



Evaluation of University-Industry Strategic Alliance: a Focus on Public Universities in the South-East Geo-political Zone of Nigeria

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Abstract

University-industry strategic alliance has in recent years assumed a phenomenal status in developed countries where it has proliferated as a means of overcoming resource constraint and fulfilling the economic mandate of universities among other objectives. But despite the fact that universities in developing countries face the same problems, their commitment to strategic alliance has been largely rhetorical. Against this background, this study investigated, based on quantitative data, the dynamics of university-industry strategic alliance from the perspective of public universities in the South-East geopolitical zone. The study showed that due to lack of research capacity and other constraints, there is low level of collaboration with industry and even this limited involvement in traditional, non-research based alliance is undertaken outside the strategic management framework. Interestingly, it was discovered that geographical location does not hinder engagement with industry.

Keywords: strategic, alliance, university, industry, collaboration

Introduction

One of the visible signs of the ferment in the country's higher education sector, particularly universities, is weakened research capacity and the attendant poor research performance. Both in quantity and quality, the level of research going on in Nigerian universities is very low. Even more worrisome is the fact that interest is more on the upstream sector in that there is little or no commercialization of the meager intellectual properties of academics. This has resulted to a dearth of academic entrepreneurs and entrepreneurship in Nigerian universities. It equally points to the fact that the interface between Nigerian universities and industry is not dynamic. In other words, Nigerian universities have not been able to fill their roles as strategic partners in the country's innovation system which requires them to complement and reinforce in-house corporate research and development (R&D)



as is the case in developed countries where corporate R&D has been outsourced to universities, especially research universities. The secondary fall-out of the above inadequacies is that our universities have made very little contribution to local, regional and national economic development.

The precarious state of affairs in Nigerian universities has often been blamed on and could be traced to budgetary/fiscal constraints or shrinking support of government for higher education. Undoubtedly, the problems of universities world over have their roots in resource inadequacy but the major difference between universities in developed countries and those in developing countries is in terms of coping strategies. While the former has developed and continues to strengthen strategic alliance, especially research-based, with industry as a means of overcoming resource inadequacy, Nigerian universities have been more rhetorical in their commitment to cultivating strategic alliance with industry. Against this background, this study sought to:

1. Ascertain the nature and state of strategic alliances between Nigerian universities and industry from the perspective of universities.
2. Identify if Nigerian universities have adopted the strategic management approach to collaboration with industry and the effect.
3. Ascertain if lack of research capacity by universities is responsible for the predominance of traditional forms of collaboration.
4. Ascertain the effect of location on a university's engagement with industry.
5. Ascertain the views of university researchers concerning the suitability of NURESDEF as a platform for strengthening university-industry relations.

Research Hypotheses

In line with the statement of problem and the research objectives the following hypotheses shall guide this study.

1. Non-adoption of the strategic management approach to industry engagement by Nigerian universities is not responsible for the low level of collaboration with industry.
2. Lack of research capacity by Nigerian universities does not account for the low level of research-based collaboration with industry.
3. There is no significant relationship between the geographical location of a university and its staff engagement with industry.

Research Design



The study adopted a cross-sectional survey of universities and lecturers in science and engineering disciplines. While the target population covered lecturers in Nigerian universities who specialized in the fields of engineering and Science-based disciplines, the survey population included lecturers in these same broad areas of specialization in Nigerian public universities located in the South-East geo-political zone of the country. This zone has been under-reported – majority of the local studies (Siyanbola, Oyewale & Isola,2010; Obanor & Kwasi-Effah, 2013; Adeoti, 2009; Alo, 1996) on university-industry collaboration focused on South-West and other geo-political zones. There are ten public universities in this region but Federal University, Ikwo, was excluded on grounds of its newness. The research study involved a multi-stage sampling process which was stratified, purposive and random. A major step of the multi-stage sampling process involved drawing a stratified random sample of lecturers of the rank of Senior lecturer, Reader (Associate Professor) and Professor from the above named disciplines. It should be pointed out that the purposive aspect of the sampling relates to the restriction of the respondents to these three ranks. The choice of these ranks of lecturers was informed by the fact that they belong to the high visibility, high net worth and highly networked ranks.

The selection of the sample size of two hundred and forty-four respondents was done through stratified random sampling. The rank of the respondents was used as the basis for stratification and the list of the lecturers was obtained from the faculties and through the universities' websites. However, in situations where the selected person was not available, we chose somebody else to replace him/her.

The questionnaire was our major instrument for the collection of primary data from lecturers. However, interview method was used in sourcing additional information from active collaborators and officers in charge of interface structures. The questionnaire which had a total of twenty-five items which are both structured and unstructured was delivered by hand to respondents by the researcher and research assistants. The collection was done by both hand and post and this was necessitated by the fact that some respondents could not readily complete the questionnaire on the day of issuance. They were, therefore, given self-addressed and post-paid envelope with which they returned the questionnaire by post.

We utilized the outcome of a pilot study to establish the validity and reliability of the survey measures. The pilot study involved six Professors, three Senior Lecturers and a Director of a University internal interface structure for collaboration with industry. These ten respondents were chosen from two universities.



Specifically we determined the content validity of the measures based on the judgments of experts in university-industry collaboration. The experts included those directly involved in the pilot study and those who had done empirical work in this area. In addition, construct validity was established based on past research works and extant theory. This is in line with Moser and Kalton's (1997:356) observation that the essence of construct validity is its dependence on theory and the examination of the observed association is as much a test of the theory as of the scale's validity. Another factor that reinforced the validity of the instrument is the fact that the variables and predictors of university-industry relations have general applicability and some of the questions were drawn from past research works. On the other hand, the reliability of the instrument was estimated based on inter-rater method which yielded a correlation (based on Minitab package) of 0.91. This method was most appropriate to the type of variables which included both categorical and continuous. Finally, the analysis of data was done with descriptive statistics such as mean, percentages and Weighted Average Index (WAI). Hypothesis testing was subsequently carried out with logistic regression and its associate statistic, chi-square.

Theoretical Framework

Bacila and Gica (2006:34) have defined university–industry strategic alliance as:

a comprehensive formally managed company- university agreement centred on a major, multi-year, financial commitment involving research, programmatic interactions, and intellectual property licensing and other services.

It is a mutually beneficial and well-defined relationship entered into between a university/researcher and a corporate body to achieve a common goal which often centers on knowledge creation and application. Generally, strategic alliances are often distinguished based on varying contractual mechanisms that dictate their governance structures, that is, control and coordinate features, (Dacin *et al*, 2007:170). The various types identified by Gulati (1995b) and Pisano (1989) can be grouped into equity-based (e.g. joint-ventures and equity swaps) and non-equity based (e.g. joint R&D, reciprocal distribution, contract research). However, specific channels of collaborations between universities and industry have been identified by Santoro and Chakrabarti (2002:38) thus: research support, co-operative research, knowledge transfer and technology transfer. Vigdor *et al* (2000:14) isolated the following mechanisms: consultancy which may be conducted on formal or informal basis; teaching and curriculum development; R & D activities including contract research, co-operative and sponsored research some



of which lead to the setting up of spin-off companies involved in capitalizing on research discoveries and inventions; others such as regular mutual visits, jointly organized meetings, conferences and seminars, joint publications, joint participation in exhibitions and fairs, industrial support to individual students or their associations, industrial representation on the governing boards of higher education establishments and vice-versa. In addition, Shadbolt and Kay (2005:1) have added joint participation in professional and industry associations, professional development, community and regional development initiatives, staff exchange, conferences, conventions, business incubators and technology parks.

The benefits of university-industry strategic alliance are multi-dimensional and can be examined from the perspective of the individual researcher, the university, industry and the nation. From the perspective of the researcher, Belkhodja & Landry (2005:7) and Beaver (2001:369) identified the following: access to equipment or resources one does not have; improved prestige and visibility; acquire tacit knowledge about a technique; increased specialization; additional income and a sense of fulfillment, fun and pleasure.

On the part of industry and the nation, UNESCO (1996:25) isolated the following. First for industry: greater competitiveness in domestic and global market, meeting the future human resource needs of industry, lower cost of R&D and technology and lower R&D human resource requirement, access to latest knowledge and technology development, continuing education of staff and lower costs of re-training and market for spin-off technologies. And for the nation: productive research and development environment, greater indigenization of technology, greater financial sustainability of institutions, new product processes, excellent quality control and standardization, and greater employment of fresh scientists, engineers and technologists. The benefits to the university include: greater financial sustainability (Vigdor et al, 2000:13, Schuetze, 2001:3); guarantees research quality and sustainability (UNESCO 1996:6; Barden,1993:223); greater utilization of expertise and infrastructure; improved quality of academic staff, (UNESCO, 1996:6); improved quality of graduates; enables universities to contribute to economic development (Etzkowitz and Leydesdorf, 1996:53).

Nevertheless, both universities and industry encounter a variety of barriers to effective strategic alliance. The Business–Higher Education Forum (2008: 27-30) identified university related barriers to include: university officials' lack of understanding of how companies operate; difficulty in handling conflicts of interest and commitment; problem of preserving academic freedom, difficulty in maintaining intellectual property and confidentiality, and monitoring the impact on students. On the other hand, corporate barriers include – the challenge of



respecting the value of research collaborations; incorporating university research into product development; risk of losing proprietary information; and inability to appreciate how universities operate. Other critical barriers that cut across the two sectors include inability to appreciate the different time horizons of the two sectors; institutional incentive structures may not sufficiently recognize or reward the key contributions that ensure successful collaboration, (GUIRR, 1999:2).

A number of researchers (Siyanbola, Oyewale & Isola, 2010; Obanor & Kwasi-Effah, 2013; Adeoti, 2009; Oyelaran-Oyeyinka, 2012; Alo, 1996) have based on both quantitative and qualitative approaches studied university-industry strategic alliances in Nigeria. Unfortunately, they through different studies arrived at the conclusion that there is low level of university-industry collaboration in the country.

Out of the several theories that explain the rationale for strategic alliance, we adopted the resource-based view of the firm. The Resource-Based view (RBV) of the firm is traceable to Penrose (1959: 24) who described a firm as a “collection of productive resources” and subsequently argued that a firm’s growth – internally and externally through mergers, acquisition and diversification – is dependent on the manner in which the firm employs its resources, particularly critical resources. A critical resource, according to Barney (1991) is one that is valuable, rare, inimitable and non-substitutable (vrin) and such a resource enables a firm to achieve competitive advantage and enjoy improved performance at least in the short run. Barney (1997:160) later modified the vrin principle to vrio (valuable, rare, inimitable and organization) arguing that in addition to simply possessing valuable, rare, inimitable resources, a firm also needed to be organized in such a manner that it could exploit the full potentials of those resources if it was to attain a competitive advantage.

Nevertheless, the resource-based rationale of alliance has been identified by Das and Teng (2007:32-33) in their observation that the resource-based view seems particularly appropriate for examining strategic alliances because firms essentially use alliances to gain access to other firm’s valuable resources. They further stated that the resource-based rationale of strategic alliance emphasizes value maximization of a firm through pooling and utilizing valuable resources. That is, it is to aggregate, share or exchange valuable resources with other firms when these resources cannot be efficiently obtained through market exchanges or mergers and acquisition, (Das and Teng, 2007:37).



Questionnaire Analysis

A total of two hundred and forty-four copies of the questionnaire were administered. We achieved a response rate of sixty-eight percent representing one hundred and sixty-six respondents. We present the result of the analysis of key questions.

Based on research orientation, we discovered that while all the respondents were involved in basic research, only fifty percent had been involved in applied research/experimental design and they belong to departments of Engineering and Agriculture. On whether the respondents had ever received research grants, fifty-nine percent responded in the affirmative and the grantors and their popularity were as follows – Federal government (31%), industry (10%), private non-profit educational foundations (35%) and others (25%). On the actual number that has a past or subsisting collaboration with industry, the responses showed that only thirty percent had done an assignment for industry. With regard to the contentious issue of who, among government, university/researcher and industry, has responsibility of initiating U-I linkages, the respondents were divided in their opinions: government (23%), university/researcher (33%) and industry (42%). This distribution shows that it is a shared responsibility which is in line with the Triple helix model. On the existence of university interface structures, while some universities did not have any, some have more than one. The list of agencies is attached as appendix A.

On the profile of Nigerian universities based on research capacity which was measured in terms of availability of facilities/equipment, manpower and fund, 65% of the respondents claimed that Nigerian universities lacked research facilities/equipment and fund. However, 75% claimed that Nigerian universities had the relevant manpower. On the related issue of research culture, 71% believed that Nigerian universities had a very weak research culture. With regard to the types of incentives needed to boost U-I collaboration, the table below shows the distribution of responses.



Table 1. Weighted average index of incentive factors

<u>Incentive factor</u>	<u>WAI</u>
i. Tax break for firms engaged in research-based collaboration with universities	3.97
ii. Tax break for firms investing in in-house R & D	3.65
iii. Appointment of academics into corporate Board of Directors	3.47
iv. Appointment of industry personnel into university Governing Council	3.29
v. Adoption of collaboration activities as promotion criteria	3.73
vi. Government’s increased provision of research fund	4.11
vii. Policy to strengthen research culture/orientation in Universities	3.87
viii. Policy to improve entrepreneurial climate/orientation of universities	3.67

Source: Field survey, 2013

The incentives cut across universities and industry. Interestingly, increased provision of research fund by the government has the greatest appeal. In terms of barriers to collaboration, apart from the usual issues of fund and facilities, lack of interest on the part of industry and lack of knowledge of industry by academics weighed heavily. This shows that there are no platforms for interaction between university researchers and industry.

Hypothesis Testing

As indicated earlier logistic regression and chi-square statistics were used in testing the hypotheses and the result is shown below.

Ho1: Non-adoption of strategic management approach to industry engagement by Nigerian universities is not responsible for the low level of collaboration with industry.

Hi1: Non-adoption of strategic management approach to industry engagement by Nigerian universities is responsible for the low level of collaboration with industry.

We defined “strategic management approach” as entailing a deliberate approach with a recognizable interface structure (agency or unit) and formal policy. On the basis of this, a two-predictor logistic model was fitted to the data to test the above hypothesis. Given that the response variable - assignment for industry - is a



categorical variable, we carried out a binary logistic regression in Minitab version 11.2. The logistic regression model is represented thus:

$$\text{Logit}(Y) = \ln \left(\frac{\pi}{1-\pi} \right) = a + \beta_1 X_1 + \beta_2 X_2 \dots (1)$$

The output of the analysis is shown thus:

Table 2. Binary logistic regression analysis of the relationship between the adoption of strategic management approach and level of collaboration with industry

Link Function: Logit

Response Information

Variable	Value	Count
INDASSIG	1	72
	0	96
Total		168

Logistic Regression Table

Predictor	Coef	StDev	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Constant	-0.8751	0.2683	-3.26	0.001			
COLLAGEN	0.7024	0.3419	2.05	0.040	2.02	1.03	3.95
POLICY	0.7528	0.3290	2.29	0.022	2.12	1.11	4.05

Log-Likelihood = -110.634

Test that all slopes are zero: G = 8.190, DF = 2, P-Value = 0.017

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	0.016	1	0.899
Deviance	0.016	1	0.899
Hosmer-Lemeshow	0.016	2	0.992

Brown:

General Alternative	0.016	2	0.992
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Symmetric Alternative 0.016 1 0.899

Table of Observed and Expected Frequencies:

(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

Value	Group				Total
	1	2	3	4	
1					
Obs	16	18	26	12	72
Exp	16.2	17.8	25.8	12.2	
0					
Obs	39	21	29	7	96
Exp	38.8	21.2	29.2	6.8	
Total	55	39	55	19	168

Measures of Association:

(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	3330	48.2%	Somers D	0.23
Discordant	1742	25.2%	Goodman-Kruskal Gamma	0.31
Ties	1840	26.6%	Kendalls Tau-a	0.11
Total	6912	100.0%		

Based on the output shown above, the results of the analysis show that:

$$\text{Predicted logit of (indassign)} = -0.8751 + (0.7024) * \text{Collagen} + (0.7528) * \text{Policy} \dots\dots\dots (1)$$

Clearly the estimated coefficients for interface structure ($z=2.05$, $p=0.04$) and formal policy ($z=2.29$, $p=0.02$) are greater than zero at an α -level of 0.05 and show



that there is a positive relationship between the presence of these mechanisms and the level of collaboration with industry. This is further confirmed by the odds-ratio values which are greater than one. The G statistic with a value of 8.190 and a p-value, $0.017 < 0.05$ confirms that there is sufficient evidence that at least one of the coefficients is different from zero. In other words, the adoption of a strategic management approach to collaboration has a positive effect on the level of collaboration. We therefore reject the null hypothesis.

The Goodness-of-fit tests: Pearson (0.016, $p=0.899$), deviance (0.0.6, $p =0.899$); and Hosmer-Lemeshow (0.016, $p=0.992$) show that there is insufficient evidence to claim that the model does not fit the data well. The adequate fit of the model to the data is further shown by the similarity of observed and expected frequencies as contained in the output.

Ho2: Lack of research capacity by Nigerian universities does not account for the low level of research-based collaboration with industry.

Hi2: Lack of research capacity by Nigerian universities accounts for the low level of research-based collaboration with industry.

The research productivity of a university depends on its research capacity as indicated by personnel of certain caliber, research equipment/facilities and fund. However, we used two of these predictors – facilities and fund - as variables of interest. The response variable – type of collaboration - was measured in terms of research-based and non-research-based. As a result, a two predictor binary logistic model was fitted to the data to test the above hypothesis. The output of the analysis is shown below:

Table 3. Binary logistic regression analysis of the relationship between research capacity and type of collaboration

Link Function: Logit

Response Information

Variable	Value	Count
COLLABTY	2	103
	1	64



Total 167

167 cases were used

1 cases contained missing values

Logistic Regression Table

Predictor	Coef	StDev	Z	P	Odds	95% CI	
					Ratio	Lower	Upper
Constant	-3.134	1.164	-2.69	0.007			
LACFACI	0.3713	0.1849	2.01	0.045	1.45	1.01	2.08
LACFUND	0.4931	0.1822	2.71	0.007	1.64	1.15	2.34

Log-Likelihood = -105.799

Test that all slopes are zero: G = 10.721, DF = 2, P-Value = 0.005

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	7.169	11	0.785
Deviance	8.332	11	0.683
Hosmer-Lemeshow	2.028	5	0.845
Brown:			
General Alternative	1.517	2	0.468
Symmetric Alternative	0.531	1	0.466

Table of Observed and Expected Frequencies:

(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

Value	Group							Total
	1	2	3	4	5	6	7	
2								



Obs	7	10	11	14	18	13	30	103
Exp	6.9	8.6	9.8	16.7	18.7	13.2	29.1	
1								
Obs	11	8	7	14	10	6	8	64
Exp	11.1	9.4	8.2	11.3	9.3	5.8	8.9	
Total	18	18	18	28	28	19	38	167

Measures of Association:

(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	3880	58.9%	Somers D	0.29
Discordant	1998	30.3%	Goodman-Kruskal Gamma	0.32
Ties	714	10.8%	Kendalls Tau-a	0.14
Total	6592	100.0%		

Based on the result of the analysis, the predictive model can be represented thus:

$$\text{Predicted logit of (collabtype)} = -3.134 + (0.3713)*\text{lacfaci} + (0.4931)*\text{lacfund} \dots\dots\dots (2)$$

The output shows that the estimated coefficients for lack of facility (lacfaci, 0.3713) and lack of fund (lacfund, 0.4931) are greater than zero. In addition, the P-values for the variables (lacfaci, 0.045 and lacfund, 0.007) are less than the α - level. Even the odds ratios for the two variables are greater than one. The G statistic with a value of 10.721 and a P-value (0.005) less than the α - level confirms that there is sufficient evidence that at least one of the coefficients is different from zero.

The Goodness-of-fit indicators, namely Pearson (7.169, P=0.785), Deviance (8.332, P = 0.683), Hosmer–Lemeshow (2.028, P=0.845) show that there is insufficient evidence to claim that the model does not fit the data well. The adequate fit of the model to the data is further shown by the similarity of observed



and expected frequencies. We therefore reject the null hypothesis and accept the alternate to the effect that lack of research capacity has a negative impact on the cultivation of research-based collaboration with industry.

Ho3: There is no significant relationship between the geographical location of a university and its staff engagement with industry.

Hi3. There is significant relationship between the geographical location of a university and its staff engagement with industry.

Ordinarily geographical location is measured in terms of urban, semi-urban, and rural areas. But a major consideration in the use of this factor is industrial density which measures the concentration of firms in the university area. Taking note of researcher mobility, we used a five-point Likert scale to capture the qualitative data provided by respondents. On the other hand, staff engagement was measured in terms of assignments done for industry. Therefore a one-predictor binary logistic model was fitted to the data to test the hypothesis. The output of the analysis is shown below:

Table 4. Binary regression analysis of the relationship between geographical location of a university and level of collaboration

Link Function: Logit

Response Information

Variable	Value	Count
INDASSIG	1	72
	0	96
Total		168

Logistic Regression Table

Predictor	Coef	StDev	Z	P	Odds	95% CI	
					Ratio	Lower	Upper
Constant	-0.2960	0.4705	-0.63	0.529			
GEOLOC	0.0025	0.1310	0.02	0.985	1.00	0.78	1.30



Log-Likelihood = -114.728

Test that all slopes are zero: G = 0.000, DF = 1, P-Value = 0.985

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	4.844	3	0.184
Deviance	4.907	3	0.179
Hosmer-Lemeshow	0.892	2	0.640
Brown:			
General Alternative	0.088	2	0.957
Symmetric Alternative	0.000	1	0.998

Table of Observed and Expected Frequencies:

(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

Value	Group				Total
	1	2	3	4	
1					
Obs	15	26	15	16	72
Exp	14.1	24.8	17.6	15.5	
0					
Obs	18	32	26	20	96
Exp	18.9	33.2	23.4	20.5	
Total	33	58	41	36	168

Measures of Association:

(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures
Concordant	1216	17.6%	Somers D 0.01



Discordant	1120	16.2%	Goodman-Kruskal Gamma	0.04
Ties	4576	66.2%	Kendalls Tau-a	0.01
Total	6912	100.0%		

Arising from the output the predictive model can be represented thus:

$$\text{Predicted logit of (INDASSIGN)} = -0.2960 + (0.0025)*\text{GEOLOC} \dots (3)$$

Even though the result shows a positive coefficient for the independent variable, the diagnostic test based on p-value (0.985) which is greater than the α - level and odds-ratio of exactly one show that it is not a significant predictor of staff engagement with industry. This is further confirmed by the G statistic with a value of 0.000 and a p-value, $0.985 > 0.05$ which shows that the coefficient is zero. Also the very low values of the measures of association: Somers D (0.01), Goodman-Kruskal Gamma (0.04), and Kendalls Tau-a (0.01) show that geographical location is not a good predictor of staff engagement with industry. We therefore accept the null hypothesis that there is no relationship.

To further confirm the independence of these two variables, we carried out a chi-square test, the output of which is shown below.

Table 4.5.4. Contingency table showing the relationship between geographical location of a university and level of collaboration

Rows: GEOLOC	Columns: INDASSIG		
	0	1	All
1	11	4	15
	8.57	6.43	15.00
2	7	11	18
	10.29	7.71	18.00
3	32	26	58



	33.14	24.86	58.00
4	26	15	41
	23.43	17.57	41.00
5	20	16	36
	20.57	15.43	36.00
All	96	72	168
	96.00	72.00	168.00

Chi-Square = 4.842, DF = 4, P-Value = 0.304

Based on the calculated chi-square value of 4.842 with a P-value of $0.304 > 0.05$, we accept the null hypothesis that the two variables are independent. In other words, the location of a university is not a significant predictor of staff engagement with industry.

Discussion of Findings

The key findings of this study can be summarized thus:

1. The intensity of strategic alliances between Nigerian universities and industry is very low and is more of the traditional or non-research based types. There is no doubt that Nigerian universities have one form of relationship or the other with the business sector but in comparison with trends in developed and even some developing countries, the level is low and the scope very narrow. In terms of level, there are very few assignments for and with industry at both individual and institutional levels; very few chair endowments by industry; little interest in applied research and experimental design and little or no commercialization of research outputs. In terms of scope, the areas of collaboration are skewed in favour of non-research related areas. These findings are in line with past research works such as Siyanbola et al (2010), Adeoti (2009) and Alo (1990). Nevertheless, one form of collaboration that has remained active in recent years is the acquisition and



deployment of ICT equipment and facilities. All the universities have one form of alliance or the other on ICT integration with ICT firms.

2. Nigerian Universities have not effectively embraced the strategic management approach to industry engagement. The adoption of the strategic management approach to collaboration with industry involves creating a formal macro and micro framework - embodying legislation, policies, interface structures and incentives to facilitate interactions between the parties. At the micro level, universities are required to have agencies responsible for managing collaboration, policies to guide and incentives to motivate collaborators. This is in recognition of the fact that collaboration with industry, particularly research-based ties, involves serious challenges which individual researchers may not be able to surmount. In addition, since the benefits – direct or indirect - get to the university, it becomes imperative for the institution to contribute to the cultivation and sustainability of collaborations with industry. Unfortunately, Nigerian universities have symbolic and weak institutional framework for collaboration. Ssebuwu, Ludwick & Beland (2012) aptly noted that while most institutions have highlighted industry linkages in their strategic plans, many lack complementary and supportive policies and mechanisms for regulating interactions with the productive sector.

This is perhaps, a reflection of the absence of a legislative framework on university-industry collaboration at the national level. As a matter of fact, even though the country may claim to have a Science and Technology policy, its operationalization in terms of driving university and industry R&D remains a pipe dream.

3. Inadequate research capacity in terms of lack of research facilities/equipment and fund remains the major barrier to improved research productivity in Nigerian universities. Research productivity is a function of research personnel, fund and facilities. In addition, it is gradually being recognized that the degree to which the corporate culture is supportive or otherwise of research is equally crucial to research performance. Nevertheless, the first three factors constitute a national or institutional research capacity but Nigerian universities only have the personnel. Lack of fund and facilities/equipment for research represent the greatest challenge facing researchers. Both Adeoti (2009) and Alo (1990) highlighted these factors in their studies. It is necessary to point out that these factors contributed to the festering disorientation among university researchers and the problem of brain drain that once plagued the universities.



4. The geographical location of a university is not a deterrent to the cultivation of collaboration with industry. The main issue in the factor of geographical location whether urban, semi-urban or rural is the level of industrial density. In other words, is the university located in an area of high industrial density? It should be pointed out that unlike in business to business strategic alliance the locality factor remains a knotty issue in university-industry collaboration. This is due to the number of mitigating factors in the relationship such as whether the knowledge is tacit or codified, applied or basic (Mansfield, 2006) and sectoral differences. However, while it is recognized that proximity (local university status) to a cluster of manufacturing firms increases the chances of collaboration, we discovered in line with Muscio (2008) that being located in an “industrial arid zone” may restrain frequency of collaboration but does not deter collaboration. A number of factors play significant roles in this direction: while co-location strengthens trade-off, researcher mobility, applicability of research outcomes and the principle of star-scientist engender distant collaboration. For instance, many of the universities in the South East geo-political zone are not located in high industrial density areas but some of their researchers have done research work for multinational oil companies based in Port-Harcourt.

5. Nigerian universities do not have any meaningful platform for interacting with industry. Interface platforms are very important to the cultivation of linkages as they provide opportunities for the parties to get to know themselves – their needs, competencies and areas of collaboration. Examples include Business Round Tables, Research and Development fairs, Research Parks, etc. While some of the platforms are set up by the government, others are private initiatives. But Nigerian universities have none except the nascent Nigerian Universities Research and Development Fair (NURESDEF) which was initiated by the National Universities Commission. Interestingly, researchers have high hopes that NURESDEF will fill the existing gap effectively.

6. Chair endowment by industry which represents a critical means of stimulating research is quite rare. In fact, none of the state universities had any active chair in the focus departments. Even among the federal universities, only UNN and FUTO had active chairs (one each) in Geology and Petroleum Engineering respectively. But gifts which are often in appreciation for honorary degrees conferred on business chief executives featured prominently.

Conclusion

The outcomes of the study show that Nigerian universities have largely non-research-based collaborative ties. The basic conditions and commitment necessary for building enduring relationships are lacking. The situation has, however, been



made more precarious by the failure of the universities to adopt the strategic management approach to the management of collaborations. In addition, Nigerian universities have been overwhelmed by a number of barriers in their bid to cultivating linkages with industry. Due to inadequate research capacity, negative research culture, massification, inappropriate and inadequate incentive structures, lecturer preference for basic research and difficulties in commercializing research outcomes, Nigerian universities have failed to achieve the threshold research productivity necessary to launch them into the trajectory of research-based collaboration. As a result, they are trapped in the vortex of the vicious circle of lack of research facilities/fund leading to low research productivity which engenders traditional collaboration which perpetuates the state of lack of research facilities.

Recommendations

1. The study identified a major weakness in the policy framework: while the parties, particularly the government recognizes the critical role of university-industry linkages in the development of the abandoned National Innovation System (NIS), it has not taken any serious step to provide the enabling legal and policy framework to give force and direction to this objective. The Federal Government should therefore develop a national legislation, beyond the one paragraph contained in the country's Science and Technology Policy, on University-industry collaboration. The idea should not be to give a legal backing to collaboration without providing the requisite condition for the actualization of alliances. The law should provide for the domestication of a certain level of corporate R & D and provide workable incentives that will motivate the participants to take initiatives and set up an operational agency.
2. All over the world, Research or Technology parks are recognized and used as launch pads for university-industry collaboration in that they serve a number of critical functions: as business incubators, avenues for stimulating and harnessing corporate R&D and structures for commercializing university research outputs. The Federal Government should take steps to actualize its old proposal to develop research parks in the six geo-political zones. Perhaps the Government should involve State Chambers of Commerce and other trade associations such as Manufacturers Association of Nigeria (MAN) as a way of securing the participation of the critical mass of firms needed for the research parks to effectively take-off.
3. The government should make it mandatory, with financial backing, for universities especially those in areas of high industrial density or that have business clusters near them to set up agencies for industrial extension services.



Such an agency will be responsible for rendering technical services to identified SMEs and the operations of the agency should fall within the regulatory purview of the NUC. We recognize that there use to be an agency known as industrial liaison office which performed part of the functions envisioned for the industrial extension services. But none of the focus universities has any functional industrial liaison office and so the extension agency fits in properly.

4. Results of this study show that avenues of contact and interaction between university researchers and industry are very few and grossly under-utilized. For instance, only an insignificant number of university researchers spend their sabbatical leaves in industry. The Government should therefore make it mandatory through the NUC for lecturers of certain departments to spend their sabbatical leaves in industry. This could even be expanded into a mutual engagement through setting up a university-industry staff exchange scheme.
5. Collaboration activities, especially research-based types should be used in discipline accreditation. This would require the NUC to develop the relevant indices for measuring a university's involvement in research-based linkages. The assessment could also focus on the performance of the university's collaboration agency.

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APPENDIX A: University agencies in charge of collaborations

AGENCY	UNIVERSITY
1. Directorate of University Advancement	MOUAU
2. Directorate of Research and Development	MOUAU
3. R & D, Biotech & Molecular Centre	MOUAU
4. FUTO Consult	FUTO
5. Intellectual Property & Technology Transfer Office	FUTO
6. Consultancy, Revenue & Linkages Mobilization Unit	ABSU
7. University Consultancy unit	EBSU
8. ESUT Consult	ESUT
9. Consultancy Board	UNN
10. Innovation Centre	UNN
11. Directorate of International Co-operation	NAU
12. IMSU Consult	IMSU

Source: Field survey 2013