

# Creativity, Innovation and Appropriate Technology as Essential Tools for Developing Entrepreneurs in Nigeria

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**Abstract:** *The study examines the challenges, prospects and reviews some of the main issues with regards to creativity innovation and appropriate technology as they apply to the development of entrepreneurs in Nigeria. The study considers creativity, innovation and appropriate technology as essential tools for developing entrepreneurs. The research method adopted for this study was survey and documentary analysis. The survey research involved collection of data from existing records and findings of the opinion on the subject through the use of structured questionnaire. Stratified sampling technique was used to select the respondents for the study. The population for the study comprised selected lecturers from tertiary institutions in southwest zone of Nigeria, managers from manufacturing industries and entrepreneurs randomly selected from Lagos, Oyo and Osun states in Nigeria, using stratified proportional random sampling technique. The internal consistency of the questionnaire was determined using Cronbach Alpha ( $\alpha$ ). The reliability of the questionnaire was 0.782. Data obtained were analyzed using mean, one-way analysis of variance, percentages and frequency count. The study revealed great prospects on creativity, improvement of life and real economic growth and transformation in the society as central issues in the development process. The study also considered and revealed that creativity, technology and innovation contribute substantially to social and ecological dimensions of development through providing solution to specific problems and by enhancing a knowledge based self-determined development. The study concludes that entrepreneur's development will involve the possession of innovative skills for creation of new and appropriate technology. The study therefore recommends that efforts must be made at defining the needs, and entrepreneurs must then search for appropriate technology that will best satisfy the needs.*

**Keywords:** *innovation, creativity, appropriate technology, development, entrepreneur, prospects, challenges.*

## Introduction

The innovative and creative approach to the application of a body of scientific knowledge and the working of the various materials in an engineering and industrial entrepreneurial environment will differ in and cannot be the same but rather relevant or appropriate technology when one considers that it is all centered on the application of science (Manuh, 2009).

It is an easily ascertainable fact that the evidence from the industrialized countries suggests that a larger number of genuine innovations are produced by small firms for every amount of money spent on research than by large businesses. Whilst comparative figures for developing countries according to Manuh (1985) are scarce, there is nonetheless plenty of evidence to suggest that small firms in developing countries are highly innovative. Moreover, many small firms employ technologies or processes which use local and scrap materials. This is in contrast to the many cases when firms, large and small, in developing countries, are encouraged to use capital-intensive machinery, most of which are imported. This has many negative implications with respect to capital, foreign exchange, labour, spare parts, as well as increasing dependence and stifling indigenous innovation. The major issues are thus concerned with deciding what is appropriate and with the choice of technology.

This study examines some of the main issues with regards to innovation creativity and appropriate technology as they apply to the development of entrepreneurs.

## Purpose of the Study

The evidence of the significant increase in the relatively high number of internationally oriented entrepreneurship businesses and activities had prompted the increased interest in the need for innovations and appropriate technologies in different countries.

Appropriately, entrepreneurial activities are technology driven, requiring urgent need for co-ordinated approach to the possession of innovative skills for creation of new ideas, substantial knowledge input, skills, machines and specialized facilities, and equipment in proper and conducive environment.

To this effect, entrepreneurs have roles to play in the economy by stimulating business through financial investment and innovation. Viewed in this perspective the government is one conduit for commercializing the results of the synthesis of innovation, appropriate technology, social and commercial need. This is frequently called, according to Hisrich, Peter and Shepherd (2008) "Technology transfer, and has been the focus of a significant amount of research effort.

Despite this effort, however, relatively new inventions resulting from sound scientific government-sponsored research have reached (been transferred to) the commercial market. Most of the by-products that are applicable require significant modification to have market appeal. Though the government has the financial resources to successfully transfer the technology to the marketplace, it lacks the business skills, particularly marketing and distribution, necessary for successful commercialization. In addition, government bureaucracy and red tape often inhibit the business from being formed in a timely manner.

Recently, some incubation centers are trying to address the problem with federal labs being required to commercialize some of their technology each year. In order to help their scientists commercialize their technology and think more entrepreneurially, some labs are providing entrepreneurial training and are working with university entrepreneurial centers, in various and varied environment.

This study examines challenges, prospects and some of the main issues arising with regards to creativity, innovations and appropriate technology as they apply to the development of entrepreneurs in Nigeria.

## Summary of Literature Review

### Innovation

According to the BusinessGov (2013) innovation generally refers to changing or creating more effective processes, products and ideas that can increase the likelihood of a business succeeding. This could mean implementing new ideas, creating dynamic products or improving existing services. Innovation can be viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs.

Lange (2013), pointed out that innovations are such changes in production functions, in the schedules indicating the relation between the input of factors of production and the output of products, which make it possible for a firm to increase the discounted value of the maximum effective profit obtainable under given market.

According to Costello and Prohaska (2013) innovation is a word that is derived from the Latin word *innovare*, this means “into new”. The simplest definition of innovation is doing something different. Innovation is a word that is often used in the business world and for companies this usually means something risky, costly and time consuming. Innovation can also be explained as a new idea, product, device or novelty. It is a mind-set, a way of thinking beyond the present and into the future. Innovation is important for companies and when used well it can be a process, strategy and management technique (Kuczmarksi, 2003). Innovation can at a fundamental level be the process of generating and combining ideas to make a relationship between present accomplishments and past experiences to solve a future problem. This is often associated with technological feats and it plays a critical role in the world economy (Baskaran & Mehta, 2016). Innovation is big in the business world and is sustainable to create value and be strong in the competitive environment. There is a link between innovation, jobs, profit and standard of living. A common way to associate innovation with is new products, materials, new process, new services and new organizations. Baregheh, Rowley & Sambrook, (2009) argued that there is a range of definitions for innovation which often overlap and there is no clear and authoritative definition. Scientist point towards this problem and without a clear definition of innovation it will be hard to develop strategies to be innovative.

Baregheh, et al (2009) further brought a suggestion of a complete and multistage process definitions of innovation: “*innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace*”.

Other definition for innovation is that it is a process of getting new tools into a given social environment or a new tool itself. New studies show that the definition is much broader. Innovation initiating new process or events, it also brings changes in behavior, personnel and approach and encompass much more than simply establish an effective tool (Reiman & Dotger, 2008). Innovation can also be described as a method and technology for new markets, new product methods and identification of new customer groups. Innovation is an activity which companies use to solve problems by combining knowledge (Fri, Pehrsson & Soilen, 2013). Innovation can have different definitions depending on which area you are in. Technological innovation is defined as a new market and/or a new service opportunity for a technological based invention which could lead to development, or production success (Garcia & Calantone, 2002).

There has been studies (Gisbert-lopez, Verdu-Jover & Gomez-Gras (2014) that found positive relationship between creative climate and innovation. If a workplace encourages a creative climate it can moderate effects between leadership, individual problem solving, group relations and innovation. The association between creativity and new ideas is close.

### Innovation and Entrepreneurship

According to Sullivan (2008) the term *entrepreneurship* and *innovation* are often used interchangeably, but this is misleading. Innovation is often the basis on which an entrepreneurial business is built because of the competitive advantage it provides. On the other hand, the act of entrepreneurship is only one way of bringing an innovation to the marketplace. Technology entrepreneurs often choose to build a startup company around a technological innovation. This will provide financial and skill-based resources that will exploit the opportunity to develop and commercialize innovation. Once the entrepreneur has established an organization, the focus shifts toward its sustainability, and the best way that this can be achieved is through organizational innovation. However, innovation can be brought to market by means other than entrepreneurial startups; it can also be exploited through established organization and strategic alliances between organizations.

According to Farriha, Ferreira, and Gonrea (2016) the key to innovation development involves a close collaboration with science, financing and technology and this has developed a model called triple helix model. Innovation nowadays has become a key ingredient to manage the global competitiveness and companies have to deal with the creation of new products and services. Innovation is more often associated with generating new ideas in products and services.

Sullivan maintained that innovation is about helping organizations grow. Growth is often measured in terms of turnover and profit, but can also occur in knowledge, in human experience, and in efficiency and quality. Innovation is the process of making changes to something established by introducing something new. As such, it can be radical or incremental, and it can be applied to products, processes, or services and in any organization. It can happen at all levels in an organization, from management teams to departments and even to the level of individual.

Sullivan also argued that innovation has been and continues to be an important topic of study for a number of different disciplines, including economics, business, engineering, science and sociology. Despite the fact that innovation has been studied in a variety of disciplines, the term is often poorly understood and can be sometimes confused with related terms such as *change*, *invention*, *design* and *creativity*. Most people can provide examples of innovative products such as the iPod or the PC, but few can clearly define the innovative aspects of these products. Among academics there is a difference of opinion about what the term *innovation* really means.

In a related sense, there seems to be more confused thinking and interpretation of the definition of innovation. The word innovation is often being confused with the word invention.

According to Lin (2006), the word innovation originated from Latin word, *innovare* which means “to make something new”. Back in 1985, Drucker had defined innovation as the entrepreneurs’ specific tool to exploit change for a diverse business or service. Drucker added, that innovation can be presented as a discipline which can be learned and practiced. In other words, innovation is also said as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Daugherty et al., 2011; Grawe, 2009; Rogers, 1995). Meanwhile, Tidd, Bessant, Pavitt and Wiley (1998) defined innovation as a process of transforming an opportunity into fresh ideas and being widely used in practice. Quite similar to Bentz (1997) who assumed that innovation is to bring out a new or enhanced process, service or products for the marketing. Afuah (1998) suggested that innovation is the “use of new technical and administrative knowledge to offer a new product or service to customers”. Thus, many authors concluded that innovation is “any practices that are new to organizations, including equipment, products, services, processes, policies and projects” (Damanpour, 1991; Kimberly & Evanisko, 1981; Lin, 2007). Khazanchi, Lewis, and Boyer (2007) also extended the conclusion where they said that innovation is one of major relevance for companies, as it can be the source of additional revenues from new products or services, can help to save costs or improve the quality of existing processes.

## Creativity

According to Rosenfeld and Servo (1991) creativity is regarded as a key building block for innovation and is an inherent capability in all human beings. Creativity is a mental process that results in the production of novel ideas and concepts that are appropriate, useful and actionable. The creative process can be said to consist of four distinct phases: preparation, incubation, illumination and verification (Wallas, 1926), in which the idea is structured and finalized in a form that can be readily communicated to others. Creativity entails a level of originality and novelty that is essential for innovation. Although creativity is a fundamental part of innovation, it is wrong to interchange the terms. Innovation encourages the further processing of the output of the creative process (the idea) so as to allow the exploitation of its potential value through development.

According to Newton (2002) creativity has been described as the organization of thought in a way that leads to different understandings of a situation.

Creativity is the development of ideas new to others. It takes creativity to discover alternate designs – construction method, systems or process that will accomplish the required functions of the present way of performing.

Surely, everyone possesses some degree of creative ability and the innate creative ability can be developed and improved through training and practice.

According to Edward de Bono (2002);

- Creativity is rapidly becoming the most important ingredient in business.
- Creativity is not a mystical talent that only a few people possess, but a skill that can be developed.
- Creativity is a matter of waiting for inspiration, but a deliberate skill that can be used as needed.
- Feeling free and liberated as in traditional brainstorming is a weak approach.
- Formal creative techniques are based on an understanding of the brain as a self-organizing information system.
- Argument is a crude and primitive way of exploring a subject. Parallel thinking is far more preventive.
- In any organization, if creativity is not an expectation it will be seen as a risk.

Considering some experiences with major multinationals and others organizations, the basic behavior is “maintenance and problem solving.” This means running things as they are solving problems as they arise. A great seal of lip service is paid to creativity but little is done.

### **The Use of Creativity**

Creativity is used to solve problems, design ways forward, resolve conflicts, simplify procedures, cut costs, improve motivation, design new products and services, and fashion strategies. Any situations that require thinking demand creativity. Without it, we are condemned to repeating the standard routines – (Edward 2002).

However, a person tied up with a rope cannot play the violin. If we cut the rope, does that make that person a violinist? According to Edward if you are inhibited you cannot be creative. If you release yourself from that inhibition, does that make you creative? That is the essence weakness of processes such as brainstorming. Creativity can be a much more discipline with specific mental operations that can be used deliberately.

### **Appropriate Technology**

The concept of Appropriate Technology (AT) stemmed from the work of a German born British economist Fritz Schumacher (1911 – 1977). Appropriate technology according to Mayolus, Nakasluma and Orr, (2009) is a grass roots approach to technology that builds a strong sense of community and encompasses benefits that span across social, environmental, cultural, economic, and spiritual facets. Appropriate technology is not a one size fits all approach, but rather adapts to best fit the community in which it is developed. Appropriate technology best fits with the community it serves because it is created by the people to meet a need. Therefore, the communities are placed at the centre of decision making and create technology that will best serve their communities in the long run.

According to Manuh and Brown (1987) technology is said to be appropriate when it is the most economic (i.e. the best balance between cheapness and effectiveness) way of performing a certain function in the context of the costs of resources where it is used. A distinction needs to be made here between intermediate and appropriate technology: whilst appropriate technology is that which is most economic in a given set of circumstances, intermediate technology is that which lies between two extremes, between the most basic and the most advanced.

Given that most developing countries have an abundant labour supply but possess little capital, one might expect to find production methods which are relatively labour-intensive. However, in many instances, the reverse obtains in industry and, indeed, in agriculture. One explanation is that because of a variety of structural, institutional and political factors, the actual ‘market’ price of labour is higher and that of capital lower than each of their true scarcity or ‘shadow’ values would dictate. The price of scarce capital is kept artificially low by a combination of liberal capital depreciation allowances, lower interest rates, low or negative effective rates of protection on capital good imports, tax rebates, overvalued exchange rates, etc. the net result of these distorted factor prices is the encouragement of inappropriate, capital-intensive methods of production in both manufacturing and agriculture – Manuh et al.

The issues are not, however, according to Manuh et al solely concerned with the economic cost of capital, labour and materials. The choice of technology affects and is itself affected by other factors such as maintenance of new machines, availability of foreign exchange for necessary materials or spare parts and the effects of new technology on the people who will have to operate it. In addition, current and future availability of fuel, electricity, water and other services need to be considered, along with supply, training

and supervision of labour. For the small business person, as indeed for any businessman/woman or investor, the ultimate consideration is profitability.

Technology according to Ihueze, Okpala, Okafor and Okonkwo (2015) refers to the body of organized knowledge, tools and machines, used by man to manipulate his environment for his general good. It involves the adoption of scientific knowledge or inventions to develop and produce goods and services useful to man, thereby solving everyday problems or facilitating tedious human activities. It is a practical problem solving enterprise, which is propelled by scientific discovery or by societal needs. No doubt, our needs are many, and we must be propelled by the same measure. Technology can be traced historically to the beginning of time to be man's quest to improve his way and quality of life.

Faluyi (1989) opined that technology is the application of a body of scientific knowledge, principles and engineering techniques to the production of goods and services. Faluyi further argued that there is no one standard technology. One hears of rubber technology, wood technology, brewing technology etc. In each case we are talking about the application of a body of scientific knowledge to the working of the various materials in an engineering environment.

Such technology defers and cannot be the same, but rather, relevant technology when one considers that it is the application of science, then, what is the definition of science? Collins English Dictionary (2009 edition) defines "science" as "the study of the nature and behavior of physical universe based on observation experiment and measurement". This definition does not permit any local application of science. Science, to be science, must be universal "truth ascertained anywhere by observation, experiment and induction."

According to Margolus, Nakashima and Orrchanlal (2009) appropriate technology is important due to its holistic nature. Firstly, it permits local needs to be met more effectively through community involvement, and for this reason it tends to be aligned with local values and traditions. Secondly, AT utilizes human labour by developing tools rather than machines. This enables people to self-organize without complicated management training and specialized knowledge. Thirdly, it minimizes transport of goods in an era of expensive and environmentally harmful energy, allowing greater local industry participation and implementation of local resources, both human and material. Fourthly, AT reinforces local control which provides a cushion against the effects of outside economic changes. Finally, it establishes a self-sustaining skill base and reduces economic, social and political dependency between individuals, regions, and nations. AT recognizes the will of local people to act on their own behalves, and is a technology made by and for the people. The benefits of AT can be realized differently by various systems or countries undoubtedly critical role in building sustainable communities. For example the version of Wicklein's evaluation includes 6 criteria:

1. Ability of technology to stand alone without additional support systems.
2. Individual versus collective technology, with regard to which one the culture values.
3. Cost of technology which takes into account full costs to social, economic and environmental impacts.
4. The risk factor including internal risks, that relate to the fit in local production systems and external risks, which relate to the needed support systems.
5. Evolutionary capacity of technology, with regard to its capability of being reconfigured to grow with the society it benefits, whereby solving different problems that the community encounters.
6. Single-purpose versus multi-purpose technology, where the later refers to technology that has the ability to complete different tasks at the same time.

Schumacher (1977) argues that technology and the organization making use of technology ought to fit the resources of our planets and the needs of man. They must be of an appropriate scale. 'Man is small, and, therefore, small is beautiful. To go for giantism is to go for self-destruction.' From this critique stems Schumacher's advocacy of 'intermediate technology' and organization for the third world, and 'smallness within bigness' for the organizations of the industrialized world.

Schumacher (1977) contended that Intermediate technology should replace the 'technology of giantism'. The trend towards ever-greater size of production equipment, and of larger organizations to run it at ever-higher speeds, is the opposite of progress. Third world poverty is a problem of two million villages to which such technologies and organizations are wholly unsuited. They result in incongruous and costly projects. According to Schumacher a textile mill in Africa is filled with highly automated machinery to 'eliminate the human factor' even though people are idle. And even though its standards demand fibres of a length not grown locally so that its raw materials must be imported. A soap factories produces luxury soap by such sensitive processes that only very refined materials can be used, which are imported at high prices whilst local material are exported at low prices. Examples of such inaptness abound.

Schumacher argues that the smallest-scale technology and organization suitable for the purpose should be used. He puts forward four propositions:



1. Workplaces should be created where people live now, not in the metropolitan areas to which they then migrate.
2. These workplaces should be cheap enough to be created in large numbers without calling for unattainable levels of capital formation and imports
3. Production methods should be sufficiently simple to minimize demands for high skills either in production or in organization.
4. Production should be mainly from local material and for local use.

Schumacher also argues that the intermediate level of technology may be symbolized in monetary terms. Suppose that the indigenous technology of a typical developing country is called a £I-technology, and that of developed countries is called a £1000-technology, then intermediate technology is a £100-technology.

Whilst intermediate technology in the third world would require the organizing of people in small units, the giants organizations of the industrialized world cannot simply be abolished. Some goods can only be produced on a large scale. So what can be done about these giants? The fundamental task is to achieve smallness within bigness and adapt appropriate technology.

## METHODOLOGY

The study considers creativity, innovation and appropriate technology as essential tools for developing entrepreneurs. The study adopted survey and documentary, analysis research methods. The study examined the challenges and prospects and the factors that contribute to and influence creativity, innovation and the application of appropriate technology in Nigeria.

The research involves collection of data from existing records and finding of views on the subject through the use of structured questionnaire. The area covered by this study consists of 75 lecturers from tertiary institutions in Southwest zone of Nigeria. 80 managers from manufacturing industries, and 120 entrepreneurs randomly selected industrial areas of Lagos, Oyo and Osun States in Nigeria.

Stratified proportional random sampling technique was used. The internal consistency of the questionnaire was determined using Cronbach Alpha ( $\alpha$ ). The reliability of the questionnaire was 0.782. Data obtained were analyzed using mean, one-way analysis of variance, percentages and frequency count.

## SUMMARY OF ANALYSIS AND FINDINGS

**Table 1: Respondents mean scores on prospects of creativity, innovation and appropriate technology.**

Prospects of creativity, innovation and appropriate technology.	Tertiary Institution Lecturers 75		Industry Managers 80		Entrepreneurs 120			Interpretations
	Mean Score	SD	Mean Score	SD	Mean Score	SD	Combined Mean	Remarks
Creativity, technological innovation play fundamental role in wealth creation, improvement of the quality of life and real economic growth and transformation in the society.	4.83	0.77	4.83	0.72	4.82	0.74	4.83	SA
Science, creativity, technology and innovation processes towards knowledge-based economic growth and prosperity than those who do not.	4.69	0.88	4.65	0.95	4.65	0.98	4.66	SA
Creativity, technology and innovation contribute to social and ecological dimensions of development through providing solutions for specific problems and by enhancing a knowledge base for self-determined development.	4.69	0.88	4.65	0.79	4.66	0.94	4.67	SA
Development and design of national innovation system provide an environment for	4.69	0.88	4.65	0.95	4.66	0.94	4.67	SA

economic agents to create and to produce new technologies and innovations.								
Creativity, innovation and appropriate technology has helped in reducing stress brought about by the movement of goods and people from one place to another by inventing better transportation approaches.	4.70	0.86	4.66	0.93	4.67	0.93	4.67	SA
Larger number of genuine innovations are produced by small firms for every amount spent on research than by large businesses.	4.59	0.85	4.59	0.86	4.61	0.80	4.60	SA
Many small firms employ technologies and processes which use local and scrap materials instead of imported ones.	4.38	1.11	4.39	1.09	4.39	1.08	4.39	A
Appropriate technology is that which is most economic in a given set of circumstances.	4.40	0.83	4.59	0.86	4.40	1.07	4.46	A

**LTI = Lecturers in tertiary institution, IM = Industry Managers, E = Entrepreneurs**

**SD = Standard deviation; SA = Strongly Agreed; A = Agree; MA = Moderately Agree; D = Disagree; SD = Strongly Disagree.**

Data in table 1 indicate the combined mean scores of the LTI, IM and ENT on the prospects of creativity, improvement of life and real economic growth and transformation in the society ( $\bar{x}$ ) = 4.83 a central issue in the development process. Data show that the participants consider and strongly agreed that the creativity, technology and innovation contribute substantially to social and ecological dimensions of development through providing solutions to ( $\bar{x}$ ) = 4.67 specific problems and by enhancing a knowledge based self-determined development. Creativity, innovation and appropriate technology have helped by reducing stress brought about the movement of goods and people from one place to another by inventing better transportation approaches ( $\bar{x}$ ) = 4.67. Appropriate technology is that which is most economic in a given set of circumstance ( $\bar{x}$ ) = 4.46. ( $\bar{x}$ ) = 4.67.

**Table 2: summary of the analysis of variance of the respondents on the prospects of creativity, innovation and appropriate technology as tools for developing entrepreneurs in Nigeria**

Sources of variance	SS	DF	MS	F	Level of Significance	Remarks
Between groups	0.003	2	0.0015	0.052	0.05	NS
Within groups	2.991	105	0.0284			
Total	2.994	107				

**SS = Sum of squares; DF = Degree of freedom; MS = Means square; F = Ratio; NS = No Significance.**

Data in table 2 shows the result of the analysis of variance ANOVA summary on data regarding prospects of creativity as essential tool for entrepreneur. The data shows that there is no significant difference between the test score on the prospects of creativity, innovation and appropriate technology on entrepreneurs development with an F- ratio of 0.05. Since the calculated F- ratio is less than the table value of 3.09 the null hypothesis is retained.

**TABLE 3: Respondents consideration with regards to challenges of creativity, as essential tool in developing entrepreneurs in Nigeria**

Challenges of creativity, innovation and appropriate technology	Tertiary Institution Lecturers 75	Industry Managers 80	Entrepreneurs 120	Combined	Interpretations
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	Mean Score	SD	Mean Score	SD	Mean Score	SD		Remarks
Poor state of science and technological innovations	4.24	1.25	4.39	1.09	4.40	1.07	4.34	A
Lack of coherent national policy guideline that is properly coordinated	4.67	0.88	4.65	0.95	4.66	0.94	4.67	SA
Lack of sound educational system with adequate infrastructure focusing on areas of technology development	4.57	0.94	4.56	0.96	4.59	0.91	4.57	SA
Lack of collaboration between industry and academia	4.58	0.91	4.56	0.96	4.6	0.86	4.59	SA
Need for fundamental and clear unique roles for sustainable industrial and economic development	4.26	1.21	4.46	1.22	4.25	1.26	4.26	A
Lack of national policies to develop science-technology-innovation synergy for the roadmap that will lead to sustainable industrial and economic development	4.24	1.25	4.25	1.25	4.24	1.25	4.24	A
Need for conducive environment, proper/adequate preparation for our engineers by training to be creative and innovative.	4.70	0.86	4.67	0.91	4.67	0.90	4.68	SA
Need for heavy investment in people, factories and infrastructure that will provide the foundation for todays industries.	4.57	0.95	4.67	0.91	4.59	0.91	4.61	SA

LTI = Lecturers in Tertiary Institution, IM = Industry Managers, E = Entrepreneurs

SD = Standard Deviation; SA = Strongly Agree; A = Agree; MA = Moderately Agree; D = Disagree; SD = Strongly Disagree.

The data in table three 3 indicates the combined mean scores of the respondents generally on the challenges of creativity innovation and appropriate technology in developing entrepreneurs. The data shows that the respondents considered the poor state of science and technical innovation, lack of coherent national policy guideline that is properly co-ordinated and the  $\bar{x} = 4.61$  lack of collaboration between industry and academia  $\bar{x} = 4.59$ ; lack of natural policies to develop science – technology – innovation synergy for the road map that will lead to sustainable industrial and economic development  $\bar{x} = 4.24$  inadequate preparations for our engineers by training to be creative and innovative  $\bar{x} = 4.68$  together with others were rated by participants as very high challenges facing the efforts to creativity, innovation and appropriate technology in Nigeria.

**TABLE 4: Summary of the analysis of variance of the responses on challenges on creativity, innovation and appropriate technology as tools for developing entrepreneurs.**

Sources of variance	SS	DF	MS	F	Level of Significance	Remarks
Between groups	0.001	2	0.0005	0.052	0.05	
Within groups	2.935	72	0.040			
Total	2.936	74				

SS = Sum of squares; DF = Degree of freedom; MS = Means square; F = Ratio; NS = No Significance.

Data in table 4 shows the results of the analysis of variance ANOVA summary on data regarding the challenges. The data shows that there is no significant difference between the test score results of the respondents on the challenges with an F- ratio of 0.039. Since the calculated F-ratio is less than the table of 3.13; Hence, the F-ratio is not statistically significant. Thus a null hypothesis was up held.

### Discussions/Interpretations

Evidence from the industrialized countries and findings from this study suggest that a larger number of genuine innovations are produced by small firms for every dollar spent on research than by large businesses.  $\bar{x} = 4.67$  whilst comparative figures for



developing countries are scarce, there is nonetheless plenty of evidence to suggest that small firms in developing countries are highly innovative  $\bar{x} = 4.70$ . Moreover, many small firms employ technologies or processes which use local and scrap materials  $\bar{x} = 4.75$ . This is in contrast to the many cases when firms, large and small, in developing countries, are encouraged to use capital-intensive machinery, most of which are imported. This has many negative implications with respect to capital, foreign exchange  $\bar{x} = 4.69$ , labour, spare parts, as well as increasing dependence and stifling indigenous innovation. The major issues are thus concerned with deciding what is appropriate and with the choice of technology.

The evidence of Manuh et al (1987) reiterated that technology is said to be appropriate when it is the most economic (i.e. the best balance between cheapness and effectiveness) way of performing a certain function in the context of the costs of resources where it is used. Conceptual confusions could however, arise between the dichotomy and distinction between intermediate and appropriate technology: whilst appropriate technology is that which is most economic in a given set of circumstances, intermediate technology is that which lies between two extremes, between the most basic and the most advanced.

Given that most states in Nigeria have an abundant labour supply but possess little capital, one might expect to find production methods which are relatively labour – intensive. However, in many instances, the reverse obtains in industry and, indeed, in agriculture. One explanation is that because of a variety of structural, institutional and political factors, the actual ‘market’ price of labour is higher and that of capital lower than each of their true scarcity or ‘shadow’ values would dictate. The price of scarce capital is kept artificially low by a combination of liberal capital depreciation allowances, lower interest rates, low or negative effective rates of protection on capital good imports, tax rebates, over valued exchange rates, etc. the net result of these distorted factor prices is the encouragement of inappropriate, capital – intensive methods of production in both manufacturing and agriculture.

The issues are not, however, solely concerned with the economic cost of capital, labour and materials. The choice of technology affects and is itself affected by other variables and factors such as maintenance of new machines, availability of foreign exchange for necessary materials of spare parts and the effects of new technology on the people who will have to operate it. In addition, current and future availability of fuel, electricity, water and other services need to be considered, along with supply, training and supervision of labour. For the small business person, as indeed for any businessman/woman or investor, the ultimate consideration is profitability.

The fundamental issue is whether there are in fact real technology choices in most industries; whether in fact the small businessman, or whoever is advising or financing him, can choose between alternatives or whether there is no other choice but to accept a particular package which may have been designed for totally different purposes, because nothing else is available.

Choice does exist in most industries. In this respect, one expert has commented: “cement, sugar, steel reinforcing bars, plastic containers, motor vehicles and even aeroplanes can be made on a small scale, using labour intensive technology which is appropriate for the resource costs of poor countries.” (Harper, 1984). Moreover, it is noteworthy that the alternatives to inappropriate technology do not merely comprise local innovations, but indeed also include the use of second-hand equipment which may be ‘redundant’ in the developed countries and can usually be purchased at very low prices.

## **CONCLUSION**

To a larger extent, majority of our respondents are of the view that for entrepreneurs to succeed in innovation, creativity and contribute to either transfer of technology or appropriate technology entrepreneurs must be developed and practice and operate in conducive environment. This brings in the question of the kind of environment under which our entrepreneurs live and work. The traditional way of looking at the learning environment as limited to the strictly formal atmosphere of the school/college clearly restrict our view of a significant element in all aspects of entrepreneurial development. Innovative and creative approach to the application of a body of scientific knowledge and the working of the various materials in an engineering and industrial entrepreneurial environment will defer and cannot be the same. Hence there is need for conducive environment  $\bar{x} = 4.68$ . For as it is argued the concept of environment extends to and includes all those stimuli that influence or provide motivations for our varied responses, because Human beings respond in different ways.

Therefore any observed short comings in one, actually weakens any elements of gain in the other environment, training centres, colleges, industry, society, is clearly becoming one which can neither stimulate nor support creative or innovative genius.

The study concludes and considers innovation and creativity as very essential tools for developing entrepreneur in Nigeria.

## **Recommendations**

Efforts must be made at defining the need, entrepreneur must then search for appropriate technology that will best satisfy the need. According to Magavero & Shane (2014) there are several strategies that can be followed and these can be divided into two major groups: The first is to develop the technology itself, and the second is looking for the technology outside the organization.

Information plays a big role in the search for new, or the most applicable technology. Organizations are particularly interested in information on products, finance and patent information. One of the successful sources of information and co-operation is higher education institutions in the form of Universities. Partnerships with these Institutions will help companies and organizations to: Access new technologies, Keep abreast of new technologies, and Access consultancy skills to develop new technologies jointly.

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