

Perspective

Fostering biotechnology entrepreneurship in developing countries

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The climate for commercial biotechnology in several developing countries is improving. As a result of the growing science base, biotechnology companies can successfully be located and thrive in these countries. The rewards which can flow from the successful exploitation of research should encourage investment in biotechnological activities.

Key words: Entrepreneur, biotechnology, investment.

INTRODUCTION

The biotechnological revolution has been characterized by the rapid pace of discovery in the biological sciences, and a tremendous impact on both fundamental and applied research. Biotechnology is multidisciplinary encompassing microbiology, chemistry, biochemistry, genetics, molecular biology, immunology, cell and tissue culture and physiology, as well as engineering. Proponents around the world project a positive future in which biotechnology overcomes food shortages, improves the environment, heals or eliminates disease and leads to a prosperous and healthy society.

PRODUCTS AND PROSPECTS

Products and services that are derived from biotechnology has been the driving force behind the establishment of biotechnology companies. For the pharmaceutical sector, these products include recombinant vaccines, hormones, vitamins and antibiotics. In plant biotechnology, engineering for insect and disease resistance, as well as storage protein and other nutritional improvements has been the trend. Furthermore, potential benefits from tissue culture, bio-fertilizers, bio-pesticides, and medicinal plants are tremendous. Plants also have considerable potential for

the production of biopharmaceutical products because they can be genetically transformed. Delivery of a biopharmaceutical product by direct ingestion of the modified plant removing the need for purification is very promising. Such biopharmaceutical proteins and edible vaccines can be stored and distributed as seeds, tubers, or fruits, making immunization programs in developing countries cheaper and potentially easier to administer.

Efficient sewage treatment and degradation of petroleum and management of oil spills by genetically modified microorganisms can be being applied to improve the environment. Industrial biotechnology has evolved as a significant manufacturing tool for products like fuel-grade ethanol, organic acids and bulk amino acids. Current development projects within the chemical industry, including lactic acid and biodegradable plastics, indicate that new biotechnological processes and products may soon approach the market place as alternatives to petrochemical products.

Developing countries are already benefiting and should continue to benefit significantly from advances in plant biotechnology. Insect-protected cotton containing a natural insecticide protein from *Bacillus thuringiensis* (Bt cotton) is providing millions of farmers with increased yields, reduced insecticide costs and fewer health risks. Many other useful plant biotechnology products that can

benefit poor farmers and consumers are in the research and development pipelines of institutions in developing countries, and should soon reach farmers' fields.

INVESTING IN BIOTECHNOLOGY

The original investment in basic science research has delivered truly incredible dividends. Through the creation of highly skilled jobs and contribution of billion of dollars to western economies, biotechnology provides the promise to vastly improve the quality of life. The new knowledge generated by investment in biotechnology research has led to a bounty of potential applications for improvement of health, which are being explored for commercial purposes by the biotechnology industry. This success can be attributed to the collaboration between industry and academia.

After a slow start, many developing countries are now investing in agricultural biotechnology. Although these countries face several constraints, efforts are being made to promote biotechnology that requires high investment with long-term returns. Nevertheless, more public investment is needed, as well as new and imaginative public-private collaboration to make this knowledge beneficial. Biotechnology research is now done in universities and research institutes in developing countries, and the number of academic degrees awarded in this field has increased in recent years. Furthermore, several scientists from developing countries have acquired biotechnology expertise, and most have been actively involved in the research in laboratories in western countries. A strong science base is one of the strongest factors for start-ups in life sciences. Most of these start-ups spin out from universities, and research institutes.

The requirement of adequate infrastructure is a critical factor for the establishment of biotechnology companies. This includes laboratory facilities, research equipments and other physical aspects. Additional factors such as management support and pilot plant facilities are also significant. While research and development budgets for biotechnology research are only beginning to pick up in developing countries, start-up funding for biotechnology companies is still very rare to come-by. Financing early stages of business development could be achieved through seed funding, easier access to loans and venture funds. Specific biotechnology funds supported by governments and international agencies, and dedicated to investment in biosciences and biotechnology companies will have a real impact.

Business incubators are unique in stimulating spin-offs from universities and research institutes, and offering young companies a dedicated space to develop their activities during the first years. However, such incubators are still very uncommon in developing countries. These incubators provide advice and mentoring for start-up

businesses, are becoming a vital strategy for nurturing young businesses. Biotechnology clusters that shares facilities and provides a supportive environment is another good strategy for commercializing research. Furthermore, access to patents at affordable license fees and relaxed biotechnology regulations will encourage young companies and investors. Tax assistance to build laboratories and to offset the long-term losses associated with biotechnology research is an important incentive for investors. This would be particularly important for smaller companies that must invest years of research before getting to the payoff of a successful product.

The often-emphasized negative view of biotechnology especially about genetically modified organisms in most developing countries' newspapers will surely hurt biotechnology innovation and acceptability. To counteract this, researchers should be more involved in societal issues and write comprehensible articles in these newspapers.

THE BIOTECHNOLOGY ENTREPRENEUR

Biotechnology has a major impact on almost all major sectors of industry and represents a major element in the transition from an agricultural-based to a knowledge-based economy. Nevertheless, the development of improved technology for agricultural production and its diffusion to farmers is a process requiring investment and time. In industrialized countries, biotechnology is viewed as an all-pervasive profit-generating technology and a strategic component of industrial competitiveness. In developing countries, the translation of this science base into commercial business is very much needed. There are so many products imported in several developing countries that can now be manufactured using biotechnology. Moreover, several developing countries have strategic advantages in some natural biological resources that can be exploited for their development. The challenge is to ensure that these ideas are marketable as value-added products.

At the forefront to exploit biotechnology in developing countries should be the entrepreneurial scientist. Such a person should have both research and management skills including marketing and intellectual property rights, and understanding of scientific regulatory and ethical issues. Biotechnology has been the path by which a number of scientists, researchers and investors have boosted their wealth over the past year. Some of the activities waiting to happen include:

1. Taking the results and products of government or international research and creating services around discovery or producing such products in commercial quantities. For example, multiplying improved seeds for sale to farmers.
2. Establishment of a well equipped and staffed

biotechnology companies to exploit the unique features in developing countries such as medicinal plants or genetically modification of profitable crops.

3. Genetic (DNA) testing, quality control and environmental assessment. Application of DNA fingerprinting for identification of parents or solving crime is also a fast growing area of biotechnology.
4. Other auxiliary companies and institutes such as biotechnology training and meeting centers, publications, venture capital firms and consulting.

In recent years, the researcher-entrepreneur has become a role model in research institutions and business circles. Formerly, most of these researcher-entrepreneurs who set up their own companies were scientists who had achieved recognition. But today, most are younger researchers who have specialist knowledge and are attracted by the capitalist adventure. Therefore, to support the acquisition of such specialist knowledge in developing countries, courses with emphasis in molecular biology, genomics, proteomics, bioimaging, and bioinformatics must be included in the curriculum. Biotechnology business-related courses will also provide students an introduction to the complexities and unique problems of entrepreneurship. There is need for would-be entrepreneurs to be exposed to the topics most critical to successfully founding, financing and operating a biotechnology company. Hence, universities should let role models give entrepreneurial courses especially to scientists, provide biotechnology enterprise fellowships, and increase awareness about patents and their possibilities.

CONCLUSION

Biotechnology is now one of the hot areas driving the stock markets as well as a frontier of knowledge and job creation. Just as the provision of research grants is a major issue, entrepreneurship and financing for biotechnology companies should also be high on government policy and educational agenda. Biotechnology can only be entrenched in developing countries with the establishment of a strong research base and entrepreneurial culture. Developing countries' scientists who summon enough courage to take part in these ventures will become part of the business elite of the future. Finally, any country that can assist its scientists and entrepreneurs in successful biotechnology start-ups will enjoy economic growth.

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