

BIOSCIENCE AND THE CHALLENGE TO ECONOMIC DEVELOPMENT

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Abstract

This paper examines the contribution of Bioscience in the course of the development process of Developing countries (LDCs). It shows that the orthodox notion of rising GDP is inadequate to development problems. The paper suggests a holistic approach to development, including environmental issues. The analysis shows that most LDCs rely on the exploitation of their environments in which agriculture remains the principal activity. Such agricultural activities in their present state do not add value to its products, thus unable to generate adequate revenue in the LDCs. This accounts for the underdevelopment and poverty of these nations. The paper, thus, suggests actions that Bioscience and Biotechnology can adopt to convert basic raw materials into semi-finished and finished goods in order to add value and contribute to the rapid transformation of LDCs. By so doing basic scientific knowledge in Bioscience can be converted to commercial success thus leading to development.

Introduction

Bioscience is usually considered as a pure science with applications in the biological Sciences. In this narrow perspective, the subject becomes redundant in the social sciences, especially in economics.

However, when we take the wider consideration of Bioscience as “connected with characteristics and behaviours of organisms, how species and individuals come into existence and the interactions they have with each other and with environment” (wikipedia.org/wiki/Bioscience), we attempt to establish a relationship between bioscience and economics, especially in the domain of economic development. But the concept of economic

development has never received any standard agreement on its meaning and dimension over the years. It has been controversial as there have been and still are economists.

In the context of this paper in which we want to establish the link between bioscience and economic developments, the following questions arise:

- i) What is economic development?
- ii) How does the environment affect development?
- iii) What linkage between bioscience and development?
- iv) Which way forward for bioscience in the development process?

What is economic development?

The concept of economic development has not received any standard agreement on its meaning and dimension over the years. The concept has been controversial as there are economists. This applies to the goals of economic development (Herrera, 2006; Adelman, 2001; Basu, 2001). In addition, the meaning and goals of development have evolved over the years with emphasis shifting from one idea to another and from one domain to another. In its modest beginning emphasis was to show how poor countries can develop (Herrera, 2006). The main thrust of idea here was that *“The economies of the less developed countries were mired in a cycle of poverty and needed a ‘big push’ to develop. This big push was seen as a large boost in investment, helped by the states infrastructural and social spending as well by private foreign capital spending and aid from the governments of developed countries”* (Herrera, 2006).

In the light of the above, emphasis in development was placed on the growth rates of national incomes of developing countries (LDCs), (Basu, 2001; Meir and Stiglitz, 2001). Less developed countries were to increase their incomes through the exploitation of natural resources. However, it was soon realized that the fast growth of national incomes/wealth measured by Gross National Product (GNP) did not engender development in many LDCs. In

some countries while GNP was increasing over the years, poverty was equally increasing; there was very little transformation of the economy and underdevelopment remained visible everywhere. GNP growth rates in some cases were attributed to the exploitation of one natural resource such as gold, diamond, petroleum etc. Basu (2001: 63 – 64) puts it this way.

“With the rise in the popularity of measuring and monitoring national income..., progress and development also came to be measured in terms of gross national product (GNP) or the per capita income of a nation. This intellectual tradition with its limited objective helped nations focus their energies narrowly and must have played a role in the rapid growth of national incomes that this century has witnessed. But it also brought in its wake dissention and disappointments”.

Maximization of income growth as a development objective ignored several issues which equally are of great importance to the general wellbeing of the individual development is supposed to serve. According to Basu (2001), *“environmental issues were left to languish on the sidelines, the standard of living was often allowed to slide; large inequalities between classes, regions and genders were ignored; and poverty was tolerated more than it should have been in the rush to generate maximum income”.*

The broadening of the goals of development became necessary in order to strip ourselves of the narrow confinement of national income growth. Sen (1985; 1999), UNDP (2001), Stiglitz (1998), Herrera (2006) and many other economists have gone beyond the narrow confines of national income to broader issues. Stiglitz (1998), for example, suggests that attention should be focused on income distributional issues, environment, health and education (Basu, 2001), while the UNDP places emphasis on human development – an “indicator of a nation’s progress that is weighted average of the nation’s literacy and educational achievement, the citizen’s life expectancy, and the nation’s per capita income”.

Other issues in the development process include human rights, access to just legal system good governance (Stiglitz, 1998; Wolfenson, 1999).

Different countries and regions have pursued one or some of the above mentioned goals in their growth process. However, one thing is clear. While it is true “that the process of economic development is highly nonlinear and multifaceted” (Adelman, 2001), it is equally true that the development debate appears to be, at last, coasting toward a consensus: developing nations must not focus their energies on the growth rates of their GDP, NNP, GNP and the like but must instead try to achieve “human development” or “comprehensive development” (Basu, 2001: 61).

Comprehensive development is an all embracing word that can turn out to be vague. However, in the context of the present paper, comprehensive development goals entail pursuing policies that will transform the lives of the poor. The transformation of people’s lives in the poor countries involves the exploitation of the environment, which of late has drawn wide attention in economics. Thus we turn our attention to environmental economics and see how bioscience fits into the jigsaw.

Environment and Development

Maler (1998), using the *Webster’s New World Dictionary* defines environment as “the conditions, circumstances and influences surrounding, and affecting the development of an organism or group of organisms”. Organisms and groups of organisms are animate and inanimate which interact to influence and/or alter the structure of the environment. The environment in turn affects these organism which Maler (ibid) classifies into groups of human beings and others groups which he calls ecological systems, or ecosystems.

As noted in section I above, development was synonymous with increase in GNP. However economists have recently come to adopt a comprehensive view of development including environmental issues. No consideration can be given to comprehensive

development without environmental consideration. In an attempt to increase GNP, the environment is exploited. A number of implications of environmental exploitation crop up and have drawn the attention of economists, policy makers and environmentalists. Some of these issues include sustainability of resource exploitation, population growth and resources, poverty and economic growth, among others (Todaro and Smith, 2003). Generally environmental resources are demanded for two main reasons (Maler, op. cit): as an amenity and as an input in production. An attempt to satisfy these two types of demands for environmental resources in most cases causes degradation of the environment. Environmental degradation therefore creates the issues raised above. The effect of environmental degradation on some development issues have been aptly summarized by Todaro and Smith (2003: 497) thus:

“... The interaction between poverty and environmental degradation can lead to a self – perpetuating process in which, as a result of ignorance or economic necessity, communities may inadvertently destroy or exhaust the resources on which they depend for survival”. The implication of this is that there is rising pressure on environmental resources which leads to degradation. This pressure arises from rapid population growth, urbanization, poverty and economic growth, among others.

In LDCs, most people still depend to a large extent on the environment for survival. Most people depend on agricultural activities which occupy about 80 percent of their time and accounts for a reasonable proportion of the GDP. Many of these countries will remain largely rural economies for some time to come. However, the dependence on agricultural activities has not improved the living standards of most of these people. Their incomes continue to fall vis-à-vis that of their counterparts in DCs. The environment in which the average LDC citizen lives continues to degrade thereby perpetuating poverty.

To illustrate this point, we would like to use a hypothetical example of two farmers – one in a DC and the other in a LDC. This example is necessary in the context of this paper in that it will show us the linkages between Bioscience and development.

A typical farmer in Tchad has one acre of land on which he produces cotton every year. He tills the land on yearly basis and hardly has the necessary inputs for maximum yield. His output drops yearly because the soil is deteriorating. Take his counterpart in America. He has the necessary inputs to produce maximum output from his one acre of land. His yield increases yearly because modern methods of cultivation are used. The government in American has also provided a good enabling environment in which the farmer can operate.

In the former case the soil deteriorates rapidly while this is not the same in the latter. While the income of the American farmer increases over the years that of the Tchadian farmer decrease. The dwindling yield of the Tchadian farmer would force him to attempt to expand the size of the land leading to extensive farming while the American practices intensive farming. Extensive agriculture exposes the land to a lot of hazards. Soil degradation and environmental damage occur.

The questions that arise from this simple illustration are: what can bioscience do to the typical African farmer to increase his yield and earn higher income? What other ways can bioscience push the typical African to live better and be able to reap from the benefits of economic growth and development? How can bioscience help in conserving the environment? These and other issues are the subject of the next section.

Bioscience and the Challenges to Development

Progress in biotechnology and bioscience has been recognized to be beneficial for agriculture, environment and health (Judith A. Francis et al. <http://knowledge.cta.int/fr/content/full/2214>). The importance of each of these is examined below.

Agricultural inputs and transformation

The example of the Tchadian farmer above is typical of over two-third of the world's poorest people located in many rural areas whose lives are dependant on subsistence agriculture. A major cause of poor agricultural yield in African countries, and rural Cameroon in particular, is the lack of inputs, especially fertilizers. In the example above, the American farmer uses enough scientific and chemical inputs to increase yield per acre, which is not the same in Africa. The problem in Africa sometimes is not the lack of fertilizers but affordability. The poverty situation of Africans renders them unable to afford this important input into agriculture.

Basic bioscience has a challenge in this respect to develop local substitutes for fertilizer that are cheap, effective and efficient. Animal droppings, household waste and even local grass are inputs into the transformation process. Evidence has shown that local household wastes have been transformed into usable farm inputs through composting (Tafah et al, 2001), which increase agricultural yield substantially. Such transformation could in turn generate income for those involved in this activity. By so doing bioscience will not only improve the yield in agriculture but would increase income at the micro level with consequent implications at the macro level.

Agricultural endeavours over the years have been characterized by attempts to select the best varieties of plants and animals that are deemed to be superior to others. As Gray (2005:3) has aptly put it:

“Selection of improved varieties probably began in an unintentional manner, but became more organized over the millennia. Eventually, the possibility of selective breeding of plants (and annuals) was recognized and became the cornerstone of modern agricultural development”.

Efforts at selecting the best varieties of crops in developing countries are very slow. This explains why most of the farmers are still in the subsistence stage. Improved variety not only increases the yield per acre but will improve the income situation of the farmers.

In the two – farmers’ example above, one of the reasons why the American farmer produces more is because research into improved variety enables him to increase his output. Modern agriculture is the foundation of modern civilization. Improved variety can transform the life of the subsistence farmer and allows him to pursue very many other activities. Here lies the challenge of bioscience and biotechnology. Gray (ibid) puts it this way “*The development of plants into diversity of useful items and products ... using unimaginable ideas continues today. Breeding programs are being revolutionized with biotechnology, leading to plants that have properties we never anticipated*”.

The challenge of bioscience and biotechnology equally lies in the transformation of local products in order to add value. Adding value to the agricultural products of our countries is a *sine qua non* for agricultural transformation in Africa. Should cocoa, coffee, cotton, timber, etc be exported in their raw forms? How can these be converted to semi finished products so as to increase their values and enable the countries earn more income from their endeavours? Transformation in the domain of food crops is equally necessary to avoid waste and increase income of the farmers. How can cassava, yams, potatoes, plantains, etc be transformed to usable flour? Sweet potatoes are being used as an ingredient in the baking industry in Bamenda. This is only a tip of the iceberg on what research can do. Basic research can transform this on a large scale. Recorded success will revolutionize the cultivation of sweet potatoes. This will not only increase incomes but will create jobs and impact on the balance of payment of the country through the saving of foreign exchange on the importation of some of the ingredients being substituted by sweet potato flour.

Many African countries produce a variety of products for export – some perishable while some are not. The perishable products are very vulnerable and therefore timing becomes very essential. Most of these perishable products, if not properly conserved, become damaged before reaching their destinations. In addition to this, the quality of exports is essential in global competition. Quality control therefore becomes very essential in the ability of a country's exports to compete favourably abroad. The recent return of Cameroon's pineapples from abroad because of low quality is a clear illustration of this point. What quality control measures can bioscientists and biotechnologists put in place to enhance the competitiveness of these products? This brings us back to the problem of local transformation in order to add value and for preservation.

Agriculture and Biodiversity

As mentioned above, one of the developmental problems that has to be grappled with is the sustainability of environmental resource exploitation. One of the major causes of environmental degradation is rapid population growth. Serageldin and Perslay (2003) confirm this assertion by alluding to the fact that more and more people are crowding the towns thereby creating food problems – "... having given up their own lives as self-sufficient farmers, they will no longer be able to feed themselves from their own fields" (p.75). The bid to feed the rapidly growing populations in both rural and urban centres has led to excessive exploitation of the environment with the consequent problems of environmental degradation and loss of biodiversity. In other words, rapid agricultural expansion to feed rapidly growing populations has a direct effect on the environment. As Pagiola et al. (1998) aptly describe:

"Agricultural expansion is a major contributor to the loss of biodiversity. Conversion of natural habitat to agricultural use substantially reduces its biodiversity. Naturally occurring plant species are replaced by a small number of introduced species...; wildlife is displaced; and insects and micro organisms are disseminated by pesticides" (p.38).

Such biodiversity damage and/or reduction threatens the many important benefits provided by diverse ecosystems such as *“improving water availability for irrigated agriculture, industry or human consumption ... providing recreational opportunities, and providing essential habitats for economically important species”*(ibid).

Biodiversity is equally very crucial to agricultural development. According to Pagiola et al (ibid) *“Many of the benefits of biodiversity accrue to agriculture itself... Although human management has often greatly modified natural ecosystems, agricultural activities still depend on many biological activities, the provision of genes for the development of improved crop varieties and livestock breeds is an important element, but far from the only one”*. To this is added others such as crop pollination, soil fertility services provided by micro organisms and pest control services provided by insects and wildlife. Thus a two way relationship exists between agriculture and biodiversity so that the damage of biodiversity usually has implications for agriculture.

This brings us to the problem of sustainability through the rational exploitation of the environment. Bioscience research has a major role to play in finding solutions to the sustainability of environmental exploitation and the maintenance of biodiversity. This can be done in the areas of regeneration, conservation and intensification of agriculture. This must be coupled with other macroeconomic policies in order to enhance the sustainability of the environment.

Bioscience and health

Health is a vital component of development and an end in itself *“Health is central to well-being; it is “fundamental to the broader notion of expanded human capabilities that lie at the heart of the meaning of development”* (Todaro & Smith, 2003: 394). LDCs are beset with so many health problems that have tended to impede their development processes.

The United Nations Development Program in its 2001 *Human Development report* brought out some indicators of health from which many LDCs are deprived. In the report, 766 million people lacked access to health services; 968 million lacked access to safe water; 2.8 billion lacked access to sanitation; 11 million children die before the age of five from preventable diseases; 163 million children under the age five are underweight; and more than 34 million people live with HIV/AIDS (Todaro & Smith, *ibid*: 90).

These health indicators and others from which LDCs are deprived are caused by, and a cause of, poverty to a large extent. Many people cannot afford the basic drugs which can be used to prevent the most common diseases.

The African ecosystem is so rich and diverse. Such rich and diverse ecosystems contain genetic materials that can help develop useful products such as pharmaceuticals to prevent some of the common diseases. Bioscience and biotechnology have a very crucial role in this area. A lot has been done in this area and more still has to be done to find solutions to common diseases such as malaria, which remains the number one killer in tropical Africa. The solution lies in finding effective and cheap, but efficient cures and preventive drugs. This will not only improve the health situation, but will impact on the development and growth of the economy and increase incomes of workers who will become healthier.

One of the health indicators that impact much, and on which life depends is water. The adage that “*Water is life*” summarizes the crucial nature of water. As indicated above, many people in the developing world are deprived of safe drinking water sources leading to water borne diseases. Apart from this, many of the reliable and clean sources for drinking water and for other uses are gradually drying up. In some places some of the watersheds have completely disappeared. This has been attributed to agricultural activities and desertification in some cases. One way of protecting water shades is through tree planting. The question is: what specie of trees? Again, we throw the challenge to bioscience. Trees are of different

varieties. Some are water 'guzzlers' while others are water 'preservers'. Apart from this, some of these trees have other economic values. Research into the best types that preserve water and are of high economic value will easily be acceptable to the people. Thus to convince those who cultivate around water sources to plant trees, these trees must be good substitutes for their abandoned crops.

Conclusion

Which way forward for Bioscience?

In this paper, we have attempted to show that development is a complex concept, embracing many issues including the exploitation of the environment in which we live. The basic objective of development is to improve on the general wellbeing of the individual. The improvement of the wellbeing of the individual involves the interaction of many forces and disciplines including bioscience.

Although the goal of Bioscience is to develop basic biological science knowledge, however, this knowledge should not be for the simple sake of scientific study, but to exploit it for the development of our environment and the general wellbeing of individuals. To this effect, agriculture, on which many LDCs will depend for a long time to come, is a clear example where bioscience knowledge can be used to effect certain actions that will transform the lives of people. Agricultural practices and resources can be exploited in a rational manner that will improve not only the practices but can transform some of the resources into basic commercial successes. The challenges of Bioscience and Bioscientists are enormous. However, Bioscientists alone will not be able to face this challenge. They need the cooperation of economists, policymakers and other scientists and technologists to carry out this daunting task of translating bioscience basic into commercial successes.

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