar restructuring was taking place in the perastatals while new creations surfaced.

First, the River Benue Authorities have been restructured, rationalized and given a fresh mandate to concentrate on water resources development. They were to pull out of productive agriculture. Again, it seems the government had become convinced that government sponsored large schemes were inefficient providers of food. Second, government has set up a major agency for the rapid development of the rural areas: the Directorate for Food, Roads and Rural Infrastructure.

This Directorate which was set up as a National autonomous organization within the office of the president engages in the construction of sample standardized rural roads, water boreholes and electricity provision. Aware as it seems, that much of the criticism had been that large sums of money had been spent with not much to show for it in the past, DFRI set up a national team of inspectors made up of citizens

Adjudged to be of the highest calibre by the Ruling Government.

Government also set up machinery for mass mobilization called MAMSER where mandate was to emphasize self-reliance among Nigerian.

These new creations are responsible for large sums of money and a sizeable proportion of the National Budget. It is, therefore, inevitable to raise questions about their usefulness.

The present writer who supports rapid development through the physical transformation of space is bound to support the basic mandate of DFRRRI, for example. However, the adhoc nature of its organization and operation raises questions of continuity. Secondly, its ambitious programme which aims at injecting money into the placement of rural infrastructure across the entire nation is bound to create problems of value in what gets built notwithstanding the integrity of the inspectors who may do the best job. Their judgment must be based on the set objectives of the contracts.

A Contractor who is asked to build an earth road without Macadam could do a good job of the specific assignment, but the selection of a road without Macadam by DFRRRI may be inappropriate.

It, therefore, seems that DFRRRI should have its own sphere of activities clearly defined, a process which inevitable is going on in the Nigerian great Rural Development Organization.

Rural Development of the spatial type needs the involvement of the local communities. The Local Government Councils

and the Community Development Committees are now all in place.

### **PART – 3**

## **ENVIRONMENTAL RESOURCES PROTECTION AND MANAGEMENT**

### **The Environmental Trilogy: Geosphere, Hydrosphere and Atmosphere**

When viewed as a physical habitat, planet earth must be appreciated as a trilogy, Geosphere (land), Hydrosphere (water) and Atmosphere (air).

Its survival and sustainability can be assured only if the components of each member of the trilogy is understood. The complexity of each member unit is such that general frameworks for analysis must be developed.

In the process of studying the land constraints for housing development in several coastal and estuarine settlements cross cutting issues related to land management have been examined in various degrees of detail. This effort enabled me to articulate frameworks found convenient for discerning planning. This further explained in subsequent sections.

### **General Issues:**

General issues highlight two key requirements; environmental observation, philosophy and objectives of development planning (see fig. 2).

**Specific Issues:**

From the medium of possibilities that may be deferred as specific issues, four issues relevant to land use resources development have been chosen for highlighting. These are Housing, Land, Demographic analysis and Household income (see fig. 3).

**General Issues: Geological/Ecological Setting**

The General Issues and the Specific Issues frameworks have proved useful in systematizing our thoughts in the analysis of field and laboratory data and in the practicalisation of these essentially theoretical models. In the subsequent few paragraphs we will demonstrate how helpful the framework is in ensuring the capture of key parameters necessary for land use planning. We will systematically employ the framework in describing the general land use issues in named coastal and estuarine settlements. The General Issues framework indicates two groups of issues - the philosophy and objectives of Development Planning and the Environmental observation. Philosophy and objectives of Development Planning.

The purpose of articulating philosophy and objectives of Development Planning is to identify a recommended approach. The three other sub units of this field of the framework are the essential stakeholders and practitioners. These are Government and Economic sponsors. The communities and the professional planners. A Careful examination of the dynamics and inter-group relationship of the oil producing areas would easily vindicate our assertion that these sub groups needed to be separately identified. The recommended approach recognized the need to identify the smallest viable planning unit, a need to articulate appropriate

modernization transformation stratifies and proposed actions based on modernization strategies.

### **Environmental Observations**

Three special activities are involved in the discerning of key environmental factors from a land use planning point of view. These are the detailed description of the Geological and Ecological setting, a comprehensive inventory of resources and a careful description of the existing land use pattern.

### **Practical Applications of the General Issues Framework**

Our model developed in 1984 predates several sad and tragic encounters in the oil mineral producing areas of Nigeria. We may call to mind the Umuechem mayhem, the Ogoni tragedies, the Odi massacres and unfortunate government response and the associated miseries and inevitable impoverishment of the affected areas.

It is heart warming that nearly twenty years later, there is refreshing evidence that the Government and other Economic sponsors are setting up protocols enabling dialogue that are adopting strategies aimed at ensuring peaceful existence between the oil producing communities and the operating firms. We will now examine the three sets of environmental observations with a view to demonstrating how they have been practically applied by the lecturer in discerning the planning elements appropriate to the named situations.

### **The Geological and Ecological Setting**

Several workers have written very illuminating texts on the Geological and Ecological setting of the Nigerian Coastline and Estuaries, Nedeco (1954, 1959, 1961 and 1980), Oyegoke et al (1983) and Macdowel et al (1983). The

lecturer undertook a content analysis of the available works and reached conclusions:

- (1) Land resources are in short supply and should be adequately improved and managed.
- (2) Sandbars development constitutes an important constraint on the Navigation of the Rivers and Creeks and a barrier to development of ports for shipping and fishing.
- (3) Poor soils make development built or operational difficult and expensive.
- (4) Salinity of marshy soils have kept out conventional agriculture from the area.
- (5) Lack of transportation and other communications infrastructure has stagnated all types of economic/commercial development.
- (6) Lack of water and electricity for domestic and industrial use.

Most of these developmental drawbacks are related to geology and ecology of the coastal zone. Such general conclusions did not suffice for the present lecturer. Hence to discern the most fundamental issues affecting coastal areas by undertaking focused study on Delta and Coastal Erosion. In this study, Deltaic Coastal and Estuarine sub-environments were defined. Their unique features were discussed with emphasis on the dynamic relationships between the three sub-environments. The role of erosion in their creation and stability were examined with specific reference to the Niger Delta, the Nigerian Coastline and Estuaries. Subsequently, the paper reported some methods of assessment of Delta and Coastal Erosion, which have been adopted by the present lecturer in Rivers State to establish the important types of erosion, a uniform basis for prioritization of affected areas

and the need to adopt the environmental management approach to solve the problem. This essentially was based on work undertaken by the lecturer at the Institute of Flood, Erosion, Reclamation and Transportation (IFERT) of the University of Science and Technology now known as the Institute of Geoscience and Space Technology. The study presented below illustrates how the most microelements of soil mechanics were effectively applied in the prioritization of flood and erosion affected locations in the Niger Delta.

Also, a depth level called the top of the first cohesive layer was identified. I believe for the first time, as an important variable which can be used to compare the draining abilities of top soils in Niger Delta Wetlands, (Bell-Gam) Ecological Disasters of Nigeria Sagua V. O. *et al* (Editors).

Deltaic, Coastal and Estuarine Sub-environments are defined. Their unique features are discussed with emphasis on the dynamic relationships between the three sub-environments.

The role of erosion in their creation and stability is examined with specific reference to the Niger Delta, the Nigerian Coastline and Estuaries.

The Nigerian coastline, estimated by various accounts to be over 900 kilometres, marks the most important land/water interphase in Nigeria. This land/water interphase is a dynamic boundary-line, which moves inland or towards the ocean depending on such influencing parameters as sea level changes and, within the estuaries, changes in the discharge of the important rivers.

The coastline is made up of several estuaries through which fluvial and marine waters mix and substantial exchange of



sediment takes place. The transportation and depositional behaviour of these sediments has caused the creation of three important sub-environments in the Nigerian coastline. These are the Deltaic, Coastal and Estuarine Sub-environments, which are briefly described below.

### **The Deltaic Sub-Environment**

The processes, which influence delta morphology, can be divided into two classes. These are:

- (a) Those associated with the river itself, and
- (b) Those associated with the body of water, i.e. the basin, into which the delta is being built – the sea or a lake.

Three properties of the river seem important: the density of the inflowing water, the amount of sediment carried, and the type of sediments carried. The amount of sediment discharged determines the delta's ability to build forward. Rivers move sediments in suspension and as bed-load. The ratio between the amounts carried in these two ways influences the sediment distribution over the delta. Large rivers, especially in warm climates, carry most of their loads in suspension, while smaller streams transport sediments mainly as bed-loads.

Basin related factors also influence the nature of the delta. First, the depth of the basin determines the thickness of sediment that must be deposited for the delta to advance. Second, the "energy" of the basin is important. "Energy" means the levels of activity of waves and tidal currents. At high activity levels, the tendency is to redistribute sediment brought to the basin by the river.

Of the six major types of delta geometry recognized (Coleman and Wright, 1973), It has been suggested that the Niger belong to a transitional class between types 3 and 4. (Wright, 1978).

The most authentic appraisal of the lithostratigraphy of the Niger Delta is that which petroleum geologists have articulated based on seismic, borehole and electric log interpretations accumulated from petroleum exploration activities, Schlumberger (1985) has pieced together the following summary. The Cenozoic Niger Delta Complex contains mainly Cenozoic formations deposited in high energy constructive deltic environments differentiated into continental basin, Agbada; and pro-delta marine Akata facies.

Figure 2 shows correlations of subsurface and surface formations of the Niger Delta Complex. The target of erosion control work is how to protect these so-called surface outcrops and their equivalents on which human settlements have been established. In a later section, we shall examine the relationships between the various types of sediments that make up those outcrops in the delta and coastal area and attempt to assemble some general guidelines on how to approach the threat erosion.

### **Coastlines**

Coastlines can be classified by employing a number of different criteria. These criteria include plate tectonics theory, dynamic processes operating at the coasts, the waves and tides; degree of modification the coast has undergone due to influences of the sea and other agents, and criteria related to the advance or retreat of the sea. Experience borne out by work on the Nigerian coastline suggests that waves and tides are the crucial elements in coastal morphology. In a later section, we

Shall examine how Nigeria's coastal areas are affected by the erosional action of waves and tides.

A distinct feature of coastlands, which attracts a lot of human attention and vandalism, is the presence of beaches. Figure 3 shows a general profile diagram of beaches and near-shore zones. As a result of constant action by waves and tides, erosion and deposition are continuous phenomena, which ensure the dynamic changes, which occur almost daily at beach sites.

Along the Nigeria coastline, sandy beaches alternate with marshy, usually mangrove, saline muds indicating that erosional and depositional sites exist side by side. In Nigeria, both natural and man-made inlets interrupt the long stretches of sandy beaches.

### **Estuaries**

An estuary may be defined as a semi-enclosed coastal body of water that has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from land drainage.

Some twenty-two estuaries of various sizes, in length and width, break through the Nigerian Coastline. All the estuaries are confined within the western and eastern updip limits of Delta Tectonics (figure 4), It is along these estuaries that salt water/fresh water mixing takes place, so much so that the landward limits of what can be called an estuary has been determined by measuring the chlorinity and the changes in the ratios of the major dissolved ions.

This landward limit has been defined as the area where the chlorinity falls below 0.01% and the ratios of the major

dissolved ions change radically from the seawater. The variability in seawater dilution in the estuary is a reflection of the ratios in the variability in freshwater runoff. This makes the estuary an unstable environment.

### **Dynamic Relationships between the three Sub-Environments**

A full understanding of the form and structure of the environments discussed above would lead inevitably to the conclusion that, as a result of their relationships in as well as in historical origin, all three are sub-sectors of a remarkable land/water interphase zone which have developed a number of unique features due to differences in modes, of formation and functional role in the essential activity of the drainage of relatively higher lands debauching on the oceans and seas.

Figure 5 shows, in more details, how this relationship takes place. In the Niger River System, waters collected from several basins in the path of the long river is carried down, loaded with sediments, into the ocean through the estuaries. In the process, a delta is formed the coastal beaches emerge and the whole system remains in dynamic equilibrium.

Changes in the system, as stated above, therefore, depend on the depositional and erosional activities, which take place at any point in time and space.

### **The Role of the Erosion Phenomenon in the Creation and Stability of the Sub-Environments based on Observations in Nigeria**

Various definitions of erosion have been put forward by several writers. One defined it as the wearing away of the earth's surface by natural agent. Running water constitutes the most effective eroding agent, the process being

accelerated by the transportation of particles eroded or weathered further upstream. In the coastal areas, three important types of erosion are encountered. These are bank erosion, gully erosion and sheet erosion.

Although each type of erosion is more accelerated by some specific factors such as the slope of the terrain, the velocity of the running water and the size of the soil particles, all three