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ROLE OF BIOTECHNOLOGY IN SUSTAINABLE DEVELOPMENT

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ABSTRACT
Biotechnologies have played an important role in the development of food products over many centuries. In recent years the "modern biotechnologies" of molecular biology and gene technologies have gained a significant role in the cereals sector, sustainable development goals that embody ecological, social, and economic requirements. In addition, biotechnology should be considered one tool in a larger portfolio of technological options, to be applied where it is needed and where it offers the best available option for solving specific problems. Biotechnology contributes a significant role to fulfill the desired nutritional requirements of blasting population of the world.

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INTRODUCTION

By 2030, the world's population is expected to grow to 8.1 billion at a rate of over 75 million people per year. Almost all of the population increases will occur in developing countries (FAO 2000) that can ill-afford additional population pressures. Based on a population-increase-only projection with per capita consumption remaining constant, world cereal production must rise from approximately 1.92 billion tons in 1990 to 2.88 billion in 2030 to match the demand[1]. Although the number of undernourished people in developing countries is expected to decrease; the global food-system situation will continue to be unacceptable. However, even if we resolve the issue of distribution in the short run, the future growth in food demand will require increases in productivity from a decreasing stock of arable land. The challenge, therefore, is not only to feed more people, but to do so with less available arable land, fewer nonrenewable resources, less water, and fewer people engaged in primary agriculture[2].

A number of significant trends in both the agricultural production and food processing sectors have led to a closer integration of these sectors. The past decade has seen a continuing move away from an historical commodity focus towards an emphasis on value-adding. At the same time the integration between agricultural production and food processing has been driven by a variety of competitive forces leading to what is now termed the "Agri-Food Value Added Chain[3].

The emergence of modern biotechnology has invoked a major global controversy over the future of world agriculture. The debates surrounding this controversy have often reflected the interests of developed countries and paid little attention to the needs of developing countries, especially those needs related to food requirements of low-income population.

ROLE OF BIOTECHNOLOGY

The application of technologies in cereals industries has become a critical competitive factor in the success for these industries.

Technologies have played a role in the integration between the agricultural production sectors and food processing.

Technologies are a vital element in the development of new value-added food products.

Technology is fundamental to all businesses in today's agri-food marketplace.

Technology provides the principal, and often only, route to:

- Differentiating products
- Reducing cost
- Providing new business opportunities
- Aligning food products with consumer needs
- Facilitating and supporting strategic change.

Biotechnologies have played an important role in the development of food products over many centuries. In recent years the "modern biotechnologies" of molecular biology and gene technologies have gained a significant role in the cereals sector. Sustainable development goals that embody ecological, social, and economic requirements. In addition, biotechnology should be considered one tool in a larger portfolio of technological options, to be applied where it is needed and where it offers the best available option for solving specific problems.

Another potential area for biotechnology application is the development of livestock that is tolerant to many tropical diseases. Modern methods, such as genomics, could be applied in this area without requiring transgenesis. Also related to agricultural production is the significance of revegetation in marginal areas. Investment in fast-growing plants could help facilitate ecological restoration in many denuded regions of the world. Such research could also add to the fodder available in these countries.

CURRENT TECHNOLOGICAL TRENDS

Transgenic applications are currently limited to soybeans, corn, canola, and cotton. Transgenic soybeans covered 25.8 million hectares in 2000; corn, 10.3 million hectares; cotton, 5.3 million hectares; and canola, 2.8 million hectares. The bulk of the crops express herbicide tolerance and disease resistance.

These trends show that the early diffusion of transgenic crops has been largely in the temperate regions and has been limited to a few major commercial crops. The promise of biotechnology where genetic modification has been used to introduce incremental changes in existing crops. These incremental changes explain why the distribution of transgenic crops is limited to geographical areas with similar ecological conditions.

The promise of transgenic applications has not been realized for two main reasons. First, crop development for low-income families, such as the Green Revolution, has traditionally been carried out by the public sector. However, the biotechnology has emerged from the private sector, which lacks the incentives to invest in crops for low-income families. Second, agricultural research in the public sector has been declining, and therefore little investment has gone into developing crops for low-income families. The situation is not likely to change without a redirection of existing research priorities in private enterprises, stemming from appropriate incentives as well as significantly increased public sector funding for agricultural research[5].

The choice of technology should be driven by the determination of local needs. Many developing countries have already indicated priorities that could be addressed using genetic modification in their agricultural development strategies. Many African countries, for example, lie in regions where drought tolerance, disease resistance, and crop-yield increases are priorities. Crops such as cassava, millet, yams, millet, and sorghum are prime candidates for genetic modification. Modification that seeks to prolong the shelf life of foods could help reduce postharvest losses significantly. The use of herbicide tolerance in low-till agriculture is another high priority, especially in helping to lessen farm labor and providing farm workers most of whom are women with opportunities to engage in other activities[6].

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CONCLUSION

Recent advances in agricultural applications of modern biotechnology show a significant potential of agricultural biotechnology to contribute to sustainable gains in agricultural productivity, reducing poverty, and enhancing food security in developing countries. As these innovations are increasingly adopted, impact assessment becomes a critical tool for addressing potential socioeconomic and environmental costs and benefits. A key question, however, is whether conventional economic impact assessments are comprehensive enough to address the complex nature of a rural community in a developing country. To further knowledge of the impact assessment of biotechnologies in developing countries, IBS organized a consultation to analyze various approaches and case studies regarding the socio- economic impact of biotechnology on the poor in developing countries[8].

The sustainable Livelihoods Framework considers the vulnerability context, policies, a community portfolio of assets, institutions, and the linkages between these components. It is well suited to address the shortcomings of conventional socioeconomic impact assessment methodologies in analyzing poor communities in developing countries.

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Table 1: Techniques used for sustainable development[4]

S. No.	Technology	Product	Traits
1.	Micro propagation Disease free plant material	 Plantain/Cassava Banana Banana Sweet Potato	 Virus-Free plant material Virus-Free plant material Virus-Free plant material Virus-Free plant material
2.	Genetic Modification B1 Toxin expression Stress tolerance/ B1 or CPTI expression Disease Resistance and Quality	 Potato Rice Tomato/Rice Papaya	 Insect Resistance Insect Resistance Cold Tolerance / Insect resistance Virus resistance and Delayed ripening
3.	Other applications Various Recombinant Vaccine Disease Diagnosis	 Cattle Shrimp	 Bio-Village Concept East coast fever Yellow Head Virus

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