

University-Industry Linkage: the New Role of Technology Business Incubators

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Abstract

Life is propelled and satisfied through financial and alternative gains and profits accruing from the various economic engagements that result in the production of needed goods and services. Gross Domestic Product (GDP) is a country's valuable productivity index indicating the standard of living and economic health of the people. The arena of productivity in the mining, agriculture, commerce, health and indeed every sector of human profession is referred to as the industry. Operations in the various industries which directly and indirectly lead to the production of goods and services are executed via firm knowledge leading to the equitable processing and applications that promote productivity. Knowledge acquisition and production, upgrading and updating is the core mandate and activity of higher institutions with the University playing the leading role of the final authority, producer, negotiator and conferrer of knowledge of the most lucrative nature and in the best applicable manner to benefit economic activities in all sectors. Lots of inventions and innovations leading to Startup and Spin off companies are generated from within the university walls. Technology business incubator (TBI) is a broad based supportive outfit which assist technology-oriented entrepreneurs in the startup and early development stage of their firms by providing workspace (on preferential and flexible terms), shared facilities and a range of business support services. The targets of the TBI are usually the Startup and Spin off companies which are supported with administrative, financial and technological inputs till they become free standing concerns. Just as life is dynamic, the system of things and the things as well as their economic and productive processes of creation are also dynamic. This dynamism in any healthy economy is fostered by new knowledge propelling growth in all ramifications. It is envisaged that the economic movement of optimum growth when canvassed through a new strategy wherefore the University-Industry Linkage is enabled by the supportive platform of the Technology business incubator to drive the country's industrial growth and economic stardom. This paper advocates for University-industry linkage involving Technology Business Incubators for optimum industrial and economic growth of the country.

Keywords:

University, Industry, Business, Incubator, Economy, Growth.

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Background to the Study

Economic Growth refers to an increase in the productive capacity of an economy as a result of which the economy is capable of producing additional quantities of goods and services. Normally our standard of living is measured by the quantity of goods and services available to us so that economic growth is synonymous with an increase in the general standard of living. Gross Domestic Product is a measure of the value of the goods and services produced in the economy irrespective of who owns the factors of production used to produce these goods and services. Thus it will be realized that economic growth and growth in GDP are synonymous. Economic Growth is important because it is the means by which we can improve the quality of our standard of living. It also enables us to cater for any increases in our population without having to lower our standard of living (Palmer, 2012).

Production of additional quantities and qualities of new goods and services to promote genuine economic growth; entails not only the three traditional factors of production of land, labour and capital but also the contributions of information, finance and innovation; the possession of which usually enhances the abilities of entrepreneurs to manage the three traditional factors into positive growth. The emphasis of the ingredients of information, finance and innovation make up the new economy currently being enunciated and called the "innovative economy", and emphasizes the role of innovations in economy. The common development of all these parts forms the new economic environment, in which an accelerated generation and implementation of innovation takes place (Abeltina, 2007).

Innovation is essential for sustainable growth and economic development. Innovation is a process of transforming the new ideas, new knowledge into new products and services. Several core conditions enable innovation and encourage economic growth. In the modern economy, innovation is crucial for value creation, growth and employment and innovation processes take place at the enterprise, regional and national level. Innovation will lead to new businesses as well as to the increased competitiveness of existing enterprises. Innovations represent a process, namely an activity of creating a new product or service, new technological process, new organization, or enhancement of existing product or service, existing technologic process and existing organization (Gerguri and Ramadani, 2010).

Entrepreneurship is the mediator and executor of innovation in all ramifications to promote economic growth. It is a dynamic capability to innovatively act in order to create incremental gain. When supported through technology business incubation the impact is fully appreciated and felt in the economy. The company masters the ability to produce and market its new product to obtain high commercial gains and achieve success. The purpose of Technology Business Incubation Center (TBIC) is to provide conducive environment to nurture small businesses. A TBIC's prime goal is to create and grow small businesses, duly supporting them with required technical, administrative and financial assistance. Young graduates are thereby enabled to commercialize new technologies, thereby strengthening local and national economies.

Business Incubation is a process which supports the progress and development of enterprises in their early phase. The TBIC offers entrepreneurs the requisite environment for development of their new enterprise, providing assistance in launching the enterprise at minimal costs and boost the confidence and enhance the capacity of the entrepreneur. It also provides the entrepreneur with the necessary networking with the resources essential in starting and scaling a viable initiative. The business incubators accept entrepreneurs for a certain specified time period till the target profit or sales revenue is obtained. It is difficult to identify an enterprise in its early phase that will not grow meaningfully, if nurturing environment is provided (Mumtaz et al., 2017).

According to OECD, (2010); the purpose of traditional business incubation schemes has been in the past as different as increasing firm survival rates; combating unemployment; contributing to the regeneration of distressed areas; encouraging ethnic-minority entrepreneurship, etc. Technology incubators share some of these objectives – e.g. improving the survival rate of new firms – but also have more specific goals such as:

- i. Strengthening the knowledge component of the local economy, also by engaging more closely the university system with the world of production.
- ii. Creating an environment conducive to technology entrepreneurship; this in turn contributes to local economic competitiveness.
- iii. Providing a nursery for the commercialization of university research, especially when higher education institutions are directly involved in the promotion and management of the incubator.
- iv. Fostering the development of cross-fertilizing technologies such as biotechnologies, nanotechnologies, or material sciences that have several possible industrial applications and have therefore a strong impact on productivity and growth.
- v. Support the emergence of high potential start-ups that can achieve significant progress in employment, sales and exports within a defined period of time (e.g. 3-5 years) (OECD, 2010),

Various components of University Industry (UI) linkages have been in existence for some time in various countries. The formal recognition of UI linkages began with the National Science Foundation's study in 1983. Since then there have been literally hundreds of studies that discuss various aspects of UI linkages such as linkage organizational structure, barriers to cooperative research, management issues, conflict resolution, cultural differences and their effect on cooperative research, financial issues, equity/payoff issues, policy/goals differences, and others (Gander, 2017).

Collaboration between universities and industries is critical for skills development (education and training), the generation, acquisition, and adoption of knowledge (innovation and technology transfer), and the promotion of entrepreneurship (start-ups and spin-offs). The benefits of university-industry linkages are wide-reaching: they can help coordinate R&D agendas and avoid duplications, stimulate additional private R&D investment, and exploit synergies and complementarities of scientific and technological capabilities. University-industry collaboration can also expand the relevance of research carried out in public

institutions, foster the commercialization of public R&D outcomes, and increase the mobility of labor between public and private sectors (Guimón, 2013).

The innovative entrepreneurship drive fostered by the mandate and characterizing activities of Technology business incubators occupies a third party sit that greatly enhances economic growth when infused into the University-industry linkage mechanism leading to industrial fast tracking and assured consistent economic growth that is impactful on a nation's GDP. This is the position of this study.

Statement of the Problem

- i. Nigeria is unable to produce her own military hardware with which to defend herself if the need arises.
- ii. Nigeria cannot produce capital goods such as tractors, lathe machines, drilling machines, cars, trains, and other earth moving equipment.
- iii. Nigeria is unable to exploit her natural resources except with the help of foreigners who will normally provide the technology and expertise to undertake the exploitation of her natural resources.
- iv. Nigeria is unable to mechanize her agriculture i.e. crude implements are still used for agricultural production activities by a large percentage of those who are involved in agricultural production.
- v. Nigeria depends on other countries for the supply of its spare parts for industrial machinery
- vi. Nigeria exports raw materials to other countries as against finished products

Uwaifo and Uddin, (2009) states that Nigeria's shortcoming in meeting the above stated conditionality marks her out as a technological backward country. The poor economic condition precipitated by the inability to engender requisite productions in several sectors is conspicuous and effecting the masses abysmally. This study emphasizes that promoting industry productivity through an Academia-Industry linkage brokered by the technology business incubation mechanism will ensure qualitative and quantitative increase in need driven products.

Methodology

Data for this paper were derived from secondary sources; previous researches and analyses of scholars, government documents; as well as journal articles that are related to the subject. The study involved an extensive literature review which critically analyzed the present status of weak industry linkage touching the technology incubation programme remotely and in most cases coincidentally.

Technology Business Incubation Programme (TBIP)

TBIP is a business support process that accelerates the successful development of startup and fledgling companies by providing entrepreneurs with an array of targeted resources and services. These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts. A business

incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding. These incubator graduates have the potential to create jobs, revitalize neighborhoods, commercialize new technologies, and strengthen local and national economies.

In general, a business incubator will focus on a range of services on clients that are designed to help them launch well managed businesses. This mix of services is generally drawn from: administrative services (photocopying, bookkeeping, etc.); business advice services (coaching, counseling, mentoring, training), technical services (technical advice, access to expensive equipment, etc.), finance raising, and networking opportunities (between clients, links to wider business community). Other services (loan & venture capital funds, lobbying for special services/bureaucratic treatment, etc.) are sometimes developed to help clients overcome specific problems in the given business environment. Clients can be resident, non-resident or affiliated to the incubator. The services targeted on clients are costly in relation to many other types of business development services (training programs, advice services) but are justified by supporters as “investment in success” because the concentrated support services should lead to higher survival and growth rates of incubated businesses (InfoDev., 2010).

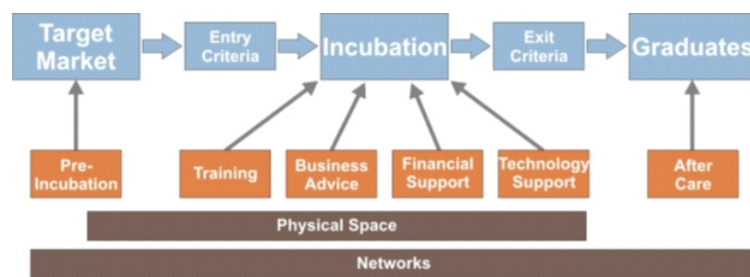


Figure 1: A typical business incubation process (InfoDev., 2010).

Figure 1 depicts the general incubation process. The prospective incubatee after meeting the entry criteria is admitted and during incubation is supported with training, business advice, funds and technology knowledge. On graduating from the TIC, the graduated entrepreneur is still eligible to access some advice as “After Care Services” (referred to as Post incubation in the TBIP scheme) till he becomes financially viable and freestanding. Business incubation practice, all over the world is structured in the pattern shown in Figure 1 above, but the objectives may differ from country to country. For instance the Jewish State of Israel in 1991 launched Nationwide Technology Incubation programme to utilize the S&T potentials of immigrants from the Soviet Union. The programme is a tremendous success. When the United States recognized the existence of critical mass of scientists, technical infrastructure, ethnically diverse and world-class universities in the system they launched the “Silicon Valley Incubator” which generated 7,000 electronics and software companies, 300,000 top scientists (1/3 born abroad) with many new firms and new millionaires made almost every month. (Adelewoetal, 2012).

The goal of TBIP is to assist small scale budding entrepreneurs to overcome the initial hurdles of carrying viable R&D results as well as innovative efforts into profitable enterprises (FMST, 2005). And the mandates are:

- a. Provide a platform for speedy commercialization of technologies by effectively linking talents, technology, capital and knowledge.
- b. Create, nurture and develop value-added technology-based enterprises.
- c. Promote the establishment of and management of viable science and technology parks, technology incubators and technology-based enterprises.
- d. Enhance linkage of tenant/technology know-how and capital in order to develop techno-entrepreneurship culture based on continuous value addition.
- e. Promote and facilitate the application of indigenous technologies and knowledge.
- f. Set standards for and regulate the establishment and management of Science and Technology parks and Incubators

University and Industry

The universities are sources of two most valuable assets for economies: educated skilled people, and new ideas. Through their teaching, universities disseminate knowledge and improve the stock of human capital; through the research they perform, universities extend the horizons of knowledge; and by their third-mission activities, they transfer their knowledge to the rest of society, work with industry and create the seeds that lead to new companies. While this third stream of activities builds upon the first (education) and second (research), it has not been 'core' in the same way as the first two streams of university activity. However, these 'third stream' or 'third mission' contributions are increasingly seen as important and distinctive in their own right, deserving of specific policies and resources to ensure their effective functioning (Veugelers and Rey, 2014).

Universities have long been recognized as sources of knowledge creation, innovation and technological advancement. Globally from western developed countries to China, Brazil and other emerging economies, universities are positioned as strategic assets in innovation and economic competitiveness, and as problem-solvers for socio-economic issues affecting their countries. In terms of teaching and training, University-Industry activities include offering professional courses on a fee-basis to respond to the particular skill and training needs of the industry (Molla, 2014).

While universities are a key sector partner to the Industrial Strategy through their education exports, there is so much more universities can do to drive economic growth. Apart from the direct commercialization of their own research, innovations generated through business-university collaboration are critical to growth in new businesses and driving efficiencies and value in existing businesses. Nowadays, universities are demanded not only to play an active role in education and science and technology development, but also increasingly to turn those scientific developments into useful innovations whenever possible and desirable. Throughout the world, governments – national, regional and local – are seeking ways to strengthen the “third stream” role of universities as agents of innovation based growth, looking for a more direct and larger scale involvement of universities in knowledge transfer than ever before (Veugelers and Rey, 2014).

Table 1: A typology of university-industry linkages, from higher to lower intensity

High (Relationships)	Research partnerships	Inter-organizational arrangements for pursuing collaborative R&D, including research consortia and joint projects.
	Research services	Research-related activities commissioned to universities by industrial clients, including contract research, consulting, quality control, testing, certification, and prototype development.
	Shared infrastructure	Use of university labs and equipment by firms, business incubators, and technology parks located within universities
Medium (Mobility)	Academic entrepreneurship	Development and commercial exploitation of technologies pursued by academic inventors through a company they (partly) own (spin-off companies).
	Human resource training and transfer	Training of industry employees, internship programs, postgraduate training in industry, secondments to industry of university faculty and research staff, adjunct faculty of industry participants
Low (Transfer)	Commercialization of intellectual property	Transfer of university-generated IP (such as patents) to firms (e.g., via licensing).
	Scientific publications	Use of codified scientific knowledge within industry
	Informal interaction	Formation of social relationships (e.g., conferences, meetings, social networks).

Source: (Guimón, 2013).

The many types of university-industry links have different objectives, scopes, and institutional arrangements. Table 1 (above) is a typology of university-industry linkages, from higher to lower intensity. Collaboration may be more or less intense and may focus on training or research activities. Collaboration may be formal or informal, from formal equity partnerships, contracts, research projects, patent licensing, and so on, to human capital mobility, publications, and interactions in conferences and expert groups, among others (Guimón, 2013).

The difference between a lead pencil and a ball pen is the amount of knowledge required in their manufacture. The making of the latter requires scientific knowledge concerning different types of alloys, liquid ink and plastics—as well as ergonomic data in order to give it a shape that fits well in one's hand. The difference between an old-fashioned typewriter and a PC is also the amount of knowledge invested into it. A typewriter is a marvelous mechanical contraption but a PC calls for much more than an input of knowledge about keyboard layout. It needs information about the binary number system, compressing transistors on a silicon chip, liquid crystal technology, programming languages, etc. In both of the above mentioned examples

(the ballpoint pen and the PC) much of the knowledge that went into these omnipresent products originated from the university-even if some of the essential components such as for the MS-DOS system had been elaborated by university drop-outs. As advanced knowledge becomes an ever more important ingredient in new products and services, indeed, it is what makes them new-the focus on university -industry linkages has become more and more prominent (Hermes and Martin, 2000).

The manufacturing or technically productive enterprises in a particular field, country, region, or economy viewed collectively, or one of these individually. A single industry is often named after its principal product; for example, the auto industry. Industry is therefore generally taken as any general business activity or commercial enterprise that can be isolated from others, such as the tourist industry or the entertainment industry. Several main reasons, which are claimed to motivate the industry to increase university-industry cooperation, have been provided namely: (1) access to manpower, including well-trained graduates and knowledgeable faculty; (2) access to basic and applied research results from which new products and processes will evolve; (3) solutions to specific problems or professional expertise, not usually found in an individual firm; (4) access to university facilities, not available in the company; (5) assistance in continuing education and training; (6) obtaining prestige or enhancing the company's image; and (7) being good local citizens or fostering good community relations. On the other hand, the reasons for universities to seek cooperation with industry appear to be relatively simple and include : (1) Industry provides a new source of money for university; (2) Industrial money involves less "red tape" than government money; (3) Industrially sponsored research provides student with exposure to real world research problems; (4) Industrially sponsored research provides university researchers a chance to work on an intellectually challenging research programs; (5) Some government funds are available for applied research, based upon a joint effort between university and industry. As far as the types of university-industry (U-I) interactions are concerned, there has not been a universally accepted classification. Nevertheless, we still can simply categorize university-industry interactions into (1) General support; (2) Contract research; (3) Research centers and institutes; (4) Research consortia; (5) Industrial associate/affiliate programs; (6) New business incubators and research parks (Wu, 1999).

The Novel University-Industry Linkage through TBIP

The Novel University-Industry Linkage executed through the technology business incubation programme assuredly brings all the faculties and benefits accruing from university and industry characteristics into a TBIP pool for successful arrangement and synchrony that would consistently precipitate increased qualitative and quantitative productivity. The industry lives in the real world of production and conversant with all the existing problems and future needs and demands of the various sectors of the economy. The University holds sway in research and development with regard to proffering solutions to production and production related problems in various sectors. The TBIP processes enhancement of industry activities using new knowledge and technology from the academia and related sources. The Technology Business Incubator seeks out startups and aids them to establish; enabling them with technological, administrative and financial links and information till they become free-standing.

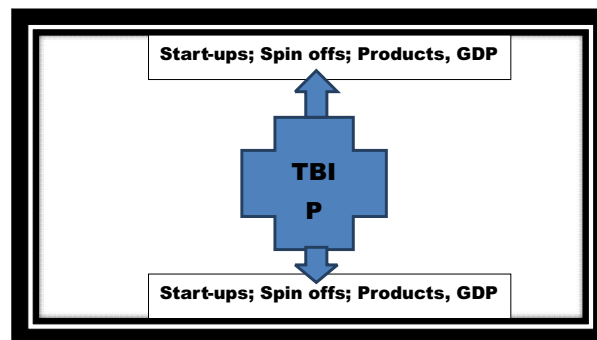


Figure 2: Schematic Representation of University-Industry Linkage through TBIP

Figure 2 depicts the effective third party harmonizing role played by TBIP in the new industrial revolution strategy called “University-Industry Linkage through TBIP” or Economic Strategy. The strategy allows Technology Business Incubators to move into the industry and access their problems and difficulties in the various sectors; and also move into the universities to access their new knowledge technology ingredients that would be employed as startups and spin offs. The incubators are at will to match outgoing graduates to requisite businesses and enterprises of their choice. These startups and spin offs are then supported by the mechanisms of TBIP till they become independent and free standing. This novel strategy apart from engendering increased productivity and new products also allocates economic direction to academic and research works of the university; while ensuring solution provision to industry problems as they come. This assuredly is a win situation for all involved and ensures consistent and continuous industrial and economic growth of the country and the individual welfare of the citizenry.

Conclusion

Economic Strategy is developed based on the experiences gathered following years of incubator practice. It is different from University Technology Business Incubation system which singularly harnesses new technologies from the universities into startups and spin offs and usually concentrates on one and related industry sectors. The UI linkage relationship in this novel strategy is deeper than the high relationship level depicted in table 1 or listed by Wu, (1999). The novel strategy permeates the university system in all disciplines and enables them with experiences from the industry; helping them to channel the course of academic and research work towards product based economic value. It houses as many departments as the various industry sectors of attention and consistently studies the industry sectors with a view to proffering solutions that would continuously enhance their productivity. I call on the government and all stake holders to employ the “University-Industry Linkage through TBIP” to drive the growth of Nigeria's economy in all ramifications.

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