

# TRANSFORMING RESEARCH FINDINGS INTO COMMERCIAL PRODUCTS USING TECHNOLOGICAL INNOVATIONS FOR NATIONAL DEVELOPMENT

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## **Abstract**

Research outcomes seem to be under-utilized in Nigerian enterprises. As such, this paper examined some essential elements that could be considered as judicious elements in the dissemination of research findings for practical use in the Nigeria enterprise sector. Thus, research findings can be efficiently transferred from the research fields into the commercial or production settings. The applied knowledge from a pool of research findings of new designs, manufacturing tools, new ideas and the utilization of knowledge-based innovations can be better maximized using appropriate channels. This effort would increase revenue capacity, profit efficiency and the general growth of the nation's economy. Furthermore, the process of transforming research and development into innovation cannot be taken out of context, and therefore, it should be treated as a component of the national innovation project. Finally, research institutions need to play a more active role in their relationship with the enterprise sector in order to maximize the use of the research oriented innovations.

**Keywords:** Development, Transforming, Products, Innovation, Research.

## **Introduction**

As generally known research and development as a crucial component of the innovation process was performed outside of enterprise such as universities and other higher education's institutions and in independent research institutions.

Universities and research institutes appear to be key components of the national innovation system responsible for creating economic opportunities and wealth. The capabilities of each component and the strength of their interactions could determine the extent of wealth creation, economic development and global competitiveness of individual nations. Universities and research institutes are saddled with the responsibility of generating and impacting new knowledge within the domains of science and technology. These institutions are essential in developing new ideas that can be transformed into market value for commercial purposes.

Nigeria has aspirations to be one of the top 20 world economies by 2020 and this creates two key issues. The first is need for massive investment in science and technological research and development over the next few years. Secondly, strategic opportunities abound for researchers in research activities and new product

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development. Thus, a national critical concern would be essential in knowing the capability of the Nigerian researchers to effectively harness these opportunities in order to achieve the Nigeria's economic revolution.

Furthermore, the need for sharing knowledge between research institutions and industries has become increasingly evident in recent years. Historically, research institutions were perceived as a source of new ideas and industries offered a natural route to maximizing the use of these ideas (Janex & Gunter, 2007). In addition, it has become clear that research institutions need to play a more active role in their relationship with industries in order to maximize the use of research findings (Janex & Gunter, 2007). The new role would require specialist staff that could function by way of identifying and managing knowledge resources with business potential. Thus, the responsibilities of these specialist staff may also include step-by-step strategic planning and harmonious utilisation of research findings. For example, other activities would include; discoveries about how best to take a new idea to market, follow-up process to ensure appropriate resources such as funding and support services are readily available for execution of research-based innovations.

The significance of innovative ideas to the general growth of societies cannot be overemphasised, for instance, it is evident that the involvement of the enterprise sector in governance of research institutions can help to orient research activities that support knowledge transfer to industries, and signal willingness to introduce innovative-oriented approaches in all activities. Such interaction has helped to facilitate inter-sectoral mobility, and perhaps, through the hiring of young graduates by industries (Janex & Gunter, 2007). In addition, the development of the knowledge economy is inducing a paradigm change in the innovation process, collaborative research and sharing of knowledge and intellectual property (Siyanbola, 2008). According to Premus (2002), technology transfer occurs when a technology crosses the boundary from one organization to another.

It is arguable that innovation processes could stand on two pillars. The first pillar lies in research and development, while the second pillar lies on the production process. Thus, a permeable transfer between the two pillars is important in technological development. Furthermore, in advanced market economies, it appears feasibly clear that good cooperation between research institutions, development sector and industry creates favourable conditions for technology transfer from science to the business sector and for technology transfer among industrial enterprises. In the situation where research and development are being performed or located mainly in the science sector while innovation is being implemented mainly in industries/enterprises, an issue of science-industry linkage or cooperation is of crucial importance and a transformation of research results into practical applications would take place. Therefore, in the case of Nigeria, the quick, broad and successful transformations of new knowledge created within the spheres of public research into industrial innovations are extremely important for improving the country's low level of innovativeness.

A key objective of publicly-funded research is to exploit the results, which goes one step further than the mere production and dissemination of new scientific knowledge. Such an approach is essential to tackle the Nigerian Paradox: which is similar to strong research-based activities but weak innovation performance.

Therefore, increased emphasis is placed on innovation in the national funded researches. Innovation is understood as any activity aiming to promote not only the dissemination of knowledge but the subsequent exploitation of the results of each research project. This implies that the innovation cycle is a continuous process with parallel activities. Thus, the national innovations system approach stresses that the flow of technology and information among people, enterprises and institutions is key to the innovative process.

### **Transforming Research and Developing Practical Applications**

When a research project is completed, a transformation of its results often begins. This would lead to a technical innovation. The essence of the transformation process would likely be the implementation and commercialization of the research outcomes. The subject of analysis here is a set of processes that can make up a whole innovation process. These partial processes are the researches; transformation of its results into practical applications; accompanying processes of technology transfer and diffusion of technological innovation into practical usage.

According to Pavitt (1999), the innovation process consists of the following phases;

- i. Scanning the business environment and processing relevant signals to identify threats and opportunities for change.
- ii. Deciding which of these signals to respond to.
- iii. Obtaining the resources to enable the response.
- iv. Implementing the project to respond effectively, and,
- v. Learning from progressing through this cycle.

More illustratively, the transforming of research findings to practice could also be seen from vertical and horizontal perspectives. Thus, a symptom of vertical technology transfers from a research institution to an enterprise setting in particular or, the industrial sector at large. On the other hand, a horizontal transfer of research knowledge and development outcomes into practical applications is essential in the case of small and medium sized enterprises which are likely not to have their own in-house research and development facilities due to the small nature of their businesses in terms of capacity, net worth and funding in comparison to multinational industries

On the basis of this, the whole set of processes can be presented comprehensively in the form of a chain as illustrated below:

### **Initiation**

A starting point here in a research initiation which can come from various sources like, enterprises, universities, research and development organisations and public/private research-oriented institutions. Subsequently, the research and development are



performed the research results are then propounded in the form of new knowledge or ideas to salvage scientific and technological solutions. Then, this knowledge is usually transferred from research institutes to various economic entities where its implementation and commercialization take place. The above illustrations could best exemplify the transformation of research findings into practical application. Finally, their diffusion should be treated as a natural, desired completion of the innovation process (Jasinski, 1992). Thus, the Nigerian processes of innovation diffusion have been very weak and narrow for many decades (Jasinski, 2011). Moreover, the diffusion processes in the national economy seems to be poorly investigated by researchers. These and many other factors conglomerate to form the rationale for the present article with visionary thoughts around the transition of evident-based ideas from various viewpoints to full utilisation.

### **The transition process from various points of view**

The process of transforming research and development into innovation cannot be taken out of context, and therefore, it should be treated as a component of the whole innovation project. Thus, the transformation process consists of several elements for suitability and structural processes. Although, there is no universal depiction of this process because it can be considered from various points of view (Jasinski, 2011). The transition process could take place in the following fashion:

**Engineering sector:** It will be a set of production and technological operations which should result in manufacturing and selling of a finished product. The process can conventionally be divided into four stages:

- i. Maturation: Results of research and development should be completed in detail and lead to a form suitable for implementation.
- ii. Real Investment: Usually new physical assets are necessary to innovate.
- iii. Implementation ending with a start of production.
- iv. Commercialization: A new product appears in the market.

**Managerial function:** It could be a decision-making process concerning investment, production, marketing, financial and similar decisions. Thus, the transformation process is subject to management. Simplifying the flow of research findings to the practice – as a decision process can be expressed in the following phases;

- i) Preparatory activities which should start before the project ends; that is, marketing, co-operation, partnership, etc.
- ii) Decision concerning a form/way of flow. E.g. commercialisation of research results, user license, etc.
- iii) Decision on who will deal with an organisation of the flow:
  - a) “We on our own” that is, the research institution where the scientific and technological solution appeared or
  - b) “Foreign hands” that means professionals.
- iv) Conclusion of contracts with producers, banks, agents.
- v) Assistance towards an innovating form in the implementation and commercialization and control of these activities.
- vi) Evaluation of the whole transformation process, together with the partners.

**Economist function:** Research findings would be essential in generating expenditures (cost) and effects (incomes, profits). In other words, an economist would look at the whole process via the prism of effectiveness. Nevertheless, he/she differently evaluates the earlier stages than the later ones;

- The research and development – via the prism of expenditures and,
- The commercialization phase – via the prism of economic effects

**For a marketer:** It will be a chain creating a value for a user/buyer in subsequent phases. In a comprehensive approach, we have three basic stages or links in an innovation creation chain viz;

- i. Initiation and establishment of a research project – the main addressees of the offer would be Research and Development.
- ii. Research and development – here an investor or entrepreneur would be the results' user.
- iii. Implementation and commercialization – in this phase, the main users of new product will be consumers/households or producers-buyers of industrial goods. In Nigeria, marketing experiences in economic entities in field of research and development and innovation seem to be very poor.

As stated earlier, each point of view is different and within each of them exist a number of stages in the transformation process that are different too, although some phases are similar. Each one needs to be evaluated as a single entity. Generally speaking, all the viewpoints should make a complex and integrated approach that could be set aside to meet different transformation conditions.

### **Conditions for the transformation process management**

For an efficient course of innovation utilisation process, a potential user of research findings such as entrepreneurs either large or small enterprises would require putting the following into cognizance;

- Become involved in the research process/project as early as possible. This refers to the concept of user-driven innovation.
- Co-finance the research projects as much as possible.
- Have potentials to attract external supports at both local and internal levels.
- Have a guarantee of decent profits.

As mentioned earlier, the transformation process is usually preceded by a technology transfer. According to Rosenberg (1982), the essence of the modern technology transfer is diffusion of information based on new scientific-technological solutions and the knowledge about their potential applications. In turn, a range and speed of information diffusion may depend on the organization and functioning of various networks using common success factors.

### **Common Success Factors of Transforming Research**

#### **Findings Into Commercial Products**

These include highly skilled and motivated research teams, enthusiastic leaders with high level of commitment and support to research projects; Close collaboration between companies and universities/research institutes. Although, there is bound to exist some

forms of challenges but they are tackled in a related fashion. Thus, good knowledge of the state-of-the-art developments in the field is needed to tackle technical problems. There is need to balance quality and cost due to budget limitations. For instance, an inflow of the new knowledge to an enterprise is the result of an outflow of this knowledge from a research institution. These are like two sides of the same coin. Both sides may create conditions favourable for knowledge transfer. However, they seem to speak different languages and have different expectations and aspirations which result from a dissimilar nature of the science sector and the business sector.

### **Benefits to Research Institutions**

Benefits to research institutions resulting from knowledge transfer to industry are not limited to financial gains. Even though, many revenues are resulting from research and development activities, as well as knowledge transfer activities respectively. However, the main benefit could be indirect and should be considered in the long term positive effect. These long term benefits may include the following:

- a. The enhancement of research institutions' research activities, access to the state-of-the-art industrial equipment, improving research institutions' project management skills, complementing the research institutions, competence based on the new skills and techniques developed in industry, improved understanding of the market needs and of industrial problems.
- b. Gaining status and prestige resulting from successful partnership and products.
- c. The enhancement of research institutions' teaching activities, involvement of industry-based lecturers, enrichment of teaching contents and materials with practical examples, learning how to apply skill and knowledge to solve real business challenges.
- d. Attracting, retaining and motivating good scientists interested in the entrepreneurial aspect or in new professional career opportunities.
- e. Contributing to public authorities, better recognition of the socio-economic relevance of publicly- funded research, potentially leading to increased funding thereof.

### **Benefits to the Society**

The successful implementation of policies to deal with inventions and collaborations with industry can lead to a number of benefits for the society at large and the local economy in particular. These benefits include new jobs, new products on the market and better education.

### **Recommendations**

Nigerian research institutions should set up knowledge transfer units and aim to improve collaboration and exploitation of research findings and their utilization by business organisations. Their success would be largely dependent on the skills and competencies of their staff as well as the strategic role assigned to them and the managerial autonomy. The personnel working on knowledge transfer are expected to possess a wide range of skills in order to carry out their tasks efficiently.



Furthermore, in order to implement knowledge transfer activities effectively, research institutions need to have sufficient autonomy to recruit experienced knowledge transfer staff on a competitive basis. The knowledge transfer staffs are staffs who participate in a range of public engagement activities to keep the public informed about current research outcomes and new innovations. Increased mobility between the public and private sectors will help research institutions and the enterprise sector to identify shared needs.

In addition, 'patent pool' is essential in this perspective as it involves initial agreement between two or more patent holders to aggregate some/or all of their patents for the purpose of cross-licencing in maximising efficiencies. It is a combination of at least two companies or individuals agreeing to cross-licence patents relating to a particular technology. In bringing research findings into commercial products for national development using technological innovations, a patent pool can help create a critical mass of intellectual property which is necessary for innovative ideas to be attractive to the public/private sector. If marketed properly, every relevant industry player could be made aware of the research centres that generated the Intellectual Property and this would help catalyse links with industry. More so, building a patent pool can lead to stronger relationships between knowledge transfer offices and provide a basis for further inter-institutional endeavours. Such pooling of resources appears to be particularly appropriate for those research institutions that do not have the scope and volume of exploitable research result to justify the establishment of a knowledge transfer office.

Note, it is obvious that promoting innovation and disseminating new knowledge can be compatible, provided that intellectual property issues are understood and managed professionally. In addition, Siyanbola (2008) posits that the concept of developing knowledge economy has initiated a paradigm shift in the innovation process and promotes collaborative research and sharing of knowledge and intellectual property with numerous benefits across board.

### **Conclusion**

There is no universal model of transforming research and development into innovations. This process requires an approach from various stand points. The process may end in success or failure wherein success here should be treated as the successful commercialization of evidence-based innovations such as new products or manufacturing process. Broad and quick inflows of a new science and technology knowledge to firms, especially to SMEs, will make the transformation process more efficient. Finally, among other various success factors, one seems most important, and this is the skilful management of both the research processes/projects as well as the transformation process of the findings into practical applications in the enterprise sector.

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