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Utilisation of Open Databases in Accessing Agricultural Information among Agricultural Professionals in Rivers State, Nigeria

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Abstract
This study assessed the utilization of open databases in accessing agricultural information among agricultural professionals in Rivers State. Two-stage sampling procedure was used to select 240 respondents for the study. A structured questionnaire was used to collect data for the study, while data collected were analysed using mean score, percentages, frequency, Ordinary Least regression analysis and Analysis of Variance (ANOVA). Results show that the agriculture professionals were mainly aware of Global Open Data for Agriculture and Nutrition (GODAN) (100%), National Bureau of Statistics (NBS) (96%), World Bank (70%), FAO-FAOSTAT (69%) and Nigeria Metrological Agency (NiMET) (68%), while NBS (95%), World Bank (84%), National Agricultural Extension and Research Liaison (58%) and FAO-FAOSTAT (53%) were the mainly utilized open data bases. The level of education (2.535, p < .05), work experience (0.084, p < .05, household size (0.382, p < .05), age (0.2886, p < .05) and marital status (-2.517, p < .05) were found to influence agriculture professional's utilisation of open data bases for accessing agriculture information. Also, significant differences existed in the utilization of open databases among agricultural professionals in Rivers state (F (2,237) =2.950, p < .05). The study recommends massive sensitisation and training of agricultural profession to develop skill and capacity for increased use of open data bases.

Introduction
Every sector of the economy needs data to survive. Informed decisions and policies could only be possible with the availability of relevant data. The agricultural sector is comprised of numerous stakeholders, who must collaborate to make the sector

effective. Agricultural researchers, agricultural professionals, and extension agents are among the key players in the agricultural sector. For the envisaged increased productivity in the sector to be achieved, information and knowledge sharing among these stakeholders must be very efficient. The availability and prompt supply of current agricultural knowledge and information are essential for the agricultural sector's performance, according to Deji et al (2023). The agricultural sector is an information-intensive industry. Timely access to and use of agricultural information among the professionals in the sector is crucial for sustainable productivity.

The advent of mobile phones and other digital tools has changed the narrative in the agricultural sector especially with regard to information sharing. Even rural farmers are caught in the web of this revolution as they show high readiness to embrace these tools (McCampbell et all, 2023), while some are already utilizing simple and accessible digital tools as a means of sharing agricultural information (Addison et al, 2024). Food and Agriculture Organization (FAO), (2021) noted that agricultural extension and advisory services (AEAS) systems have been changing over the past decades, persistently adopting new tools and methods to improve their efficiency with digital tools among the key tools adopted. Agricultural extension agents are not left out in this revolution in agricultural communication. Ifeanyi-obi and Corbon (2023) in their study of utilization of digital tools in extension service delivery amongst extension agents in Akwa Ibom State, Nigeria found that over 70% of extension agents in the state used digital tools in extension service delivery with WhatsApp and video camera being the major tools utilized. This further shows that the acceptance and utilization of digital tools among key professionals in the agricultural sector is high.

As advocacy for the use of digital tools to support the timely dissemination of information in the agricultural sector increases, it is important to note that the availability of these data will facilitate the adoption of digital tools. Digital tools may not thrive sufficiently where the data to be shared are not available and accessible to the users. Owolabi et al (2022) noted that the emergence of social media platforms and ICT in agricultural information is stimulated by the increased access to ICT devices, and advocated that data should be left accessible to further harness opportunities in social media usage. Simply put, Open data is making data accessible so that it can be accessed, used, and reused by citizens and policymakers.

Open data supports sharing crucial information across national boundaries, facilitating the transfer of best practices. It also facilitates high tech agricultural practices like precision agriculture, remote sensing and mapping. It has also contributed to improving institutional responsiveness to recognized needs as well as development of informed policies in the sector. One typical example of the numerous benefits of open data is the Global Open Data for Agriculture and Nutrition (GODAN) initiative, an initiative that has significantly contributed in making relevant data of agriculture and nutrition available and reachable globally, supporting the development of high-level policy as well as informed interventions in the agricultural sector. Laperriere (2019)

noted that open data has helped farmers to access information and other climate services, strengthening their capacity to absorb shocks and better manage climate vagaries. Open data helps in closing the wide gap between different stakeholders in the agricultural sector, as stakeholders can better connect with others in other areas of specialisation making it easier for them to better understand each other, collaborate in learning and sharing experiences (Schap, 2019). Furthermore, Davies (2019) suggested that making data open and more accessible, will subject it to more scrutiny and, hence, stimulate an increase in quality and credibility of available data.

On the other hand, Ifeanyi-obi and Asuquo (2023) in their study of constraints to conducting research uptake activities found that the lack of a centralised site for sharing information hinders research uptake conduct. It is sad to note that a great percentage of agricultural research outcomes still lay untapped on the universities' shelves despite their usefulness. Embracing open data holds much potential in making these research outcomes accessible to end users. With the increasing population in Nigeria further stirring increased demand for agricultural produce, the need to embrace technical advancements and novel strategies for enhanced production is inevitable. Data is the seed of innovation and open data is crucial to facilitate the development and sharing of ideas to birth innovations in the sector. It is important to access the utilization of open data among professionals in the sector with the intent of identifying constraining factors to utilization and devising strategies to eradicate them. It is against this background that this study was conceived.

The broad objective of this study was to assess the utilization of open databases in accessing agricultural information among agricultural professionals in Rivers State, Nigeria. Specifically, the study

1. determined the awareness of open databases among agricultural professionals;
2. ascertained the utilisation and level utilisation of open databases in assessing agricultural information;
3. determined the relationship between the socio-economic characteristics of agricultural professionals and the level of utilisation of open data bases in accessing agricultural information, and;
4. determined the difference in the utilisation of open databases among agricultural professionals in Rivers state.

Methodology

This study was carried out in Rivers State, Nigeria. Rivers State lies at latitude 4°45' North and longitude 6°50' East. Rivers State is a predominantly low-lying pluvial state in southern Nigeria, located in the eastern part of the Niger Delta on the oceanward extension of the Benue Trough (Omega & Adelusi, 2023). The state has a total area of 11,077 km2 (4,277 sq mi), making it the 26th largest state in Nigeria. The state is divided into upland and the riverine area and the livelihood of the people depends on the area, planting for upland and fishing for the riverine.

The population of this study comprised all agricultural professionals in Rivers State. For the purpose of this study, the classification of agricultural professionals by the Ministry of Agriculture in Rivers State was followed. This includes agricultural professionals from higher institutions, governmental agencies and agro-allied industry.

Agriculture professionals from higher institutions include professionals from the University of Port Harcourt, Rivers State University, Ignatius Ajuru University of Education and Captain Elechi Amadi Polytechnic; agricultural professionals from governmental agencies include those in Rivers State Ministry of Agriculture, Rivers State ADP, NSPRI, Fadama III, School to Land, while agricultural professionals from agro-allied industries include those from Port Harcourt Flour Mill, Indorama, SIAT, Rivers Cassava processing Plant, ARAG and Elephant Rice.

A two-stage sampling procedure was used to select the sample for the study. The first stage comprised a purposive selection of all agricultural professionals in the senior staff cadre across the three categories in the state. This is based on the fact that it is mainly those who have risen to that rank may have the duties and more need to access information from databases. Hence, the list of all agricultural professionals in the senior staff cadre across the three categories was developed. The second stage comprised a simple random sampling of 40% of the professionals (615) across the three categories that were listed in the first stage. This gave rise to a total sample size of 240 respondents.

Table 1: Table showing the population and sample size selected for the study

Organizations	**Number in the organizations (Total number of staff in the senior cadre) (N)**	**Number of agricultural staff sampled (40%)**
Government Agencies		
School to Land	51	20
Ministry of Agriculture	21	8
National Stored Produce Research Institute (NSPRI)	19	7
FADAMA 111	63	25
Agriculture Development Programme (ADP)	45	18
Institutions		
Rivers State University	63	25
University of Port Harcourt	74	29
Captain Elechi Amadi Polytechnic	44	17
Ignatius Ajuru University	55	22
Agro-allied Industries		
Port Harcourt Flour Mill	37	14
Indorama	28	11
SIAT	22	8
ARAG	19	7
Elephant Rice	31	12
Rivers Cassava Processing Plant	43	17
Total	**615**	**240**

Data were collected with the aid of questionnaire. Level of utilization of open data among agricultural professionals was captured using a four-point Likert type scale of very high, high, low and very low with 4, 3, 2 and 1 assigned as scores, respectively.

Based on the weight assigned, a midpoint of 2.5 was obtained. The decision rule was that item statement with mean scores of 2.5 and above implies high utilization, while mean scores of less than 2.5 imply low utilization. Data were analysed using mean scores, frequency counts, percentages, Ordinary Least Square regression analysis (OLS) and Analysis of Variance (ANOVA). The relationship between the socio-economic characteristics of agricultural professionals and the level of utilization of open data bases in accessing agricultural information by agricultural professionals in Rivers State was determined using OLS. The model specification for the OLS is stated as follows:

$Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X5 + \beta6X6\ldots + \varepsilon$

where Y is the dependent variable (pooled index of the utilization of Open data bases by agricultural professionals captured using Highly utilized = 4, Utilized = 3, Not Utilized = 2, Highly Not utilized = 1),
X1 = Gender (Male = 1, Female = 2)
X2 = Age (Years)
X3 = Marital status (Singel = 1, Married = 2, Widowed = 3, Divorced = 4, Separated = 5)
X4 = Level of Education (No formal education = 1, Primary education = 2, Secondary education = 3, Tertiary education = 4)
X5 = Household size (Actual number of persons living in the household)
X6 = Work experience (Number of years)
β0, is the intercept,
E = Error term
It is expected a priori that the coefficients of X1, X2, X3, X4, X5, X6>0 The relationship between the dependent and each of the independent variables was examined using the four functional forms: linear, semi-log, exponential and double- log. A lead equation was chosen based on the appropriateness of signs, magnitude of coefficient of multiple determination (R2), statistical significance of the variables and a priori theoretical expectations. The functional forms tested are as follows:
Linear: Y= B0 + B1X1 + B2X2 + B3X3 + B4X4 + B5X5 + e
Semi-Log: Y= B0 + B1 logX1 + B2 logX2 + B3 logX3 + B4 logX4 + B5 logX5 + e
Exponential: logY=B0 +B1X1 +B2X2 +B3X3 +B4X4 +B5X5 + e
Double Log: logY=B0 +B1 logX1 +B2 logX2 +B3 logX3 +B4 logX4 +B5 logX5 + e

Results and Discussion

Awareness of agricultural-related Open Databases among agricultural professionals in Rivers State

Results in Table 2 show that the agricultural professionals in Rivers State were mainly aware of Global Open Data for Agriculture and Nutrition (GODAN), (100%), National Bureau of Statistics (NBS), (96%), World Bank (70%), FAO-FAOSTAT (69%), Nigeria Metrological Agency (NiMET), (68%), National Agricultural Extension and Research

Liaison (NAERLS), (53%), AgAnalytics (58%), National Information Technology Development Agency(NITDA), (58%), and European Union Open Data Portal (58%).

The findings show that the awareness of open data bases among agricultural professionals is still low as only 9 out of the 38 open data bases used in this study had up to 50% of the respondents were aware of them. This could impact the use of open databases as people hardly adopt or utilize what they are not aware of. Similarly, Ifeanyi-obi et al (2020), in their study of Extension Agents' perception of open data usage in agricultural communication in Abia State found that a moderate percentage (68%) of agricultural extension agents in Abia State were aware of open databases. On the contrary, Nwabugwu et al (2019) reveal that agricultural professionals are aware of all types of agricultural databases.

Table 2. Identification of Agricultural-related Open Databases by agricultural professionals

Agriculture-Related Open Databases	Websites	Percentage
Global open data for agriculture and Nutrition (GODAN)	www.godan.com	99.5
National bureau of statistics (NBS)	https://www.nigerianstat.gov.ng/	95.8
World Bank (Agriculture and Rural Development)	https://data.worldbank.org/topic/agriculture-and-rural-development	70.0
FAO-FAOSTAT	https://www.fao.org	69.1
Nigeria Meteorology Agency (NiMET)	https://www.nimet.gov.ng	67.5
Ag-Analytics	https://www.analytics.ag	58.3
NITDA	https://nitda.gov.ng	57.9
European Union Open Data Portal	https://data.europa.eu.	57.9
National Agricultural Extension and Research Laison Services (NAERLS)	https://naerls.gov.ng/	53.3
AgroClimate	https://agroclimate.org	47.1
USDA-FoodData	https://fdc.nal.usda.gov/	47.1
Open Data Institute (ODI)	https://theodi.org	46.6
Global Yield Gap Atlas (GYGA)	https://www.yieldgap.org	46.6
Agriculture and Agri-Food Canada (AAFC)	https://agriculture.canada.ca1112	46.7
OpenAQ	https://openaq.org/	37.9
Open Data for Development (OD4D)	https://www.od4d.net/	26.7
National Agricultural Statistics Service (NASS)	https://www.nass.usda.gov/	26.7
Climate Data Online (CDO)	https://www.ncei.noaa.gov/	26.7
AgroDataCube	https://agrodatacube.wur.nl	26.3
OpenWeather	https://opoenweathermap.org/	26.3
Crop Ontology	https://cropontology.org/	26.3
Family Farming Knowledge Platforms	https://www.icsf.net.org	22.5
Agricultural Market Information System (AMIS)	https://www.amis-oatlook.org	20.4
Food and Agricultural Microdata Catalogue (FAM)	https://microdata.unhcr.org	11.6
ARS Pesticide Properties Databases	https://www.ars.usda.gov	11.3
Consortium of International Agriculture Research Centers (CGIAR)	https://www.cgiar.org/	11.3
Farm Connect Platforms	https://bigdata.cgiar.org	11.3
AgroFIMS	https://agrofims.org/	9.58
Nigeria Open Data Access (NODA)	https://gisresources.com	9.5
AGRICOLA	www.agricola.nal.usda.gov	9.1
OpenWeatherMap	https://openweathermap.org/	0.42
PlantVillage	https://plantvillage.psu.edu/	0.42
AgriMetSoft	https://agrimetsoft.com/	0.42
TRIDGE	https://www.tridge.com	0.0
Aquatic Science and Fisheries Abstract (ASFA)	https://www.sts.illinios.edu	0.0
AGRIVI	https://www.agrivi.com/	0.0
USDA ARS	https://www.ars.usda.gov/	0.0
Global Agricultural Monitoring (GLAM)	https://data.nal.usda.gov/	0.0

Source: Field Survey 2023

Utilization of Open Databases in Accessing Agricultural Information Among Agricultural Professionals in Rivers State

As revealed in Table 3, the result shows that major open databases utilised by agricultural professionals in accessing agricultural information in Rivers State were NBS (95%), World Bank (84%), National Agricultural Extension and Research Liaison (58%), FAO-FAOSTAT (53%) and Agriculture and Agri-Food Canada (AAFC), (41%).

Unfortunately, some of the open data bases, namely; FAM (9%), GYGA (9%), Open Weather (9%), USDA FoodData (4%), USDA ARS (4%), GLAM (4%), NASS (4%), AgriMetSoft (0.4%), TRIDGE (0.4%) were rarely used while Plant Village, ASFA, AGRIVI, CDO, Crop Ontology, AgroFIMS and AGRICOLA were not used at all.

It is not surprising that only 4 of the 38 open data bases that were used for this study had up to 50% of the respondents indicate usage of the databases. Mohammed, et al (2021) found a significant relationship between awareness of databases and their use by scientists in agricultural research Institutes. Awareness predisposes people to utilization. The awareness of the existing open data bases by agricultural professionals was low hence low utilization. Similarly, Iyere-Freedom and Enwelu, (2023) found a positive relationship between extension visit and utilization of Information Communication technologies among women and youth in agricultural sector.

Table 3: Utilization of open databases in accessing agricultural information among agricultural professionals

Open Databases	Percentage
NBS	95.4
World Bank	84.2
NAERLS	58.3
FAO-FAOSTAT	55
AAFC	41.3
EUODP	37.5
NiMET	32.5
NITDA	32.1
GODAN	32.1
AgroDataCube	27.1
OD4D	26.6
ODI	26.3
Family Farming Knowledge Platforms	22.9
AMIS	22.5
OpenAQ	22.5
Farm Connect Platform	20.8
AgroClimate	20.8
NODA	11.7
ARS Pesticide Properties Databases	11.3
CGIAR	11.3
AgAnalytics	11.3
OpenWeatherMap	11.3
FAM	9.5
GYGA	9.2
Open Weather	9.2
USDA-FoodData	4.2
USDA ARS	3.8
GLAM	3.8
NASS	0.42
AgriMetSoft	0.42
TRIDGE	0.4
AGRICOLA	0.0
ASFA	0.0
AGRIVI	0.0
PlantVillage	0.0
AgroFIMS	0.0
Crop Ontology	0.0
CDO	0.0

Source: Field survey 2023 *Multiple responses

Level of Utilization of Open Databases in Accessing Agricultural Information Among Agricultural Professionals in Rivers

From Table 4, FAO-FAOSTAT (Mean = 3.0), Nigeria Metrological Agency (NiMET), (Mean = 3.0) and Farm Connect Platform (Mean = 3.0), were open data bases that

were highly utilized by agricultural professionals in accessing agricultural information. Grand Mean was 1.90 showing an overall low utilization of open data bases among agricultural professionals in Rivers State. This result corroborates that of Obiano et al (2023) that agricultural professionals underutilized electronic databases.

Table 4. Level of utilization of open databases in accessing agricultural information among agricultural professionals

Open data bases	Mean	Standard Deviation
FAO-FAOSTAT	3.0**	2.3
NiMET	3.0**	2.3
Farm Connect Platform	3.0**	2.3
Family Farming Knowledge Platforms	2.5**	1.9
NITDA	2.5**	1.9
ODI	2.5**	1.7
NODA	2.5**	1.9
AMIS	2.5**	1.9
ARS Pesticide Properties Databases	2.5**	1.8
CGIAR	2.5**	1.8
USDA-FoodData	2.5**	1.9
World Bank	2.5**	1.9
NAERLS	2.5**	1.9
GYGA	2.5**	1.9
AgroClimate	2.5**	1.8
AAFC	2.5**	1.8
OD4D	2.5**	1.9
FAM	2.3*	1.6
ASFA	2.3*	1.6
USDA ARS	2.3*	1.6
NBS	2.3*	1.4
AgroDataCube	2.3*	1.4
OpenAQ	2.3*	1.4
Crop Ontology	2.3*	1.4
AGRICOLA	2.0*	1.2
OpenWeatherMap	2.0*	1.2
EUODP	2.0*	1.3
NASS	2.0*	1.3
AgriMetSoft	2.0*	1.2
AgroFIMS	2.0*	1.2
Open Weather	2.0*	1.2
TRIDGE	1.5*	1.3
AGRIVI	1.5*	1.0
GODAN	1.5*	1.0
AgAnalytics	1.5*	0.8
PlantVillage	1.5*	0.9
GLAM	1.5*	0.9
CDO	1.5*	0.8
Grand mean	**1.90***	

Source: Field survey 2023 **High utilization *Low utilisation

Relationship between the socio-economic characteristics of agricultural professionals and the level of utilization of open data bases in accessing agricultural information by agricultural professionals

The result in Table 5 shows the outcome of the regression analysis of the socio-economic characteristics of agricultural professionals and the level of utilization of open data bases. Four functional forms, namely, linear, semi-log, exponential, and double log were tested. However, the linear form was chosen as the lead equation because it showed the best fit among the four forms tried as it recorded the highest R^2 value, appropriateness of signs and more variables were found to be significant at different levels of significance.

The linear form was thus used as a lead equation for further analysis. The coefficient of determination (R^2) was 0.694, which suggests that approximately 69.4% of the variance in the dependent variable (level of utilization) can be explained by the predictor variables. Two (level of education and work experience) of the six independent variables correlated positively and significantly with the level of utilization of open data bases by agricultural professionals while three (Household size, age and marital status) correlated negatively and significantly.

Level of education was found to correlate positively with a t-ratio of 5.591. This could imply that the more educated the agricultural professionals are, the more they utilize open data bases. Work experience also correlated positively and significantly with a t-ratio value of 4.701. This implies that those who have more years of experience are more likely to utilize open data bases to share agricultural information. The result further showed that as the age of the agricultural professional increases, the level of utilisation of open data reduces. This also applies to household size and marital status. This result corroborates the findings of Owolabi et al (2022) who also found a significant relationship between agriculturists' socio-economic characteristics and the level of utilization of digital tools.

Table 5: Relationship between the socio-economic characteristics of agricultural professionals and the level of utilization of open data bases

Variables	Linear +	Exponential	Semi Log	Double Log
(Constant)	61.914(13.980)	1.795(61.370)	38.870(3.936)	1.636(25.711)
Gender	-0.130(-0.213)	-0.001(-0.263)	1.408(0.654)	0.009(-0.263)
Age	-0.2886(-5.827) *	-0.002(-5.898) *	-27.754(-4.831) *	-0.185(-5.898) *
Marital	-2.517(-5.170) *	-0.016(-5.054) *	-7.282(-3.464)	-0.046(-3.298)
Education	2.535(5.951) *	0.017(3.062) *	29.081(4.261) *	0.198(4.396) *
Household size	-0.382(-4.881) *	-0.003(-2.904)	-2.632(-2.299)	-0.017(-2.276)
Work Experience	0.084(4.701) *	-0.001(-1.881)	-0.522(0.351)	-0.004(-0.446)
R^2	**0.694**	**0.611**	**0.650**	**0.646**
F-Statistics	**32.383**	**30.115**	**27.096**	**26.698**
f- Value				

+ Lead equation, Values in parentheses are t-value, *Significant at 5%

Difference in the utilization of open databases among agricultural professionals in Rivers state.

The result shows that there was a significant difference in the utilization of open databases among agricultural professionals in Rivers state ($F(2, 237) = 2.950$, $p < .05$). This may not be surprising as the job description for the different categories of agricultural professionals used in this study differs, hence, the difference in their use of open data bases. For instance, agricultural lecturers in the universities may have more need to utilize open data bases than professionals in the industry. The lecturers are saddled with the task of research which entails extensive literature search during the review of literature. This process could require them to access different databases, unlike other agricultural professionals in the other areas.

Table 6. ANOVA Analysis of the utilization of open databases among agricultural Professionals in Rivers state

	Sum of Square	Df	Mean Square	F
Between Groups	72.608	2	36.304	2.950*
Within Groups	2916.687	237	12.307	
Total	2989.296	239		

P≤ 0.05

Having established significant differences in the utilization of open data bases by agricultural professionals in Rivers State, A Scheffe Post Hoc test was conducted to identify where the difference lies. The result shows that the mean score for Agricultural professionals in the institutions (M = 87.213, SD = 13.51) significantly differ from that of professionals in Agro-Allied Industries (M = 97.657, SD = 17.01). The mean score for professionals in government agencies (M = 93.549, 14.45) did not differ from that of either those in the institution or agro-allied industries. This shows that utilization of open database among professionals in Rivers State differs mainly among professionals in institutions and agro-allied industries.

Agric. Professional		Mean Diff.	Std. Error	Sig.	95% Confidence Interval	
					Lower bound	Upper Bound
a	b	- 7.45611	1.76501	0.00	- 12.3101	- 2.8745
	c	- 3.23411	1.76501	0.108	7.5671	0.5445
b	a	7.23541	1.76501	0.000	2.8745	12.3101
	c	3.17823	1.76501	0.050	0.0111	8.2540
C	a	3.83452	1.76501	0.108	- 0.5445	7.5671
	b	- 4.53476	1.76501	0.050	- 8.2540	7.5671

a. Professionals in Institutions, b. professionals in Agro-allied industries, c. professionals in government agencies

Conclusion and Recommendations

Despite the high potential of open data bases in making data available and accessible to users, the utilization of these open data sources among agricultural professional was low. Also, the level of education, age, and work experience among other socio-economic characteristics of agricultural professionals influenced their use of open data bases, hence should be considered for optimum utilization of the databases. The study recommends massive sensitization of the benefits of utilization of open data bases for information sharing among professionals in the agricultural sector. The Ministry of Agriculture and University management could play a vital role in this regard. Training courses could be made available for these professionals to help upscale their skills and capacity in the utilization of open data bases.

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