LIFE SCIENCES AND DEVELOPMENT IN NIGERIA[1]

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INTRODUCTION

The topic of this paper invokes a whole lot of issues that have complex and important relation ships. The task, it seems, is to articulate these issues and attempt at least a tentative exposition of their relationships. In so doing, it is hoped that new perspectives will emerge towards apprehending the relationship of natural sciences to development in Nigeria and countries with her kind of status in today's world.

The life sciences or biological sciences constitute a component of the category referred to as the natural sciences and shares that category with the physical and earth sciences and mathematical sciences. Of course, other sciences include the social sciences (science of society) and science of thought (philosophy, epistemology). Needless to say, all these categories have critical interfaces and connections. More importantly, the natural sciences share processes and principles among them. The biological systems for example obey many principles and laws of physics and chemistry, while the mathematical sciences aid analysis and interpretation of observation in biology. At a general level, science can be said to be a category of knowledge based on propositions which are internally coherent, that can, and are subjected to constant processes of verification and possible refutation and are made more precise and more reliable in the course of practical experience of society. This knowledge equips man to produce his needs, reproduce himself and his society and interact in a purposive way with his environment.

For a very long period of human history, deliberate and programmed seeking and application of knowledge towards conquest of necessity was constrained by the pace of accumulation of material surplus. All these changed at various speeds in various human societies in the last two centuries or so.

The rapid development of science and its application (technology) in the last century especially has also led to the dichotomy between pure science and applied science (technology) and occasioning the incorporation of the former into the latter. As we shall observe late, these developments were not fortuitous. They arose from important economic and political developments at nation-state, regional and global levels. These developments were propelled and reinforced by new means and methods of accumulating surplus (resources and financial) on world scale and by international power relations that sustain them. In the so-called developing (third-world) countries like Nigeria, the consequences of the developments especially since the early 1970's will also become evident.

Whichever way we look at it, science and the technologies that flow from it have become pivotal in the bringing into being what we now call development. This concept, development, is characterised predominantly as the progressive *conquest* of nature to free man from necessity and to enhance the use of existing knowledge and resources for overall material and spiritual well-being of man. As we shall see later very little, if any, of the promises of the development strategies have produced any credible results. Given this failure of promises, the intellectors (both foreign and indigenous) of the development paradigms have started modifying their vision for development in poor countries: they now talk and write about "sustainable development" which will remain a concept of dubious integrity unless it is defined genuinely popular sovereignty in a country.

It is quite obvious why scientists must start raising critical questions about science and development in countries like Nigeria. Questions should be raised on why Nigeria's capacity has not only not grown but also started to decay in the last thirty years or so. The answer to that question must be sought in the intersection of national economic programmes and international economic tendencies on one hand and the international and internal political forces that superintend the tendencies.

Life sciences and development in Nigeria in the last forty years

The promise of independence and the generally ambitious vision of the nationalists, the basic sciences and their application received ample boost immediately after independence. Educational facilities at primary, secondary and tertiary levels expanded, or created anew, departments of botany and zoology and later departments of microbiology and biochemistry in the universities; these departments were engaged largely in basic research leading to publication of books and journal articles.

Of course, a whole lot of post-independence advances in studies of Nigerian flora and fauna were pivoted on the work carried out under, and often commissioned by the colonial authorities. In such a category of works were Volumes I, II and III of *Flora of West Tropical Africa* (Hutchinson & Dalziel, 1954-1972) and *Nigerian Trees* Volumes I & II (Keay, *et al.*, 1960; 1964). Between the mid-60's and mid-80's, professional organisations of *scientists* were also virile and active even across national frontiers (publishing journals such as *Journal of West African Science Associations*—JWASA, *Nigerian Journal of Science*—NJS and *Journal of the Entomological Society of Nigeria* etc.). Indeed many contributions in applied sciences (engineering, agriculture, medical sciences) appeared regularly in these journals.

By the close of the 1970's, the appearance of Structural Adjustment Programmes (SAP) in many developing countries in the world including Nigeria and the consequences of the attendant austerity measures (1981-1982 in Nigeria) began to take their tolls on the universities. The clamour for *applied research* and *relevant research* along with the creation of universities for applied sciences (universities of technology and universities of agriculture) began to create problems for survival for all aspects of basic sciences and, of course, the humanities. The SAP policies as they affected funding of teaching and research in higher education and even in the research stations of course had a systemic and deleterious impact. Under SAP's liberalisation both industrial and applied research decayed. Consequently neither the pure sciences nor the applied ones made progress. The quantity of academic production declined, textbooks cannot be published, graduate students cannot be trained or trained adequately, and scientists cannot be recruited.

The state of life sciences is particularly sad because this is an area in which countries like Nigeria have comparative advantage for significant contribution. Unlike the physical and mathematical sciences, the objects of study in the life sciences are locational. Consequently, our own scientists are best placed to make contributions and break new grounds. This is especially true because all critical indigenous manpower is available locally and abroad. What is required is a nationalistic policy that is backed up by funds and facilities.

Three specific areas of concentration may be identified; these are conservation of genetic resources of our environment, a systematic effort in the study of structural and taxonomic botany, zoology and biology of organisms in our environment ("traditional" studies in biology of organisms) and capacity building in the frontier areas of biotechnology. These are all goals that are clearly within our reach.

Life Sciences Conservation and Development

The most important asset of man is the environment. In many respects, the plants and animals are critical elements of that environment and a sustainable strategy for the use of that environment is a critical condition for survival and development.

Conservation of plant and animals in an ample sense implies conservation of genes, species, communities, ecosystems and biomes in a managed, semi-managed or un-managed milieu. Nowadays, commercial agriculture, corporate control of genetic resources and extractive industries (mining, logging, poaching etc.) have become important factors in the progressive depletion of biodiversity, in both managed and unmanaged ecosystems, leading to overall narrowing of the genetic base of global biodiversity. These forces have intensified poverty which has, in turn, intensified assaults on biodiversity.

In Nigeria today, a substantial proportion of agricultural production depends on germplasm of plants and animals that are in the custody of peasant farmers and have provided considerable stab ility, if not enhanced productivity, to agriculture generally. In this rural context, a significant proportion of the needs of rural and other communities derive directly from wild genetic resources(unmanaged plant and animal genetic resources—PGR and AGR). The dominant strategies for conservation in *situ* (largely in national parks and

reserves) and ex situ (seed banks, laboratory cultures and related strategies) ignore these needs of the rural communities. Consequently they create what has beco- me known as intergenerational and intra-generational inequities which debilitate the conservation programmes themselves. If indigenous knowledge of the flora and fauna are to be conserved and if the users of wild resources will be pivotal to national conservation strategy, as they ought to be, a creative and people based reappraisal of strategies are imperative.

Life Sciences and Traditional Areas of Biology

Although it is a general fact that basic sciences quite often lag behind applied sciences and techno- logy and that science and technology today have only tenuous boundaries, it is incontrovertible that applied science and technology thrive and survive only on a solid culture of basic or pure sciences. It is also true that science has become a direct productive force and "....the main feature of the [Scientific and Technological Revolution] STR is the lag of natural sciences...." behind technological innovations, the sciences must be there to start with. No area of the natural sciences is more illustrative of the foregoing facts than the life sciences.

The underdevelopment of the life sciences is directly related to the urgency of the need for appropriate and equitable biodiversity conservation strategies. Swanson (1992) observed from the data of McNeely *et al.* (1990) - - quoted in Swanson (Ibid) that:

> *"A listing of countries with the greatest number of species reveals several patterns. Many of these countries share common characteristics; they are typically tropical, forested developing countries..... Perhaps the single most striking characteristic of the distribution of species wealth throughout the world is the extent to which it is located in developing countries. Virtually all of the most significant sites for diversity conservation are situated in countries with some of the lowest per capita incomes in the world". (My emphasis)*

Given the arrest of development of our knowledge of our flora and fauna since the 70's or so and the consequent underdevelopment of that knowledge, two problems exist. One problem is that so much of our flora and fauna are known and the fruits of knowledge from what we know can not be harvested because we have not been able to build on that knowledge. At yet another level, a different category of problem exists. Firstly, potentials of the unknown cannot be realised because, secondly, things that are unknown may never be known because they are disappearing: they are being lost. As Swanson notes:

> *"These are irreversible losses. They can also be very substantial losses. The variety of microbes, plants and animals that have only recently been discovered to be of usefulness illustrate the potential value of the Undiscovered."*

We dare say "the potential usefulness" of the known, the unknown and the unstudied! Hence the rationale and the robust case for resuscitation of the studies in the traditional areas of the life sciences.

Biotechnology and the other Frontiers of Life Sciences

Towards the end of the last millennium the abstract of a paper by Charkrabati and Bargava (1989) summarised what they called "the facts, hopes, dreams and doubts" of certain key areas of biotechnology as follows:

> *"Thanks to the remarkable progress made in genetic engineering and cell culture techniques in recent years, we are now in a position to persuade living cells to do jobs that they have never done before. Microbes and plant cells are being exploited to produce an already wide range of useful chemicals, and the prospects for major new developments in this new areas biotechnology are good".*

More specifically, their application and promises with production of new vaccines, probes for diseases, chemicals from all cultures, production of complex chemicals for plants and animals, genetic

"empowerment" of crops and domestic animals, exploitation of chemical capacities of microbes etc. were highlighted. We need not belabour these achievements and potentials any further here.

There is something very instructive for our discussion on the importance of pure science about the bold emergence of biology from its almost unnoticed position among the natural sciences in the last half century before when chemistry and physics were dominant in their promises to technology.

The antecedents of biotechnology and genetic engineering were the discovery of DNA as the genetic material in the 40's largely through the work of microbiologists and the elucidation of the structure of DNA as a double helix by Watson and Crick in 1953. These were all pure science stuff! The possibilities that inhere in the actual applications and potentials of genetic engineering did not emerge until about twenty years later when in 1972 the isolation, in the intervening decade, of DNA ligase and restriction enzymes (1967 and 1970 respectively) made production of recombinant DNA possible.

If constant running water and electricity are available, if laboratories are reasonably funded and scientists are reasonably comfortable, research in biotechnology and genetic engineering is a practical proposition anywhere including our laboratories. In this general regard, Nicholl (1994) noted:

> *".....in many laboratories around the world, it is now routine practice to isolate a specific DNA fragment from the genome of an organism, determine its base sequence and assess its function. What is particularly striking is that this technology is readily accessible by individual scientists, without the need for large scale equipment or resources outside the scope of a reasonably well-funded research laboratory."*

Biotechnology and genetic engineering research are, consequently, not more frontier than that Indeed all serious countries have built considerable capacity in biotechnology and genetic engineering because it is also relatively cheap to run.

Development and Underdevelopment in relation to Research and Development in the Natural Sciences

The 1980's and 1990's represent a significant turning point for many poor countries in the world and virtually all countries of sub-Saharan Africa (including Nigeria). The essence of that turning point was that many of the programmes that promised to engender self-reliance, increased industrial capacity, enhanced social services (better health, education, housing, transportation, employment), more productive agriculture, better understanding and control of human environment etc. etc., collapsed. In the place of these promises, there was greater economic and cultural dependence, collapse of social services, collapse of agriculture, reduced industrial capacity utilisation, increased national debt and enlarged debt repayment regimes, generalised poverty and increased gap between the rich and the poor. It had become quite obvious to everyone that development and its paradigms have run into serious crises at national and supra-national levels.

So what has created the inability of science and technology to democratise its fruits among umanity at a planetary level and at regional levels in the world? Why has the large majority of the world remained poor? And why have certain nation states like Nigeria remained underdeveloped in spite of the immediate post-independence hopes? How has underdevelopment developed?

The main perspective of this contribution is that the decline and decay of the scientific and overall development capacity of our country arose from the economic, social and political pilosophy of Nigeria's ruling circles which derive from the ascendancy and dominance of the global neo-classical economic philosophy which took root especially since the 1980's. in Nigeria thephilosophy has changed names from SAP to Vision 2010 and now to NEEDS (SEEDS). At the international level, international finance capital (IMF, World Bank) and business interests and coalitions of state organisations behind them (EU, G8, EC etc.) have reinforced this philosophy and instigated other dispersions and illusions like AGOA, NEPAD etc. to advance this same philosophy.

In a recent paper by Saint *et al.* (2003) on the state of higher education in Nigeria, it was observed that:

> *"For education, Nigeria spends an estimated 2.4% of its GDP, while sub-*

Saharan Africa as a whole spends 5.1% ..... In Nigeria, primary education enrolls 81% of the relevant age group and graduates 61% ... School dropouts have been rising ....." (p.261)

"Between 1990 and 1997, for example, the value of government allocations for higher education declined by 27%. The result is a dramatic fall in the quality of university education and research as implied by the 62% drop in the real value of recurrent expenditure per student during this period." (p.263)

On research and development, Saint et al. (Ibid) observed:

"In 1996, OECD countries accounted for 85% of the total R&D investment; China, India, Brazil and East Asia represented 11% and the rest of the World [including Nigeria] only 4%. Nigeria has only 15 scientists and engineers per million persons. This compares with 168 in Brazil, 458 in China, 158 in India and 4,103 in the United States (World Bank, 2002a, Table 5.11)" (p.260)

"Nigeria's number of scientific publications for 1995 was 711 – significantly less than its output of 1,062 scientific publications in 1981 by a comparatively smaller university system (Task force, 2000) .... Nigeria's federal university system spends only 1.3% of its budget on research (Harnett,2000)."

Needless to say, the situation has worsened considerably since 1999.

More importantly these are all the results of the so called reforms and adjustment programmes which generate debt peonage, the removal of the so called subsidies etc. while creditor states are enlarging their own subsidies to agriculture, steel, education and even fraudsters that superintend multinational corporations pushed to the brink by their "executives".

It is not just that the Nigerian ruling class has surrendered, in their own class interest, to alleged global and globalisation trends by reducing expenditure towards public purpose, the creditor countries and their agencies ensure that the social surpluses which should power public purpose (education, including science and science education) are seized from countries like Nigeria. It is these surpluses that assure the ability of nations to engage in intellectual activities whose promises are only in the future. Accumulation of this surplus is *conditio sine qua non* for the possibility of its deployment for science and science education and for public purpose in general. The existence of this surplus (through colonial, neo-colonial and other expropriation processes) were the pivots on which the head start and the scientific and technological hegemonies of the industrialised states of the world were erected.

Conclusion

In conclusion, we assert categorically that the backwardness of science and technology arisesfrom lack of political commitment by decision makers. But this lack of political commitment did not arise from ignorance. Rather it is the product of surrender to exploitative forces which continually seize the social surpluses that are needed to produce and reproduce scientists and science. Authoritative and massive resource allocation is imperative for rebuilding capacity in science and its application.

It is not fortuitous that we are contemplating science with regard to national development. At least since World War II, the nation-state has been central to that development almost everywhere and it has been the singular force in most colonised states like Nigeria. We have shown that the imposi -tion of adjustment regimes since the 80's especially have subverted that development particularly in Nigeria. The growing precariousness of the economic, political and social condition of Nigeria and its peoples under adjustment regimes in the last two decades indicts development paradigms pivot ed on prescriptions supervised by the industrial states of the northern hemisphere. The decline in natural sciences in Nigeria is a direct fall out of effects of adjustment regimes on social services (education especially) and public purpose generally. These paradigms subvert national independence and autonomy. They need to be discarded for greater national independence and autonomy of growth and development.