

Biotechnology: Advances and Prospects for Sustainability, in Nigeria

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Abstract

Biotechnology is a multi-disciplinary branch of science whose applications are diverse and because science is dynamic, there is tremendous development in the use of biotechnology in the world. Advances of biotechnology are prominent in Nigeria, where government initiatives, the private sector as well as that of NGOs are recognisable.

Advances that have been commercialized are stated, other national provisions for potential developments are also well enumerated. On the other hand, challenges, to be overcome, so as to produce have also been identified. Drawbacks, shortcomings or constraints to meeting biotechnology demands have also been looked at in order to make concrete development agenda in this area of science for this millennium.

Introduction

Biotechnology offers high prospects of a bright future for mankind. Benefits can be social, economic or both depending on how it is managed, or manipulated (2). Biotechnology is not new. Micro-organisms had been exploited for many hundreds of years and in some cases thousands of years by those making cheese ("Wara") local brews and wine. What is new is the dramatic and fundamental discoveries in molecular biology concerning the role of DNA. Thus, scientists are disposed with the privilege of making scientific breakthrough associated with genetic engineering

For Nigeria, there is already steady interest in the biotechnology in the context of upgrading the traditional processes to industrial level of application for national development. The issue of ascertaining how far Nigeria has gone in this regard needs to be documented so as to compare with the global scientific and technological developments.

Biotechnology is therefore defined as "the application of scientific engineering principles to the processing of materials by biological agents to provide goods and services".

Growth in biotechnology means harnessing traditionally existing technologies and making them sustainable by improving on the scale of production as well as , product quality which can be easily commercialised to cater for the need of growing populations.

So many vaccines have been commercialised over the years by National Veterinary Research Institute (NVRI) of Nigeria. There was a recent breakthrough in developing typhoid vaccine by Federal University of Technology. There is ongoing progress in other key institutions such as Research Institutes, Universities, Polytechnics and Private Sector.

A concise perusal on recent advance in biotechnology in Nigeria is therefore important in order to help see where emphasis should be placed so as to provide a basis for sustainable development.

Application for Biotechnology

Biotechnology though not new is constantly and currently being revitalised in all stages. The applications for biotechnology are numerous and some important ones include :-

- Human therapy
- Human immunology
- Contaminant monitoring
- Petroleum exploration, enhanced oil recovery etc.
- Recombinant DNA technology
- Industrial chemical production

Biotechnology advances In Nigeria [3,4,5,6]

One can only attempt to give a window view unto the store of what has been accomplished in this activity in Nigeria, amongst such are :-

- a. Biomass production of some fungal isolates
- b. Recovery of useful fungi cassava extracts
- c. Millet fermentation to produce *kamu*
- d. Chicken manure used as nitrogen source for cassava fermentation at low pH and High temperature
- e. Cassava Starch effluent treatment with concomitant single cell protein production.
- f. Enzyme production (amylase)
- g. Mushroom production from waste organic materials
- h. Alcohol production and some few chemicals
- i. Starch production
- j. Various breeds and species of animals/poultry have been developed through Artificial insemination and Embryo Technology.
- k. The National Veterinary Research Institute [NVRI] Vom, Plateau state, has produced vaccinee for Cattle, Sheep, Goat, Dog and Cat, poultry and humans, before now (10) bacterial vaccines have been commercialized, (10) viral and about (20) are ready for commercialisation, from 1926 to 1999.
- l. At (IITA) International Institute for Tropical Agriculture, the following developments have been accomplished:

- i. Molecular genetics, non-sexual gene transfer technology for somatic embryogenesis and plant generation, protoplast transformation and gene transformation by DNA flow, cytometry for ploidy determination; molecular diagnosis, for invitro germplasm presevation and micropropagation in vitro; wide crosses/ Embryoculture and Rescue, all these for mandate crops. Cassava, yams plantains / Banana and Cowpea, various training workshops and collaborations are also conducted.
 - ii. Natural biocides for mosquito control have been reported (1991), tick control (1993) and microbial control (1961, 1989), various other plants with insecticide properties have been reported.
 - L. Biofertilizers, the works of scientist and engineers are been tried on Lautech Farm at Ogbomosho presently with liquid biofertilizer.
 - M. At the National Root Crops Research Institute, Umudike, a lot has been done in domestication of plants, Breeding and selection, Micro-propagation, Development of disease and pest free propagates, Processing techniques development using micro organisms and storage techniques.
 - N. Various applications of recombinant DNA technology are surging up at National Institute of Pharmaceutical Research and Development (NIPRD) Abuja, with PCR-Polymerise chain reaction and other biotechnology principles.
 - O. Vinegar from palm wine alcohol, biomass from our industrial waste or by products by FIIRO-Lagos.
 - P. An attempt has been made to initiate local fabrication of a plant for bakers' yeast production by Ministry of Science and Technology.
 - Q. Local sourcing of micro-organisms for appropriate application, have been done widely.
 - R. Various fermented food and beverages.
 - S. Malting procedures for sorghum, that gave rise to sorghum malt for beer production in the country.
 - T. Cocoa sweetener as by-products from cocoa processing on laboratory scale is also available.
 - U. Raw Material Research and Development Council (RMRDC) is currently working on protein sweeteners and corn starch syrup.
 - V. Various attempts have been made to produce chemicals, inoculates and insecticide from biotechnological activities.
- Microbial enzymes (amylases) by the international Breweries plc in Ilesa by the support and collaboration of the Raw Material Research and Development Council (RMRDC) is good encouragement, also along this line RMRDC is currently working on the commercialization of the cornstarch syrup.
 - Many other institutional supports, individuals or group of individuals have also been given grants, collaborations at various levels and for various relevant interest groups have been established, encouraged and financed.

The Private Sector Advances

Though many of them are imported, some form of local initiatives and inputs are involved:-

- Cadbury Plc now make Dawadawa cubes and presently some amount of Soya-beans are added, while the locust bean form the lot of the condiment, their malt also are locally sourced.
- "SAMCO" Produces yoghurt from imported culture of *lacto bacillus*.
- Nono - Is currently been produced by traditional cattle reares "Fulani".
- NIYAMMCO: Mandated to produce bakers' yeast and currently producing alcohol on the premise that the demand is less and there exist lack of materials for bakers' yeast.
- International Breweries Plc in Ilesa now producing amylase.
- NISUCO: Bacita is importing cellulase high yield sugar cane plants.
- Nigerian Tobacco Company (NTC) has developed improved varieties of tobacco plants.
- Leventis Plc, has developed and is marketing improved and high yielding varieties of crops such as tomato and pepper.

Non-Governmental Organisations Contributions

Many (NGO) have been acting as pressure groups for biotechnological development in Nigeria and as such their place are well known. They include:

- Foundation for African Development through international biotechnology at Nnamdi Azikiwe University Awka in 1992, aimed at training 1000 Africans in cloning by the year 2000.
- Nigeria Gessellschaft fur biotechnologische Forschung (Nigeria GBF Club) Club at Obafemi Awolowo University, Ile-Ife, aimed at promoting biotechnology in Nigeria and Africa.
- Others are, Biotechnology Society of Nigeria, Nigeria Institute of Food Science and Technology, Science Teachers Association of Nigeria, Nigeria Society of Engineers, Nigerian Society of Chemical Engineers (NSChE) and many others, are all making one effect or the other on this area of national development.

Traditional Processes that Have been Commercialised in Nigeria

- The small-scale production plant for bottled palm wine.
- Works are in progress for the market for appearance of canned "kuka" sauce.
- Fermented *garri* production, and even that which is fortified with protein source, are in market.

Government Initiatives

The government has been responding to biotechnological needs of the nation, but chief among other accomplishments are :-

- In 1987 a centre was set up at Ibadan the National Centre for Genetic Resources and Biotechnology.
- A National Committee on biotechnology to provide a Master Plan.
- National workshop on biotechnology was held as an aftermath of the National Committee efforts in 1993.
- In 1998, another workshop on Biotechnology techniques: Bio-reactor system was held and follow-up meetings.
- Guidelines on Biosafety proper for Nigeria 1994.
- Adoption of local grains for beer brewing was influenced by public policy, through SAP in 1986 by banning importation of barley malt and other cereals.

- Some group of academicians are looking at the commercial bottling of "Burukutu" and "Pito" local brews, currently.
- Various vaccines have been commercialized at NVRI Vom and the one developed at Federal University of Technology, Minna has now been commercialized (typhoid vaccinee)
- There are other traditionally tested products, that have found dominance in various localities and regions, we can help devote them at small scale industrial production level, some have been identified, some not classified.

National Provisions for Potential Development

There are on going, initiatives that upon emergence, will set Nigeria on biotechnology global map, if they are developed and utilised fully.

- IITA Ibadan has so much to offer in genetic transformation DNA thechnology and related activities.
- NIPRD Abuja has so many plants where a lot of work has gone on for various application of medicine.
- The RMRCDC is willing to sponsor upto pilot plant level, only realistic, viable and proven research interests.
- NASENI is pursuing vigorously through workshops collaboration and support, initiatives of biotechnological principles.
- NVRI Vom is currently developing a standard molecular biology laboratory for high-tech vaccines.
- The National Chemical Research Institute, Zaria is working on novel tanning methods and sourcing of tanning chemicals locally, and other areas of national interest.
- National Cereals Research Institute Badeggi Bida is also developing varieties of high yielding cowpea etc.
- There are presently about 9 biotechnology related laboratories at the Federal University of Technology, Yola.

Challenges for More Advances and Development in Nigeria

With all of the above, it is noted that except for works at Vom and NIPRD most of the advances are in the area of food security and development.

- No current works on industrial chemicals from this source.
- Only Nestle, Plc is involved currently in biotreatment of waste.
- No specially formulated policy on biotechnology only section 2.3.6, (a,b) of the Science and Technology Policy accomodate such a vast area of life activities.
- Energy provision beyond biogas is another area in view of depleting number of forest reserves and environmental degradation from traditional practices.
- DNA Technology if at all exist is at its embryonic stage.
- No pharmaceutical firm in the country is producing biotechnology products. They rely purely on imported raw materials.
- The removal of the offensive odour in Bitumen or local tar is another challenge, so as to widen its applications. What of the use of micor-organisms for enhanced oil recovery in petroleum exploration, coal processing, and other solid minerals.
- Biocides, Biofertilizers and Biosensor are all need closer

attention.

Challenges faced

Improved funding and improved infrastructural facilities will give biotechnological development in the country some impetus. Other challenges to be tackled are lack of expert groups, poor research linkages, sabotage by some multi nationals, weak science and technology base, unstable governments, poor institutional industry relationship, low public understanding and attitude towards new science and technology, lack of capital, equipment, poorly equipped laboratories, brain drain, secrecy or research interest, lack of knowledge by entrepreneurs to appreciate the potential value of biotechnology, social and political implications all go down as challenges to be overcome in order for Nigeria to move forward.

The Way Forward

It would take sacrifice, discipline, commitment, hardwork and self motivation vis-a-vis a measure of inspiration to surmount all these challenges. Some solutions are:

- Harnessing the familiar traditional processes.
- Compiling a relevant register and pursue professional linkages and resource groups among the Nigerians.
- Strengthening relevant organisations to lobby for funds to stimulate biotechnological industrial growth. This tranforms biotechnology to biochemical engineering.
- Organise biotechnology fairs to showcase and harness traditional and new development processes and products.
- Provision of a viable and sustainable enabling environment by government.-(politico-economic environment)

Aknowledgements

Special thanks to my employer (Federal Polytechnic), Mr Deji Lawal and all those who made it possible for the compilation of this report.

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