

STEPS NECESSARY TO ACHIEVE INDIGENOUS TECHNOLOGY -
THE ONLY ASSURED BASIS FOR SOUND INDUSTRIAL DEVELOPMENT

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ABSTRACT

This paper will discuss the development of indigenous technology in Nigeria, its promises and problems. Attention will be drawn to licenced technology and the pace of industrial development since our national independence. Contrast will be drawn between the potential rate of development using indigenous and borrowed technologies. Inward resourcing of raw materials and industry planning will be discussed in the light of indigenous and borrowed technologies.

The importance of Research and Development (R&D) in industrial and economic independence of a nation and the reliability of foreign consultants and the justification for their present level of participation in Nigeria R & D are discussed. Then, the position of National Universities and other national research centres in R & D is considered with emphasis on the current level of success enjoyed by these institutions as well as the factors that limit their success. The discussion also touches on the general cost of foreign R & D contracts. Some of the possible ramifications of foreign R & D contracts on national security and overall development are mentioned.

A number of questions emerge and their implications on inventions are highlighted. Finally, suggestions are made on some of the steps that should be taken by the government, public and private organizations to ensure sound indigenous technology development in Nigeria and the eventual utilization of these technologies by Nigerian industries.

1. INTRODUCTION

No nation is considered developed until it can assess its materials and human resources and harness these resources towards its security, sovereignty and improved standard of living for its citizens. A developing nation must therefore embark upon satisfactory training and utilization of the engineering and technological potentials of its people. Today, in Nigeria, industrial development is a "mere wish" for many and just a "dream" for a few.

There is an old adage which says, "he who goes a borrowing goes a sorrowing", and the truth of this saying applies to individuals as well as organizations. It is not prudent for any person to rely solely on a 'friend' for his needs, especially when such needs include technological know-how. Our unnatural partnership with foreign developed nations, in the area of science and technology, does not yield our aspirations for affluence through ownership and exploitation of natural resources such as land, the sea and its products, minerals, and human resources through physical or economic power.

There are those who still question the need for technology in Nigeria, particularly indigenous technology. The quest for technology is justified by the fact that it is an instrument of change and progress in any society, when it is properly applied. The level of technology in a country is a measure of its economic independence and national security. In short, technology creates wealth, power and confidence and it is a guarded commodity which can be acquired through development, purchase or rent.

Every nation aspires for technological and industrial development but most developing countries cannot acquire these know-how on outright purchase and must therefore rent or borrow from the developed countries. Current economic situation in Nigeria clearly points out the fact that we cannot rely on borrowed technologies for our industries. It is, therefore, of necessity to develop our technologies - indigenous technologies for Nigerian industries. These technologies will utilize our local raw materials, create wealth and employment opportunities. We cannot feel secure when our plants depend largely on borrowed or licenced technologies, nor can we afford to mortgage our destiny to the multi-nationals. Lapses in meeting its own commitments by any of the parties involved may create shut-downs.

This paper explores some of the methods that we can adopt to forge indigenous technology for our industries and regain the control of our national destiny. It is therefore directed to our policy makers, industrialists, financial institutions, public and private sectors of the economy as well as our academe.

2. DEVELOPMENT OF INDIGENOUS TECHNOLOGY IN NIGERIA

There have been indigenous technologies in Nigeria before her colonialization. These technologies are still in use today as evidenced by palm oil

extraction, cassava processing and cereal storage/preservation. However, the permeating scope of these technologies, coupled with the quality and quantity of their output have been very minimal over the years. Modern technology should be pervasive and revolutionary in scope.

Let us analyze the progress of our industries by looking at the agricultural and manufacturing industries. Agriculture is chosen because a lot of research has been carried out in this area and meaningful ideas have been advanced. On the other hand, our manufacturing industries have been heavily dependent on licensed technologies. It is hoped that by careful analysis of these industries, it will be possible to see the roles played by indigenous and licensed technologies in our economic and industrial development.

3. TECHNOLOGY IN AGRICULTURE

In the agricultural sector, indigenous technologies have been developed to enhance crop production in the country. Breeding progress have been made in respect of crops like oil palm (*Elaeis guineensis*), maize (*Zea mays*), yam (*Dioscorea spp*), cocoa (*Theobroma cacao*), cotton (*Gossypium hirsutum*), etc. Massive utilization of these improved crop cultivars at the local level has been limited by factors such as awareness, soil fertility and cost of chemicals. A good bread of crop requires a fertile soil for optimum yield and soil fertility is enhanced by strong agro-chemical industry. However, corporate farmers, who can import the necessary chemicals for soil and pest control, are reaping the fruits of improved crop cultivars. The contribution from peasant farmers also add to the abundance of agricultural products in the country.

Agriculture has provided continuous availability of basic non-processed food items including: gari, yam, maize, palm oil, plantain, rice, beans, etc. Prices have been known to drop in some cases reflecting increased output. On the contrary processed food items such as wheat flour, vegetable oil, canned products, etc, are very expensive and scarce. This anomaly in the agricultural sector can be attributed to the fact that food processing depends on licensed technologies and utilize imported raw materials. Indigenous know-how in soil fertility enhancement and food processing are the missing links in our agricultural revolution. With the current emphasis on agriculture and rural

development, one foresees a situation where appropriate attention is given to research and development efforts in agro-chemical and food processing industries.

4. MANUFACTURING INDUSTRIES

Unlike agriculture, engineering technologies are mostly licensed or borrowed, and they form the framework upon which our factories operate. Experimentation on substitute or local raw materials and product types are strictly limited by the licensing contract. Our manufacturing and processing industries therefore rely on foreign sources for their raw materials to satisfy the specifications established in the plant design. When the products from these factories are geared for domestic consumption, their prices are normally higher than those directly imported into the country. This shows a sharp contrast between non-processed agricultural products whose prices have either stabilized or increased in moderation due to inflationary forces in a background of our increasing population. Most manufactured goods have enjoyed price increases well over 100% compared to prices twenty-six years ago.

Table 1 displays the consumer prices for "Household Goods and other Purchases" for the period 1980- March 1984. The trend speaks for itself in both urban and rural areas. Higher prices have been paid in subsequent years due to inflation and government economic policies such as the Second Tier Foreign Exchange Market (SFEM) and the Structural Adjustment Programme (SAP).

TABLE 1 CONSUMER PRICES*

Consumer	YEAR SURVEYED				
	1980	1981	1982	1983	MARCH 1984
RURAL	181.5	194.6	213.4	328.1	530.1
URBAN	179.9	194.5	206.9	281.2	425.7

* SOURCE: Central Bank of Nigeria, *Economic and Financial Review*, V. 22, No. 1, March 1984; P.51.

The price is but one dimension of borrowed technology; product availability and freedom of choice should also be considered. Peugeot passenger cars have gone from ₦4,000 in 1975 to ₦50,000 published price in recent months yet even when you have the money at hand, you cannot find the car to buy.

We have assembly plants which operate at very low percentage of installed capacity and the products are rationed by some political yardstick. Under the present circumstances, one might tend to believe that having a car is a luxury in Nigeria but only to turn around and ask "how efficient are the telephone and postal systems?" Pseudo monopoly is granted to every manufacturer and there is no competition and no choice. The quality of products is also a problem especially when standards are not adhered to. When the producer is a government parastatal, consumer protection is undermined by legal immunity granted to such companies. If it is a private company, on the other hand, it is their money against yours. When there is no competition, companies tend to have no incentive for good public image and consumer relationship.

The hope for backward and forward linkage in manufacturing industries has not been realized. Without import substitution, our raw materials are not utilized, and the absence of export substitution reflects our lack of technology and progress.

5. INWARD SOURCING OF RAW MATERIALS

Local raw materials can be effectively developed and utilized where there is indigenous technology but restricted otherwise. The following points/facts can be made in favour of indigenous technology and local raw materials sourcing and utilization:

- Technology is developed to solve problems in production, processing and improvement of local raw materials.
- Plant design and siting is based on actual raw materials' characteristics and availability and therefore tailored to local needs.
- There is freedom and flexibility in the substitution of raw materials thus giving rise to continuous product availability.
- Maintenance of plants and processing techniques are not restricted and this ensures high capacity utilization of facilities and raw materials.
- The technology is adaptable for other needs resulting in new raw materials consumption.
- High level management positions are not reserved for foreigners.
- Expansion is made to absorb increase in population and export needs.
- Markets for finished products are not restricted thus ensuring availability and choice.
- The technology is easily transferred and local

human and material resources are employed.

The above benefits are restricted in borrowed or licensed technologies thus perpetuating scarcity of products, high cost, stagnation and low capacity utilization of plants, limitation of indigenous materials input, unemployment, import dependence and lack of development. Speaking on U.S. Technology Policy, Dr. Simon Ramo (1) made the following remarks, "A modern nation cannot be successful, no matter how well it handles other things, if it is not successful in the professional practice of engineering". This is also true of Nigeria.

6. IMPORTANCE OF RESEARCH AND DEVELOPMENT (R & D)

Dr. Robert L. Park (2) made the following observation on U.S. National Security and Technology Transfer, "Scientific secrets are, moreover, quite unlike other state secrets. They are held first by Nature, and our opponents can learn them as we do, without violating our security. The futility of attempting to permanently lock up scientific and technical information is thus generally recognized". The message is very clear:

- That scientific and technical information are free from nature to those who are willing to learn.
- That these information can not be locked up.

Nigerians must accept the fact that no human race has monopoly in intellectual ability and that creativity is born out of adventure, opportunity and suitable environment. There has to be goal oriented education and the drive to know more because these lead to understanding Nature, the source of scientific and technical knowledge. Research requires sound principle, questioning limitations and exclusions, thus collecting more facts and information for the extension of knowledge. Research and Development (R & D) is an adventure having its financial, material and sociological risks. We are slow to develop industrially not because we lack intellectual ability but because we are unwilling to take scientific/technical risks; we are not doing organized and goal oriented research. Failure of licensed technologies in our industrial sector speaks to the fact that our salvation will not come from outside but must be inwardly derived.

7. FOREIGN CONSULTANTS AND R & D

Learning is modified by environment while Belief is a conviction induced by experience or induction-

tion. As Nigerians, we have come to believe that "foreign is better". We perceive ourselves as being inferior especially in the field of science and technology. Our industrial, business and political executives believe that for a project to be sound and functioning, we must bring in "foreign experts" and pursue it as a policy. The race for foreign consultants/partnership became more intense in recent years as our greed, parochial interest, ethnicity, and the ever popular "5-20% kickback" were written into our constitutions.

Obsession with our "inferiority" and lack of confidence in our ability manifest in many ways including:

- Acquisition of untested ideas (hypothesis) which are sold in packages we do not want to question.
- Flooding our ports and plants with obsolete equipment.
- Encouraging and abetting the abandoning of projects, thus draining our economy.
- Intentional taking over for the purpose of defrauding the country of plants and other construction projects with full knowledge of existing major defects in design and construction.
- General state of indiscipline and corruption at high and low places.

We do not see anything wrong with these vices and so do our foreign partners; after all, it is government money. Our foreign experts recommend that we import more and produce less (3). How can you stand up against these criminal activities when your "palm is greased" with a substantial deposit in your foreign bank account. We are the perpetrators and victims of our vices and failures.

8. R&D IN NIGERIAN UNIVERSITIES AND INSTITUTIONS

8.1 The fallacy of our belief in racial inferiority can be proved by the products of our academic and research institutions. Nigerians have been known all over the world to be intellectually astute and industrially aggressive and have been accorded responsible positions and recognitions on their personal merits. However, we wait for the world to recognize them before we own them, and as a result, we are reluctant to tap their resources and their honest advice.

Our academic and research institutions are filled with reasonable men and women of vision who

can fill our need for expert advice. These institutions have demonstrated their potentials and capabilities through their work and inventions:

- The Engineering Building at Victoria Island, Lagos - conceived, developed, built and maintained by Nigerians.
- Yam pounder, traffic light, electric shaver and a lot more technical developments have been carried out in our institutions.
- Vaccine and local drugs have come from our health research centres.
- Improved cultivars and crop production are credited to our agricultural institutions.

The products from these institutions have been shown to be comparable to those imported and in some instances better in meeting our needs. Above all, they utilize our raw materials and human resources.

The factors that work against technological achievement in our institutions are many and varied. They include lack of equipment, financial support, recognition and acceptance by the public, and dedication.

8.2 Lack of Equipment - We cannot wait until we develop our measuring or analytical instruments before we start our research. Measuring distance by counting foot steps is not good enough for the design and construction of a machine that requires tight tolerance between components.

8.3 Lack of Financial Support - Meaningful research work requires good financial support. In the United Kingdom, the private sector of the economy spent about \$6,450 million in support of R & D work in 1983/84. At the same time, the government spent \$6,044 million which was just over 3 percent of her budget. In 1982, U.S. National R & D spending was about \$80 billion (4). Private support of R & D in Nigeria has been very insignificant. If the allocations from the national budget to the 16 Federal universities in the country reflect government support of R & D, such support has been decreasing in real term in recent years: N429m, N395.5m and N316m for 1985, 1986 and 1987 respectively (5). Considering the Second Tier Foreign Exchange Market (SFEM) with respect to 1987 allocation, it is less than N100m in real term. More support is needed for R & D from both the government and the private sector.

8.4 Lack of Recognition and Acceptance - It is necessary for the public to recognize that R & D work can be carried out in our universities. Expert advice or consultation with qualified Nigerian professionals is good and cost less than those given by foreigners.

8.5 Lack of Dedication - R & D is a tedious work and therefore requires dedication and patience. Commitment to excellence and astute priority setting are major requirements in accomplishing research objectives.

9. SOME IMPLICATIONS OF FOREIGN R & D CONTRACTS

It is not that we should not use foreign R & D expertise in some areas of our industrial development, rather, we should utilize to optimum, indigenous experts in their respective fields of specialization. Acquisition of foreign R & D should be based on cost/profit considerations, verification of concept through proven application, warranties and quality responsibilities through binding contractual agreements. These requirements have not been adequately articulated considering construction and operational problems in industries such as automobile, iron and steel, paper and pulp, petroleum refining, and mining. The print media is full of depressing stories about the deplorable state of our manufacturing industries.

It must be recognized that foreign consultants on R & D owe their loyalty first to their country, then to their personal gains before their Nigerian employers. They can deny or delay our ability to produce the goods that we need so that we continue to buy from their countries and allies. If good judgment is not exercised, Nigeria can continue to remain the dumping ground for inferior products and a consumer nation.

10. PROTECTION AND TRANSFER OF INDIGENOUS TECHNOLOGY

10.1 A good leadership and challenge to Nigerian engineers and technologists can produce indigenous technologies in many fields. The emerging inventions should be recognized, organized and encouraged by both government and industries.

10.2 Protectable Ideas - When an idea can be worked on a commercial scale for the purpose of improved productivity and competitiveness, then it is protectable. Such ideas, based on simple hypothesis, precede the theories that explain their validity and gain acceptance through application.

10.3 Reward System - Recognition or praise is no vice until it becomes exclusive. Subordinates are seldom praised in our society yet they do the dirty or hard work. We are unwilling to share any derived glory and diligently seek to discredit the work of others. These exploitationary attitudes do not encourage creativity and inventions. We should give praise where praise is due.

10.4 Publish or Perish - This is a familiar phrase especially to the academicians. Most of our work is published outside the country. If a Nigerian develops a novel method for processing any local raw materials, the publishers will be the first to know. The information in the paper can be passed to foreign entrepreneurs who use it to manufacture or produce goods which are eventually imported into Nigeria. The author has met his publication needs but lost an invention. Research findings should therefore be adequately analyzed and discussed before eventual publication. Research needs of government and industries should be documented and adequate dissemination of research information established.

11. STEPS TOWARDS INDIGENOUS TECHNOLOGY - FUNCTIONS OF GOVERNMENT, UNIVERSITIES AND INDUSTRIES

11.1 The government, universities and industries should see themselves as partners in the development of indigenous technology. Some suggestions are therefore advanced on ways each institution can effectively partake in technology development.

11.2 Government:

- Should formulate appropriate policy with comprehension of advances and potentials of indigenous technology and the associated problems.
- Resolve to develop through education, a national ethos that wealth creation must precede wealth utilization.
- Collect, process and maintain social, educational and industrial statistics.
- Measures should be instituted to enhance incentive for young faculty and academic researchers.
- Direct support of research and development (R & D) by providing grants, equipment, chemicals, and other needed materials/facilities.
- Must have means to protect privacy, detect fraud, force sensible standardization of

products, encourage efficiency, and guarantee fairness.

- Create markets and international agreements for the products of inventions.

11.3 Industries - The roles of industries in R & D are similar to those of government.

- Provide capital and materials for R & D
- Keep accurate operating, sales and products statistics.
- Share information and discuss problems through professional or commercial conferences.
- Join effort with other companies for international competitiveness, especially against foreign based competitor.
- Employ new indigenous technologies.

11.4 Universities - The universities as centres of learning have the duty to develop the human and material resources.

- Seek to develop and apply science and technology to benefit society.
- Encourage research capable of striking a balance between wealth creation, competitiveness, safety, environmental protection and resources conservation.
- Provide awareness for information and training for efficiency.
- Maintain a strong library for information and data base.

Finally, indigenous technologies will introduce new dimension to the society, and bring with it a continuing increase in complexity. They will help us exploit our natural resources, employ our human resources, create wealth, and enjoy economic and political independence.

12. REFERENCES

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