AUTHORSHIP TRENDS IN GHANA JOURNAL OF AGRICULTURAL SCIENCE: A BIBLIOMETRIC STUDY.

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ABSTRACT

*The paper examined authorship patterns of feature articles, research and development notes, subject review articles, provisional communications and documentation in the **Ghana Journal of Agricultural Science (GJAS)**. Content analysis was undertaken to collect feature articles, research and development notes, subject review articles, provisional communications and documentation in the GJAS from 36 volumes, published over a 35 year period (1968-2003). Authors' institutional and geographic affiliations were examined. Descriptive statistics was used in analyzing the data.*

A total of 663 articles authored by 1202 authors were analysed. Results indicated that 332 articles were single-authored while 331 were co-authored. The proportion of single-authored papers had decreased from 90% in 1968 to 6.25% in 2003. During the period, there was an increase in average number of authors per paper from 1.10 in 1968 to 2.87 in 2003. Degree of collaboration also increased from 0.10 to 0.94. The research should sensitize Ghanaian authors to collaborate more with experts from outside Ghana, especially from the developed world.

KEYWORDS*:* AUTHORSHIP, AGRICULTURAL SCIENCE, AGRICULTURE, BIBLIOMETRICS, GHANA.

Introduction

Any bibliometric study seeks to quantitatively measure patterns of communication in any literature and trends within a profession's publishing. The term was coined in 1969 by Pritchard to replace the term "statistical bibliography" as it was known in the 1890s (Sengupta, 1992). The term is explained as the study of the use of documents and patterns of publication in which mathematical and statistical methods have been applied.

It is defined by Prytherch (1987) as the application of mathematical and statistical methods to the study of the use made of books and other media within and between library systems. It was pointed out in the literature that, bibliometrics can be divided into 'descriptive' and 'evaluative', both of which can further be divided by 'productive count' (geography, time and discipline) and 'literature count' (reference and citation). Two other terms, used more or less interchangeably are scientometrics and informetrics (Feather and Sturges, 1997).

Bibliometrics is applicable in many fields. For example, bibliometric studies help unearth writing patterns, habits of scholars in different subject fields, subject analysis in terms of history of the subject, problems in the subject field among others. The study of the term also helps in selection of books and periodicals, features of subject literatures, evaluation of collections and bibliographies, and historical and sociological studies. Other areas of application include use studies such as measuring the impact of publications, studying subject interrelationships, and tracing diffusion of ideas. The growth of literature in a subject area, how much literature is contributed by various languages, how the literature on some subjects are scattered and study of authorship in publications, forecast of past, present and future publishing trends, adaption of an accurate weeding and stacking policy, prediction of productivity of publishers, individual authors, organization, country or that of entire disciplines among others are also some areas of applying the technique, (Sengupta, 1992 & Osareh, 1996).

In summary, Pritchard quoted in Sengupta (1992), stated that the purpose of bibliometrics is to shed light on the process of written communication and of the nature and course of development of a descriptive means of counting and analyzing the various facets of written communication.

The focus of this study was authorship trends of ***Ghana Journal of Agricultural Science***. Authorship studies provide valuable information concerning characteristics of authors; their collaboration, assessing and monitoring research activities among others. Some

specific areas in studying authorship are discovering changing patterns in the area of authorship, frequency, gender, geography, institution affiliation, etc.

Background Information of GJAS

One of the avenues where agricultural research information is shared with the public and other scientists in Ghana and elsewhere is through the ***Ghana Journal of Agricultural Science*** (***GJAS***), which is a peer reviewed journal. The journal provides the means through which scientists in the universities and research institutions in Ghana and elsewhere make research findings known to the public, in addition to disseminating research results of Ghanaian origin to the international community. It also serves as a medium for disseminating original research and development results concerning Ghanaian and other West African agriculture and related disciplines. ***GJAS*** is published and managed by the Council for Scientific and Industrial Research (CSIR.).

The publication of ***GJAS*** started in June 1968. It was supposed to be published twice yearly; in April and August. It was proposed that publication times would be increased to three times a year (April, August, and December) starting from 1972 when the number of papers submitted for publication increased.

Unfortunately, the interval for the issuance of the publication has not been consistent. The publication is currently issued once a year. In 1971, the publication had two parts in one issue; in 1975, 1977, 1978 it had three parts in one issue. From 1981 some volumes were published into one issue. For example:

- 1981-1986, vols 14-19;
- 1987-1990, vols 20-23;
- 1991-1994, vols 24-27.

In 1995, publication of one volume per issue a year was resumed. From 1997 to 2000, the publication was issued in two parts per issue. From 2001 to 2003 the publication was issued in one part per issue. The journal is one of the African Journals Online and the table of contents and abstracts of some of the issues can be found on the Internet.

Review of Literature

A number of studies have been undertaken to discover changing patterns in the area of authorship. Characteristics from which the authorship trends were sought were co-authorship, occupation, institutional affiliation, job status, gender, geographical distribution, frequency of authorship among others.

A study undertaken by (Al-Ghamdi et al, 1998) on authorship in the ***Journal of the American Society for Information Science*** (***JASIS***) indicated that about 78% of all the articles examined were written by an author appearing only once. Over 90% of all the articles were contributed by an author who appeared one or two times. Those whose work appeared six or more times constituted only 2.2%. These findings reinforced Lotka's Law which suggests that in any subject field, only a small percentage of the authors are highly productive.

Another trend in authorship studies is growth of co-authorship. It is a notable change in the social organization of research in the last few decades and has been rapidly leading to the spread of collaboration research and teamwork (Uzun,1998). From a survey conducted by Uzun into the profile of social science research in Turkey for the period 1987-1996, it was realised that single authored papers decreased from 68% in 1987 to 41% in 1996. Rana and Agarwal (1994) found a similar trend in their study. They observed that in 1980 single authored and co-authored papers were 63.68% and 36.32% respectively. However, in 1989 single authored papers came down to 52.74% and that of multi-authored papers increased to 47.26%.

Although co-authorship has grown considerably, the extent to which collaboration is practiced varies from discipline/subject to discipline/subject. Glanzel (2002) in his study of co-authorship patterns and trends in the sciences, observed that subjects in the biomedical research (BRE) field had 48% co-authorship, while Chemistry (CHEM) and Mathematics (MAT) had 24% and 17% respectively over the period of 1980, 1986, 1992 and 1998. Co-authored papers were thus predominant in BRE with a substantial number being five authored papers while two and three authored papers decreased. In CHEM,

two authored papers were 33%, while three authored papers were 25%. In MAT only 6% of the papers were two authored. In general, authors in experimental fields such as Biomedicine, Chemistry and other life sciences tend to co-operate more frequently than their counterparts for example, in Mathematics and Philosophy (Uzun, 1998).

A study by Oyeniyi and Bozimo (2004) threw light on co-authorship patterns as a function of an author's productivity. Out of the 1260 articles written by 420 authors, 940 were single authored while 382 were co-authored. They found that the highest number of publications by one author was 44 papers followed by 28 and 27 papers respectively. Authors who had five publications and below constituted 94.53% while those with 6 and above constituted 5.47%. The study also revealed that authors who topped the rank of productivity also topped the rank of collaboration.

In another study, Glanzel (2002) examined 11 East and Central European countries in the 1990s to measure the share of international co-authored publications as well as strength of co-publication links between countries. He noted that the international co-publications in the national total of all countries under the study exceeded 40% and in some cases even 50%. In all, there was an increasing scientific collaboration especially within highly developed countries with Germany and the USA being topmost in the 1990s. Al-Ghamdi et al (1998) also noted in their study that international participation in ***JASIS*** was significant. That 1156 (78%) of authors represented in the study were affiliated to institutions in the USA while 327(22%) were located outside the USA. In summary non-US authorship trend was a fluctuating one between 12% and 36%.

Alemna (2001) examined the periodical literature of Library and Information Science in Africa for the period 1996-2000 as in ***African Journal of Library, Archives and Information Science (AJLAIS).*** He observed that the degree of representation by various African countries varied. West Africa topped with 50.6%, followed by South/Central with 32.9% and East Africa with 12.7%. Developed country participation in ***AJLAIS*** was very minimal with 2.5% UK representation and 1.3% Canada

representation. Raptis (1992) also noted various international representations in his study.

Another characteristic in authorship study is institutional affiliation. Generally, it was observed from the literature that academics or those from academic institutions dominated the publication of articles. For non-academics (those from corporate institutions, government agencies etc) had minimal representation, (Atinmo and Jimba, 2002, Raptis, 1992 and Al-Ghamdi et al, 1998).

Purpose/Objectives of the study

The study seeks to look at authorship trends in the literature of the ***Ghana Journal of Agriculture Science*** since its beginning by examining:

- Authorship patterns in the ***GJAS***.
- Degree of collaboration in ***GJAS*** among authors.

Methodology

Bibliographic data over the 35 year period, from 1968 to 2003 (36 volumes) were gathered. Specific types of ***GJAS*** articles such as: feature articles, research and development notes, subject review articles, provisional communications and documentation were all analysed. Book reviews were excluded because they were not considered as original research. For each issue, volume, year, number of authors and titles were recorded. All individuals identified as authors in the heading of the paper were included and counted manually and the results tabulated.

Each author's affiliation was identified and classified into the following categories: academic, research, corporate, Government agency, international organization and Non-governmental Organisation (NGOs).

Academic here refers to universities, colleges and libraries; Research refers to research institutions; government agency refers to government establishments, for example, Ministries; International Organisations refers to agencies such as the Food and

Agricultural Organisation (FAO), United States Agency for International Development (USAID) etc.; and Corporate Bodies refer to industries/ companies. For the geographical location, individual countries were identified and named.

The geographical location is the country from which the author submitted the article. This was taken from the addresses the authors provided and indicated under the title of the articles. The work also looked at frequency of authorship, as well as geographic and institutional affiliations. Gender was excluded because there were inconsistencies in the writing of the names of authors. Some names were written by indicating titles e.g. Mrs., some indicated full first names whilst others indicated only initials. It was therefore difficult to determine gender in many cases.

Results and Discussion

Authorship Trends

The total number of papers published from 1968 to 2003 was 663 and written by 1202 authors. The number of authors per article ranged from one to six. The data in **Table 1** revealed that there were 332(50.23%) papers with single authors, 198(29.71%) with two authors, 80(12.07%) with three authors, 33(4.98%) with four authors, 17(2.56%) with five authors and 3(0.45%) with six authors.

From the analysis it was observed that single authored papers were slightly more than the multi-authored papers. The number of articles per volume had not been stable. It increased steadily from 1968 to 1976 and started falling from 1977 to 1997. There was an increase in 1998 then it started falling in 1999 to the current number of 16 in 2003. It seems not many people are contributing to the journal at the moment. It could be that researchers were publishing in other international journals or lesser papers were being published because of the increase in co-authorship.

Table I. Number of Authors of Ghana Journal of Agric Science Research Papers

Year	Vol.	No.	Number of papers with 1, 2, 3, 4, 5 and 6 authors respectively						Total no of papers
			1	2	3	4	5	6	
1968	1		18(90)	2(10)	-	-	-	-	20
1969	2		13(72.22)	3(16.66)	1(5.56)	-	1(5.56)	-	18
1970	3		26(86.66)	2(6.67)	2(6.67)	-	-	-	30
1971	4	1&2	23(74.20)	6(19.35)	2(6.45)	-	-	-	31
1972	5		23(74.20)	4(12.90)	4(12.90)	-	-	-	31
1973	6		25(75.76)	8(24.24)	-	-	-	-	33
1974	7		25(71.42)	10(28.58)	-	-	-	-	35
1975	8	1,2&3	23(60.53)	12(31.58)	2(5.26)	1(2.63)	-	-	38
1976	9		22(53.66)	16(39.02)	3(7.32)	-	-	-	41
1977	10	1,2&3	18(54.55)	12(36.36)	1(3.03)	2(6.06)	-	-	33
1978	11	1,2&3	19(59.37)	11(34.38)	2(6.25)	-	-	-	32
1979	12		10(43.48)	10(43.48)	2(8.70)	1(4.34)	-	-	23
1980	13		11(52.38)	9(42.86)	1(4.76)	-	-	-	21
1981-1986	14-19		15(60.00)	7(28.00)	3(12.00)	-	-	-	25
1987-1990	20-23		7(38.89)	8(44.44)	3(16.67)	-	-	-	18
1991-1994	24-27		12(54.17)	9(33.33)	3(12.50)	-	-	-	24
1995	28		4(28.57)	7(50.00)	2(14.29)	1(7.14)	-	-	14
1996	29		4(21.05)	5(26.32)	4(21.05)	2(10.53)	3(15.79)	1(5.26)	19
1997	30	1&2	4(18.18)	6(27.27)	6(27.27)	2(9.10)	4(18.18)	-	22
1998	31	1 & 2	11(29.73)	12(32.43)	6(16.22)	6(16.22)	2(5.40)	-	37
1999	32	1&2	2(6.67)	10(33.33)	9(30.00)	5(16.67)	3(10.00)	1(3.33)	30
2000	33	1&2	6(18.75)	10(31.25)	10(31.25)	6(18.75)	-	-	32
2001	34		5(29.41)	7(41.18)	2(11.77)	1(5.88)	1(5.88)	1(5.88)	17
2002	35		5(21.74)	5(21.74)	9(39.13)	3(13.64)	1(4.35)	-	23
2003	36		1(6.25)	7(43.75)	3(18.75)	3(18.75)	2(12.50)	-	16
TOTAL			332(50.23)	198(29.71)	80(12.07)	33(4.98)	17(2.56)	3(0.45)	663

Single versus multiple authors

Co-authorship is the listing of more than one author for a paper. From the analysis, from 1968 to 2003 there were 332 papers with single authors as against 331 with two or more authors. (See Table II). The degree of co-authorship hass been increasing steadily and this reflected in the trend of increased co-authorship reported in other fields as the subjects matured (Beaver and Rosen quoted in Cunningham & Dillion, 1997). The percentage of single authorship in 1968 was 90% whilst that of co-authorship was 10%. However, in 2003 the percentage of single authorship decreased to 6.25% whilst that of co-authorship increased to 93.75%. A similar trend was observed by Al Ghamdi et al. (1998). They found that the percentage of co-authored papers doubled from 14% in the 1970s to 28% in the 1990s.

Table II. Single Versus Multiple Authors

Year	Single author		Multiple author		Total no. of papers
	No of papers	%	No of papers	%	
1968	18	90	2	10.00	20
1969	13	72.22	5	27.78	18
1970	26	86.66	4	13.34	30
1971	23	74.20	8	25.80	31
1972	23	74.20	8	25.80	31
1973	25	75.76	8	24.24	33
1974	25	71.42	10	28.58	35
1975	23	60.53	15	39.47	38
1976	22	53.66	19	46.34	41
1977	18	54.55	15	45.45	33
1978	19	59.37	13	40.63	32
1979	10	43.48	13	56.52	23
1980	11	52.38	10	47.62	21
1981-1986	15	60.00	10	40.00	25
1987-1990	7	38.89	11	61.11	18
1991-1994	12	50.00	12	50.00	24
1995	4	28.57	10	71.43	14
1996	4	21.05	15	78.95	19
1997	4	18.18	18	81.82	22
1998	11	29.73	26	70.27	37
1999	2	6.67	28	93.33	30
2000	6	18.75	26	81.25	32
2001	5	29.41	12	70.59	17
2002	5	21.74	18	78.26	23
2003	1	6.25	15	93.75	16
Total	332(50.22)		331(49.78)		663

The growing complexity of science and the increasing specialization of scientists imply that solutions to scientific and technological problems require a variety of inputs, which can only be derived from complementing knowledge and skills of different scientists. This has led to the consistently increasing trend towards collaboration among various branches of science and technology, which leads to collaborative authorship in literature (Rana and Agarwal, 1994). In all, collaboration was high among the authors. This finding was at variance with the findings of Atinmo and Jimba (2002) and Raptis (1992) who found from their studies that single authored articles were 83.2% and 86.46% while co-authored ones were 16.8% and 13.54% respectively.

Degree of Collaboration

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

- Degree of collaboration is CC=Nm/(Nm + Ns).
- CC stands for degree of collaboration in a discipline.
- Nm is the number of multi-authored research papers in the discipline published during the year.
- Ns is the number of single authored papers in the discipline published during the same year.

Using this formula, the degree of collaboration has been increasing steadily from 0.10 in 1968 to 0.94 in 2003 (see Table III).

Table III. Degree of collaboration in GJAS

Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Degree of collaboration	0.10	0.28	0.13	0.26	0.26	0.24	0.29	0.39	0.46	0.45	0.41	0.57	0.48
Year	1981-86	1987	1991-94	1995	1996	1997	1998	1999	2000	2001	2002	2003	
Degree of collaboration	0.40	0.61	0.46	0.71	0.79	0.82	0.70	0.93	0.81	0.71	0.78	0.94	

Average number of authors per paper

During the period of study, there was an increase in the average number of authors per paper from 1.10% in 1968 to 2.87% in 2003 (see Table 4). These increases could be due to the growing complexity of research, which calls for more collaborative and interdisciplinary research (Sobal and Ferentz quoted in Cason, 1990), or due to increased pressure upon academics to publish, get grants and to get tenure (Gelman and Gibelman, 1999). Perhaps, it could also be due to the inclusion of persons as coauthors who did not contribute substantially to the study (Lazar, 2004). The analyses also revealed that there was more sharing of authorship among two or three authors (see Table I). Gelman and Gibelman (1999) also detected a strong increase in the number of dual and triple authored articles in their study of social work journals.

Table IV. Average number of authors per paper (AAP) in GJAS

Year	Total no of papers (P)	Total no of authorship (A)	Average no of authors per paper (AAP=A/P)
1968	20	22	1.10
1969	18	27	1.50
1970	30	36	1.20
1971	31	41	1.32
1972	31	43	1.38
1973	33	41	1.24
1974	35	45	1.28
1975	38	57	1.50
1976	41	63	1.53
1977	33	53	1.60
1978	32	47	1.46
1979	23	40	1.73
1980	21	32	1.52
1981-1986	25	38	1.52
1987-1990	18	32	1.77
1991-1994	24	38	1.58
1995	14	28	2.00
1996	19	55	2.89
1997	22	62	2.81
1998	37	87	2.35
1999	30	90	3.00
2000	32	80	2.50
2001	17	40	2.35
2002	23	59	2.56
2003	16	46	2.87

Frequency of authorship

From the analysis of the data as depicted in Table V, about 30.87% of the authors had published only one article between 1968 and 2003. Also, 48.51% contributed one or two articles whilst 51.49% contributed between three and 14 articles. This confirms an earlier study by Al Ghamdi et.al. (1998).

Table V. Frequency of Authorship

Total no.(N) of times an author appears	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. of authors with N articles	372	106	43	39	11	11	9	5	5	4	1	-	-	1
As a % of total no. of authors	30.87	17.64	10.73	12.98	4.58	5.49	5.24	3.33	3.74	3.32	0.92	-	-	1.16

Productivity of Authors

Some authors contributed more articles than others. The names of those who contributed more than six articles are listed in Table VI.

Table VI. High contributing authors

GJAS Authors with More than Six Publications 1968 – 2003			
Author	Articles Published	First Volume	Latest Volume
Abutiate, W. S.	7	1969	1994
Amoah, F. M.	7	1996	2003
Asante, A. K.	7	1991	2002
Danquah, E.Y.	7	1998	2003
Gyawu, P	7	1996	2003
Ofori, C.S	7	1968	1976
Ofori-Frimpong, K	7	1997	2003
Ofosu, A	7	1971	1990
Haizel, K.A.	7	1972	1996
Godfrey-Sam-Aggrey	8	1968	1975
Nerquaye-Tetteh, Gladys A	8	1975	2002
Osei-Bonsu, K	8	1987	2003
Halm. AT	8	1968	1979
Sallah, P Y K	8	1997	2002
Ankrah, E.K	9	1971	2000
Karikari, S. K.	9	1970	1974
Takyi, S. K.	9	1970	1975
Doku, E.V	9	1969	1978
Ahenkorah, Y.	9	1969	2000
Appiah, M. R.	10	1974	2002
Atta, J.K.B.A.	10	1973	1980
Tuah, A.K.	10	1974	1998
Oddoye, E.O.K.	10	1997	2002
Carson, A.G.	11	1975	1997
Fleischer, J. E.	14	1996	2002

Prominent among those authors who contributed most of the articles are J.E. Fleischer (14) and A.G. Carson (11). Some of the authors who had seven or more articles published in ***GJAS*** had their writings spread over a long period of time whilst others had their articles spread over a shorter period of time. There were a few spreading over a narrow range of years. Fleischer's articles were spread between 1996 and 2002 whilst that of Carson spread between 1975 and 1997. Overall, multiple-authorship was an important factor in research productivity among the leading contributors to ***GJAS.***

Testing Lotka's Law for individual authors.

Lotka's Law describes the frequency of publication by authors in a given field. It states that "the number of authors making n contributions is about $1/n^2$ of those making one; and the proportion of all contributors that make a single contribution is in the region of 60 per cent". This means that out of all the authors in a given field, 60 per cent will have

just one publication; 15 per cent will have two publications ($1/2^2$ times 0.60); 7 per cent will have three publications ($1/3^2$ times 0.60), and so on, (quoted from Rowlands, 2004).

More generally, the law takes the form; $an = a_1/n^c$, n = 1, 2, 3, …,
Wherea_n = the number of authors publishing n papers,
a_1 = the number of authors publishing one paper
c = a constant.

The purpose of this testing is to determine whether author distribution comply with Lotka's Law.

Table VII:Testing Lotka's Law for individual authors

Year	No. of Papers	No. of authors	Frequency Distribution in Percent						
			1	2	3	4	5	6	>6
1968	20	19	84.2	15.8					
1969	18	21	76.2	19.0	0.48				
1970	30	29	79.3	17.2	0.34				
1971	31	33	81.9	15.2	3.0				
1972	31	36	83.3	13.9	2.8				
1973	33	30	73.3	23.3	3.3				
1974	35	33	72.7	21.2	3.0	3.0			
1975	38	48	85.4	12.5	2.1				
1976	41	57	87.7	10.5	1.8				
1977	33	51	100						
1978	32	40	87.5	10.0	2.5				
1979	23	37	94.6	5.7					
1980	21	27	81.5	18.5					
1981-1886	25	33	87.9	9.1	3.0				
1987-1990	18	23	73.9	17.4	8.7				
1991-1994	24	30	76.7	16.7	6.7				
1995	14	21	71.4	28.6					
1996	19	34	76.5	8.8		8.8	2.9	2.9	
1997	22	49	75.5	22.4	2.0				
1998	37	66	77.3	16.7	3.0	1.5	1.5		
1999	30	75	82.7	14.7	2.7				
2000	32	66	90.9	4.5	4.5				
2001	17	36	94.4	5.6					
2002	23	53	88.7	9.4	1.9				
2003	16	41	87.8	12.2					
All Articles	**663**	**988**	**59.3**	**18.24**	**8.44**	**5.74**	**1.85**	**2.2**	
Lotka's Law			**63.4**	**15.9**	**7.0**	**4.0**	**2.5**	**1.8**	**5.3**

In the data analysis all author contributions (i.e. actual different names) were counted as one. The last two rows in Table VII compare the theoretical and actual frequency distributions for all the 25 issues of the ***GJAS*** studied. Among the 594 authors, 352 authors representing 59.3% published only once, 110 (18.2%), twice, 50 (8.4%) three times and only one author (0.2%) appeared 14 times, during the period.

The analysis indicated the actual proportion of all authors with a single publication (59.3%) is quite close to Lotka's prediction of 63.4% in his law. So also was it for authors contributing two, three, four, five and six times. The application of the prediction to individual contributions in each volume was, however, not close. For individual year or volume publications, more authors contributed once only as compared with repeated authors. However, the percentages were higher at this stage. This ranged from100% in 1977 to 71.4% (the lowest) in 1991-1994. The average percentage (82.8%) of a single publication for individual volume was larger than that for all the 25 volumes as a whole (63.4%). This indicated that authors published in more than one volume of the ***GJAS***.

This finding was similar to the findings of Chung and Cox (1990) and Rowlands (2004). Chung and Cox (1990) found that the proportion of all authors with single publishers to finance literature (62.2%) was very close to Lotka's prediction of 60.8%. The prediction however, did not come close to the result average percentage of 76.7 when applied to individual journals.

Country of Authors

Contributors of articles to ***GJAS*** for the period under study came from various countries all over the world. The geographic distribution of these authors is illustrated in Table VIII

Table VIII. Geographic Distribution of Authors

Country	No. of Authors	Percentage (%)
Ghana	910	75.71
Nigeria	159	13.23
United Kingdom	27	2.25
Canada	25	2.08
Japan	19	1.58
Sierra Leone	18	1.50
USA	6	0.50
Germany	4	0.33
Kenya	4	0.33
Not stated	4	0.33
Denmark	3	0.25
Cameroun	2	0.17
Tanzania	2	0.17
Italy	2	0.17
Jamaica	2	0.17
Mali	2	0.17
South Africa	2	0.17
Austria	1	0.08
France	1	0.08
Switzerland	1	0.08
Uganda	1	0.08
Hawaii	1	0.08
Trinidad	1	0.08
Sweden	1	0.08
Philippines	1	0.08
Cote d' Ivoire	1	0.08
Australia	1	0.08
Netherlands	1	0.08
Total	**1202**	**99.99[1]**

1 = total did not add up to 100% due to rounding up.

With reference to Table VII, contributors of articles to ***GJAS*** were from 27 countries. Majority were from English speaking countries. They were from Africa, Europe, US, Canada, Americas, and Australia. The trend clearly showed that authors from Ghana dominated. Ghanaian authors constituted 910 (75.71%) of the 1202 authors. This was followed by Nigeria with 159(13.23%). Those with values of 5 and above are UK-27, Canada-25, USA 6, Sierra Leone-18, and Japan-19. Classifying it on continental basis, Africa contributed 1101 authors (about 91.60% of the authors), Europe 41(3.41%) authors, Americas 35 (2.91%), Asia, 21 (1.75%). This shows that those from outside the continent were small in number, just about 101 (8.40%) in all. The geographical location of four authors could not be determined.

The trend of dominance of African authors in general and Ghanaian ones in particular is in agreement with the findings of Alemna (2001), Al-Ghamdi et al (1998) and Raptis (1992).

Alemna (2001), for example found that African contributors to the ***African Journal of Library, Archives and Information Science*** was 96.2% whilst those from outside the continent was 3.8%. It was observed from these findings that authors from the country of origin of the journals studied were more than those from outside. It could be that because the journal is published in Ghana, geographical proximity and determination of the citizens to sustain the growth of the journal might have explained why Ghanaian authors dominated the contributors to ***GJAS***.

International participation in ***GJAS*** cannot however be ignored. The overall percentage of non-Ghanaian authorship was about 24.30%. With the advent of communication technologies and the interplay of the Internet, it is hoped that agricultural experts would forge contacts with people outside the country to improve international participation in the ***GJAS***. This will greatly help in bringing international visibility to local journals.

Contributions from some countries fluctuated over the period. It was only UK that has been consistent with at least every other volume having an author. Although Nigerians did not contribute for the first six years of the life of the journal, they have been contributing since then. Sierra Leone was regular but ceased contributing in 1977. Canada also was consistent until 1986.

Institutional Affiliation of Authors

In order to identify the number of authors contributing from the various institutions, the authors were categorized into six areas as shown in Table VIII. They are academic; research; corporate; government agencies; non-governmental organizations; and international organizations.

Table IX. Institutional Affiliation

Institution	No. of Authors	Percentage (%)
Academia	636	52.91
Research	525	43.68
Corporate Body	13	1.08
Govt. Agency	15	1.25
NGO	2	0.17
International Org.	9	0.75
Not Stated	2	0.17
Total	**1202**	**100.01[1]**

1 = total did not add up to 100% due to rounding up.

The results indicated that out of the 1202 authors, those from academia were more than those from other institutions put together. Academia contributed 52.91% while those from research contributed 43.68%. Academia and research together contributed 96.59% forming a very large proportion of authors contributing to ***GJAS*** during the period. The number of authors from other institutions (corporate bodies, NGOs, government agencies etc) was negligible. For example, authors from corporate bodies were 13(1.08%) while those from government agencies were 15(1.25%). NGOs and international organizations contributed 2 and 10 authors respectively.

The possible explanation for this trend could be that in Ghana, like many other academic institutions and research communities in the world, faculty in the universities and researchers in the research institutions need to publish before they are promoted. The popular expression in the literature, "publish or perish" is thus relevant in this study. This observation was also made by Atinmo and Jimba (2002), Uzun (1998), and Alemna (2001).

Another explanation could be that the relative privileged intellectual environment such as access to research grants, freedom from teaching and administration, esteem of peers, access to specialist equipment, stimulation of teams of fellow researchers and supportive and well managed research culture could also stimulate high productivity among

academia and researchers. This could have influenced the high number of authors from the academia and research contributing to the ***GJAS*** (Rowlands, 2005).

From 1968 to 1974 there were more contributions from researchers than from academics. But from 1975, authors from academia outnumbered those from research. Contributors to the journal from academia in 1968-1974 were 110 whilst those from research were 133. However, from 1975-2003 contributors from the academia numbered 426 while those from research numbered 392.

Further, Oyeniyi and Bozimo (2002) also quoted Afolabi as saying that solidarity group in the form of collaboration hardly exists in library and information science literature in Nigeria. This could confirm the findings of Glanzel (2002) and Uzun (1998) that, the extent of collaboration work varies from subject discipline to subject discipline. The subject field agriculture falls under the life sciences and this could also explain the high collaboration found in this study.

Institutional Collaboration

As depicted in Table IX, authors collaborated more within their institutions than from outside. From the 331 co-authored titles 162 titles (48.94%) were written by academics coming together, while 94 titles (28.40%) were written by researchers coming together. Collaboration between authors from government agencies yielded only 4 (1.21%) articles.

Table X. Institutional Collaboration of authors based on number of articles.

Collaborating Institutions	No. Of Articles	Percentage (%)
All Research	94	28.40
All Academia	162	48.94
All Government Agency	4	1.21
Research + Academia	54	16.31
Academia + Corporate Body	6	1.81
Research + Corporate Body	4	1.21
Research + International Organization	2	0.60
Academia + Government Agency	1	0.30
Academia + International Organization	1	0.30
Research + Government Agency	3	0.91
Total	**331**	**99.99[1]**

1 = total did not add up to 100% due to rounding up.

In cross collaboration, researchers and academics' cooperation yielded 54 (16.31%) articles. Cooperation among other institutions was minimal. For example, cooperation between academic and corporations yielded 6(1.81%) articles. Cooperation between researchers and authors from corporate bodies yielded only four articles while researchers and authors from government agencies yielded only 3(0.91%).

It is difficult to explain why collaboration between academics and people from other institutions was low. Collaboration with researchers and also between researchers and others besides collaborating with academics was also very low. One can only encourage all institutions to collaborate with one another. This encouragement identifies with Kumaramangalam's study (2005).

Kumaramangalam (2005) stated that scientists working in industry should collaborate with their academic colleagues on research publications because this is an opportunity for exchange of tacit knowledge, a good sign for the growth of industries/firms and also an evidence of joint problem solving. Increased collaboration between academia, researchers and corporations and government agencies in ***GJAS*** could lead to improved influence in the agricultural sector. Kumaramangalam (2005) however, added that joint authorship could be costly in terms of effort as well as other resources. This could be a reason for the low cross collaboration noticed in ***GJAS*** between academics, research and other institutions.

Country collaboration

The results indicated high collaboration among authors. Out of the 663 articles, two or more writers co-authored 331 articles, representing about 49%. Collaboration was however, slightly higher among authors from the same country than those from different countries. Out of the 331 co-authored articles, writers from the same country co-authored 280, whilst writers from different countries co-authored 51 articles. This represented 84.6% and 15.4% respectively.

Tables Xa and Xb illustrate intra and inter country collaborations.

Intra Country Collaboration

Table XIa. Geographic collaboration of authors from the same country based on articles

Country of authors	No. Of Articles	Percentage (%)
All Ghana	215	76.8
All Nigeria	48	17.1
All Canada	5	1.8
Others	12	4.3
Total	**280**	**100**

The results illustrated in Table Xa and Xb indicated that collaboration among authors from Ghana was higher than among the other countries. Out of the 280 articles, Ghanaians co-authored 215 (76.8%), Nigerians co-authored 48 (17.1%), whilst writers from Canada co-authored 5 (1.8%). The rest of the collaboration was between same country's authors beside those mentioned and this was below five articles.

The explanation for this trend was that, Ghana has been undergoing agricultural sector reform from the early 1990s under projects such as National Agricultural Research Programme (NARP) and Agricultural Services Sub-sector Investment Project (AgSSIP) and these projects could trigger collaborative research work, hence co-authorship.

Inter Country Collaboration

Table XIb. Geographic collaboration of authors from different countries based on articles

Country of authors	No. Of Articles	Percentage (%)
Ghana + Canada	11	21.6
Ghana + United Kingdom	11	21.6
Ghana + Nigeria	7	13.7
Ghana + Japan	6	11.8
Others	16	31.4
Total	**51**	**100.1[1]**

1= total did not add up to 100% due to rounding up.

In cross-country tabulation, collaboration between authors from Ghana and Canada yielded 11(21.6%) articles. Collaboration between authors from Ghana and United Kingdom (UK) also yielded 11 articles. Ghana and Nigeria; and Ghana and Japan yielded seven (13.7%) and six (11.8%) articles respectively. Collaboration among authors from other countries yielded below five articles each. All such collaboration put together amounted to 16 articles. One can only re-echo here that with the developments in ICTs,

agricultural scientists should utilize these to collaborate more with colleagues outside Ghana.

Conclusion

The analysis of the data confirms the principle that a small number of authors contributed most articles to ***GJAS*** whilst a majority of the authors contributed one or two articles. The trend toward collaboration seems to be increasing during the period under review and this was good in that it will bring in more experts who would share experiences and increase the quality of research.

The study also discovered a low international participation in the journal. We hope this trend would change and institutions would also collaborate more with outsiders than from their own domain. Further, now that gender issues have been promoted to the pedestal of international discourse, names of authors should be written in such a way that female contributors to the journal is determined so that their contribution to the journal could be assessed.

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