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The Place of Innovation and Indigenous Technology in National Economic Transformation

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Abstract

There is a need for Nigeria to acquire adequate technology and follow through an innovative part in order for the economy to bootstrap. At present the economy of the nation is nose-diving and requires an emergency turnaround if we have to develop. A country blessed with rich mineral and natural resources, but has failed to add value to its produce but rather export the raw material in other to get finished products in return thereby creating room for its own economic mishap. The research work tries to find ways to improve above the present current economic recession using local home made products as a point of contact. To boot, the report has shown that the application of indigenous technology will navigate our Nation into a decent economic, infrastructural development and well as human development.

1. Introduction

There is a sheer visceral crying need for Nigeria to acquire appropriate technology and adopt innovative practices needful for production of goods and services delivery [1]. Unfortunately, those in positions to influence the decision to actualize this need appears to adopt a clinical posture to the problem. The current state of play tends to portray Nigeria incongruously as technologically lame elephant or a star that fails to ignite (red dwarf). It's blushing that a country that is richly endowed with numerous natural and human resource, cannot process them albeit with innovations to add value in production and service delivery, in the process create wealth in order to nudge the economy towards a decent future. However appropriate applications of innovation practices can sway this perception or opinions. [2] Japan, North Korea, China and other emerging economies are constantly innovating and applying Management of Technology (MOT) to their economies. Incidentally too these economies are not endowed with petroleum resources. It is instructive to note that many countries in Africa including our beloved country, shares the characteristics of a banana republic which although endowed with abundant natural resources lack the capacity or know – how to process them into finished products through value addition. Rather they resort to

exporting the raw materials to develop economies who would on their own add value to them through know how and innovation and then sell them back to us at exorbitant costs. Indeed, is blushing and a crying shame.

1.1. Literature

[3] Posited that the promotion of innovation, in particular technological innovation, in developing countries is becoming a fashionable subject. The growing interest in the subject stems from recognition that it is necessary to go back to basics after experiencing the limits of traditional economic policies encapsulated in the "Washington consensus" (2000) approach [4]. [5] Posited that this set of privatization, liberalization, and deregulation policies have clearly demonstrated their limits for promoting sustainable growth in the developing world. Similarly, policies focusing on modernization, in the sense of building infrastructure and institutions with a more interventionist government, have not yielded the expected fruits. Innovation is regarded as the use of new knowledge to offer a new product or service that consumer's want. [6] Stressed the fact that the application of that knowledge is to be emphasized rather than its acquisition. In less developed countries, [7] has suggested that innovation must be thought of as a process of adoption, absorption and diffusion of available technology. When talking of innovation in a less developed economy like Nigeria, [8] noted that it matters much more for countries to focus on the adaptation, diffusion and upgrading of technologies that already exist rather than pushing (or even attempting to push) the global knowledge frontier further. It follows, then, that I-Techs offer significant opportunities for innovation in Nigeria. This is so for two main reasons: they are already available and they are already acceptable. [9] Stated that managing technology and innovation creates competitiveness there drives in change in positive direction towards economic growth.

2.0 Methodology

2.1. Research Design

This study is built around survey design. The researcher is well aware of the shortcomings of this type of study and has accordingly taken some steps in order to eliminate loopholes. One of the methods adopted to achieve this was to select literate and well informed class as respondents. This class or sample of the population consist of people who have first degree and above and who have practiced construction in Nigeria for at least 3years and above. It is the belief of the researchers that this group or classes of people are knowledgeable and experienced in the factors being sought. Besides, these factors are not easily quantifiable except by non-parametric statistics which is directly consistent with the recommendations of some previous researchers in this area of study. Another way of ensuring the reliability of this approach is to adopt some sophisticated approach to the analysis of the data. To this end, we have adopted a non-parametric statistical approach such as use of ordinal scale (Likert's model). The scale items are then put in the form data matrix. Kendall's coefficient of concordance is used to rank the scores of the respondents and this ranking is tested for statistical significance using the inferential statistics such Chi square distribution. Having known the order of the importance of these factors, the most dominant of these factors say the first 10 – 30 are selected and subjected to the StatisXL for factor analysis. The communalities and hence factor loadings are obtained.

2.2. Area of Study

The location covered by the study includes at least three states in the six geographical areas in Nigeria.

2.3. Population

To enhance the reliability and validity of the instruments adopted in the survey, a special population consisting of stakeholders and practicing civil construction engineering managers with a minimum of first degree and minimum of three years' experience was selected. The purpose as explained is to tap from the experience of this class of practitioners who would understand the scale items and also provide reliable information.

2.4. Sample and Sampling Procedure

i) Sample

Sample size of 37 was collected i.e. a minimum of 3 from each of the LGAs considered. This sample size is purposive and convenient sample.

ii) Sampling Procedure

A systematic approach was put in place to collect the relevant data for the study.

2.5. Instrument for Data Collection

Data collection was done through the use of the following instruments: Questionnaires, Literature search. Personal interviews and visit of sites.

2.6. Validation of Instrument

The questionnaires were well structured to eliminate ambiguities and vagueness. Besides, they were administered to class of people with relevant professional knowledge who understood the scale items and responded as expected. Questionnaires with incomplete information were discarded and treated as drop outs in order to enhance the strength of the research work. Furthermore, out of 15 judges, 13 returned the questionnaire which is 86% success rate. The ranking of the questionnaire by 13 judges were tested for statistical significance to ascertain if they were consistent in the ranking. This gives some confidence level on the reliability of the ranking done by the judges. The eigen values and eigen vector were computed from the correlation matrix and reduced matrix. These were tested to ensure that; the variance and Contribution of each factor, are all meaningful.

2.7. Reliability of the Instruments

χ^2 –distribution inferential statistics was adopted to check the reliability of the measurements done by the judges. Cluster analysis technique was adopted at verifying the togetherness of value of the factors investigated.

2.8. Method of Data collection

Field assistants was recruited to visit various LGAs in the state listed, where the respondent are resident. These assistants were well tutored in what to do in other to facilitate the retrieval of the questionnaires.

2.9. Subjects

The subjects consist of 37 questions (scale items) relating to the factors (dominant factors) which were administered to 29 respondents was assessed based on factorial analysis.

Factors analysis approach is adopted (which would be explained later). The data matrix was used to generate the correlation matrix. A new set of variables were subsequently constructed on the basis of the formulated relationships found in the correlation matrix.

K. The Kendall Coefficient of Concordance

The analysis of the respondents was done using the Kendall's Coefficient of Concordance as follows:

a. Let N = the number of scale items ranked
b. k = the number of judges
c. R_j = sum of ranks given to each factor by the various judges
d. S = Variance

Kendall's Coefficient of Concordance is given as:

$$W = \frac{S}{\frac{1}{2}k^2(N^3-N)}$$

$$S = \sum\left(R_j - \frac{\sum R_j}{N}\right)^2 \qquad (1)$$

2.10. Research Strategy

The research strategy selected is (m,n) = (37,29). The ideal strategy would have been (many, many): 100 by all standards are considered many. However, because of space constraints in obtaining spread sheet for computer output, a research strategy of (37, 29) was selected.

In all that followed, we sketched the plan of the research study and explained the models to be employed.

3.0 Results and Discussion

The subtopic provides the analysis of the various responses from the administered questionnaire on factors constraining the development of technology and innovation in Nigeria.

Table 1: Sampling Variables

Var. No.	Variable Description	Factor loading	D.P	Mean Score
1	Serendipity	**0.630**	**1.71**	**4.137**
2	Unexpected failure	**0.921**	1.29	4.379
3	Incongruity	**0.765**	1.71	4.31
4	Unexpected outside event	**0.759**	2	3.793
5	Process needs	**0.518**	1.43	4.207
6	Industry structural change	**0.596**	1.14	4.241
7	Change in market	**0.798**	1.71	4.207
8	Demographics	**0.802**	2	3.966
9	Change in perception	**0.596**	2.29	3.931
10	New knowledge	**0.829**	1	4.689
11	Bright idea	**0.541**	0.71	4.31
12	Missing Link Supply	**0.424**	1.86	4.069
13	Analysis of opportunities	**0.529**	1.57	4.138
14	Creating new uses	**-0.626**	1.14	4.448

15	Creating new market	**0.743**	1	4.586
16	Gradual innovation Introduction	**0.628**	1.29	4.483
17	Leadership targeted innovation	**0.793**	3	3.483
18	Simplicity Centered innovation	**-0.728**	1.57	4.31
19	Concentrated effort innovation	**0.353**	2.43	3.172
20	Innovation is work	**0.621**	1.43	4.31
21	Core competence	**0.774**	1	4.621
22	Innovation begets transformation	**0.737**	3.29	3.138
23	New Technology	**0.872**	1.17	4.207
24	Emerging technology	**0.914**	2.86	3.862
25	High Technology Innovation	**0.522**	1.17	4.103
26	Low technology innovation	**0.732**	1.86	3.034
27	Medium technology innovation	**0.697**	2.28	3.655
28	Appropiate technology	**0.786**	2	3.689
29	Codified technology innovation	**0.511**	2.28	3.552
30	Tacit technology innovation	**0.771**	1.43	4.034
31	Management of technology	**0.800**	2.29	3.759
32	Excogitation	**0.868**	1	4.586
33	Radical innovation	**0.812**	2.29	3.966
34	Incremental Innovation	**0.852**	1.85	3.828
35	Routine innovation	**0.409**	1.43	3.689
36	Creativity as innovation	**0.633**	2.43	3.276
37	Invention	**0.513**	2.57	3.483

3.1. Factor Interpretation

The statistiXL software employed has enabled the extraction of thirteen (13) factors after 21 iterations of the Varimax rotation. Previous to this step, the Opinion Discrimination Analysis (ODA) applied led to the development of Discriminative Power index. Further, mean scores were obtained from the data matrix. These three parameters as decision support system are displayed side by side as depicted in the tables of factors that have been creatively labeled.

Table 2: Factor 1-Flagship of Innovation

Var. No	Variable Description	Factor loading	DP –value	Mean sore
2	Unexpected failure	0.924	1.29	4.379
25	High Technology innovation	0.522	1.71	4.103
32	Value Addition	0.868	1.0	-1586

PCA presents it as the leading source of innovation being that it wields the highest factor loading of 0.924, indicating its importance as a source of innovation. Further, the DP – value is low suggesting the variable is a consensual assertion. This follows from the lemma that the DP, the more consensual is the variable. Conversely the higher the DP, the more controversial is the issue raised. Moreover, the mean score (MS) is quite high (4.379) suggesting that respondents cannot agree more to the fact that unexpected failure is a good source of innovation.

Table 3: Factor 2-Hub of Innovation

Var. No	Variable Description	Factors loading	DP-value	Mean score
11	Bright Idea	0.541	0.71	4.31
17	Leadership targeted innovation	0.793	3	3.48
26	Management of Technology	0.723	1.86	3.03
31	Low Technology	0.83	2.29	3.75

Table 4: Factor 3-Rarity of Innovation

Var. no	**Variable description**	**Factor loading**	**DP – Value**	**Mean score**
4	Unexpected outside event	0.759	2.0	3.793
13	Analyses of opportunities	0.529	1.57	4.138
16	Gradual innovation introduction	0.628	1.29	4.483
33	Radical innovation	0.812	2.29	3.966
37	invention	0.153	2.57	3.483

Table 5: Factor 4-Applied Innovation

Var. No.	Variable Description	Factor Loading	DP-Value	Mean \Score
12	Missing Link	0.424	1.86	4.069
18	Simplicity centered innovation	-0.728	1.157	4.31
22	Innovation Begets Transformation	0.737	3.29	3.138
28	Appropriate Technology	0.786	2.0	3.689

Table 6: Factor 5-Situational Innovation

Var no	Variable description	Factor loading	DP -value	Mean score
5	Process needs	0.518	1.43	4.207
7	Change in market	0.798	1.17	4.207
8	Demographics	0.802	2.0	3.966
9	Change in perception	0.596	2.29	3.931

Table 7: Factor 6-Unfledged Idea Harmonization

Var. no	Variable description	Factor loading	DP – value	Mean score
19	Concentrated effort innovation	0.353	2.483	3.17
24	Emerging technology	0.914	2.86	3.86

Table 8: Factor 7-Inspiration

Var. no	Variable description	Factor loading	DP – value	Mean score
10	New knowledge	**0.829**	1	4.689

Table 9: Factor 8-Progression in Innovation

Var.No	Variable Description	Factor loading	DP-value	Mean Score
34	Incremental innovation	0.856	1.85	3.828
35	Routine innovation	0.409	1.43	3.689

Table 10: Factor 9-Novelty Drive

Var. No	Variable Description	Factor loading	DP value	Means Score
15	Creating new markets	0.743	1.0	4.586
20	Innovation is work	0.61	1.43	4.31
36	Creativity as innovation	0.633	2.43	3.483

Table 11: Factor 10-Ability and Focus

Var.No	Variable Description	Factor Loading	DP-Value	Mean Score
6	Industry Structural change	0.596	1.41	4.241

14	Creating new uses	-0.626	1.41	4.448
21	Core Competence	0.774	1.0	4.621

Table 12: Factor 11-Content-Variance Orientation

Var.No	Variable description	Factor loading	DP-value	Mean score
3	Incongruity	0.765	1.71	4.31
27	Medium technology innovation	0.697	2.28	3.655
29	Codified technology innovation	0.511	2.28	3.552

Var. No.	Variable description	Factor loading	DD-value	Mean Score
1	Serendipity	0.630	1.771	4.137
30	Tacit Technology innovation	0.771	1.43	4.034

Table 13: Factor 12-Kimono Syndrome

Table 14: Factor 13-Novelty

Var.No	Variable Description	Factor Loading	DP-Value	Mean Score
23	**New Technology**	**0.872**	**1.17**	**4.207**

3.2. Factors Implications

The pith of innovation revealed by the study using the PCA model has been creatively labeled by the authors and it comprises of the following: Flagship of Innovation where factor is threesome and stocky loaded and PCA revealed a factor loading of 0.924 for the unexpected failure, indicating its importance as a source of criteria for innovation, further the DP-value is low suggesting the

variable is a consensual assertion, also the MS is quite high at 4.379 suggesting that the respondents cannot agree more to the fact that unexpected failure is a good source of innovation. Secondly, the Hub of Innovation having of foursome stocky factor loading wielding positive loadings has shown that low technology variable (31) has more implicating factor that hinders innovation and Nigeria is to strive to develop its technological base in order to enhance innovative discoveries [10]. Thirdly, the Rarity of innovation wielding five-some stocky positive loadings has also brought to fore that Radical innovation brings about serendipity in innovation development. The factor four (4) creatively labeled Applied Innovation has also proven that if appropriate technology is applied it will yield positive results in development of the Nigeria technological base as well as nudging the economy to decent future. Factor five (5) creatively labeled Situation Innovation have variable number (8) demographics with factor loading 0.802 have brought to bear the need for qualify manpower in order to enhance innovation. Factor six (6) creatively labeled unfledged idea harmonization is a bivariate sturdy having a mediocre and meritorious factor loadings respectively, the DP-value are reflecting to the fact that both are controversial. In this context the respondents are doubtful if Nigeria can really support such a monumental task such as emerging technology and concentrated effort towards innovation. Factor (7) creatively labeled inspiration is a lone factor with variable as New Knowledge with factor loading of 0.829 signifying the importance of novelty of knowledge for technological advancement of the country. Factor eight (8) creatively labeled Progressions in Innovation is another bivariate factor which has shown that continuous progression should paramount in order to realize the 2030 MDAs, goals for third world countries. Factor nine (9) is a threesome Factor duly labeled Novelty drive and it wields substantial factor loadings respectively, with Creating New Markets as the trump up variable, which implies that innovation requires a market for such demands, as the more there's increase in demand the supply of innovative technology will be fostered. This particular factor loading is indicating that the Nigeria Citizens should patronize more local technology. Factor ten (10) which is creatively labeled Ability and Focus with core competence of number 21 variable with factor loading of 0.774, calls for self confidence in the local innovators. Factor eleven (11) wielding Content-Variance Orientation, having threesome stocky factors with incongruity representing the discrepancy between "What is" and "What is ought to be". So the import is that Nigeria innovation hub should strive to accept only the best after all the resource abound. Factor twelve (12) creatively labeled the Kimono Syndrome having a bivariate variable with tacit technology innovation as the clear variable above average indication its importance to technological development. Factor thirteen 13 creatively labeled Novelty is a lone factor which loaded New Technology in the value of 0.872 which reflects a very substantial factor loading. The DP-value is 1.71 suggesting that the respondents are doubtful if Nigerians has been using it to good effect. The mean score index for the variable shows that even though it is not currently used, its potential for innovation in indigenous technology is significant.

4.0 Conclusion

Arising from the foregoing analysis and discussion, it is evident that applications of innovations to the development of indigenous technology are few reflecting the fact that we are like stars that fail to ignite. There are several reasons for this incongruity.

i. Most researchers in polytechnics and universities are motivated merely by the need for promotion. Little effort is directed towards research and development and innovation.

ii. Innovation demands chunking i.e. Focused attention and concentrate on R and D that will create value, and gain market acceptance.
iii. Lack of funds for conducting research has been a gag in the conduit of research and development efforts.
iv. It would appear that the Nigeria nation is yet to show deep interest in the acquisition of indigenous technology for national development. In the meantime, we are complacent with importation.

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