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DETERMINANT OF E-RESOURCES LITERACY SKILLS AMONG AGRICULTURAL RESEARCHERS AND EXTENSION PERSONNEL IN NORTH-WESTERN, NIGERIA

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ABSTRACT

This study examined the literacy skills of electronic resources among agricultural researchers and extension personnel in North West, Nigeria. Specifically, the findings show their socio-economic characteristics and types of e-resources accessibility. A multistage sampling procedure was adopted. In the first stage, three of the States' ADPs out of seven (Katsina, Kano, and Kebbi States) were purposively selected, with reference to geographical representation, security situation, and coverage of the Zone. In the second stage, based on the lists of 715 NAERLS researchers (Frame) from various agricultural disciplines obtained from the Institute, 251 staff members were randomly and proportionately selected, as recommended by Raosoft's sample size calculator. In the third stage, according to the list of 1431 (Frame) extension personnel obtained from the three states' ADPs, 443 extension personnel were sampled randomly (balloting) and proportionately. This number was based on the recommendation of Raosoft sample size calculator as the sample size. Thus, making the total sample size 694, selected proportionately for the study. Data was collected using structured questionnaires. Analytical tools included Exploratory Factor Analysis (EFA) and descriptive statistics. Researchers displayed higher competence in computer operations (93.3%) compared to extension personnel (28.6%). The findings of the study on the determinants of factors influencing the usage of e-resources among the Researchers and the Extension personnel show that the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0.941, which is above the minimum threshold of 0.60 suggested by Kaiser (1974), indicating a high degree of common variance among variables. Also, Factor analysis identified infrastructure, digital literacy, and institutional support as significant predictors of utilization. The study further recommended targeted training, improved ICT infrastructure, and supportive institutional policies to enhance e-resource adoption for agricultural research and extension.

Keywords: *Exploratory Factor Analysis, NAERLS, agricultural innovation, e-resource*

INTRODUCTION

Background to the study

Globally, agriculture is considered a pillar of the overall development of any nation, including Nigeria. Nigeria's agricultural system employs 70% of the workforce, generates about 40% of the country's Gross Domestic Product (GDP), supplies over 80% of the country's food needs, and accounts for 70% of non-oil exports (Ogbanga, 2018; Olu et al., 2023; Aderemi et al., 2021; Tochukwu et al., 2022). The nation's desire to make agricultural research and extension services delivery more scientific led to the establishment of research institutes and Councils in the post-independence era. The Agricultural Research Council of Nigeria (ARC�) has a mandate to support, promote, guide sector development programs, and coordinate the agricultural research system in the Nation.

The ARC� supports the agricultural research system through establishing policy options to promote innovation, establish a knowledge management capacity, and strengthen the nation's agricultural research system. The Council coordinates 15 National Agricultural Research Institutes (NARIs) and 10 Federal Colleges of Agriculture in Nigeria. Each of the institutes under the council has its specific mandate commodities, which keeps each institute focused on a specific commodity. For instance, the Institute for Agricultural Research (IAR) and the Institute for Agricultural Research and Training (IAR&T) are saddled

with the genetic improvement of crops and are responsible for assigning agricultural ecological zones and their respective farming systems.

All institutes are to operate within structured research programs that reflect findings from on-station and on-farm research (Khalid et al., 2021).

The National Animal Production and Research Institute (NAPRI) is saddled with the genetic improvement of livestock and livestock systems in structured research programs. The National Root Crops Research Institute (NRCRI) supports cassava research. More so, the Federal Department of Agricultural Extension (FDAE) is responsible for the agricultural extension policy. Similarly, the National Agricultural Extension and Research Liaison Services (NAERLS) has the National mandate and is responsible for the development, collation, evaluation, and dissemination of agricultural technologies, conducting research in agricultural extension methodologies & policy, and provide leadership in capacity building of stakeholders to meet the present and future agricultural development in Nigeria. In addition, it has direct synergy with the Agricultural Development Programmes (ADPs) and the ADPs are the direct links to the farmers. Furthermore, all the institutes have extension units, which also liaise with the NAERLS. The NAERLS further promotes agricultural technologies that are developed at any of the institutes through their ADPs linkages. More so, extension data

generated by the NAERLS through linkages with ADPs and other NARIs often inform policy decisions by the FDAE (Issa and Kagbu, 2019).

Blum et al. (2020) revealed that innovation is conceptualized in different ways, ranging from diffusion perspectives, focused on technology transfer, to applications that consider innovation as emerging from social learning processes that occur in the interaction among multiple actors. Similarly, Cook et al. (2021) and Goulet et al. (2019) highlight the multiple benefits and positive impacts of strong working relationships between researchers and rural extension and between these elements and farmers. In the same perspective, Ng'ang'a et al. (2022) and Becerra et al. (2024) noted that a good communication dynamic among researchers, rural extension, and farmers is a key element for the promotion and uptake of agricultural innovation processes. Consistent with this, Mirghani (2022) affirmed that in the agricultural research and extension continuum, robust linkage mechanisms facilitate flow and enhance technology generations and effective transfer to end users. This corroborates with Urhibo (2021) who confirmed that researchers and extension personnel working relationships enhance the feedback processes from farmers and extension agents to researchers; thus, the production technologies sourced are adapted to the farmers' problems and the local ecological conditions. This concurred with Kassem et. al, (2018), who pointed that strengthening active research-extension favorable working climate, provides an effective technology transfer mechanism and timely end users' feedback to research.

1. This reality justifies an empirical-based impact assessment such as these. Thus, this study seeks to determine the e-resources accessibility among researchers and extension personnel in North-Western Nigeria. The specific objectives are to: describe the socioeconomic characteristics of the respondents in the study area

2. identify the e-resources literacy skills possessed by the researchers and the extension personnel
3. determine factors influencing the usage of e-resources among the researchers and the extension personnel in the study area.

This study was carried out in North-western Nigeria, which falls within the Sudano-Sahelian agro-ecological zone (Abaje et al., 2015). The zone is composed of seven States, which are Kano, Kaduna, Katsina, Sokoto, Zamfara, Jigawa, and Kebbi states. North-western Nigeria lies between latitude 14° to the North and 10° to the south and longitude 4°21 to the West and 10°151 to the East. It has boundaries with the Niger Republic in the North, Bauchi, Yobe, and Taraba States in the East, FCT, Niger, and Nasarawa States in the South and Benin Republic in the West (Adefila and Madaki, 2014; Abaje *et al.*, 2015).

METHODOLOGY

Sampling procedure and sampling size

The population of this study include researchers of the NAERLS that has a national mandate for research and training of the ADPs extension personnels across the 36 States of the Federation, and ADPs extension personnels. A multi stage sampling procedure was employed in this study. In first stage, three of the States' ADPs out of seven (Katsina, Kano and Kebbi States) was purposively chosen, taking into cognizance on the need to give geographical representation, security situation and coverage of the Zone. In the second stage, based on the lists of the 715 NAERLS researchers 251 staff were randomly and proportionately selected as recommended by Raosoft sample size calculator. In the third stage, according to the list of 1431 extension personnel's gotten from the three states ADPs, 443 extension personnels were sampled randomly and proportionately. This number was based on the recommendation of the Raosoft sample size calculator as the sample size Thus, making the total sample size 694 selected proportionately for the study.

Table 1: Sample Frame and Size

SN	Organizations	Sample Frame	Sample size
1	NEARLS Zaria (Researchers)	715	251
2	States ADPs (Extension personnel's)		
	Katsina	78	65
	Kano	1253	298
	Kebbi	100	80
	Total	2146	694

Source: Field work 2025

Data collection

The researcher collected data from both primary and secondary sources. The primary data were collected using structured questionnaire.

Model specification

The mathematical model of EFA is very similar to the general factor analysis model but specifically focuses on exploring the latent structure of the data without any predefined hypotheses.

The EFA model can be expressed as:

$$X_i = \lambda_{i1}F_1 + \lambda_{i2}F_2 + \dots + \lambda_{im}F_{12m12} + \epsilon_i \dots \dots \dots (1)$$

Where:

x_i : The i -th observed variable (Use of e- resources);
 x_{ij} : Factor loading of variable i on factor j
 F_j : The j -th common (latent) factor
 ϵ_i : Unique (error) factor specific to variable
 i ; X : Vector of observed variables
 L : Matrix of factor loadings
 F : Vector of common factors
 ϵ : Vector of unique errors.
 The factors influence the use of e-resources among the researchers and extension personnels are as follows:
 F_1 = awareness
 F_2 = skills or ability to use
 F_3 = availability of required devices
 F_4 = mobile internet connectivity
 F_5 = effective ICT policy
 F_6 = Government support
 F_7 = Training and capacity building
 F_8 = accessibility to e-resources facilities
 F_9 = access to uninterrupted power
 F_{10} = cost of connectivity
 F_{11} = educational level

RESULT AND DISCUSSION

E-resources literacy skills possessed by the researchers and the extension personnel's

The results of this study on e-extension literacy skills of the respondents in table 2 indicates that There is high concentration of advanced computer literacy among agricultural researchers, with an overwhelming 93.28% reporting very high competence in basic computer operations. This aligns with expectations, given their institutional exposure and academic orientation. In contrast, extension personnel reflect a more heterogeneous proficiency profile 28.64% reported *very high* competence, while 37.09% fell within the average range. These figures indicate that, although extension personnel possess moderate technical familiarity, the gap in advanced digital competence relative to their research counterparts may hinder effective adoption of sophisticated e-resource platforms (Ajuwon, 2003; Izuogu et al., 2023). Finally, the results also show that majority of Agricultural researcher's 93.66% knows how to use Agricultural mobile apps for e-extension purposes while extension personnel 29.34% with very low skills. This highlights a critical barrier to adopting and utilizing mobile-based agricultural solutions, which are increasingly becoming a primary mode of information delivery and data collection in the field.

Table 2: E-resources literacy skills possessed by the researchers and the extension personnel's

E-Resource literacy skills	Extension Personnels					Agricultural Researchers				
	Average	High	Low	Very high	Very low	Average	High	Low	Very high	Very low
How to use computer	37.09	16.9	10.33	28.64	7.04	4.1	1.49	0.75	93.28	0.37
How to maintain and do simple repairs of electronic items like computers, phones, etc	25.82	14.32	19.25	23.71	16.9	2.61	6.72	70.9	18.66	1.12
How to use Midget for audio recording	30.75	15.49	16.9	21.36	15.49	1.49		3.73	94.03	0.75
How to handle camera	27.23	25.59	10.33	26.06	10.8	3.73	1.12	0.37	94.4	0.37
How to edit video recording	31.92	18.08	14.08	20.89	15.02	3.36	0.75	0.37	94.03	1.49
How to edit audio recording	32.16	16.9	15.73	22.07	13.15	3.73	1.12	0.37	93.28	1.49
How to write script for e-resource purpose	32.16	18.78	12.44	24.88	11.74	3.36	1.49	1.49	93.28	0.37
How to develop agricultural content for e-resource platform	34.04	19.95	12.91	24.18	8.92	2.99	1.49	1.49	93.28	0.75
How to use and manage WhatsApp account	19.95	27.93	5.4	38.73	7.98	2.24	2.99	0.37	94.03	0.37
How to use and manage YouTube account	24.41	23.71	14.55	24.41	12.91	2.61	2.24	1.49	93.28	0.37
How to store content	25.35	22.77	13.62	26.53	11.74	2.99	2.61	0.37	93.66	0.37
How to write (or store) on CD/DVD using Writer	24.65	16.43	21.6	20.66	16.67	1.87	2.24	1.87	93.28	0.75
How to conduct interview	28.17	27	8.22	27.93	8.69	2.61	3.73	0.37	92.91	0.37
How to Use SMS for e-extension purposes	21.36	29.11	6.1	35.92	7.51	2.61	2.99	1.12	93.28	
How to make calls for e-extension purposes	17.84	25.82	6.57	42.72	7.04	2.61	2.61		94.4	0.37
How to use Online meeting platforms (like Zoom) for e-extension purposes	23.71	24.41	10.33	30.99	10.56	2.61	1.87	1.87	92.91	0.75
How to use E-mail for e-extension purposes	22.54	26.53	11.5	30.99	8.45	2.99	1.49	2.24	92.91	0.37
How to use/manage website	26.29	21.13	15.26	25.12	12.21	2.24	1.49	7.09	82.46	6.72
How to use Projector	27.93	15.26	17.61	23.71	15.49	2.24	1.49	2.24	93.28	0.75
How to use Agricultural mobile apps for e-extension purposes	23.24	27.93	9.39	29.34	10.09	2.99	2.99		93.66	0.37

Source: Field work, 2025

Determinant factors influencing the usage of e-resources among the Researchers and the Extension personnels in North Western Nigeria

Exploratory Factor Analysis (EFA) was used to determine the factors influencing the usage of e-resources among Agricultura researchers and Extension personnels. The results of the Exploratory Factor Analysis (EFA), as presented in Table 3, provides a robust empirical foundation for understanding the latent dimensions that shape the utilization of electronic resources (e-resources) among agricultural researchers and extension personnel.

The results shows that Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0.941, which is above the minimum threshold of 0.60 suggested by Kaiser (1974), indicating a high degree of common variance among variables. Furthermore, Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 6614.11, p < 0.001$), suggesting that the correlation matrix significantly deviated from the identity matrix and confirming that the items share enough common variance to warrant factor analysis (Hair et, al. 2006).

The result also extracted a single dominant factor with an eigenvalue of 7.407, accounting for 67.33% of the total variance. This percentage exceeds the 50% minimum typically recommended in social science research (Fornell & Larcker, 1981), thereby suggesting a strong unidimensional structure.

All the observed variables, with the exception of *Educational Level*, demonstrated factor loadings above 0.70, indicating strong associations with the extracted factor. The highest loading was recorded for *Training and Capacity Building* (loading = 0.888), reaffirming the pivotal role of continuous professional development in enhancing digital competency among agricultural professionals. This aligns with earlier findings by Arokoyo (2005) and more recent studies such as Adejo and Ewetan (2021), who argued that training improves not only technical proficiency but also the confidence and pedagogical adaptability of extension agents in deploying e-resource tools. Additionally, the Average Variance Extracted (AVE) was 67.33%, indicating a high degree of shared variance among the items and further reinforcing the model's convergent validity. Training (0.888), Government support (0.854) and effective ICT policies (0.855) has accounted for the most important factors to e-resources usage among the Agricultural researchers and extension personnels in the study area.

These findings align well with theoretical perspectives such as the Technology Acceptance Model (TAM) (Davis, 1989) and the Diffusion of Innovation (DOI) Theory (Rogers, 2003), both of which emphasize that users' perceptions of utility, ease of use, and enabling conditions strongly influence technology adoption. The dominance of institutional, infrastructural, and capacity-building variables in this model suggests that effective use of e-resources is shaped not solely by individual motivation, but by a confluence of systemic and environmental factors.

Table 3: Determinant factors influencing the usage of e-resources among the Researchers and the Extension personnel's

Variables	Factor loadings	Eigen Value	Cronbach's (α)	AVE
		7.407	0.947	67.33
Awareness	0.776			
Skills ability to use	0.811			
Availability of required devices	0.828			
Mobile internet connectivity	0.850			
Effective ICT Policies	0.855			
Government Support	0.854			
Training and Capacity Building	0.888			
Accessibity to E-Resources Facilities	0.839			
Access to Uninterrupted Power	0.778			
Cost of Connectivity	0.801			
Educational Level	0.454			
KMO Measure of Sampling Adequacy.	0.941			
Bartlett's Test of Sphericity	6614.11 ***			
Chi-Square	587.01 ***			

Note: AVE = Average Variance Explained (***) = Significant at 1%.

CONCLUSION

The findings of this study on E-resources literacy skills possessed by the researchers and the extension personnels revealed that there is high computer literacy among agricultural researchers, with an overwhelming 93.28% reporting very high competence in basic computer operations. In contrast, extension personnel reflected more heterogeneous proficiency profile with 28.64% reported very high competence, while 37.09% fell within the *average* range.

The result on the E-resources Infrastructure availability by the researchers and the extension personnel's shows that email, phone calls, SMS, and WhatsApp recorded the highest levels of accessibility across both cohorts. Specifically, email access was reported by 100% of agricultural researchers and 98.36% of extension personnel, with similarly high figures (99.06 and 96.01%) observed for mobile telephony and messaging platforms respectively.

The findings of the study on the determinant of factors influencing the usage of e-resources among the Researchers and the Extension personnel's also shows that Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0.941, which is above the minimum threshold of 0.60 suggested by Kaiser (1974), indicating a high degree of common variance among variables. Furthermore, Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 6614.11$, $p < 0.001$), suggesting that the correlation matrix significantly deviated from the identity matrix and

confirming that the items share enough common variance to warrant factor analysis also the Average Variance Extracted (AVE) was 67.33%, indicating a high degree of shared variance among the items and further reinforcing the model's convergent validity. Training (0.855), Government support (0.834) and effective ICT policies (0.855) has accounted for the most important factors to e-resources usage among the Agricultural researchers and extension personnels in the study area.

RECOMMENDATIONS

Based on the findings of this research work the following recommendations were made to help improve the situation:

- i) Government and NGOs should put more efforts on training and capacity-building for all the staffs of both research institutes and ADPs especially ICT literacy.
- ii) Rigorous impact assessments should be conducted on digital literacy interventions to measure their effectiveness the purpose of improving e-resource utilization, enhancing agricultural outcomes, and ultimately contributing to sustainable development.

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