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Authorship Patterns in Research Output of Faculty Members in University-Based Agricultural Research Institutes in Nigeria

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Abstract University-based agricultural research institutions in Nigeria are established to change the face of agriculture in Nigeria based on the recommendations of UNESCO. These institutes are affiliated to Federal Government owned universities and nationally mandated to undertake agricultural research. Authorship pattern is perceived as a behavioural study component that influences research output. From 2009 to 2018 authorship pattern was investigated to establish influence on collaboration and geographical spread of research output. The result shows that research output published contained more than one author, the highest number of authors per paper was those papers with four (234, 23.90%). On collaboration, two third of the paper 349 (41%) showed internal collaboration, the least was intra-institutional collaboration (23%) which suggest that inspite the related institutional mandates collaboration seldom take place among them, and should be blamed for research disconnect. Geographical spread showed large dissemination media outlet used to be traced in Africa (47.30%) and the least South America (4.6%). The study has facilitated understanding of areas needing intervention to sustain research output to include intra-institutional collaboration and the visibility of research beyond the continent of Africa.

Keywords Agriculture, Authorship pattern, Collaboration, Faculty, Research output, Nigeria

1. Introduction

Authorship pattern is a measure of behavioural studies used by bibliometricians to compute and shed light on the roles of authors when flourishing intellectual and technical contributions to the production of research output. Though authorship pattern is a recent development in the history of scientific writings, it is reported to be tied to reputation, career success, remuneration and publication salience [1]. Authorship pattern reveals the number of authors per publication [2] and was standardised by Lotka's model which categorically showed the influence and prominence of multidisciplinary and extent of research expansion [3].

Authorship pattern is important to information scholars because of its role of ensuring orderliness in bibliographic arrangement and ease of use when acknowledging the contribution of others whose works have been cited [4].

Authorship pattern also reveals the extent of knowledge shared with others through the adduced number of authors' affiliations in collaborative works. Therefore, the inquest to understand authorship pattern in research output of faculty members in university-based agricultural research institutes in Nigeria is to investigate factors affecting the production and sharing of research findings worthily of peers. This have benefits such as sustaining strong social ties associated with experimental based fields. Therefore, such finding can help to establish projectable and associable causes of research output performance of the institutes. This premise is based on [5] assertion that authorship pattern mirrorsthe shared level of collaboration and research biasamongst these researchers because of their diverse areas of specialisation. With the seemingly areas of specialisation of faculty members –which is agriculture, we were compelled to ask if authorship patterns can be substantiated ordinarily? Of course one of the classical works on authorship pattern that projected authorship pattern was de Sola Price who in 1963 reported that single authorship pattern would cease in favour of multiple authorship in the twenty-first Century. Could this be the case of faculty members in university-based agricultural research institutes in Nigeria?

Birnholtz [6] perceived authorship as patterned by scholar behaviour because it denotes some level of peer influence and institutional consequence towards collaboration. In Nigeria, Harande [7] cohort the benefits of authorship pattern to research output as a leverage for the critiquing of

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scientific endeavour by peers, particularly to help improve the research output as well as make it acceptable for publication. However, as a bibliometric method, authorship pattern facilitates the in-depth study of research output using author characteristics [8]. According to [9] these characteristics of authors are embedded in their research output which when ascertained helpto reveal the patterns of scholars operations, achievements, possession and the discoveries of academic in Universities. These peculiar characteristics are easily seen following publication trend pattern over a period of time. The aforementioned showed that understanding institutional authorship pattern can influence decision making drawing from the statistical facts established. Authorship pattern as component of behavioural studies help to obtain uncompromisingdata from each research output – a quantitative thrust of bibliometric analysis [10].

Basic attributes of research output included revealing the number, quality, essence, methodology and rigor found in documents. Research output are information couriers used for the dissemination of researches. This means that research output show the aggregated issues, content and context of documented efforts. This makes using research output for any institutional assessment study highly desirable. Agriculture as a field of applied science is adjudged by its procedural and highly calibrated requirements. This has consequence on study such as this. Therefore, the focus was deliberate such that the assessment of research output was performed using refereed journals, conference papers, seminar papers, books, chapter in books, technical papers and other miscellaneous publications utilised by faculty members for the dissemination of research output.

Faculty members in university-based agricultural research institutes in Nigeria are familiar with intellectual processes of research and are employed to undertake research in specialised areas in both the formal and informal sectors. The formal and informal sectors are those permissible by the Federal government of Nigeria and depend on the mandate by federal government to the institution. The function of each sector has a working research regime. Formal researches take place in controlled on-station, and the informal takes place on-farm. The target of on-station research is to explore expert-to-expert contribution, while on-farm explore expert-to-stakeholders contributing to research output. This simply implied that research output from university based agricultural research institutes in Nigeria consist of diverse authorship patterns.

The desire to make agricultural research, growth and development in Nigeria scientific led to the constituting of research institutes in post-independence Nigeria. The institutes comprised of Institute for Agricultural Research (IAR), Samaru; Institute of Agricultural Research and Training (IAR&T), Ife; National Animal Production Research Institute (NAPRI), Shika and National Agricultural Extension and Research Liaison Services (NAERLS), Samaru [11]. The four were affiliated to federal universities by statuses which also involved the faculty members in teaching, supervision of students (undergraduates and postgraduates), research, provide agricultural communities with services nation-wide and beyond. IAR and IAR&T are saddled with genetic improvement of crops and responsible for assigned agriculture ecological zones and their respective farming systems. All the institutes are to operate within structured research programmes that reflect findings from on-station and on-farm researches [12], [13]. NAPRI is saddled with the genetic improvement of livestock and livestock systems in structured research programmes and NAERLS is responsible for the development, collation, evaluation, dissemination of agricultural technologies, conduct research in agricultural extension methodologies and policy, and provide leadership in capacity building of stakeholders to meet the present and future agricultural development in Nigeria [14], [15].

2. Research objective

The main objective is to determine the authorship patterns in research output of faculty members in university-based agricultural research institutes in Nigeria. The specific objectives are:

1. determine the authorship patterns in research output of faculty members in university-based agricultural research institutions in Nigeria from 2009 to 2018;
2. determine the types of collaboration among faculty members in university-based agricultural research institutions in Nigeria from 2009 to 2018; and
3. find out the geographical spread of research output of faculty members in university-based agricultural institutions in Nigeria from 2009 to 2018.

3. Methodology

The method adopted by the study is bibliometric analysis, the choice of the method was to ensure that the indicators used can substantiate quantitatively authorship patterns, types of collaboration among faculty members and geographical spread of research output. This thrust can help with empirical data needed to resolve ambiguities when deploying the methods. The *Ex post facto* research design was utilised to enable it sample research output. With an introductory letter from the Department of Information Resources Management and clearance certificate by the Babcock University Health Research Ethics Committee (BUHREC) approving the conduct of the research, the university-based agricultural researches in Nigeria consented. The study was able to establish population, sample size and access to data collection instrument.

The population of the study was 79 faculty members who were promoted or ascended the esteemed academic cadre of professor and associated professor within the study period (2009 – 2018). This figure represented 70.9% of totalled faculty members in the study areas. A proportionate sample size was then drawn from each of the institutions randomly

using one-pick balloting. A new sample size of 33 (42%) was used for data collection because it ensured that no institution was disfranchised. The data collection instrument were the validated publications submitted to the appointments and promotion committees in charge of screening research output before sending them for external assessment.

The resolve to use the instrument is because it is validated and homogenous among the institutions where it is used for the appointment of academic staff. From literature, it has been established by [16] that such type of instrument can be used for bibliometric analysis because of its quality control. Bornmann, Mutz, Neuhaus and Daniel [17] supported use of such instrument and characterised the features to include authenticity, representiveness and meaning. Data analysis was descriptive.

4. Results and Discussion

4.1. Results

Table 1 showed the results of established authorship pattern contained in the research output by faculty members in the four university-based agricultural research institutions in Nigeria. Specifically, it looked at the number of authors contribution towards the production of research output. The number of authors was perceived to be intellectual and/or technical contributions for the production of research output. From the results obtained, research output containing four-authors contributing led the record numerically with a total of 234 authors that accounted for 23.90% of the distribution. Distantly followed was research output containing three-authors with 195 authors that was equivalent to 19.90%, six and above – authors in a research output got 172 entries which accounted for 17.50% of the log. The publications' containing five-authors totalled 140 or 14.30%, was also followed by those with two-authors that pooled 125 entries and accounted for 12.50%, respectively. The research output containing only single author was the least pattern practiced with only 115 entries that accounted for 11.70% of the produced research output throughout the period of the study.

The nexus of the results among the four institutions, showed that the pooled number of authorship revealed that only NAPRI showed relatively lowest numbers of averaged authorship of 132 authors which accounted for 13.46% of the cumulated frequencies. Closely following was NAERLS with 142 authors which accounted for 14.47%. There was increase to 184 or 18.77% of the cumulated frequencies for IAR&T, and finally 523 cumulated frequencies were recorded for IAR, that accounted for 53.30% of the authorship patterns. The implication of these results is that authorship pattern among the university-based agricultural research institutions in Nigeria is generally multiple and that there is significant increase from single authorship to multiple authorship pattern during the study period. This behavioural parameter had shed light on the expectations of subjection of authorship pattern in the discourse of scientific evaluation of research output emanating from university-based agricultural research institutions in Nigeria. This can serve as standards to flourish intellectual and technical contribution to the production of research output which literature established as one of the basis for co-production of scientific publications.

Table 2 showed the extent of collaboration among faculty members in the study locale. The result revealed that the three types of collaboration produced a total of 866 papers. Two-third of these papers, 349 (41%) assessed showed that faculty members collaborated internally, that is, working with other faculty members of the same institution. The international institutional collaboration closely followed with 315 (36%) papers assessed, perhaps as a result of their efforts to be visible internationally. This means that faculty members collaborated with scientist/researchers from institutions in other countries. Finally, the result showed that inter-institutional collaboration was the least number of papers showing faculty members collaborating 202 (23%).

Table 1. Distribution of authorship pattern in research output of faculty members from 2009 -2018

Institution	Number of authors						Pooled number of authors	
	1	2	3	4	5	6 and above	Cumulative frequency	Percentage
IAR	61	73	102	124	62	101	523	53.30
IAR&T	29	31	50	38	20	16	184	18.77
NAERLS	16	14	22	39	32	19	142	14.47
NAPRI	9	7	21	33	26	36	132	13.46
Total	**115(11.70)***	**125(12.70)**	**195(19.90)**	**234(23.90)**	**140(14.30)**	**172(17.50)**	**981**	**100**

Source: Field survey, 2019; **Note:** *are the relative percentage of total research output
Key: IAR – Institute for Agricultural Research; IAR& T- Institute of Agricultural Research & Training; NAERLS- National Agricultural Extension & Research Liaison Services; NAPRI – National Animal Production Research Institute

Table 2. Distribution of types of collaboration among faculty members of university-based agricultural research institutions in Nigeria (2009 – 2018)

Institutions	Nature of collaboration						Total
	Internal		Inter-institutional		International institutional		
	Freq.	%	Freq.	%	Freq.	%	
IAR	170	20	129	14	163	18	462
IAR&T	65	8	31	4	59	7	155
NAERLS	55	6	19	2	52	6	126
NAPRI	59	7	23	3	41	5	123
Total Average	**349 (10.60)**	**41**	**202 (6.10)**	**23**	**315 (9.55)**	**36**	**866**

Source: Field survey, 2019
Note: Figures in brackets are average number of papers each faculty member produced in collaboration internally, intra-institutional and internationally = $\Sigma_{AC} = \frac{N_{TC}}{RR_T}$ where Σ_{AC} – mean of collaboration, N_{TC} – total score for type of collaboration, and RR_T – research respondents (total) used for the study
Key: IAR – Institute for Agricultural Research; IAR& T- Institute of Agricultural Research & Training; NAERLS- National Agricultural Extension & Research Liaison Services; NAPRI – National Animal Production Research Institute

Table 3. Geographical spread of research output of faculty members of university-based agricultural research institutions in Nigeria (2009 – 2018)

Institution	Geographical location					Total
	Africa	Asia	Europe	North America	South America	
IAR	259	62	87	84	31	523
IAR&T	58	19	47	49	11	184
NAERLS	64	27	25	26	-	142
NAPRI	83	17	22	7	3	132
Total	**464 (47.30)***	**125 (12.70)**	**181 (18.50)**	**166 (17.00)**	**45 (4.60)**	**981 (100)**

Source: Field survey, 2019, **Note:***figures in brackets are percentages of collaboration frequencies of each geographical location
Key: IAR – Institute for Agricultural Research; IAR& T- Institute of Agricultural Research & Training; NAERLS- National Agricultural Extension & Research Liaison Services; NAPRI – National Animal Production Research Institute

The observed patterns may suggest that faculty members engage in more of internal and international collaboration than inter-institutional collaboration. Average of 10.60 papers were produced as a result of internal collaboration each year throughout the study period, likewise 9.55 papers were produced by international collaborations. This showed that inspite of the related institutional mandates assigned to the university-based agricultural research institutions in Nigeria poor inter-institutional collaboration exist. This poor inter-institutional collaboration may mean a possible research disconnect among these institutions and incapacitate them to fully take opportunity to further actualise research efforts of the institution and the nation at large.

Table 3 contained the results of the geographical spread of research output to the international scientific platforms. The result focused on five locations in different continents. The result showed that Africa dominated the geographical location where research output from university-based agricultural research institutions in Nigeria where easily found within the period of the study. Africa contained 464 or 47.30% research output, this accounted for almost half of the total produced research output spread across the globe combined. Europe with 18.50% or 181 came second place with research output attracted to it by faculty members in university-based agricultural research institutions in Nigeria. Third, was North America which stood at 17% or 166. However, it was relatively low in South America where the combined results were mere 4.6% or 45, respectively. The pattern that emerged can help institutions pick out geographical locations where faculty members are most visible and attributing factors for the preference can be determined particularly influence of linguistic, economic, prestige, expertise, and development trends.

The result subjectively showed that the gap among Europe, North America and Asia is not very wide when factors such as economic parity, linguistic and development trends are considered. But when compared with between Africa and South America the margin is very wide. This means faculty members are encouraged to bridge the gaps of poor visibility of their research output in the affected geographical locations to contribute to the growth of literature, information and knowledge on agricultural development.

4.2. Discussions

The findings revealed that prevalent authorship patterns in published/presented research output among faculty members in university-based agricultural research institutions in Nigeria is dominated by research output containing more than one author (multiple authorships). There could be numerous factors that tie up to explain authorship patterns found by these study and the significance it buttressed with

the role played on research productivity. Ahmad, Jan and Khan [18] believed that authorship pattern support the sharing of knowledge with others thereby influencing research output. These suggest some of the benefits of multiple authorships as a promoter of high level of interaction among the faculty members irrespective of their areas of specialisation. Zupic and Cater [5] writing on the benefits of authorship patterns, opined that it has strong social ties with other related fields and help to critique research output using broader measures.

Findings on collaboration among faculty members across the university-based agricultural research institutions in Nigeria revealed that internal collaboration persisted. Another type of collaboration is international, this type of collaboration counts affiliations showing collaboration of faculty members with others outside the country. Inter-institutional collaboration exists and had the lowest scores in this study. Even though the inter-institution collaboration is low compared to the other two, it does not change the essence of collaboration which according to [19] is to influence sharing of publications on topical issues and the debate which such mix attracts. The study shares the same sentiments.

The geographical spread of published/presented research output considered where those found on the publications and then situated on the globe. Five categories emerged that showed the spread, Africa as a region had the widest spread compared to the rest of the world. The findings contradict [20] who reported that analysis of geographical spread of titles published showed that 76.2 percent originated from South and Central America and only 29 percent came from Africa with 16.7 percent. The finding agrees with [21] who reported improvement of effort expended by faculty members on the internationalisation and domestication of research output. The results revealed that the university-based agricultural research institutions in Nigeria have elite faculty members, and are ready and confident to expose their location of origin.

5. Conclusions

It is evident from the study findings that authorship pattern was dominated by many faculty members contributing to produce research output when compared to those produced by single author. Collaboration was substantial to conclude that faculty members of university-based agricultural research institutions in Nigeria contribute to global research literature on agricultural development. Geographically, the institutes have closed the gaps against perceived poor visibility of research output from Nigeria with virtually publishing in all the continents of the world.

6. Recommendations

The following recommendations are proffered:

1. The institutions have not deviated from the joint authorship expected of applied research fields. Faculty members should be encouraged to sustain multiple authorship that is specialised and participatory, and therefore recommended that faculty members should be encouraged to sustain the efforts.
2. Collaboration among faculty members and indeed with the institutional support suggests that faculty members should be encouraged to collaborate inter-institutionally to bridge research gaps and avoid waste caused by duplicated efforts which inter-institutional engagement can readily reveal.
3. Faculty members and indeed the institutions disseminate research output globally. The efforts have made faculty members and indeed their respective institutions to be globally cosmopolitan, but because production of research output comes with cost. It is recommended that palliative measures should be instituted to support globalisation of research output.

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