

*Full Length Research Paper*

# Collaborative strength and pattern of authorship among agricultural engineers in Nigeria: A case study of the 2000 – 2010 NIAE proceedings

Oyeniya, J. Oluwakemi\* and Olaifa, Teye Paul

National Centre for Agricultural Mechanization (NCAM) P.M.B. 1525, Ilorin, Kwara State, Nigeria.

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There is no doubt that collaboration is a common phenomenon in research. This paper examined the collaborative strength and patterns of authorship among agricultural engineers in Nigeria, using the Nigerian Institution of Agricultural Engineers (NIAE) proceedings between 2000 and 2010 with the exclusion of 2008 data, covering a period of 10 years. The results of the data were analysed based on the number of articles published per year, pattern of authorship featured in the proceedings, and the collaborative degree and strength of authors. There are a total number of 589 articles published by 1315 authors in the years under study. Out of the 589 articles, 421 (71.5%) are joint works while only 168 (28.5%) are single authored works. The degree of author's collaboration was also calculated to be 0.715, while the mean numbers of single authored and joint authored articles are 16.8 and 42.1 respectively. In this research, the average numbers of author per paper are between 1.9 and 2.7. The author's productivity revealed that two authors ranked first with 14 published articles credited to each of them while many other authors also ranked high differently.

**Key words:** Collaboration, strength, pattern, authorship, proceedings, Nigerian Institution of Agricultural Engineers (NIAE).

## INTRODUCTION

Collaboration is defined by Chambers 20th century dictionary (1983) as "to work in association" while BBC English dictionary (1992) defines collaboration as the act of working together to produce a piece of work, especially a book or some research project. It has been realized, according to Newman (2004), that co-authorship of articles in learned journals provides a window on patterns of collaboration within a given community. Collaboration of works can be accessed through a broad view such as the number of papers authors write, how many people they write with and how has this affected their productivity. It was stated further that it is possible to extract from authorship data a measure of the strength of the collaboration between pairs of individuals. This, he reported, can be done simply by a count of the frequency with which two people have co-authored paper over a

given interval. Given a mathematical illustration that each paper co-authored by a given author pair adds an amount. The inverse of  $n-1$  is the strength of their collaboration, where 'n' is the total number of authors on the paper. He opined that the rationale behind the choice is that an author directs his/her time between the  $n-1$  other authors with whom he/she works on a paper hence the strength of the connection to each of them varies inversely as  $n-1$ . Therefore, this paper discusses the function of agricultural engineers in their collaborative works as deduced from the pattern of co authorship of their papers.

Agricultural engineering is an application of engineering knowledge and principles to the problems of agriculture, with the aim of producing and delivering food and fibre to the world under safe working conditions and protected environment. Agricultural engineering research is also geared towards finding practical solution to effective mechanized activities for the advancement of sufficient agricultural products necessary for both domestic and international consumption in Nigeria. Nigerian Institution

\*Corresponding author. E-mail: [olukemioyeniya@yahoo.com](mailto:olukemioyeniya@yahoo.com).  
Tel: +2348033602788.

of Agricultural Engineers (NIAE) proceedings are the publication of the Nigeria Institute of Agricultural Engineers. These proceedings are the outcomes of the annual conference papers.

## OBJECTIVES OF THE STUDY

### This study looks at:

- i) The pattern of authorship among agricultural engineers in the NIAE proceedings.
- ii) The collaborative strength and pattern among Agricultural Engineers.
- iii) Degree of collaboration among members of the Nigerian Institution of Agricultural Engineers (NIAE).

## RESEARCH METHODOLOGY

The bibliographic data of authors as it appears in the NIAE proceedings from year 2000 to 2010 (with an exception of year 2008 when the proceeding was skipped) were used for this study. For each issue, volume, year, number of authors and titles were recorded. All individuals identified as author(s) in the heading of the paper were included and counted and the result tabulated. The result were then analysed based on:

- a) Numbers of articles published per year
- b) Pattern of authorship features in the proceedings
- c) Collaboration degree
- d) Collaborative strength of author

Simple statistical methods were used to bring the point home, while the formula proposed by Subramanyam (1983) was used to determine the strength or degree of authorship.

$$C = \frac{Nm}{Nm + Ns}$$

The degree of collaboration,  
Where,  $C$  = Degree of collaboration  
 $Nm$  = number of multi-authored articles  
 $Ns$  = number of single-authored articles

A sample of 589 journal articles of 2000 to 2010 published from Nigerian Institution of Agricultural Engineers (NIAE) Proceedings is used for the study.

## REVIEW OF LITERATURE

No study can take place without the knowledge acquired in the past. Obviously, there are many studies that have been done in the past on collaboration. According to Mali et al. (2010), there has been tremendous growth in the number of and overall percentage of co-authored publications in all fields of science. The first co-authored scientific paper was published in 1665 by Lukkonen et al. (1992) and this has improved tremendously. In the study, it was suggested that a large number of possible factors contribute to collaboration taking place; they include

economic, cognitive and social factors.

The benefits of collaboration through co-authored publications according to Mali et al. (2010) can be expressed in terms of both research input and output.

There is also a degree of collaboration as defined by Rana and Aganwal (1994), which is a ratio of the number of collaborative research papers to the total number of research papers in the discipline during a certain period of time.

$$\text{Degree of collaboration: } CC = \frac{Nm}{Nm + Ns}$$

- a)  $Cc$  stands for degree of collaboration in a discipline
- b)  $Nm$  is the number of multi authored research papers in the discipline published during the year.
- c)  $Ns$  is the number of single authored paper in the discipline published during the same year.

Collaboration, according to Melin and Persson (1996), is an intense form of interaction that allows for effective communication as well as the sharing of competence and other resources. He stated that however, the complex nature of human interaction that takes place between collaborators and the magnitude or their collaboration is not easily captured by quantitative tools. The precise relationship between quantifiable activities (that is, data analysis), and intangible contributions (that is, ideas) and their weight in the final product of the collaboration (that is, a research paper) is extremely difficult to determine.

According to Newman (2004), it is possible to extract from co-authorship data a measure of the strength of the collaboration between pairs or individuals. The simplest of such measure would just be a count of the frequency with which two scientists have co-authored papers, the number of co-authored papers over a given interval, for instance. He however opined that, this fails to take into account the numbers of other co-authors on each paper. To account for this effect, they proposed the measure of collaboration strength which stated that each paper co-authored by a given pair adds an amount  $n/n-1$  to the strength of their collaboration. Where  $n$  is the total number of authors on the paper. That is to say an author divides his/her time between the  $n-1$  of other authors with whom he/she works on a paper.

Looking at the strengths and limitations of collaborative research, Violanti (2009) agreed that collaboration is an essential part of research process. He added that while conducting a research, two or more people share progress, ask for comment or paper drafts, receive resources, have a conversation that spans an idea or even complete the entire projects with one or more other people. Udofia (2002) also compares authors' collaboration in the periodical literature of African Trypanosomiasis. The study was based on the literature abstracted in the 1990 to 2000 articles of Tropical Disease Bulletin and Tsetsefly, and Trypanosomiasis Quarterly using the counting method. It is found that both the annual rates and the accumulation of author's

**Table 1.** Year-wise distribution of article publications from 2000 to 2010.

Year-wise distribution of article publications			
S/No	Publication Year	Total articles published	Percentage (%) of 589
1	2000	44	7.5
2	2001	63	10.7
3	2002	38	6.5
4	2003	38	6.5
5	2004	84	14.3
6	2005	68	11.5
7	2006	72	12.2
8	2007	55	9.3
9	2009	60	10.2
10	2010	67	11.4
Total		589	100.0

**Table 2.** Single authored vs. co-authored publications from 2000 to 2010.

Single authored vs. co-authored articles						
S/No	Year	Single authored	Joint authored	Total articles published	% of single authored articles	% of Joint authored articles
1	2000	15	29	44	34.09	65.91
2	2001	22	41	63	34.92	65.08
3	2002	18	20	38	47.37	52.63
4	2003	14	24	38	36.84	63.16
5	2004	22	62	84	26.19	73.81
6	2005	21	47	68	30.88	69.12
7	2006	18	54	72	25.00	75.00
8	2007	8	47	55	14.55	85.45
9	2009	15	45	60	25.00	75.00
10	2010	15	52	67	22.39	77.61
Total		168	421	589	28.52	71.48

collaboration for each period of the ten years were high. He also found that each year's literature is dominated by multiple authorship; and in all, two or three authored papers were predominant.

Degree of collaboration varies from one discipline to another. According to Garfield (1979), it is generally high in the intensely collaborative scientific and technical fields, but low in humanities in which the lonely scholar, working without the trappings of 'big science' still produces much of the scholarly interactive. Author's collaboration has been studied in some literature in the humanities, social sciences, and natural sciences but little is known about studies on agricultural engineering in Nigeria.

Oyeniya and Bozimo (2004), while studying the relationship between author's collaboration and productivity on sorghum literature in Nigeria, revealed that top ranked authors in productivity also ranked top in collaboration. The study further revealed that authors who are truly productive in terms of numbers of publication also collaborate extensively.

## RESULTS AND DISCUSSION

### Year-wise distribution of article publications

Here, an attempt was made to calculate the scholarly publication during the period of ten years from 2000 to 2010 (2008 exempted). Table 1 presents the year-wise distribution of number of articles indexed.

In Table 1 a total number of 589 articles were published. No NIAE proceeding was published in 2008. The average number of articles publication for the ten year record was 58.9 articles per year. The lowest articles were published in 2002 and 2003 (38 articles each), while 2004 recorded the highest publication of 84 articles (14.3%). This may be connected to the fact that few papers were published for the two years preceding (2002 and 2003).

Table 2 reveals that joint authorship is a common phenomenon among agricultural engineers. It can be deduced from the table that out of 589 published articles within the period, 421 (71.45%) are joint authored papers,

**Table 3.** Authorship pattern.

S/No	No. authors (unit)	No. of articles	Total No. of authors	Percentage(%) of articles	Cum. (%) of articles
1	Single	168	168	28.52	28.52
2	Two	215	430	36.5	65.02
3	Three	135	405	22.92	87.94
4	Four	51	204	8.66	96.6
5	Five	16	80	2.72	99.32
6	Six	2	12	0.34	99.66
7	Seven	1	7	0.17	99.83
8	Nine	1	9	0.17	100
Total		589	1315	100	

while 168 (28.52%) are single authored papers. This confirms the findings of Mattson (2008) in his study on “bibliometrics – an important tool in research evaluation”. He noted that researchers in smaller and developing countries co-author work within one another. He also observed significant differences in collaboration pattern across field in which Engineering, Computing and Technology have the highest collaboration works; agricultural engineering being one of the afore-mentioned groups.

**Authorship patterns**

Authorship pattern of the articles is presented in Table 3. The study reveals that a total of 1,315 authors have contributed to the 589 articles, where two authored papers are rated highest with 215 articles. The table also revealed two different articles that were co authored by seven and nine authors, respectively.

The research showed that multi authorship is predominant among agricultural engineers. Out of 589 published articles within the period under study, 421 (71.5%) are joint works, while 168 (28.5%) are single author works. Two-authored articles comprised the highest percentage (36.5%) with 215 articles, while seven-author and nine-author ranked lowest with one articles each of the total 589 articles.

**Degree of author’s collaboration**

There are various methods to calculate the degree of research collaboration. Here, in this study, the formula proposed by Subramanyam (1983) has been used.

The degree of collaboration:

$$CC = \frac{Nm}{Nm + Ns}$$

Where, C = Degree of collaboration;

Nm = number of multi-authored articles;  
 Ns = number of single-authored articles;  
 Thus, Nm = 421;  
 Ns = 168.

$$C = \frac{421}{421 + 168} = 0.715$$

Thus, the degree of collaboration (C) is 1.4. This implies that collaboration is on a high side in the NIAE publication in the years under study.

**Mean numbers of authors per publication from 2000 to 2010**

Using the formula:  $M = \frac{Ex}{n}$

Where Ex = summation of all the values  
 While n = number of elements  
 Thus:

$$\frac{15 + 22 + 18 + 14 + 22 + 21 + 18 + 8 + 15 + 15}{10} = 16.8$$

∴ Mean of single authored articles = 16.8

$$\frac{29 + 41 + 20 + 24 + 62 + 47 + 54 + 47 + 45 + 52}{10} = 42.1$$

∴ Mean of Joint Authored Articles = 42.1

According to the mean values given above, it is clear that joint authored articles are more prominent in NIAE publication in the years under study. While the mean

**Table 4.** Average number of authors per paper (AAP) in NIAE.

Year	Total no of papers (P)	Total no of authorship (A)	Average no of authors per paper (AAP = A/P)
2000	44	95	2.2
2001	63	118	1.9
2002	38	73	1.9
2003	38	76	2.0
2004	84	181	2.2
2005	68	147	2.2
2006	72	186	2.6
2007	55	146	2.7
2009	60	146	2.4
2010	67	147	2.2
Total	589	1315	

**Table 5.** NIAE authors with more than nine publications (2000 – 2010).

Author	Articles published
AHANEKU, I. E.	14
MIJINYAWA, Y.	14
EL-OKENE, A.	13
ANI, A.O.	12
MBAJIORGU, C.C.	11
OLUKA, S.I.	11
OBIAKOR S.I.	11
OKONKWO, W.I.	10

value of joint authored papers is 42.1, the mean value of single authored papers is only 16.8.

### Average number of authors per paper

Table 4 revealed that co-authorship is a predominant practice in the study. Almost all the years have an average of two authors per paper.

Table 4 further buttressed the fact that co-authorship is a common phenomenon in research. From the table, it can be deduced that each paper in the whole year under study has an average of two (2) authors. Year 2007 recorded the highest average numbers of authors per paper (2.7) with 146 authors authoring 55 papers. Meanwhile, 2001 and 2002 rated the lowest with an average of 1.9 each. In the study, the contributions of four different years (2000, 2002, 2003 and 2007) were less than the average publication per year.

### Authors' productivity

Some authors contributed more articles than others. The names of those who contributed more than nine articles

are listed in Table 5.

The table shows that some authors are outstanding in their contribution in the proceeding. Two authors (Ahaneku and Mijinyawa) ranked first with 14 published articles credited to each of them. They are followed by an author (El-Okene) with 13 articles and another author (Ani) with 12 articles. There are 3 authors (Mbajorgu, Oluka, and Obiakor) who produced 11 articles each; while another author (Okonkwo) had 10 articles. Many other authors produced nine (9) articles and below.

### Conclusion

Agricultural engineering research findings are geared towards finding practical solution to effective mechanized activities for the advancement of sufficient agricultural products necessary for both domestic and international consumption in Nigeria. Research of this nature is designed to determine the quantity and quality of research in this field. An understanding of the characteristics of authors in a field is very important as well so that the information specialist in the field will get acquainted with the clientele.

It is glaring from the study that co-authorship is a common phenomenon among agricultural engineers in Nigeria. From the ten years data gathered, co-authored papers surpassed single author papers for each year which shows a sign of solidarity in this field. More so, the pattern of authorship also shows that two and three authored works are common, but there is still a record of a paper with nine authors. The average paper per authors has the highest percentage of 2.7 and the lowest is 1.9 authors per paper. Two authors were credited with 14 articles each, one with 13 articles, one with 12 and three with 11 articles each.

Findings from reviewed literatures show that there are different ways in which authors of different area of subject collaborate. In fact, it was ascertained by many authors that productivity increases as authors try to collaborate

with one another.

The implications of this study are considerably analysing the social life of agricultural engineers. This work indicated that the research front is dominated by a small core of active workers with a large and weak transient population, who only write once or twice. However, it should be noted that agriculture is a very large field; these authors must not be seen as if they have not contributed to the literature. They can probably be active in another aspect.

Therefore, the top productive authors in the field should encourage the low productive ones, because this will help to gear them up in writing articles. Putting forward the area of research and inviting other writers to contribute will increase the rate of productivity. This will also increase the collaborative rate in the field among agricultural engineers in Nigeria.

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