

## Product Research And Development Projects For Entrepreneurship Development In Nigeria

Ubani Emmanuel, Ononuju, Charles, Echeme, Ibeawuchi

Department of Project Management Technology, Federal University of Technology, Owerri – Nigeria  
[drecubani@yahoo.co.uk](mailto:drecubani@yahoo.co.uk), [ononujucn@gmail.com](mailto:ononujucn@gmail.com), [ibeecheme@yahoo.com](mailto:ibeecheme@yahoo.com)

**Abstract:** This paper explores the necessity of product Research and Development (R&D) projects in the quest for entrepreneurial development so as to contribute significantly to production, venturesomeness, employment generation and economic transformation of Nigeria. Products (R&D) create jobs and prosper nations, as the results usually motivate and assist prospective and potential entrepreneurs to set up small scale business units of their own. The survey research and multistage sampling techniques were used. Based on identified factors, the data used for the study were obtained from industrial research centres and institutes. The data were subjected to analysis using Relative Importance Index (RII) model. The identified factors and their respective RII were ranked in their order of influence of products R&D projects in stimulating entrepreneurship development. The result infers that business viability and marketability of products;  $X_6$  with RII of 4.78, quality and reliability;  $X_{16}$  with RII of 4.77 and availability of raw materials and technology;  $X_5$  with RII of 4.73 top the list. These are to be given prime consideration in the formulation of policy and strategy for entrepreneurship development through product R&D products. The adoption and institution of products R&D initiatives will help indigenous entrepreneurs to continuously add value to products resulting from the project and broaden the scope of self development and self directed motivational changes.

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### 1. Introduction

To be successful in entrepreneurship ventures and economic transformation, products research and Development (R&D) need to be considered in the formulation of economic policy and commercial objectives for the manufacturing sector of the economy. R&D projects refer to organized efforts that are directed towards increasing scientific knowledge of products and process innovation within budgeted cost and scheduled completion time and, performance and quality specifications. Most of the advances in communications, semiconductors, medicine and space technology can be attributed to R&D efforts. Product research provides a source of idea for new or improved products, which can be developed for new investment potentials and patented for the benefits of interested entrepreneurs and manufacturing firms. Lock (1996) asserts development projects for consumer goods must produce articles that satisfy the market requirements. The design concept, engineering and quality have to result in a reliable entrepreneurship driven products from production process. The main objective of the entrepreneurial development scheme in Nigeria is to motivate and assist prospective and potential entrepreneurs to set up small scale business units of their own and thereby become self-employed and continue to contribute significantly to production and employment

generation in the country. Entrepreneurial development programmes increase the entrepreneurial spirit and provide scope for self development by focusing attention on the self directed motivational changes. Quadir and Jahur (2014) are of the view that entrepreneurs and entrepreneurship are significantly correlated with the economic development of a country.

Nigeria is faced with problems of unemployment with adverse and negative consequences such as crime, hard drug addiction, prostitution and other social vices. The entrepreneurial development will help to stimulate and boost business units for individuals and cooperative ventures which will in turn, contribute to Nigeria economic transformation and growth. The realization of the entrepreneurial development objectives will depend to a great extent on the formulation of formidable business strategy. According to Emmanuel (2008), business strategy may take any of the following forms; increase in the market share, new product development, new market development, diversification, merger and acquisition. Some of the cardinal entrepreneurial philosophies are to promote new inventions and innovations so that new ideas for products and businesses could be generated and developed, coordination of different factors of production, arrangement of raw materials, machinery and finance, employment of labourers,

selection of plant size and site, study of business and selection of business, management of business and taking decision (Khanna 2006). These philosophies are geared towards exploring R&D knowledge needed to stimulate entrepreneurship for economic transformation and growth. Hans (2007) enumerates five avenues to stimulate entrepreneurship as follow:

- ❖ Demand side intervention: R & D expenditure, stimulating competition,
- ❖ Supply side intervention: Labour mobility, regional development.
- ❖ Influencing input factors: Higher education, venture capital market.
- ❖ Influencing preferences: Attitude/mindset, image of entrepreneurship.
- ❖ Individual decision making process: Taxes, social security, level of benefit.

According to Kumari (2014) entrepreneurs convert ideas into economic opportunities through innovations which are considered to be major source of competitiveness in an increasing globalizing world economy. The explorative and qualitative reasoning of product R&D project are predicated on the generation of idea for new products and processes. The constraints posed by the phases of product life cycle at the saturation and decline stages of the existing products in gaining or sustaining competitive advantage and capturing market share are serious challenges to entrepreneurs. Prospective and intending entrepreneurs venture into different new business units or improve on the existing ones from the successful results or end items of the projects. Product R&D projects prosper and contribute to the economic growth of the country. A typical example is the research and development of analogue telephone to the mobile cell phone which has generated self employment to millions of Nigerians in the areas of commercial phone call centres, sales of telephone handsets, spare parts and accessories, repairs and services of handsets etc. However, the product design and development stage must take into consideration, design for manufacturability, robust design, value analysis, standardization, modularity, quality and reliability of the products for successful entrepreneurial ventures. The consideration of these attributes in product R&D will generate massive self employment from the output with lasting and durable product life cycle. Zimmerer and Scarborough (2005) posit that product is any item or service that satisfies the need of a customer. Ubani (2012) observes that products travel through various stages of development. Zimmerer and Scarborough (2005) further state that the demand for a product generally tends to follow a predictable pattern called product life cycle. Products go through a series of stages beginning with start-up or introduction of the product,

followed by rapid growth, maturity, saturation and finally, decline. The problems arise at the saturation and decline stages because the firms are vulnerable to folding-up the operations, creating unemployment and reduction in gross domestic product if the system lacks R&D strategy. The bane of Nigeria economic transformation and sustainability could be attributed to lukewarm attitude to R&D projects. Product R&D projects are usually cost intensive, but unfortunately, the funding by government agencies and corporate bodies are usually characterized by apathy and skepticism. R&D are not given adequate attention and funding and as a result, many entrepreneurial ventures have failed to prosper and survive coupled with poor business results and low profitability.

Different factors contributing to the failure of entrepreneurial ventures are problems associated with poor management, labour, high fixed cost of production, marketing, finance, and neglect of business, fraud and natural disaster. The production and value adding activities of R&D usually encounters production problems such as lack of production planning and control, frequent machine breakdown, poor quality raw materials, power costs, labour problem, lack of technical know-how, insufficient quality control, wastage in materials, high rate of rejection etc. (Khanna 2006). Many people venture into entrepreneurship without prior environmental scanning, Strength, Weakness, Opportunity, Threat (SWOT) analysis, lack product development strategy and projection of product life cycle. These have resulted to many businesses going into premature moribund or extinction; thereby negating the motives and objectives of entrepreneurship. Brockhaus (1987) lists the common motives for starting a business as: job dissatisfaction, the desire to work independently i.e the desire for personal autonomy of being one's own boss, perception of greater financial return, the need for more concrete feedback, the desire to accomplish tasks involving some unique ideas which, in turn yield intrinsic rewards of self fulfillment and accomplishment, the desire to identify unexplored opportunities, and unemployment or underemployment which might arise from lay-offs, retrenchment or flexible working conditions.

This paper is aimed at instilling entrepreneurial spirit and motivating self employment business interest in the areas of new products or improved products as a result of R&D findings. Also, to identify and examine the factors that could influence product R&D projects for entrepreneurship development in Nigeria and rank them in significant order of importance. The business potentials of the products could be continuously diversified for more employment generation and contributions to economic

transformation and growth. The appropriate government agencies such as FIIR Oshodi and PRODA Enugu, as well as manufacturing firms will appreciate and imbibe the spirit of periodic product R&D for the prosperity of the country. The synthesis of the ideas will provide knowledge-based synergy that will actualize robust product R&D results and, therefore, serve as a veritable or formidable strategy for competitive advantage, sustainability, self employment and economic growth. Small scale business entrepreneurs can as well delve into R&D project because it is a matter of ingenuity and total commitment by exploring failure mode and supply gap/demand analyses. New ideas for new and improved products result to new and improved business opportunities for entrepreneurs.

## 2. Theoretical Framework of Entrepreneurial Development

Innumerable theories exist for entrepreneurial development. A critical examination of Emmanuel (2008) narrates the contribution of some theorists to entrepreneurial development as follows: Peter Kiby (1968) postulated that entrepreneurs in developing economies should be concerned with “adaptation” of production processes through which they can be familiar with their environmental setting and by constant monitoring and evaluation, can get their business objectives achieved. Ludwig Mises (1962) sees ability to make gain in the face of uncertainty as a factor determining entrepreneurial performance. Frank Knight (1971), also known as Knightian entrepreneurship, based his own on the expression of self confidence in one’s ability to forecast the future, undertake and secure the factors that will help someone to start and successfully manage an enterprise towards production of goods for an unknown future demand by customers, with superior opinion in the face of uncertainty. Hans (2007) sees an entrepreneur as someone who has different skills for co-ordination of the available scarce resources. Owuala (1999) enumerates the characteristics of entrepreneurship as a function of the components of entrepreneurial role behaviour. These are moderate risk-taking as a function of skills, not chance, decisiveness, energetic, individual responsibility, knowledge of results of actions, anticipation of future possibilities, organization and skills. Emmanuel (2008) also posits: competitiveness, use of resources, goal setting, achievement etc. Olson (1987), taking a leaning towards classical theory of capitalist, defined an entrepreneur as a risk-taking innovative individual who establishes and manages a business for purposes of profit and growth. He identified the critical traits of entrepreneurs as:

- ❖ A keen sense of innovation; knowledge of what is important and what need to be accomplished.

- ❖ A high tolerance for ambiguous, unstructured situations.

- ❖ An intuitive and analytical ability; creative talent to discover connections not recognized or developed before; and the capacity to follow them until they are realized.

Amrine, et al, (1975) and Stevenson (2007) state that R&D efforts may involve basic research, and applied research and development.

- ❖ Basic or pure research has the objective of advancing the state of knowledge about a subject, without any near-term expectation of commercial application. It is consciously directed investigation to find new knowledge.

- ❖ Applied research has the objective of achieving commercial applications.

The thrust of this paper is predicated on the applied research as development converts the result of applied research into useful commercial applications. Ubani (2007) has identified other different types of research as; pure research, product research, manufacturing research, materials research, market research, and operations research. He also classifies development as process development and product development. Lock (1996) argues that project for pure research can consume vast sum of money, last for years and result to profitable discovery or be a complete waste of money. Applied research is an investigative and experimental work directed towards specific problems, products or processes. Research projects carry very high risk; and they aim to extend the boundaries of current knowledge and their end objectives are usually difficult or impossible to define (Lock 1996). Also, research often involves a good deal of uncertainty about the technological and economic success of a project. Monks (1985) further states that Bayesian statistics offers managers one measure of how much money is justified for market studies, pilot project etc. to reduce or remove uncertainty about the outcome of research. Development is the activity of converting research results into commercially viable ventures. Development efforts often consume the bulk of R&D fund, but Lock (1996) asserts that budget have to be set in line with available funding. Once developed, many products undergo value engineering or value analysis. This is an attempt to see if any materials or components can be substituted or redesigned in such a way as to perform the desired function, but at a lower cost. After prototype units are designed and produced, the products are further analyzed and tested to see how well the quality; performance and costs conform to the design objectives. Though Ubani (2007) observes that budget cut and reduction in overheads have often meant the shrinking of R&D facilities that could be as a result of ignorance of the economic

potentials of R&D project. Devine et al, (1979) however aver that “it is apparent that the growth of industrial spending on R&D has to a considerable extent been motivated by the search for another means of achieving product differentiation. Once some firms turn to R&D for this purpose, the pressure is on their competitors to follow suit. The result is a stream of product improvement or new products. In either case, much of the research involved is inevitably defensive in nature, aimed at protecting market positions, and the emphasis is therefore on rushing project that secure immediate benefit. Similarly, Ubani (2007) recognizes that product research attempts to ensure continued prosperity of the company by uncovering new product ideas that will meet the requirement of customers and prospective customers. Results of the development could open sustainable business opportunities for intending entrepreneurs. In expanding product research, particular effort may be directed toward altogether new and different products, new and original uses for present products or the utilizations of a by-product. It is obvious that stimulation for product research could come from many sources including the results of some pure research efforts, some ideas from customers, the need to utilize some particular technical skills possessed by the company or simply, the desire to expand the product line in whatever direction seems most feasible. In any case, emphasis is placed upon discovering useful and saleable products suitable for business venturesomeness. Therefore, for a company to prosper, grow and withstand competition, it must do more than keep up with its competitors. It must get ahead of them whenever possible through research, development and engineering so as to make use of the innovative technologies, managerial skills, and impact operational efficiency in the business which opens avenues for entrepreneurship. Applied research also has more appeal to the industrial concern and entrepreneurial development for they can see the prospect for quicker return for the investment made. According to Amrine et al, (1975), in this type of research, the basic sciences are adapted to industrial processes, materials or products. The hope is to improve the present product by making it cheaper, using better materials, improving the containers, adding a new customer’s appeal or improving its appearance. In addition, the company might hope to improve the operating efficiency of the plant or even develop a total new product. It follows that most industrial research is applied research, for in most industrial projects, the goals are rather specific and practical entrepreneurial applications are expected from the results. Development usually follows applied research and often is concerned with the construction of pilot plants to show that a process is feasible or

with the construction of models, to demonstrate that the basic ideas are incorporated in the new products. Amrine, et al, (1975) further state that the work of the research and development group must be transformed into commercial benefits. This means achieving a workable process on a production basis or a product capable of economical manufacture or both in timely and cost effective manner. Devine, et al, (1979) notice that in a capitalist economy in which firms have at least to avoid continuing losses if they are to survive, corporate research and development will be concentrated on projects closely related to the firm’s immediate commercial requirements and will tend to eschew the less predictable more basic research. They postulate that “to be successful in business, research and development must be related to the financial position and commercial objectives of the firms” and that “the firm which is speedy and successful in scientific and technical progress is one in which research, production and sales are coordinated”. The emphases of industrial research and development activity on short run projects are geared to the firm’s immediate competitive situations and have far reaching normative implication.

Materials research is basically linked with both product research and manufacturing research. The discovery and improvement of materials often makes possible new product or processes that were impossible prior to that time. Manufacturing research is usually directed towards the development of tools and equipment, handling devices and method of manufacture, all of which tend to reduce costs and increase productivity. Ubani (2007) on the other hand, opines that if productivity improvement has to be an ongoing, continuous and competitive process for survival and growth of an organization, R&D becomes an important and effective technique that should be introduced formally. The first step in product development cycle is obtaining ideas. Rowan (1984) observes that ideas are sources of industrial progress. They underline the development of new products, new companies and new industries. Ubani (2007) shares the same view with Rowan (1984), but argues that budget cut and reduction in overheads have often meant the shrinking of R&D facilities.

### **3. Product Development and Manufacturing**

Product development and manufacturing operations should not be discussed in isolation with process development because of their synergy in value-added manufacturing process. Accordingly, Gaither (1996) states that there is a continuous interaction between product design and process design. Process development has to do with machines, tooling, methods, plant layout, and the design of any special device or combination of devices needed to manufacture products. Process development is

conceptually very close to manufacturing engineering. Like process development, product development is a bridge between research works and engineering work. Amrine, et al, (1975) have written that the typical work of product development group consists of making several product designs, and then testing and evaluating these designs. The testing of such designs is not only limited in the market, but also in terms of performance in the laboratory or on the customer's premises. Another possible activity of which a product development group usually carried on in co-operation with process development would be the making of one or more pilot runs of the new product. Such runs would provide some actual products for testing as well as giving an opportunity to examine the process being used and to work out any flaw that might turn up. In addition to revealing the need for minor changes in product design, tooling and methods of work, such runs also reveal some cost information that would be useful in price setting.

Phases in the product development process are enumerated by Stevenson (2007) as follow:

- ❖ Idea generation- through research based, supply chain based i.e customers, suppliers, distributors, maintenance and repair personnel can provide valuable insights, feedback suggestion, complaints, through reverse engineering i.e. dismantling competitors products for improvement.

- ❖ Feasibility analysis- market analysis demand, economic analysis, development cost and production cost, profit potential and technical analysis (capacity requirements and availability, and the skills needed) etc.

- ❖ Product specifications- descriptions of what product is needed to meet or exceed customers wants and requires collaboration between legal, marketing and operations.

- ❖ Process specifications- for the process that will be needed to produce the products, Alternatives must be weighed in terms of cost, availability of resources, profit potential and quality.

- ❖ Prototype development- one or a few units are made to see if there is any problem with product or process specifications.

- ❖ Design review- make any necessary changes or abandon the project.

- ❖ Market test- to determine the extent of consumer acceptance; if unsuccessful, return to design review phase

- ❖ Product introduction- promotion of the products in the market.

- ❖ Follow-up evaluation- determine if changes are needed and refine forecast.

In their own view, Amrine, et al, (1975) posit that the development of a new product or the improvement of an old one commonly goes through

seven steps called product development cycle, before the new product is ready for the customer to purchase. These steps are: obtaining ideas, screening ideas, technical evaluation, market evaluation, final decision, getting into production and introduction to the market. They further state that the steps are not always separate and distinct, for in many cases, it is desirable to carry on two or more steps at the same time. The point is that all are carried out either knowingly or unknowingly in the development of any new product.

The next step after product design and engineering is the product manufacture. Product engineering is mainly concerned with the product and getting it ready for production. Production department will perform actual manufacture; however, engineering plays a considerable role in getting efficient manufacturing processes set up and operating them properly. The design of a suitable process is the concern of manufacturing or industrial engineering activity. Frequently, this work must be coordinated with product engineering, since the design of a suitable product may depend to a large extent on the design of manufacturing processes. The other concerns of the manufacturing process design are: tooling and equipment, methods, layout and materials handling, quality control and economic evaluation.

#### 4. Methodology

The study adopted expository and survey research design with multistage sampling technique of 6 geopolitical zones and industrial research centres and institutes such as Federal Institute of Industrial Research Oshodi, Project Development Institute, Enugu, etc. The primary data obtained from the professionals with the instrument of standardized questionnaire modeled in likert five point scale. Out of 102 (100%) copies of questionnaire administered to respondents, 92 (90.2%) responded. The data obtained were subjected to analysis using Relative Importance Index (RII) model in order to assess the influence of the identified product R&D factors on the stimulation of entrepreneurship development.

$$RII = \frac{\sum w_i N_i}{N \dots \dots \dots 1}$$

where  $N_i$  = number of respondents scoring a particular weight to factors.

$N$  = the total number of respondents

$W_i$  = weight of each factor as given by a respondent.

The following factors were hypothesized to influence products R&D projects for entrepreneurship development as adopted from Twiss (1998), Amrine et al (1975), etc.

$X_1$  = level of risk

$X_2$  = schedules completion and throughput time

$X_4$  = environmental friendliness

X5 = availability of raw materials and equipment  
 X6 = business viability and marketability of the products  
 X7 = manufacturability and production efficiency  
 X8 = supply and demand gap  
 X9 = process capability and simplification  
 X10 = integrity and mindset of researchers  
 X11 = modularity and maintainability of the products  
 X12 = innovative and business ideas  
 X13 = contribution to national economy  
 X14 = government policy and regulation  
 X15 = management support

X16 = Quality and reliability of the products.

### Conclusion

Product R&D project has been examined for entrepreneurship development. The result of the analysis infers that business viability and marketability of the products, quality and reliability of the products, availability of raw materials and equipment with RII of 4.78, 4.77, and 4.73 respectively are to be given prime consideration and reasoning in the formulation of policy and strategy for product R&D projects for entrepreneurship development.

**Table 1. RII and Ranking of all Identified Factors**

VAR	SA	A	N	D	SD	Σ	RII	Rank
X1	4	5	33	42	10	233	2.48	11
X2	-	8	22	36	28	198	2.11	13
X3	-	-	45	48	1	232	2.47	12
X4	28	36	30	-	-	374	3.98	7
X5	69	25	-	-	-	445	4.73	3
X6	73	21	-	-	-	449	4.78	1
X7	32	41	21	-	-	387	4.12	5
X8	-	14	55	25	-	271	2.88	9
X9	-	-	26	34	34	180	1.91	15
X10	-	-	10	21	63	135	1.44	16
X11	5	7	34	43	5	246	2.62	10
X12	17	69	8	-	-	385	4.10	6
X13	42	38	10	6	-	404	4.30	4
X14	-	-	26	44	24	190	2.02	14
X15	7	19	58	10	-	305	3.24	8
X16	72	22	-	-	-	448	4.77	2

Product R&D projects develop new products and processes and improve on the existing products and processes. The identified and explored factors have to be taken into consideration. The results of product R&D open up new business units and entrepreneurial ventures for economic development, employment generation and self employment. However, government should consider the comparative advantage of funding R&D project because of high cost profile. While getting into the production stage of R&D projects, plans could be considered for introducing the products to the market. From the market evaluation, the size, location and characteristics of the market are known, and means must be devised to impress the market favourably and interested entrepreneurs who may wish to venture into the end-items. They may also venture into product diversification for wide market share and competitive advantage. Diversification, which is the process of adding new products line or adding more varieties and

sizes of products, will make companies to prosper and grow. However, it could be unfortunate to conduct a great deal of research and development work and introduce a new product only to have some competitors start making the same product soon thereafter. It could be a colossal financial waste and if this trend is not checked, entrepreneurs will be discouraged in performing research and development work. The laws of the country prohibit this practice, by providing that inventors may patent their invention, thereby preventing others from using them without their permission.

In Nigeria, the erratic and incessant electric power failure is the bane of small scale business entrepreneurship development. Conscious Governmental effort should be directed to the provision of alternative source of electric power with emphasis on portable, durable, reliable, and cost efficient solar energy to revolutionize entrepreneurial development especially in the rural areas.

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**Correspondence to:**

Echeme, Ibeawuchi' Department of Project Management Technology  
Federal University of Technology, Owerri – Nigeria  
Telephone: +2348032403835  
[ibeecheme@yahoo.com](mailto:ibeecheme@yahoo.com)

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