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Africa Needs Biotechnology Incubators

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Abstract: The primary goal of technology incubators is to promote the development of technology-based firms while encouraging entrepreneurship among researchers and academics. Biotechnology incubators will help individuals and firms move research from academic laboratories to the marketplace for the benefit of mankind. African governments should provide scientific and business equipment and support services to create an appropriate setting for biotechnology startups. This will establish the continent as a player on the life science frontier and biotechnology innovation.

Key words: Biotechnology, incubator, entrepreneurship, Africa

INTRODUCTION

The rapid evolution of the technology-driven global economy is placing an ever-increasing emphasis on effective development of new technology and its speedy commercialization into the marketplace (Mian, 1997). Business incubators such as Hotbank, CMGI and Idealab are a booming industry (Hansen *et al.*, 2000). Offering office space, funding and basic services to start-ups, these organizations have become the hottest way to nurture and grow fledgling businesses. Small business incubators have become vital to the creation of thriving new enterprises in the developed economies. They serve as an important intermediary in commercialization. Technology incubators are involved primarily in the commercialization of new products and services using recent developments in the fields of biotechnology, information technology and telecommunications. Technology incubators have become an accepted mechanism worldwide for supporting the development of new technology-based firms. Through the sharing of resources, incubators can realize the synergies between the needs of research organizations and the needs of start-up firms. They provide support through the use of shared facilities, the provision of core training in business management, assistance in the preparation of the business plan, access to information and much more.

The ability of firms to innovate and grow is widely recognised as the fundamental driving force behind rising incomes and living standards. Small innovative firms, including new technology-based firms, are a major part of this process as they speed structural change and create new jobs to replace those destroyed by the decline of older industries or the downsizing of large firms. Technology incubators are a means of increasing returns from public research and development spending by

promoting its commercialisation and diffusion. Universities and research institutes in Africa have not been to develop the incentives and institutional linkages that have made biotechnology a major source of jobs in the western world. Just as the provision of research grants is a major issue, entrepreneurship and financing of 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. 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 (Tonukari, 2004a). Moreover, it is becoming insufficient to dream up scientific ideas, test them in the laboratory and just publish the results. The concept of the incubator is to take one step further to create a product or service from the knowledge. This is especially necessary since most university technologies need further development to become commercially viable. For local start-up companies to exploit such new technologies and develop them commercially, they need the specialized facilities, equipment and business support of the incubator to increase their chance of success.

BIOTECHNOLOGY INDUSTRIES

Biotechnology industries are at the forefront for a new kind of technological revolution. Biotechnology research has vast potential for commercialization in the areas of agriculture, human and animal health, environment, diagnostics, immunobiologicals, blood

products and various industrial products like antibiotics, industrial enzymes, vitamins and other biochemicals. Literature and documents with information on biotechnology issues in diverse fields including industrial ecology, *in vitro* culture techniques, transgenic technology, genetic conservation, molecular diagnostics and biopharmaceuticals are available (Tonukari *et al.*, 2003).

It is no secret that Africa is much behind in the field of biotechnology. With a plethora of natural resources, African governments must invest public funds to enhance technology commercialization. There is, however, cause for some optimism. The plan by The New Partnership for Africa's Development (NEPAD) to set up Biotechnology Centers of Excellence is wonderful as they will create a critical mass of biotechnologists to stimulate the economic development of biotechnology. The ultimate goal of such Centers is to make substantial financial investments in people, laboratories and equipment. Nevertheless, these will remain glorified research institutes producing brains for export unless they have an incubator to try out their ideas and innovations. Therefore, NEPAD should also draw-up plans to start low-cost incubators. This will lead to a strong and conscious determination to position Africa at the forefront of leading edge technology and scientific research, commercialization and industrial growth (Tonukari, 2004a)

As a high capital-intensive venture, there must be direct governmental program to establish or expand biotechnology expertise, capabilities and innovations. This can be achieved through the establishment of biotechnology incubators close to universities where most of the knowledge are produced. In order to assure innovation, the biotechnology incubator should be established alongside a postgraduate research laboratory with accreditation to offer courses leading to Ph.D degrees. Such postgraduate education is very much needed as most African Countries lack central facilities to conduct high technology research. Synergies between the biotechnology incubator and postgraduate school will provide much needed expertise and funding for research. Also research findings from such institution can provide the basis for a start up company. The whole concept is to have a blend of research, incubation and commercial activities. It is also necessary to realize that good scientists worldwide now require more than a salary and laboratory. They want an opportunity to benefit financially from their work. Commercialization of research must now be considered to be an appropriate academic function. Biotechnology incubators will expose university lecturers to the concept of entrepreneurship. They will

become a forum for academicians to discuss and consider commercialization of their scientific findings, especially in conjunction with small start-up companies located nearby.

Postgraduate-degree awarding and research institutions serving biotechnology incubators should be focused only on high-tech research including discovery-based research and technology development in the areas of functional genomics instrumentation, gene discovery, drug design and delivery and biosensors. They should also conduct research that will lead to the development of new therapies to effectively prevent and treat disease. In order to achieve these, they must have the facilities to perform high throughput operations in gene expression, protein scale-up and purification, combinatorial chemistry, structural biology and pharmacogenomics. Furthermore, they must also focus on the application of genomic theories and technologies to solve problems in agriculture, biosciences, bioengineering and veterinary medicine. However, more urgent is for these Centers of Excellence is to conduct research leading to the production of common pharmaceuticals, biochemicals and nutraceuticals that are currently imported into Africa. Other important research focus should be food and feed production, genetic screening and alternative medicine. These are areas where biotechnology incubators will make a quick impact if they participate and commercialize such research.

BIOTECHNOLOGY INCUBATORS

Much has been written about the poor facilities and state of economy of sub Saharan countries. However, there are still innovative research groups coming up with excellent knowledge and services. The International Livestock Research Institute (ILRI, Kenya) biotechnology group has successfully used advanced molecular techniques to isolate vaccine candidate genes (Graham *et al.*, 2006), which has now been patented in several countries including USA, Kenya and Mexico. The institute currently is conducting animal trials on the vaccine it has developed with this technology. Furthermore, the currently increasing cassava production will lead to higher amount of starch available making it cheaper for industrial processes and opening up new markets. There is also abundant capacity in many tropical countries such as Nigeria to increase cassava production (Tonukari, 2004b). Several research groups are focused on diverse application of cassava tuber especially in the production of biochemicals. There are also several opportunities to apply the new biotechnologies such as bioinformatics, genomics, microarrays and proteomics.

Biotechnology incubators should be designed to help small and medium enterprises, specially the young entrepreneurs who are not in a position to secure high capital but have capabilities to develop, design and perfect new biotech products and processes. Such biotechnology incubator program should be for start-up or early stage companies that need to conduct research for new products or services in the molecular life sciences. The objective of the biotechnology incubators will be to foster the development of new commercial ventures in all areas relating to the molecular life sciences including medicine, agriculture and the chemical and environmental sciences. The primary mission will be to provide space, equipment and support services to expedite research and commercial development of promising biotechnologies in the context of viable, well managed start-up companies that will benefit the economy. According to Wiggins and Gibson (2003), typical services offered by technology incubators:

- Assistance with business basics
- Marketing assistance
- Accounting/financial management
- Investor and strategic partner linkages
- Networking activities
- Links to higher educational institution
- Conference rooms and other shared facilities
- Shared administrative services

For biotechnology incubators, typical laboratory facilities to be provided should include Cell banking, molecular biology laboratory, genomic and proteomic laboratory, cell cultivation and fermentation laboratories and pilot plant facility for microbial and non-microbial systems. In addition, custom DNA sequencing, proteomics, electron microscopy, flow cytometry, hybridoma and computing services ought to be provided for a subsidized fee. Furthermore, business seminars, business plan assistance, introductions to experienced lawyers, accountants and other service providers including banks, assistance recruiting management team and graphic design/illustration support for logos, PowerPoint presentations, website, brochures and other graphic needs to be provided by the facilitators of the biotechnology incubator. Other requirements include furnished entrepreneurial offices with high speed internet, conference rooms, library, low cost copying/printing facility and digital projector and whiteboard for presentations. Incubators create environments of learning and sharing in which information, experience and ideas are freely exchanged.

Biotechnology incubators will encourage commercialization of faculty and student discoveries, increase technology transfer, stimulate collaborative research projects between local companies and universities, provide opportunities for student research and employment and contribute to Africa's academic competitiveness in recruiting and retaining lecturers and professors. They will also serve as a magnet for large foreign companies active in biotechnology. Economically, biotechnology incubators will provide a financial return to investors and stakeholders, encourage a return to public health from public investment in research, translate university and institute's research results into products that solve unmet needs, attract new and existing companies to Africa and stimulate economic development and competitiveness. Tenants of such incubators should be start-up companies with access to business services and entrepreneurship training, as well as assistance in accessing grants, prizes and other funding opportunities. The companies should be granted one-year renewable terms, subject to an annual review of the company's progress.

The biotechnology incubators should be established as a commercial business ventures. Each incubator should be led by a Chief Executive Officer (CEO) and have a board of directors and other officers that will carefully screen and accept tenants that have viable projects (Fig. 1). They will serve as the link between the government, business communities and the bioentrepreneurs. They will also negotiate for substantive government support, state of the art laboratory facilities and access to an extensive network of potential investors. The incubator management would assist the would-be entrepreneurs with assessing the commercial potential of their technology and forming a company, as well as forming a mentoring board to provide business guidance and strategic insight.

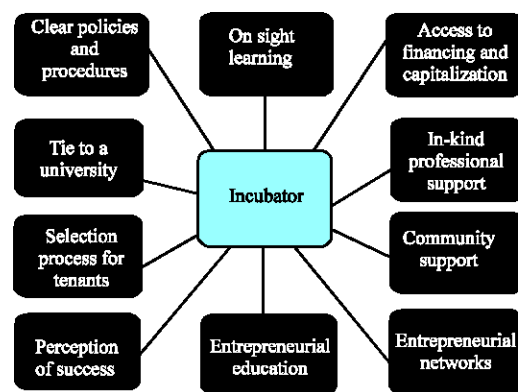


Fig. 1: Ten success factors for technology incubators (Adapted from Wiggins and Gibson, 2003)

RESEARCH COMMERCIALIZATION INCENTIVE PROGRAM

Generally, technology incubators provides tangible and intangible services to new technology-based firms, entrepreneurs and spin-offs of universities and large firms, all with the aim of helping them increase their chances of survival and generate wealth and jobs and diffuse technology (OECD, 1997). Biotechnology incubators will serve as development conduits for the commercialization of life sciences research, products, services and technology platforms. It will attract and nurture the highest quality tenants in this niche area providing business infrastructure, guidance, strategy and financial and legal advice. In addition, it will actively source funding lines for individual tenants and/or projects and assist in the procurement and management of such funds. 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 (Tonukari, 2004a). Initial funding for the biotechnology incubators should come from both the government and private sector and this will allow the establishment of the incubator in terms of infrastructure, branding and marketing as well as provide financial input for tenants on a review basis. The justification for government support lies in market and systemic failures that limit the ability of small technology-based firms to survive impede the commercialisation and diffusion of technology by new firms and of entrepreneurs to overcome the uncertainty and obstacles associated with the early stages of firm creation (OECD, 1997).

The benefits of biotechnology incubators, in terms of contributions to scientific knowledge, human health and quality of life and growth of bio-based industries through the creation of new jobs and new companies, will be very significant within a few years of their establishment. African countries will derive direct economic benefits from well funded biotechnology incubators. As such, there must be a culture of financing intelligent ideas that can lead to good business from the laboratories. A research commercialization incentive program will encourage small businesses, research groups and individual scientists to explore their technological potential and maximize profit from commercialization. This will be in addition to the establishment of biotechnology incubators and pilot plant facilities.

Incubators are a tool for promoting new businesses, especially technology-based firms. A main underlying goal of support for new business formation is job

creation. Approximately half of the estimated 4000 firms that have emerged from German technology and business incubation centres since 1990 are university-spin-offs (OECD, 1997). One of the most important impacts of technology incubators is making universities more aware of industry and giving academic entrepreneurs business skills. Promoting entrepreneurship through incubators is another objective of public support. Entrepreneurship is increasingly recognised as a critical element in the process of innovation and the creation of technology-based firms. There is, however, evidence that the proportion of founders with science Ph.Ds has increased in recent years. Incubators, in particular those located in universities, can act as a laboratory for commercialising the ideas of academics and provide a training ground for entrepreneurs (OECD, 1997).

PERSPECTIVES

There are currently over 600 business incubators in the United States and Canada of which around 90% are sponsored by public agencies, government, academic institutions. Most US technology incubators are directly or indirectly associated with universities, the primary source of trained human and intellectual capital (Mian, 1997).

The very low level of commercialization of research findings should not be seen as a failure of science in Africa, but an indicator of how little university and government administrators have done to take advantage of viable relevant research. Most universities in developing countries' regulations strongly discourage academicians from engaging in other economic activities. Biotechnology incubators will lead to paradigm shift in African universities and institutes; it will encourage academicians and professors to engage in research and consulting for the private sector. Furthermore, incubators provide cheap space for its graduates eager to start businesses. Wiggins and Gibson (2003) conclude that business incubators must accomplish five tasks well in order to succeed:

- Establish clear metrics for success
- Provide entrepreneurial leadership
- Develop and deliver valuable services to member companies
- Develop a rational new-company selection process
- Ensure that member companies gain access to necessary human and financial resources

With a strong national drive to achieve excellence in biotechnology, the establishment of biotechnology incubators and access to strategic market information, local entrepreneurs will also be keen on investing in the

business of developing and marketing biotechnology products. The ultimate goal is to grow indigenous technology and provide employment. This will spawn several small high tech companies initially, some of which may later grow into large corporations. Finally, there must be a culture of financing smart ideas that can lead to good business from the laboratories. Successful indigenous biotechnology companies will provide the foundation for investment in this sector in African and will also attract the already established biotechnology firms in the developed countries to set laboratories, production facilities and partnership. Africa cannot afford to let biotechnology pass it by; its universities and research institutes must engage in commercial ventures that will strengthen the regional economy.

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