COMPARATIVE ASSESSMENT OF TECHNOLOGY GENERATING PRACTICE AMONG UNIVERSITIES AND RESEARCH INSTITUTES IN NORTH CENTRAL ZONE OF NIGERIA

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ABSTRACT

In order to examine the technology generating practice among universities and research institutes in north central zone of Nigeria, the study examined sources of funds for technology generating activities, compared agro-technology generating practices and identified factors hindering technology generating practices. One hundred and fifty-two academic staff were randomly selected from universities and one hundred and thirty six respondents were drawn from research institutes. Validated questionnaire with reliability coefficient of 0.92, was used to elicit data. Data collected were analyzed using descriptive statistics, T-test and Factor analysis. Majority (93.4%) of the universities respondents used their personal funds to generate new technology compared to their counterpart in research institutes. The mechanism widely employed for generatingagricultural technologies was joint radio programmes (mean= 3.38) while the least was biotechnology (mean=2.57). Major areas of difference were the physical distance between technology generation ($t=13.54;P<0.05$), farmers participate in field research trial ($t=8.50;P<0.05$), farmers co-financing adaptive research trial ($t=3.77;P<0.05$) and adequate research facilities and incentives to workers ($t=2.05;P<0.05$). Factors constraining variable based on technology generation for universities respondents was poor access to knowledge and information on new innovation ($r= 0.815$) while for research institutes, it was limited physical resources (ICT, Telephone) ($r= 0.801$). It was recommended that respondents should seek external funding for their technology generating practice, joint radio programme should be strengthened, while technological linkage advisory council should be formed and formalized.

Key words: Technology, Constraining Factor, Linkage practice, Linkage mechanism and innovative stride.

Background to the Study

In the face of changing environmental and economic realities, technology generating system in agriculture constitutes the cornerstone in effort to develop agricultural production and to improve the livelihood of farmers in Sub-Sahara African (Sanginga *et al*., 2004). Sound innovation policy is essential to ensure that necessary condition exist in linking of agencies/ subsystems to meet the family needs of rural populace. Globally, universities are recognized as the centre of production of knowledge and knowledge transfer through research and scholarship. Universities all over the world are mandated to perform three functions, namely teaching, research and community service, with the overall aim to produce trained manpower for essential areas of social development (Okiki and Mabawonku, 2013). Nirman (2007) asserts that the mission of higher

education is to advance knowledge, create knowledge, disseminate knowledge through research and provide services to the rural farm families and community. In Nigeria, the aim of establishing the research institutes and universities are imperative, but the issues of establishing a cordial relationship between institutional technology design among actor constitutes critical issues in technology generation in Nigeria universities and research institutes, more so, there are obvious challenges in instituting efficient collaboration and linkages among various agencies for greater innovative stride.

The findings will inform the policy makers the opportunity of designing and implementing holistic and regional approach and appropriate strategies for tackling the problems associated with technology generation to meet the need of farm families in rural communities.Technology generation is the discovery or invention of new ideas, information, fact and /or new agricultural techniques and practice through systemic and organized empirical investigation within the research system.

Objectives of the Study

The main objective of the study isto examine technology generating practice among research institutes and universities in North Central Nigeria.The specific objectives are to:

1. describe the socio-economic characteristics of the respondents in the study area.
2. examine sources of funds for technology generating activities;
3. compare agro-technology generating practices of ARI's and Universities in the study area; and
4. identify factors hindering technology generation.

Methodology

The study was conducted in North Central agro-ecological zone of Nigeria. The region occupies a total land of 296, 898km^2 representing about 32% of the land area of the country. It is located between latitude 6^O 30^1 N to 11^O 20^1 N and Longitude 2^O 30^1 E to 10^O 30^1 E. The region has two main season; namely dry and wet season, with the wet season beginning toward the end of the March and ends at October, with the average of 187 to 220 rainy days with average monthly temperature ranging from 21° C to 37° C. The vegetation of the zone consists of the forest savanna mosaic, southern guinea savanna and the northern guinea savanna. Geographically, the zone is characterized by varying landforms such as extensive and swampy features which are common in the lowland areas which occurs in the areas along the valleys of Niger and Benue rivers, alongside deep valleys, large hills, mountains and plateaus. The vegetation, soil and weather pattern are favourable for production of wide spectrum of agricultural food, industrial and cash crop of various types. Niger and Kwara States were purposively selected for the study from the north central agro-ecological zone of Nigeria. Their selection was based on the existence of University with agro-transfer outreach programme and functional research institutes. A total of 288 respondents were sampled from established sampling frame of 353 using Yamane's fomula.

A validated questionnaire which was subjected to Cronbach's Alpha reliability test (r= 0.92) was used for data collection. Data were collected on the respondent's socio-economic characteristics, sources of fund for technology generating practice andmechanism employed for generatingagricultural technologies as well as on factors hindering technology generating practices.Age, research experience were measured in years; while household size was measured in number. Sources of fund for technology generation were measured by asking the respondents

to indicate their sources of research funding. Technology-generating practice were measured by asking the respondents to rate nine possible technology generating practice on four point Likert scale of non-existed (4), weak (3), somewhat strong (2), quite strong (1). Constraining factors to technology-generating practice were measures by identifying twenty-eight possible constraining variables on four possible factors. Factor one (1) was political and/or policy related constraints which includes pressure from policy and its effect on value, reward and sanctions; factor two (2) was organizational/ institutional constraints; factor three (3) was attitude-related factors, and factor four (4) was poor motivational factors. Data collected were analyses using descriptive statistics (frequency, Percentage and mean), Likert scale, T-test and factor analysis.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Respondents

Table 1 reveals that majority of the university staff (43.4%) were between 41 and 50 years old while majority of the research institute respondents (55.3%) were between 31 and 40 years old. This means that universities had relatively older staff than research institutes. Generally, there were no significant difference between the respondents mean age (41 and 39years) respectively. The implication of this is that the generality of staff of universities and research institutes are young and in the active age bracket, and therefore able to face challenges associated with research activities. The table shows that, in the university system, only 14.7% of the respondents had research experience of less than five years while 43.4% of the research institutes fell in the same category. The mean work experience of the respondents was years, suggesting that the institutions studied were young, as it corroborates the findings of Ogungbaigbe (2004), who reported that a relatively inexperienced institution is one with researchers having less than five years of work experience. Madukwe *et al.* (2000) conducted their research in older universities all over the country, this study drew its respondents mainly from younger universities. Also, the brain drain and the retirement from service scourge in the past decade must have left behind in the systems, staff with relatively few years of research experience.

The data in Table 1 shows that about 20.4% of the research institutes staff had HND certificates, while none of the university staff was in this category. The table further shows that, about 66.2 % of the university respondents had Ph.D qualification, while only 5.9% of the research institutes staff had same qualification. This means that Universities had higher qualified manpower than research institute. This agreed with the findings of Oyedokun (2000), who reported that universities in Nigeria have higher number of qualified researchers than the agricultural research institutes. More so, the more the difference in qualification of staff of the both system, the less the level of linkage between them. The table revealed that, majority (51.5%) of university respondents had household size ranging from 6-10. while 64.5% of research Institutes staff had household size from 1-5. Universities respondents had more members in their family than their counterpart in research institutes, suggesting a higher sense of family responsibility. Majority (99%) of the university respondents were members of professional bodies while for research institutes, 61% were members of professional bodies. This indicates that majority of the respondents from both systems were members of professional bodies. The higher percentage of membership for both systems is because belonging to professional bodies is needed for assessment in promoting academic staff.

Table 1: Socio-economic characteristics of respondents

Characteristics	Universities n=136	Research Institutes n=152
Age (years)		
21-30	18 (13.2)	18 (11.8)
31-40	45 (33.1)	84 (55.3)
41-50	59 (43.4)	40 (26.3)
>50	14 (10.3)	10 (6.6)
Mean	***41***	***39***
Research Experience (years)		
1-5	20 (14.7)	66 (43.4)
6-10	74 (54.4)	52 (34.2)
11-15	21 (15.4)	8 (5.3)
>15	21 (15.4)	26 (17.1)
Mean	***11***	***9***
Educational Qualification		
HND	-	31 (20.4)
BSc/ Btech	7 (5.1)	53 (34.9)
MSc/M.Tech	39 (28.7)	59 (38.8)
PhD	90 (66.2)	9 (5.9)
Marital Status		
Single	7 (5.1)	28 (18.4)
Married	129 (94.9)	124 (81.6)
Household Size		
1-5	64 (47.1)	98 (64.5)
6-10	70 (51.5)	54 (35.5)
11-15	2 (1.5)	-
Mean	***5***	***5***
Membership of Association		
Member	134 (98.5)	92 (60.5)
Non-Member	2 (1.5)	60 (39.5)
Gender		
Male	117 (86.0)	124 (81.6)
Female	19 (14.0)	28 (18.4)

*values in parentheses are percentages

Sources of Funds for Technology generation:

The data in Table 2 shows that 60% of respondents from research institutes received direct government financial support for research, while only about 12% of the university respondents received from the same source. However, both the university respondents (75%) and research institutes (73.7%) indicated that their highest source of fund came from their establishments. This conform with Adams and Onuka (2006), who reported that government is the sole provider of the funds for Nigeria universities, accounting for 94%. It however, contradicts the opinion of Obayan (2006) that the practice in some part of the world is basically the responsibility of all stakeholders to contribute to funding university education. Private sector sponsorship for research was quite high for research institutes (44.7%) compared to their counterpart in the universities (8.1%). The table also shows that 93.4% of the university staff used personal funds for their research while 10.3% of them used loans. The high dependent on personal fund for research is probably

explained by Musa (1988), that the bulk of university research are driven by demand for publication towards career advancement. In the research institutes, only 40.8% of staff used personal funds for research while3.3% used loans.

Table 2: Distribution of Respondents by Source of Fund for Technology Generation

Sources	Universities n=136	Research Institutes n=152
Personal fund	127 (93.4)	62 (40.8)
From Universities/research institutes	102 (75.0)	112 (73.7)
Direct government funding	*16 (11.8)	*90 (59.2)
Private sector sponsorship	11 (8.1)	68 (44.7)
Support from farmers	2 (1.5)	35 (23.0)
Loans	14 (10.3)	5 (3.3)

Values in the parentheses are the percentage*Multiple responses.Field Survey, 2014

Comparison of agricultural technology generating practice of Universities and Research Institutes.

Table 3 shows that a significant difference ($t=8.50;P<0.05$) exist in the level of farmers participation in field research trial by the universities and research institutes in generating agricultural innovations. Farmers' participation in field research trials contributes largely to orienting innovations towards sustaining farmers' interest. The results further reveal that universities and research institutes differed significantly in terms of adequate research facilities and incentives to workers ($t=2.05;P<0.05$);Also, research institutes differed significantly from the universities in the physical distance between technology generation ($t=13.54;P<0.05$). The close physical distance between the innovation generation and transfer sub-system could explain why in the research institutes system, the innovation generated were within farmers' co-finance adaptive research trials. Distance between innovation generation and transfer sub-system had been identified as a major factor influencing the quality and time of providing innovation to participating farmers (Blum, 1991;Madukwe, 1996). The table revealed that universities and research institutes also differed significantly on the practices of farmers co-finance adaptive research trial ($t=3.77;P<0.05$).

Table 3: T-test results showing differences in Agricultural Innovation Generating Practices between University and Research Institution.

Innovation generating practices	Universities (max.=4)	Research Institutes (max.=4)	t-cal
Autonomy in technology generation	3.11 (.857)	3.18 (.958)	1.07
Technology generation base on field problem	3.38 (.731)	3.48 (.825)	1.10
Farmers participate in field research trial	3.17 (.985)	2.13 (.951)	8.50*
Adaptive research trials are located in farmers field	2.10 (.871)	1.97 (.973)	1.23
Extension agents participate in field research trial	3.28 (1.05)	3.34 (.929)	0.84
Adequate research facilities and incentives to workers	1.98 (.843)	1.73 (.942)	2.05*
Farmers co-finance adaptive research trial.	2.31 (.963)	2.76 (1.110	3.77*

Data in parenthesis are standard deviation *P<0.05. Field Survey, 2014.

Factors constraining the linkage activities of the respondents

Table 4shows the factor matrix on linkage constraints base on factor analysis. Four factors were identified: Factor one (1) were political and/or policy related constraints which includes pressure from policy and its effect on value, reward and sanctions; factor two (2) were organizational/ institutional constraints; factor three (3) were attitude related factors, and factor four (4) were poor motivational factors. Items that loaded high in factor 1, (political/ or policy related constraints) included poor government commitment to extension (0.754), unclear delineation of function (0.702) and multiplicity of varying ideologies (0.756).Items that loaded high on factor 2 (organizational/institutional constraints) included limited qualified human resources in the agencies for linkage leadership (0.636), poor access to knowledge and information on new innovation (0.815) and low mobility of expert/ professionals (0.804). Items that loaded high in factor 3 (attitude related factors) included long administrative procedure/administrative bottleneck associated with public agencies (0.765), poor macro system linkages (0.675) and excessive organization fragmentation (0.793).Items that loaded high in factor 4 (poor motivational factors) include poor training opportunity for professionals (0.758).However, variables that were bolded in the table loaded high in more than one factor and were, as a result not considered in the process of extracted factors because they overlapped.

Table 4: Factors constraining the linkage activities of the respondents

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Rank
Overlapping mandate/objectives	**.580**	.172	.232	**.327**	-
Limited qualified human resources in the agencies for linkage leadership	.241	.636*	.074	.254	9th
Lack of adequate sources of finance	**.567**	**.490**	.236	.095	-
Limited physical resources (ICT, Telephone)	**.410**	**.517**	**.331**	.251	-
Poor access to knowledge and information on new innovation	.158	.815*	.167	.239	1st
Low mobility of expert/professionals	.196	.804*	.049	.125	2nd
Poor logistics support and incentives for linkage	**.369**	**.655**	.200	.043	-
Organizational rigidities	**.466**	.292	**.455**	.156	-
Long administrative procedure/administrative bottleneck associated with public agencies	.214	.136	.765*	.041	4th
Weak legal frame work/lack of rule for interaction/linkage	**.308**	.002	**.770**	.248	-
Poor macro system linkages	.278	.274	.675*	.195	-
Excessive organizational fragmentation	.247	.125	.793*	.060	3rd
Inappropriate government policy on agriculture	**.597**	.041	**.309**	.199	-
Poor/differences in orientation of personnel of agencies	.164	**.312**	.261	**.553**	-
Influence of international/donor mandates	**.450**	-.177	-.119	**.375**	-
Lack of farmer's interest in extension	-.070	**.590**	.167	**.607**	-
In equality in qualification and salary	**.528**	.224	-.023	**.493**	-

scale of staff of the agencies					
General poor attitude and low morale of extension workers	.208	**.357**	-.017	**.703**	-
Poor training opportunities for professionals	.277	.054	.184	.758*	5th
Traditional public characteristics of most extension information.	.044	**.300**	.243	**.741**	-
Poor government commitment to extension	.754*	.032	.183	.115	7th
Wrong view of famers incapable of taking rational decision	.000	**.557**	.102	**.395**	-
Un equal status among agencies	**.520**	.109	**.346**	**.330**	-
Top down decision making procedure	**.678**	**.387**	.135	.024	-
Unclear delineation of Function	.702*	.282	.233	.074	8th
Multiplicity of organization with varying ideologies	.756*	.190	.277	.031	6th
Management policy	**.655**	.266	**.408**	.075	-
Bureaucratic bottleneck	**.659**	.286	**.399**	.182	-

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. *Sig. Field Survey, 2014*

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, it can be concluded that:

The mean age of the respondents for both system were almost the same. The number of Ph.D holders in the universities were more than research institutes. Universities respondents utilized their personal funds for research than their counterpart in research institutes Technology generating activities keep pace with current field practices was the major area where the universities and research institutes form greater linkages for innovation generating practice. Research institutes differed with the universities in the physical distance between technology generation and technology transfer. Poor access to knowledge and information on new innovation rank first and as such was identified as major constraints by universities respondents while limited qualified human resource in the agencies ranked least. Limited physical resources (ICT, Telephone)was identified as a major constraint by research institutes respondents which was poor motivational factor while lack of adequate source of finance rank least which was policy related factors.

Recommendations

Base on the findings of the study the following recommendations are giving for improving the linkages between the actors involved for better innovation development.

1. The number of Ph.D holders in the universities were more than research institutes. It is recommended that scientists in research institutes endeavour to further their educational pursuit.
2. Considering the personal fund expended for research by universities respondents, it is recommended that they should be trained on writing research proposals to funding agencies to secure grant.
3. It is recommended that linkage advisory council should be formed and formalized as in the case of Ethiopia, this may help in getting government fund.

4. Since poor access to knowledge and information on new innovation rank first in terms of constraints face by the universities respondents. It is recommended that every academic staffshould have internet in their various offices and allowed to attend international conference from where they will interact and cross fertilize ideas.
5. It is recommended that Sound innovation policy should be put in place to ensure that necessary condition exist in linking the agencies. Governing rule and regulation of the linkage council should be revised and updated regularly adapting into the context it operate.

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