CHAPTER 5

The Role of Technology and Entrepreneurship as a Strategy for Economic Development in Nigeria

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Introduction

Empirical research have shown, both theoretically and empirically, that technological innovation and entrepreneurship play an important role in fostering the development of today's industrialized nations. This is because the development of technological innovation and the capacity to translate such innovation into entrepreneurial ventures is a positive step in the direction of socio-economic development (Schumpeter 1934). This has made the developing nations to recognize technological entrepreneurship as important component of technology policy and indigenous socio-economic planning. In fact, the present emphasis on technological entrepreneurship stems from the failure of past attempts to stimulate Third World development by borrowing or transferring advanced technology from developed nations [1].

Consequent on the above, identifying and supporting the activities of potential and existing entrepreneurs has become a major concern for an increasing number of governments in developed and developing countries. In the case of developing countries, public policies are designed to increase the pool of entrepreneurs and to promote the formation of certain types of businesses at the micro and small enterprise levels, which foster technological activity. The objectives of these policies are to encourage indigenous technological activity and enhance the competitiveness of local manufacturing industries in this age of globalization and market driven economy [2].

Innovation is an important force behind the dynamism of capitalism. That is, by constantly making new combinations of existing means of production to establish new products, a process, known as **'industrial mutation'**, emerges. This incessantly revolutionizes the economic structure from within, incessantly destroying the old one, and incessantly creating a new one [3]. This process of **'creative destruction'** is thus the engine of economic development and the essential source of dynamism in the capitalist system.

Entrepreneurship, as the second important factor, is responsible for establishing these new combinations. That is, entrepreneurship is the function of innovation. It is the factor that establishes new combinations of means of production. Entrepreneurs acts with confidence beyond the range of familiar beacons, overcome any resistance that might arise, and also develops aptitudes that are present in only a small fraction of the population [3].

Therefore, while technological innovation means breaking with routines. It however requires people with special qualities (capabilities) to get things done, and inspiring and motivating others to change. Hence, both technological innovation and entrepreneurship are inter-related, in that, while entrepreneurship is the essence of economic development, but cannot exist without technological innovation.

This paper therefore attempts to link technological innovation with entrepreneurship as an important component of a much broader level of technological development and economic growth.

Entrepreneurship

The origin of the word **"entrepreneur"** was ***"entreprendre"*** (French word), and may be traced back to sixteenth century. This French word means to **'undertake'**, that is, people who organized and managed military and exploration expeditions in France [4, 5, 6]. The word "entrepreneur" was first used to refer to economic activities in the early eighteenth century [7].
A further search of the literature also reveals that researchers have been inconsistent in their definition of entrepreneurship. There are a minimum of a hundred definitions to explain the concept of entrepreneur and entrepreneurship. Their meanings depend on when they were developed and in the society in which the various researchers developed them [8].

The early 18th century French economist Richard Cantillon cited in [9] defined the entrepreneur as the agent who buys means of production at certain prices in order to combine them into a new product. Entrepreneurship is also defined as self-employment of any sort where the entrepreneur is the bearer of uncertainty and risk. He is someone who shifts economic resources out of an area of lower to an area of higher productivity and greater yield. Someone who brings other people together in order to build a single productive organization [10].

Entrepreneurship, both technological and commercial, is the driving element behind an organization. The skills associated particularly with technological entrepreneurship are rare and limited in supply. The abilities of entrepreneurs are so numerous that very few people can sufficiently exhibit them. Entrepreneurial activity involves identifying opportunities within the economic system, filling market deficiencies through input-completing activities including the process of identifying, developing and bringing a vision to life. This vision may be an innovative idea, an opportunity or a better way of doing something. The end result of this process is the creation of a new venture, the expansion of an existing one carried out under conditions of risks and considerable uncertainty [11].

However, in the last century, many writers have identified entrepreneurship with the function of uncertainty and risk bearing; and others with the coordination of productive resources, the introduction of innovation and the provision of technical know-how [12]. Therefore, the term "entrepreneurship" has become a well-defined domain of management, and the key concepts of entrepreneurship are explained as strategic orientation, commitment to opportunity, commitment of resources, control of resources, management structure, and reward philosophy.

The characteristics of entrepreneurs include among others desire for responsibility, preference for moderates' risk, confidence in personal success, desire for immediate feedback, high level of energy, sufficient emotional stability, objective approach to interpersonal relationships, and a comprehensive awareness of total environment [13].

Technological Entrepreneurship

Therefore, in recognition of the considerable risks and uncertainty associated with entrepreneurship, Afonja (1999) made a clear distinction between technological entrepreneurship and commercial entrepreneurship [5]. The former involves product manufacture or the provision of technical services while the latter involves trading, buying and selling or provision of non-technical services. The pre-requisites for success and risk factors involved differ significantly for the two types of entrepreneurship.

A vast body of research has emerged over the years on technology-based entrepreneurship, which refers to the creation of new firms by independent entrepreneurs and corporations to exploit technological discoveries. Technology entrepreneurship is a style of business leadership based on the process of identifying high-potential, technology-intensive business opportunities, gathering resources such as talent and cash, and managing rapid growth using principled, real-time decision-making skills.

Technological entrepreneurship could also be defined as the creation of a new company, the expansion or modernization of an existing one based on the **commercialization of an innovative product or process from scientific research or technological development** [14]. Technological entrepreneurship placed an emphasis on innovative skills for creation of new products, new production methods, markets and new forms of organization. He further posited that wealth is created when such an innovation results in new demand. Thus, the function of the technological entrepreneur involves combining the various input factors in an innovative manner to generate value that will exceed the cost of input factors and generate profit. The combinations can take several forms including the introduction of a new product or quality, the introduction of a new method of production, opening of new market, the discovery of a new source of supply of raw materials and the creation of a new organization [6].

Technological entrepreneurial process is characterized as involving all the activities and actions associated with the perceiving of opportunities and the creation of organizations to pursue them [15]. Other authors further explain that the entrepreneur risks all his personal cash flow, some or all his personal capital and his career to start a new venture that would not be viable without him [16, 17].

Some other school of thought on the role of the technological entrepreneur is that of a risk-bearer in the face of uncertainty and imperfect competition. However, while many current theories on technological entrepreneurship agree that there is an inherent component of risk, they also argued that the risk bearing theory alone could not explain why some individuals become entrepreneurs and others do not. Therefore, to build a developmental model of entrepreneurship, it is necessary to look at other characteristics that help to explain why some people are entrepreneurs while others are not [12].

The role of a technological entrepreneur is also that of an innovator which involves the ability to combine various inputs into new innovations in order to satisfy unfulfilled market demand. In this context, innovation could be technological, process, product, market factor or even

organizational innovations [8]. However, this classical theory of innovation, as the bedrock of technological entrepreneurship, may be difficult to apply to a developing country such as Nigeria.

Often, in less developed countries, technological entrepreneurs who are engaged in manufacturing industries are not truly innovators in the traditional sense of the word since they rarely produce brand new products. Rather, they imitate the products and production processes that have been invented elsewhere in the world, mostly in developed countries. This process, which occurs in developed countries as well, is called **creative imitators** [10]. In this context, the innovation process is often that of **imitating and adapting** instead of the traditional notion of new product or process discovery and development. Though a consensus on a precise definition of technological entrepreneurship may seem impossible, what cannot be denied is the economic significance of technological entrepreneurship and its way of inspiring creative individuals to pursue opportunities and take risks.

Another definition of entrepreneurship was given by another author as the process of creating value through technological innovations by putting together a unique package of resources to exploit an opportunity [18]. The process itself consists of the set of activities necessary to identify an opportunity, develop a business concept, assess and implement the concept and then manage and harvest the concept. On the other hand, entrepreneurship could be regarded as a process that encourages new independent competitors to establish small-scale manufacturing companies.

It is evident from the above studies by scholars and researchers that the underlying concepts of entrepreneurship are the three key dimensions of innovativeness, risk-taking and proactiveness.

(a) **Innovativeness** refers to the seeking of creative, unusual or novel solutions to problems and needs. These solutions can take the form of new technologies and processes as well as new products and services. [1]

(b) **Risk-taking** involves the willingness to commit significant resources to opportunities having a reasonable chance of costly failure. These risks are typically manageable and calculated.

(c) **Proactiveness** is concerned with implementation, with doing whatever is necessary to bring an entrepreneurial concept to fruition [19]. The process usually involves considerable perseverance, adaptability and a willingness to assume some responsibility for failure. To the extent that a manufacturing industry demonstrates some amount of innovativeness, risk-taking and proactiveness, it can be considered an entrepreneurial event and the person behind it an entrepreneur.

Critical components of the above definitions are the necessary condition that the organization created actually produced manufactured products through value addition.

The common thing among the above definitions particularly of technological entrepreneurship is the creation of new organizations, either as a new small industry or as a new industry within an existing organization [20]. It is this distinction that sets technological entrepreneurship apart from commercial entrepreneurship and the routine management tasks of allocating resources to an existing organization. Therefore, technological entrepreneurship is defined as the process of

recognizing a market need, identifying an opportunity to meet the need, creating a new or improves upon a current innovation, acquiring and organizing the resources to bring the innovation to fruition.

Technological Innovation and Entrepreneurship Development

Innovation, both technological and scientific, is one of the key ingredients to sustained economic growth and improved social prosperity. This is true regardless of a country's economic stage. The difference in technological capabilities among nations is not a disadvantage but rather calls for different optimal combinations of science and technology. However, there exists the **"Valley of Death"** (Figure 1) between research resources (various research outputs in the engineering- and science-based courses in tertiary institutions) and commercialization of resources (turning the technology into business venture).

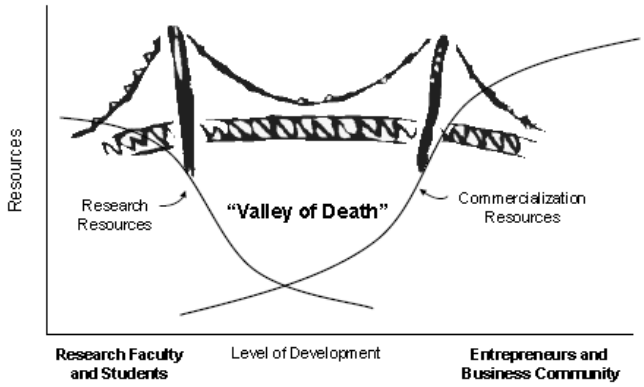

Figure 1: The ***Valley of Death*** (Bridging the Gap between Research and Commercial Application Resources) [21]

Within the context of developing countries like Nigeria, the valley of death is referred to as the extreme difficulties faced when converting an invention into a successful and concrete application. While lack of funding and lack of private sector interest are prominent, yet there is still the need for technology entrepreneurship skill to adequately transverse this valley. Hence, technology entrepreneurship is an important link that will bring together the technical and commercial worlds (Figure 2). Therefore, by combining these innovations and administrative capabilities, technology entrepreneurship sets the foundation for successful organizational management.

As seen from the figure, the process of forming new technology-based ventures often involves interaction between a vast array of agents, both from the private and public sectors. Technological innovation has long been viewed as an integral part of entrepreneurship [10], and the individual as its primary driving force [22]. One of the true measures of success, that stands out, for technological entrepreneurs is the extent to which they can develop and bring to market radically innovative new products and/or services. Radical innovations are important not only for the positive economic impact they typically create, but also because they fundamentally change the behavior of consumers, often in ways that improve their lives. Therefore, the ability to innovate and to translate innovations into entrepreneurial ventures is dependent on the political

economy of a nation and to the attitude of people and their reactions to the structural constraints of the economy.

Technological Entrepreneurship in Nigeria

In Nigeria, considering the crucial role that technological innovation and entrepreneurship play in fostering economic development, it has been recognized as important components of technology policy and economic planning. Moreover, the present emphasis by government and stakeholders on indigenous technological innovation and entrepreneurship was further aroused, because of the failure of past attempts, through the import substitution strategy; structural adjustment programme (SAP); national economic empowerment and development strategy (NEEDS); and economic recovery and growth plan (ERGP), to stimulate development by borrowing or transferring advanced and sometimes inappropriate and unsustainable technologies from developed countries.

The problem is further compounded by the inability of government to harness resources for technological innovations and entrepreneurship. This has resulted in the dependence on **exogenous technologies** that are inappropriate for the environment [1]. It has also been responsible for Nigeria's exports which have largely been based on raw materials and semi-manufactured goods with the petroleum sector as the most important. Less than 5% of these exports are, on the average, attached to knowledge intensive goods and services [1, 23]

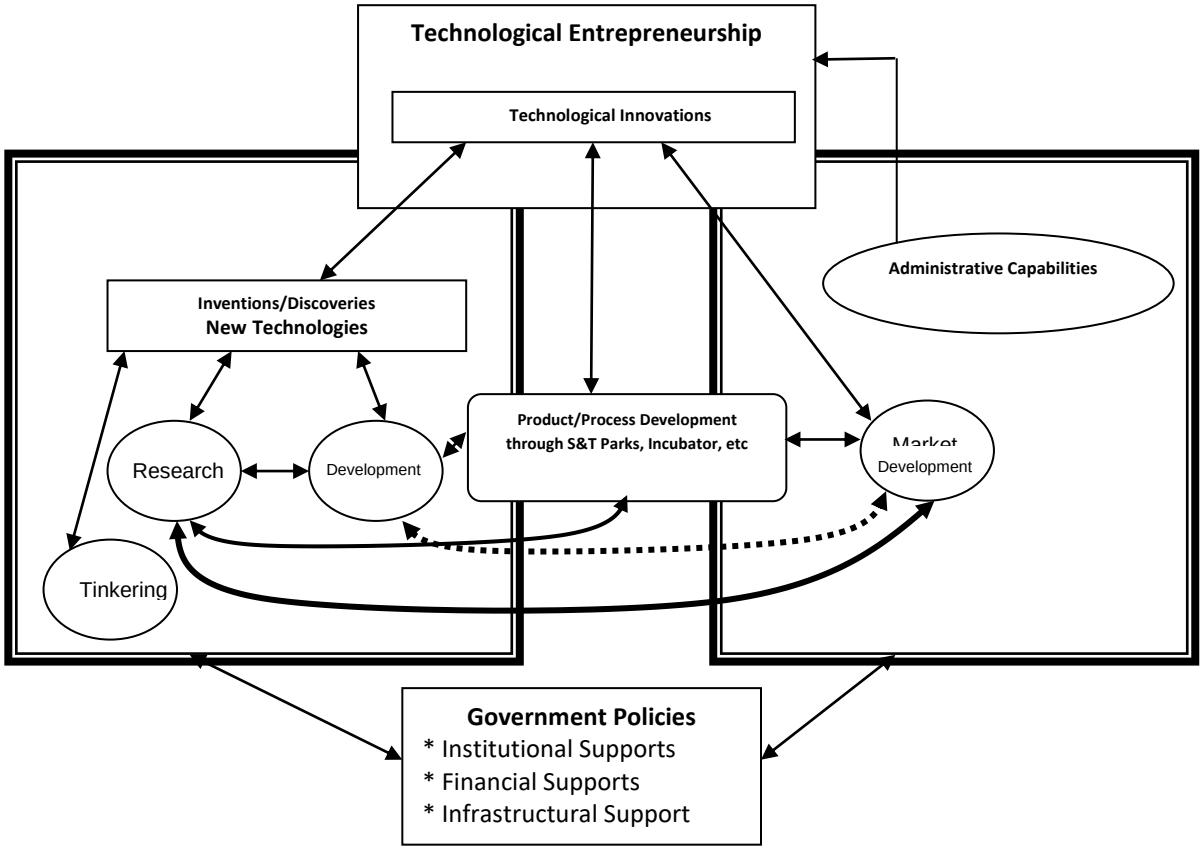

Figure 2: Interaction among Technical World, Commercial World and Government for Technological Entrepreneurship Development (Modified). [24]

The problems became acute in the 1980's, 1990's, 2007-2008, as well as the economic recession of 2016-2017 when Nigeria experienced stagnating industrial output and decreasing crude oil prices while industrialization through the production of indigenous technological development became central topics in the industrial policy debates. As a result of this, it is argued that if Nigeria is to join the league of industrialized economies, industrial activities have to converge and focus more on **knowledge-based production** particularly in the small and medium scale manufacturing and processing industries [25].

Unfortunately, in Nigeria, after more than four decades of import substitution strategy, structural adjustment programme (SAP), commercialization and privatization of ailing state-owned enterprises and general economic decline, the manufacturing sector's contribution to the Gross Domestic Product (GDP) in Nigeria is still very small and plagued by low productivity, low capacity utilization, and low-quality output [26]. This is compounded by the increase in competition from imports, which has resulted in downsizing or outright closure of many manufacturing industries.

Therefore, the extent to which the restructuring of the private sector as the engine of growth of the economy will succeed is dependent on the fostering and development of technological entrepreneurship among the indigenous population. In particular, the establishment of small-scale manufacturing industries, the introduction of new technologies, processes and products will be determined by the availability of technological entrepreneurial talents and skills. Technological entrepreneurship is expected to support national development by increasing output and employment, improving income distribution, and reducing poverty. Entrepreneurs are seen as the bedrock of a market-driven and knowledge-based economy. Their development implies development of societies that allow and even encourage private accumulation of capital for investment.

The nature and importance of entrepreneurship in developing and transferring technology and positively impacting an economy is therefore an area of importance to the society. This requires the creation of something new and of value to the organization and the market by technical entrepreneurs who are willing to assume the social, psychological and financial risks involved.

This view was subsequently enunciated in the various development plans, national budgets, rolling plans and in the programs elaborated in the National Economic Empowerment and Development Strategy (NEEDS), the seven-point agenda and the Economic Recovery and Growth Plan (ERGP). The central theme of these policies has been that small industries should spearhead the nation's drive towards economic recovery. Studies have shown that small industries in many countries provide the mechanism for promoting indigenous technological entrepreneurship, enhancing greater opportunities per unit of capital invested and aiding the development of local technology [27, 28].

In Nigeria, small-scale businesses represent about 90% of the industrial sector in terms of the number of enterprises. They also account for 70% of national industrial employment if the threshold is set at 10 – 50 employees, contribute 10% of manufacturing output and a meager 1% of gross domestic product (GDP) in 2018 [29]. Similarly, they have also contributed

significantly to economic development through employment, job creation and sustainable livelihood [30].

However, generally in developing countries, the problems of entrepreneurship are more acute. The absence of a viable industrial and private sector, the deficiencies of the existing infrastructure and the often apparent dominance of foreign-owned firms in the local economy tend to have a limiting effect on the capacity of the community to give birth to national entrepreneurs. Thus, the challenge facing the public policy-maker in such a community is "to grow an adequate cadre of persons endowed with the qualities for successful business enterprise".

Different views are expressed concerning African entrepreneurship. At one extreme is the view that, for one reason or the other, technical entrepreneurial talent that involves the establishment and management of manufacturing industries for productive activities in the real sector of the economy, is lacking in Africa [28]. On the other hand, it was argued that entrepreneurial talent is indeed available but that the economic environment has not been conducive to this talent to develop. Supporters of this second view point to the fact that the kind of economic policies that have been adopted in many African countries in the two or three decades after political independence have not always been conducive to private enterprise. This position is consistent with a third view by another author that the African entrepreneurs is alive and well, but rather than undertaking manufacturing businesses, they are engaged in non-productive, rent-seeking activities which researchers have referred to as commercial entrepreneurship [1].

According to this author, technical innovation and entrepreneurship are conditioned by the political economy in Nigeria [1]. That is, the institutions, the socio-cultural opportunities and constraints, and the orientations of individual actors in the social structure. On the general level, it was discovered that the success of an innovation can be hindered by conditions that contribute in a major way to the economic strangulation of Nigeria. For instance, the quest for the quick returns from retail trade rather than the delayed returns from production; and the domination of the local market by mercantile capitalism, which discourages receptivity for local innovations [1].

However, in spite of these challenges, Government of Nigeria has taken various steps to promote and develop technological entrepreneurship. These include among others:

(i) Establishment of Technology Incubation Centers (TICs).
(ii) Establishment of Industrial Development Centers (IDCs).
(iii) Establishment of Research and Development (R&D) Institutions to conduct scientific and technological research and transfer results and inventions to entrepreneurs.
(iv) Financing of enterprises in the real sector of the economy through Agriculture and Small and Medium Enterprises Investment Loan Scheme of the Central Bank and Bankers Committee (AGSMEEIS).
(v) Introduction of entrepreneurship education in the tertiary institutions, including universities.
(vi) Collaboration with the United Nations agencies to foster entrepreneurship among the Nigerian entrepreneurs.

Conclusion and Recommendations

It is evident that the technological entrepreneurs are very central in the development and growth of the economy of any country. They take the lead in the innovation process, initiate changes, and pull others along in the process of change that will lead to economic and industrial development. Hence, for Nigeria to further benefit from technological entrepreneurship, the following recommendations are made:

(i) Provision of infrastructural facilities to reduce the cost of production.
(ii) Encourage patronage of locally made goods.
(ii) Strengthening of research institutes and tertiary institutions with adequate facilities to be able to conduct researches and transfer the results that can be translated to innovations.
(iii) Strengthening of the existing institutions for Small and Medium Enterprises (SMEs) development in Nigeria.
(iv) Conscious search for true entrepreneurs who will commercialize the research results and inventions from research institutes and universities.
(v) Strengthening of the existing technology incubation centers and establishment of science and technology parks that will nurture the R&D results from knowledge centers such as tertiary institutions and research institutes. Hence, the science and technology parks should be closely linked to the knowledge centers.

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