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Keywords: website visibility, agricultural research institutes, webometrics, digital presence.

Classification: LCC Code: S494.5.I5

Language: English

Great Britain Journals Press

LJP Copyright ID: 925653
Print ISSN: 2631-8490
Online ISSN: 2631-8504

London Journal of Research in Science: Natural & Formal

Volume 25 | Issue 5 | Compilation 1.0

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I. INTRODUCTION

Website visibility is an indicator of how visible a website is in the organic search results when queries are entered into search engines. It refers to the ease and effectiveness with which a search engine crawler can find and index a webpage (Weideman 2009). Ojokoh and Akinola (2017) stated that visibility considers two parameters: number of external links and number of referring domain. Weideman (2009) stated that external links are hyperlinks on webpage B, linking to webpage A, where webpage A is the one currently under consideration. Many external links from other websites in the same community makes a positive contribution to website visibility. A webpage coder has very little control over the quantity and quality of external links, but the website owner could canvass for external links from other high-quality websites. The referring domains (ref. domain) are pages on different websites that points to resources in the target domain. It is a domain for links that redirect visitors to the target website. One referring domain can have more than one link to different pages on a website, for example a link in a referring domain to Postgraduate School of University of Port Harcourt, and another link in the same domain to School of Sciences of the same Institution. Ahrefs and Majestic, having a weighted score of 50%, can be used to determine the visibility of websites (Kunosic et al. 2019).

According to Patel (2015), one important aspect of visibility is search engine optimization (SEO). SEO is the process of improving the quality and quantity of website traffic by increasing the visibility of a website or a web page in a search engine's unpaid results. This can be achieved through a combination of on-page and off-page optimization techniques, such as keyword research, meta tags, and backlink building. Also, another important aspect of visibility is the use of social media. Social media can be used to promote a website and increase its visibility through the sharing of links and content, it can be used to engage with users and build a community around a website, which can also help to increase visibility.

Website visibility is important for several reasons, including increasing website traffic and improving search engine rankings. When a website has good visibility, it means that it appears high in search engine results, making it more likely for users to find and visit the site. This can lead to an increase in website traffic, which can in turn lead to more sales, leads, and conversions. Again, websites that are visible on search engines are more likely to be considered reputable and credible by users. Website visibility is also important for businesses because it can help to improve brand awareness and reputation. When a website is visible on search engines, it can help to establish the business as a leader in its industry, which can help to build trust and credibility with potential customers. Furthermore, visibility can help to generate interest and engagement from potential customers and help to build relationships with them. In addition, website visibility can also affect how users perceive the website. A website that is visible on search engines is often seen as more professional, reliable, and trustworthy than a website that is not. This can have a positive impact on the user's experience and increase the likelihood that they will return to the site in the future (Rosario, 2021).

II. STATEMENT OF THE PROBLEM

The insufficient number of change agents or development facilitators assisting millions of development beneficiaries serves as a clear indication of the need for media help. According to Davis et al. (2019), Nigeria has a workforce of over 7,000 public agents, with an extension agent to farmer ratio of between 1:5,000 and 1:10,000. Using a website is unavoidable if any progress is to be made quickly, and the web presence of agricultural research institutes play an essential role for all key actors. Like university websites that attracts students, academics, funding, and make these institutions widely known through E-learning programs and open access initiatives, while spreading knowledge beyond physical boundaries (Razak et al., 2019), websites of agricultural research institutions should be visually appealing, polished, and professional to reflect the institutions' services and mandates. It should help users' complete tasks quickly through on-site search and keep them engaged by suggesting relevant content, while minimizing dead ends. The websites should be fast, correct, and perform as intended, and should be built to web standards, rigorously proofed, and regularly tested for speed or functionality issues. But most of the agricultural research institutes have dormant websites, the few that are not dormant, are not visible enough. This agrees with Ogege (2011) who stated that Nigeria is well recognized for having abandoned websites, and among parastatals, agencies, and ministries, only a select few have an amazing record in building websites that are really useful, while numerous others merely have websites that maintain static home pages. At such, the required collaboration is not there, for instance, between the academia, the industries, government, societies, professional associations, etc. These websites of the agricultural research institutes are not visible enough to reflect the true image of the various research going on in the research stations. The study therefore examines the visibility of agricultural research institutes in Nigeria.

III. OBJECTİVES OF THE STUDY

This study aimed to address the following objectives:

i. Ascertain the online visibility of the websites of agricultural research institutes.
ii. Identify the types of agricultural activities that are visible on the websites of the agricultural research institutes.

Hypothesis of the Study

H_0: Webometric indexes do not influence the online visibility of the websites of agricultural research institutes.

IV. METHODOLOGY

This study employed a descriptive research design. This type of research design was employed because the nature of the study required the collection of quantitative and qualitative data from the entire population on webometric factors using webometric tools and the result would provide a detailed understanding of each sample in the entire population of the study. The study was undertaken in Nigeria. Between the latitudes of 4° and 14° and the longitudes of 3° and 14° is where Nigeria is found in West Africa. It covers 923,768 square kilometers in total. The Republics of Niger and Chad border it to the north; the Republic of Benin borders it to the west; and the Republic of Cameroun borders it to the east all the way to the Atlantic Ocean's coastlines, forming the southern limits of Nigerian Territory (Akinwale et al. 2023).

The study's population comprised of 34 national and international agricultural research institutes drawn from the six (6) geopolitical zones in Nigeria. Purposive sampling technique was employed to select the 34 national and international agricultural research institutes in Nigeria.

The study employed secondary data collection. The secondary data for the study were collected through the use of webometric tools such as SEO (Search Engine Optimization) tools, Moz, Similarweb, and Ahrefs. These webometric tools can be accessed online through their URL links.

The researcher designed a research brief and employed the following procedures:

Step 1: Access the link online for Ahrefs: https://www.ahrefs.com.

Step 2: Enter the institute's URL into the accessed link in step 1.

Step 3: Retrieve the required information for the institutes.

V. RESULTS AND DISCUSSION

5.1 Visibility of Websites of Agricultural Research Institutes in Nigeria

Table 1 shows the extent of visibility of the websites of agricultural research institutes in Nigeria. The websites of ARMTI, CIFOR, NAERLS, NSPRI, WARDA, FRIN, IFPRI, ICRISAT, NIFOR, NAPRI, NIFST and ICRAF agricultural research institutes had high visibility with scores ranging from 63% to 86%. The websites of CRIN, IAR, IITA,ILRI, NIHORT, NVRI, NRCRI, NCAM, NACGRAB, NIOMR, NISS, NIFFR, CIMMYT and CIP agricultural research institutes had moderate visibility with scores ranging from 39% to 62%. The websites of IART, LCRI, NWRI and RMRDC agricultural research institutes had low visibility with scores ranging from 15% to 38%.

The high and moderate extent of visibility could be as a result of positive user experience and continuous website updates with new research findings, trainings, trends, and events. This agrees with

the findings of Pant & Pant (2017) who reported that websites with larger number of engaging pages are associated with higher visibility. Also, the high and moderate extent of visibility can be associated with sharing of links and contents, as well as maintaining an active presence on social media platforms such as facebook, twitter, linkedIn, youtube, instagram, etc., thereby building links and generating traffic to the websites. This agrees with the findings of Zhang & Cabage, (2016) who claimed that social media can be a useful tool for generating traffic quickly and that link building and social media both increase website traffic and profitability. The high and moderate extent of visibility suggests that when agricultural information users such as the government decision-makers, agricultural policymakers, planners, researchers, educators, students, program managers, field staff, and farmers make queries for information on search engines, only the visible websites will appear on search engine result page. For example, when a user is looking for information on the use of fertilizers in maize production, they may use keywords such as "maize," "fertilizer application," and "yield improvement." An agricultural research institute that has conducted research on the use of fertilizers in maize production and uses these relevant keywords in their content strategically or have RSS field on their website and social media handles with notifications being sent on every content uploaded and updated, search engines are more likely to display the website in the search results, increasing its visibility to the users, and the website can also attract organic traffic from such users and establish themselves as a reliable source of information on the subject.

Table 1: Extent of Visibility of Website of Agricultural Research Institutes

S/N	URL	Visibility Score (%)	Remark
1	www.armti.gov.ng	75	High
2	www.crin.gov.ng	60	Moderate
3	www.cifor.org	85	High
4	www.frin.gov.ng	67	High
5	www.iar.gov.ng	46	Moderate
6	www.iart.gov.ng	30	Low
7	www.iita.org	55	Moderate
8	www.ilri.org	60	Moderate
9	www.ifpri.org	71	High
10	www.icrisat.org	71	High
11	www.lcrimaid.gov.ng	15	Low
12	www.nihort.gov.ng	55	Moderate
13	www.nwrikd.edu.ng	38	Low
14	www.napri.gov.ng	69	High
15	www.nvri.gov.ng	55	Moderate
16	www.nrcri.gov.ng	55	Moderate
17	www.ncamng.org	50	Moderate
18	www.nacgrab.gov.ng	45	Moderate
19	www.niomr.gov.ng	55	Moderate
20	www.nifor.gov.ng	69	High
21	www.niss.gov.ng	50	Moderate
22	www.nifst.org	71	High
23	www.naerls.gov.ng	75	High
24	www.nspri.gov.ng	75	High

S/N	URL	Visibility Score (%)	Remark
25	www.niffrng.org	60	Moderate
26	www.rmrdc.gov.ng	38	Low
27	www.africarice.org	75	High
28	www.worldagroforestry.org	71	High
29	www.cimmyt.org	55	Moderate
30	www.cipotato.org	56	Moderate

Source: Researcher, 2023 Low (15-38), Moderate(39-62), High (63-86)

*Data were available for only 30 Agricultural Research Institutes

5.3 Activities on the Websites of Agricultural Research Institutes

Figure 1 shows the word cloud depicting the activities of the agricultural research institute. The size of the word determines how frequently it was mentioned. The boldest of all the words is the most mentioned word indicating the most prominent activity. “Research” was the most mentioned word for CIP, FIIRO, FRIN, IART, IAR, IFPRI, IITA, NCRI, NAPRI, NRCRI, NSPRI, and NVRI agricultural research institutes. In the case of WARDA and ICRISAT “development” was the most mentioned word. “Food” was the most mentioned word for CIMMYT and NIFST agricultural research institutes. “Capacity” was the most mentioned word for CRIN, while “livestock” was the most mentioned word for ILRI. “Agricultural”, “genetic”, “fish”, “palm”, “marine”, “soil”, and “production” were the most mentioned words for NAERLS, NACGRAB, NIFFR, NIFOR, NIOMR, NISS, and NIHORT respectively. Findings revealed that “research” was the most mentioned word for CIP, FIIRO, FRIN, IART, IAR, IFPRI, IITA, NCRI, NAPRI, NRCRI, NSPRI, and NVRI agricultural research institutes, demonstrating that research is an important part of their activity. In the case of WARDA and ICRISAT, “development” was the boldest word. This implies that these institutes main focus is agricultural development, which entails enhancing and advancing agricultural methods and technologies. Also, the word tag for CIMMYT and NIFST agricultural research institutes was “food”, this suggests that these institutions are engaged in research and initiatives concerning food production, food security, and food technology.

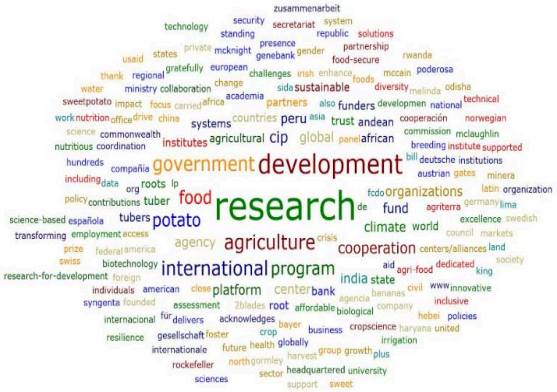
Furthermore, ARMTI was associated with the word tag “management”. This suggests that ARMTI concentrates on studies and initiatives pertaining to agricultural management, which could entail things like agricultural policy, resource management in the agricultural sector, farm management methods, and agribusiness management. The use of the word "management" underlines the institute's focus on efficient and effective management procedures in agriculture. Also, the word tag for CRIN was “capacity”, which implies that CRIN focuses on strengthening the abilities and knowledge of farmers, researchers, and agricultural practitioners as a way of building capacity in the agricultural sector. The word tag for ILRI was “livestock”. This demonstrates the expertise of ILRI in research and activities pertaining to raising livestock, including animal health, breeding, and production. The word tag for NAERLS was “agricultural”, which implies that NAERLS works on several facets of agriculture, including agricultural policy, extension services, and rural development. The most mentioned word for NACGRAB was “genetic”. This suggests that NACGRAB engages in genetic research as well as projects including crop improvement, genetic resources, and plant breeding. Furthermore, the most mentioned word for NIFFR was “fish”. This implies that NIFFR focuses on studies and initiatives pertaining to fisheries, aquaculture, and aquatic resources. The most mentioned word for NIFOR was “palm”. This demonstrates that NIFOR concentrates on studies and initiatives pertaining to the growth of palm trees, the production of palm oil, and palm-derived goods. The most mentioned word for NIOMR was “marine”. This implies that NIOMR focuses on studies and initiatives pertaining to the management of marine ecosystems, marine biology, and marine resources. For NISS, the most mentioned word was

"soil", which suggests that NISS concentrates on studies and tasks pertaining to soil science, soil fertility, and soil preservation. In the same vein, the most mentioned word for NIHORT was "production", which demonstrates that NIHORT focuses on studies and initiatives pertaining to the cultivation of horticulture crops, such as fruits, vegetables, and ornamental plants. The most mentioned word for RRIN was "rubber", which implies that RRIN focuses on studies and initiatives concerning rubber production, rubber tree cultivation, and rubber processing. The institute's work focuses on generating novel rubber tree kinds, enhancing rubber tree farming practices, researching rubber processing techniques, and addressing issues unique to the rubber industry.

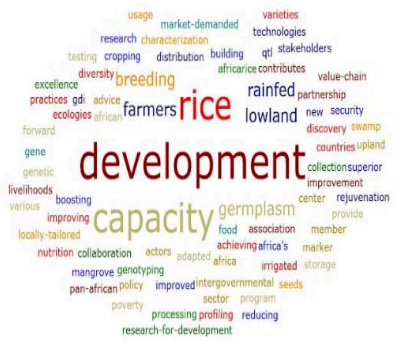
Although the word cloud might reveal some of the most significant activity taking place within agricultural research institutes, it does not indicate that these activities are open to the public. According to Clement et al., (2021), the visibility of agricultural research institutes operations is affected by several factors, including their communication plans, outreach initiatives, publishing of research results, interaction with stakeholders, and information distribution through their websites, conferences, journals, and other platforms. Agricultural research institutes can effectively drive traffic to their websites by making the most mentioned words keywords for their websites' contents, thus, increasing their online visibility.

ARMTI

CIP



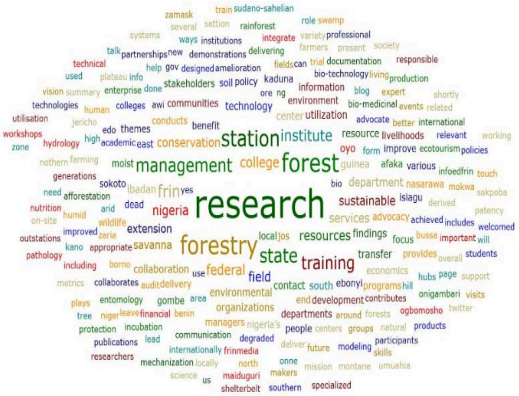
WARDA



CIMMYT

CRIN

FIIRO



FRIN

IART

IAR

ICRISAT

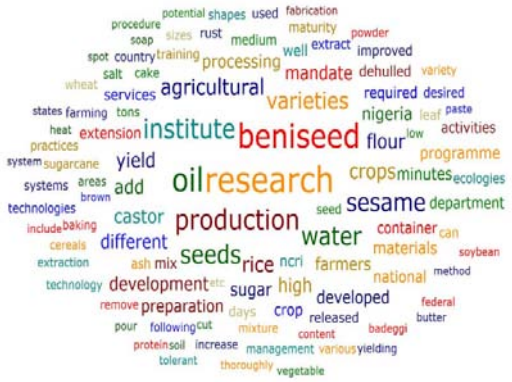
IFPRI

IITA

ILRI

LCRI

NAERLS

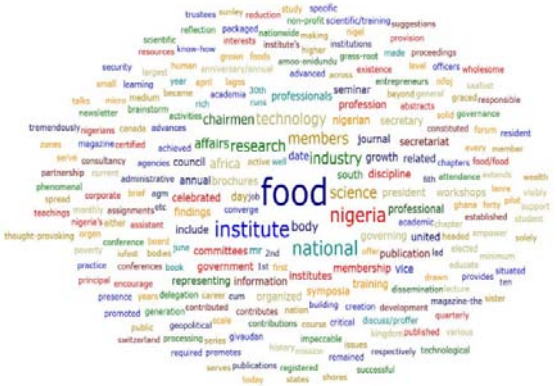


NCRI

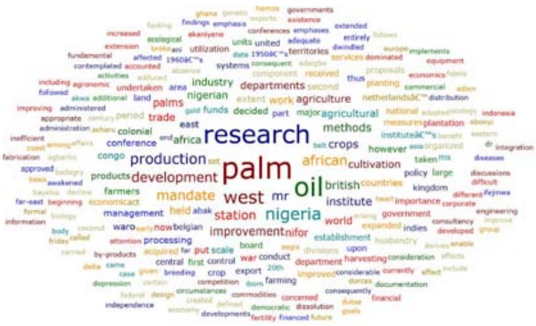
NACGRAB

NIFFR

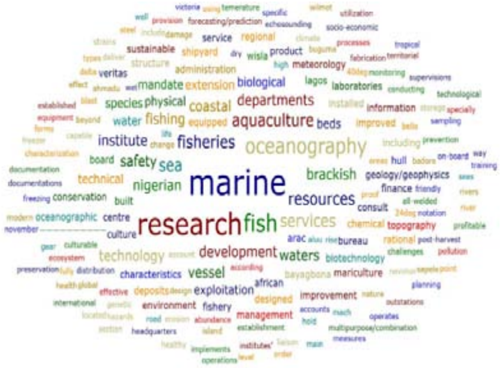
NAPRI



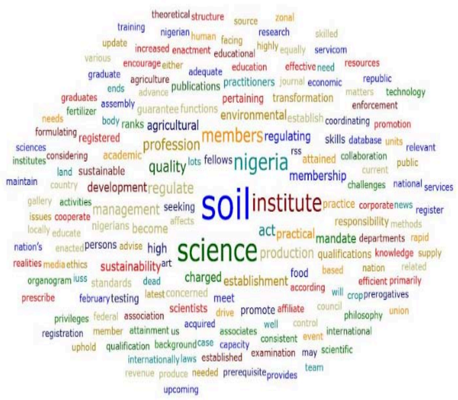
NIFST



NIFOR



NIOMR

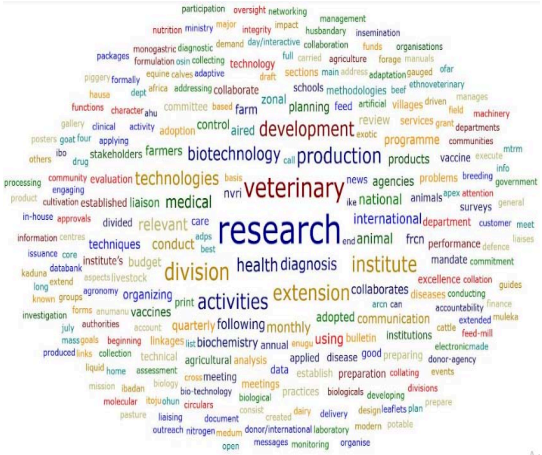


NISS

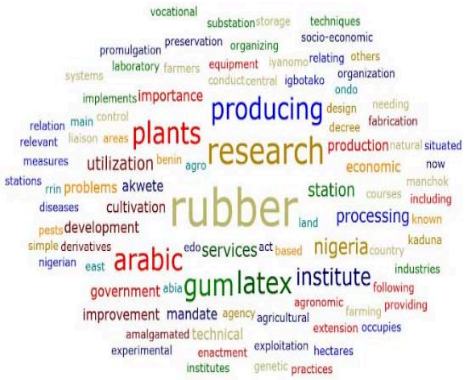
NIHORT

NRCRI

NSPRI



NVRI



RRIN

CIFOR

Figure 1: Word Cloud of Activities of Agricultural Research Institutes

5.3 Regression Analysis of Webometric Indexes Influencing the Visibility of Websites of Agricultural Research institutes in Nigeria

The result in Table 2 shows the regression analysis of webometric indexes on the extent of visibility of websites of agricultural research institutes in Nigeria. The Semi log functional form was chosen as the lead equation based on the highest R^2 value, number of significant variables, and correct signs (+, -). The R^2 value of 0.561 indicates 56.10% variation in the extent of visibility explained by the independent variables. From table 4.6, two (2) out of the eight (8) variables used in the analysis were statistically significant. Global rank correlated positively (3.653; $P<0.05$) with visibility of the websites. The relationship was significant at 0.05 level. Visit duration correlated negatively (-21.029; $P<0.05$) with visibility of the websites. The relationship was significant at 0.05 level. The null hypothesis was therefore accepted that the webometric indexes does not influence the extent of visibility of the websites of agricultural research institutes in Nigeria.

The coefficient of global rank was found to have correlated positively with visibility of website. This implies that as the global rank increases (indicating higher global visibility or recognition), the extent of visibility of websites of agricultural research institutes in Nigeria also increases. In their research on the impact of organic traffic on user engagement and global rank of airline websites, Sakas & Reklitis (2021) found a positive correlation between user engagement and global rank, indicating that user engagement helps the airline website's global rank to increase. The coefficient of visit duration was found to have correlated negatively with visibility of websites. This suggests that as the visit duration increases (indicating longer time spent on the websites), the extent of visibility of these websites decreases. However, this does not conform to a priori expectation as visit duration should enhance visibility. According to Graus et al. (2015), longer visit duration signify that visitors are engaging with the website content and finding it beneficial. Increased user engagement measures, such as reduced bounce rates and better click-through rates, can result from users browsing a website for longer periods of time, which signals a good user experience that leads to improved visibility. In the same vein, Drivas

et al. (2020) stated that longer loading time for websites impact user experience negatively because it reduces the visit duration of website patrons thereby increasing the bounce rate.

Findings revealed that the coefficient of bounce rate had a negative correlation with visibility of websites. Although it was not significant, but it suggests that websites with lower bounce rates tend to have better visibility or higher levels of online presence. According to Ilbahar & Cebi (2017), search engines frequently give preference to websites that keep visitors engaged, resulting in improved visibility. Websites that provide relevant and valuable content, aligning with user expectations and intent, tend to have lower bounce rates. These websites may provide a seamless user experience, engaging visitors and encouraging them to explore more. Furthermore, user experience may be improved, and bounce rates can be decreased on websites with easy navigation. Visitors are more likely to remain longer and interact with the content of a website if they can easily access different areas, discover the information they need, and navigate to it. Better visibility is more likely to be given to websites that have a solid structure (Panda et al., 2015).

Table 2: Regression Analysis of Webometric Indexes Influencing the Visibility of Websites of Agricultural Research institutes in Nigeria

Variables	Parameters	Semi Log +	Double Log	Linear	Exponential
(Constant)		37.890 (0.846)*	1.985 (1.735)	40.296 (2.408)	1..513 (3.246)
Country Rank	X_1	1.762 (0.937)	0.001 (0.027)	3.345E-5 (0.541)	3.381E-7 (0.196)
Global Rank	X_2	3.653 (2.237)*	0.121 (2.907)*	1.571E-6 (1.840)***	3.912E-8 (1.645)
Total Visits	X_3	1.730 (0.192)	-0.080 (-0.349)	8.025E-5 (1.365)	1.776E-6 (1.084)
Pages per visit	X_4	-14.594 (-0.872)	-0.430 (-1.007)	0.460 (0.196)	-0.015 (-0.234)
Bounce Rate	X_5	-6.889 (-0.508)	-0.366 (-1.056)	0.010 (0.067)	-0.001 (-0.307)
Visit Duration	X_6	-21.029 (-2.709)*	-0.405 (-2.042)***	-2.274 (-3.274)*	-0.049 (-2.404)*
Speed	X_7	-0.769 (-0.054)	-0.185 (-0.512)	0.122 (0.137)	0.000 (-0.016)
Keywords	X_8	2.884 (0.558)	0.153 (1.158)	-0.001 (-0.324)	-2.041E-5 (-0.366)

Source: Field Survey Data, 2023 R^2 =0.561, F-ratio = 3.195, n = 28, + = Lead equation.
Data were available for only 28 Agricultural Research Institutes.
*Values in parentheses are t-value. * significant at 5%, *** significant at 10%*

VI. CONCLUSION

The study concluded that the visibility of agricultural research institute websites varied across different institutes, with some achieving high visibility, others moderate, and a few experiencing low visibility. The high and moderate levels of visibility were linked to the active sharing of links and content, as well as maintaining a presence on social media platforms such as Facebook, Twitter, LinkedIn, YouTube, and Instagram, which facilitated link-building and increased website traffic. Additionally, the study highlighted that the size of words in the word cloud reflected their frequency of mention, with the most prominent activities represented by words such as “research,” “development,” “food,” “capacity,” “livestock,” “agricultural,” “genetic,” “fish,” “palm,” “marine,” “soil,” and “production.” Furthermore, the findings indicated a positive correlation between global rank and website visibility, meaning that

institutes with higher global recognition had greater online visibility. However, visit duration showed a negative correlation with visibility, suggesting that websites with longer user engagement did not necessarily achieve higher visibility.

VII. RECOMMENDATIONS

The study recommended that agricultural research institutes actively utilize social media platforms such as Twitter, Facebook, and LinkedIn to promote their website content and drive traffic. Regular sharing of research findings, updates, and engaging content on these platforms can enhance visibility and attract a wider audience. Additionally, adopting search engine optimization (SEO) strategies, improving website content quality, and fostering link-building collaborations with relevant institutions can further strengthen online presence. Institutes should also monitor website analytics to assess engagement patterns and optimize their digital strategies for better visibility and accessibility.

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