

**RESEARCH PRODUCTIVITY IN THE FIELD OF LIBRARY
AND INFORMATION SCIENCE: A SCIENTOMETRIC
ANALYSIS BASED ON ARTICLES PUBLISHED IN UK
JOURNALS**

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The present paper examines gender differences in published LIS literature in the four journals of UK during 2007-2017. The results shows that 56.29% total male as first authors while 43.71% female LIS first authors contributed articles. Male as single authors are cited 12.42%, followed by male-male co-authored publications with 12.36% of papers, though the cited gap is less prominent among both the genders. The citation received by articles elucidates that male-male authorship pattern with 25.12% and male solo with 21.3% citations supersedes female solo 15.33% and female-female accumulated citations i.e. 12.08%. Further proved by Kruskal-Wallis test which revealed the significant differences between citations and authorship collaboration ($\chi^2=23.088$), followed by Mann-Whitney test for citation data across author collaborations has found significant difference between the following authorship affiliations and citations received by *MM & F* ($U=61030.500$); *M & MM* ($U=76616.500$); *M & MF* ($U=36967.500$ s); *MF & F* ($U= 29300.500$) and *MF & FF* ($U= 21842.500$). Male LIS researchers from academic category and female LIS researchers from non-academic professional category contributed articles. The study proved gender difference in research among LIS professionals of UK though the difference is marginal.

Keywords: Scholarly Publication; Publication Productivity; Scientometrics; Research Productivity; Bibliometrics; Citations

INTRODUCTION

Publication of original research in peer-reviewed journals is one of the most important factors in determining appointments, promotions and career advancement. There are a limited number of ways in which the knowledge produced and accumulated by particular disciplines can be characterized. It has been observed that a contribution to scientific knowledge is only recognized by making it available to society at large (Merton, 1988). One problem is to obtain measures of the alternative ways in which knowledge is made available – and used. If easily measured and accessible indicators are to be used to measure research performance,

then the list of available indicators is limited. The evaluative index includes publications (books, journal articles) as well as other visible outputs of scholars (e.g. music composition, architectural completions). These products reflect effort and output but they are unlikely to be useful when one is concerned with the quality of the output. Citation counts (impacts) are likely to be one of the main indicators used to rank scholars on the quality of their outputs. Journals are the primary medium through which an academic community certifies additions to its body of accepted knowledge, and a means whereby individual scientists compete for recognition (Hargens & Schuman, 1990). The present study holds relevance by shedding light on gender publishing rate over a decade; it tends to illuminate visibilities of female LIS professionals in the country UK through its scholarly publication pattern, which is a key indicator of leadership in a particular field.

REVIEW OF LITERATURE

Research trends in the subject of LIS in Korea shows that total of 2,401 peer reviewed publications from 2001 to 2010 by 159 tenured academic faculties on 34 Korean universities were analysed. The Korean LIS faculty showed an uprising trend (Xie & Shauman, 1998). Bhattacharyya and Shapiro (2000) analyzed Otolaryngology literature to identify changing trends in female authorship in each of the years 1978, 1988 and 1998. Paucity of female authorship was found in the subspecialty of plastic and reconstructive surgery. Although the subspecialty area of pediatric otolaryngology

tends to be concentrated by female authors. Goel (2002) studied women's research output confined to theses in India during the period 1976-77 to 1985-86. The purpose of the study was to assess gender inequality along the parameter of number of articles emanated from the theses and productivity in terms of quality and quantity of publications by male and female authors. Men took more initiative in publishing their Ph.D findings in the form of articles compared to women. However, the trend line analysis indicates this gender gap in the field of psychology. ISI web of science database was studied and researchers found no significant gender differences in the field of chemistry and in the field of astronomy, immunology and oceanography journals (Leta & Lewison, 2003 ; Bordons et al., 2003). A study conducted on four top political science journals to explore female representation in terms of lead author, co-authorship and in obtaining research grants with the method of content analysis. The findings revealed that 80 percent of males as lead authors compared to 20 percent females as lead authors contributed research papers (Evans & Moulder, 2011).

Garg and Kumar (2014) analysed 9,957 article contributions of Indian scientists in the Web of Science (WoS) database in the 12 sub-disciplines of life science during 2008-2009. They found that women researchers published in low impact factor and domestic journals and are also cited less compared to male researchers. Gul et al. (2016) in the field of ecology revealed men outnumbered women in terms of publications. In the discipline of political science gender citation rate was inquired and it was found that less

propensity of females to self-archive research articles than male authors (Atchison, 2017). Bebi and Kumar (2017) conducted a study to analyse contributions of women in the field of physics in the select institutions of Delhi during 2011-2015. The data set consisted of 44 women faculties with 802 contributions. Women contributed as second authors in most of the co-authored articles, highest number of citations i.e. 120 were received by a women co-authored article. A bibliometric study was conducted to evaluate peer-reviewed educational technology journals found decrease in gender disparity overtime, but still underrepresentation of females exists (Scharber et al., 2019). Astegiano et al. (2019) performed global meta-analysis in the field of science, and stated gender gap has been characterized by articles published by men have higher global impact but only if self-citations were included. Gender bias has been found in research fields where women are underrepresented. Chauvin et al. (2019) explored gender in equity in academic psychiatrists in Canada found gender differences in academic output only for junior faculty and not for associate and full professors.

Though there was no significant differences found in publication pattern of both the gender amongst faculty of public administration in the NASPAA accredited schools (Knepper et al., 2020). Mayer et al. (2020) explored the research productivity of psychology professors in relation to gender in Germany. Significant gender differences exist in the research productivity in the academic journals even if variables like individual and organizational factors were controlled.

AIMS AND OBJECTIVES OF THE STUDY

This study holds critical importance in terms of presence of women scholars in LIS journal publications in the country UK, regardless of the gender composition that comprises professionals engaged in different academic pursuits. The major objectives of the present study for the period 2007-2017 are as follows:

1. To study chronological growth of journal literature from 2007-2017 in each of the four sampled journals by calculating average growth rate and doubling time.
2. To analyze journal wise gender distribution of male and female authors.
3. To find authorship trends along with Degree of Collaboration and Collaboration Coefficient and assess gender-wise author collaborations.
4. To find the influence of various co-authored teams on citedness and on citation counts.
5. To establish a relationship between the productivity of authors with their professional category from a gender perspective.
6. To assess gender wise national and international research collaboration.

HYPOTHESES

H_{o1} : *There is no association between male and female researcher's frequencies in the journal literature of UK.*

H_{o2} : *There is no relation between cited pattern and gender in UK.*

H_{03} : *Number of citations to publication is independent of gender make up of authorship patterns in the journal literature of the country UK.*

H_{04} : *Productivity of male and female authors is not independent of their professional status in UK.*

SCOPE OF THE STUDY

The study analyses gender differences in authorship, collaboration and impact (as measured by citations) in a cross section of Library science journals published from UK. The author's gender was confirmed by consulting the author's biography that accompanied the article itself or if not appended in the journal article the author's affiliated websites and other professional networks like Research Gate and other social networking sites were seen to identify the gender of the author. The Journals selected for inclusion in this study are prominent research-oriented journals in the subject of LIS. For the purpose of the study, certain criteria were applied for selecting journals in the refined sample. Firstly, the journals must have publications in English language only and also must have included a fair count of research articles. Secondly, these journals should be indexed and abstracted by proper indexing and abstracting services. Thirdly, these journals should have commenced their publication on or before 2007. From each of the three sampled countries four journals from each country fulfilling these criteria were selected. The research focuses on select LIS journals that publish peer-reviewed research articles. Further from UK four prestigious journals are chosen to

conduct the study. The period of study is from 2007 to 2017.

1. The Electronic Library (Electronic Lib.)
2. Journal of Documentation (J.Doc.)
3. Journal of Information Literacy (J.Inf.Lit.)
4. Library Management (Lib.Manage.)

DATA METHODOLOGY

The data extracted manually, was further processed and analysed for making relevant comparisons and analysis. The methodology applied for the purpose of the study is as follows:

- The straight count method was employed to distribute credit among the authors of the paper. For the purpose of analyzing gender wise authorship pattern and cited and citations received data the first two author positions in team formation were considered only. Further, authorship for each article was delineated into first author professional designations and subsequently analyzed in terms of author's gender. To evaluate the literature growth, authorship pattern, gender wise author combinations along with cited and citation pattern and other related bibliometric indicators, data was collected manually from each article.
- The citations related data i.e. cited articles and citations received by each article in each journal for the period covered 2007-2017 was collected from the following database i.e. SCOPUS. The data was analyzed with the help of computers using MS-Excel and statistical package SPSS ver.20 was used to test the

hypotheses formed. The normality test proved negative when applied to data collected. So, Non-parametric tests such as Chi-square, Kruskal-Wallis and Mann-Whitney tests have been used for testing the hypothesis.

BIBLIOMETRIC INDICATORS

Growth Rate Analysis:

The growth rate analysis is done with respect to the Relative Growth Rate and Doubling Time. Relative Growth Rate per unit of publications per unit of time (yr) i.e.

$$R(a) = \frac{W2W1}{T2-T1}$$

R (a) = Relative Growth Rate over a period of interval.

W1= log w1 (Natural log of initial number of publications);

W2= log w2 (Natural log of final number of publications);

T2-T1= the unit difference between the initial and final time.

Doubling Time (DT)

A direct equivalence relationship exists between the Relative Growth Rate and Doubling

Time. If number of articles in a subject field doubles during a given period then difference between logarithms of numbers at the beginning and end of this period must be the logarithms of number 2. If natural logarithm is used this difference has a value of 0.693. The formulae for calculation of doubling time (Mahapatra, 1985) have been used:

$$\text{Doubling Time (DT)} = \frac{0.693}{R(a)}$$

In the table 1 in the journal Electronic Library the mean relative growth rate for the entire period was 0.23. It has a mean doubling time of 3.17. There has been decrease in the number of publications but increase in doubling time. In Journal of Documentation the whole study period has a mean doubling time of 3.17 while in Journal of Information Literacy the mean Relative Growth Rate for the entire period is 0.20 and the study period has a mean doubling time of 4.19. Library Management has the mean Relative Growth Rate for the entire period is 0.21 with a mean Doubling Time of 3.93. The analysis shows that RGR of articles has decreased gradually during the studied period i.e. 2000-2017, whereas, doubling time for publications witnessed an increasing trend in all the four UK journals.

Table 1: Relative growth of articles and doubling time of publications

Journal Name	Year	No. of Articles	Mean (RGR)	Mean of Doubling time
The Electronic Library	2007-2017	624	0.22	3.83
Journal of Documentation	2007-2017	535	0.238	3.1713
Journal of Information Literacy	2007-2017	147	0.2016	4.198
Library Management	2007-2017	513	0.215	3.93

Year wise growth of articles

The table 2 reveals the distribution of articles during 2007-2017. The decade study showed that the highest number of articles i.e. 624 (34.3) has been accredited to Electronic Library, followed by Journal of Documentation (535, 29.41%) contributions out of 1819 total publications. The data related to total number of authors in the four journals and break up of author count in Electronic Library, i.e. 1361 (38.8%) with the highest total count of authors, followed by Journal of Documentation i.e. 1016 (28.65%).

The male-female break-up of authors in the selected four journals portrays that out of total 1819 contributions 1024 (56.29%) are males and 795 (43.71%) are female authors. Journal of Documentation has 69.71% men and 30.28% females with total of 535, followed by Electronic

Library with more male count of 61.86% and 38.14% females summing up to 513. The findings of this study proves that in UK periodical literature female publication productivity has been found low compared to males which coincides with the previous studies (Fox, 2005 ; Kyvik, 1990 ; Mauleón & Bordons, 2006 ; Long, 1992 ; Xie and Shauman, 1998).

Ho₁: There is no association between male and female researcher's frequencies in the journal literature of UK.

The Comparison of male and female author's frequencies

In the table 3 a test analysis is performed on the total number of authors in the UK journals showed significant association ($\chi^2 = 28.830$, $df = 1$, $p = .000$) between male and female LIS professionals.

Table 2: Year wise growth of articles

Journal name	No. of Articles	%	No. of Authors	%	No. of Male authors	%	No. of Female authors	%
The Electronic Library	624	34.3	1361	38.38	386	61.86	238	38.14
Journal of Documentation	535	29.41	1016	28.65	373	69.71	162	30.28
Journal of Information Literacy	147	8.08	256	7.22	49	33.33	98	66.67
Library Management	513	28.2	913	25.75	216	42.11	297	57.89
Total	1819	99.99	3546	100	1024	56.29	795	43.71

Table 3: The Comparison of male and female author's frequencies

Gender				Test Statistics
	Observed N	Expected N	Residual	Gender
Male	1024	909.5	114.5	Chi-Square=28.830 ^b df=1
Female	795	909.5	-114.5	
Total	1819			Asymp. Sig.= .000

*Significant at 0.05 level

UK Journal articles: Cited pattern

In the table 4 the analysis of citation pattern under various author combinations shows that in Journal of Information Literacy, the most cited authorship is female solo (F) with 18.36% cited articles and 34.69% uncited papers in the same type. Journal of Documentation has 12.5% citedness in single male type (M) and the uncited part has 21.49% which also belongs to same category. Male-male (MM) affiliation type has cited percentage 22.91%, followed by uncited percentage as 4.48% in repetition of the same i.e. male (MM). Library Management represents male authored articles are cited with 11.31% and uncited published papers 13.86% are in the same composition. Male single authors' along with MM

collaboration are cited slightly higher than female single as well in collaboration.

H_{02} : *There is no relation between cited pattern and gender in UK.*

In the table 5 the chi-square value shows difference in male and female and cited pattern in UK. The values of $\chi^2=3.063$, $df=1$, $p=.044$, $p<0.05$ so at 95% confidence interval shows that there is an association between gender and citedness of papers.

UK: Gender combinations and citations received

The table 6 represents the data related to citations received with the highest percentage share of citation by Electronic Library (57.39%)

Table 4: UK Journal articles: Cited pattern

Journal Name	No. of Cited Papers						No. of Uncited Papers						Total
	M	MM	MF	F	FM	FF	M	MM	MF	F	FM	FF	
The Electronic Library	88 (14.1%)	143 (22.91%)	76 (12.17%)	54 (8.65%)	52 (8.33%)	71 (11.37%)	23 (3.68%)	37 (5.92%)	21 (3.36%)	16 (2.56%)	19 (3.04%)	24 (3.84%)	624
Journal of Documentation	67 (12.52%)	59 (11.02%)	15 (2.8%)	25 (4.67%)	20 (3.73%)	11 (2.05%)	115 (21.49%)	93 (17.38%)	26 (4.85%)	41 (7.66%)	36 (6.72%)	27 (5.04%)	535
Journal of Information Literacy	13 (8.84%)	1 (0.68%)	2 (1.36%)	27 (18.36%)	4 (2.72%)	4 (2.72%)	24 (16.32%)	6 (4.08%)	4 (2.72%)	51 (34.69%)	3 (2.04%)	8 (5.44%)	147
SRELS Journal of Information Management	58 (11.3%)	22 (4.28%)	35 (6.82%)	78 (15.2%)	18 (3.5%)	51 (9.94%)	59 (11.5%)	23 (4.48%)	20 (3.89%)	72 (14.03%)	26 (5.06%)	51 (9.94%)	513
TOTAL	226 (12.42%)	225 (12.36%)	128 (7.03%)	184 (10.11%)	94 (5.16%)	137 (7.53%)	221 (12.14%)	159 (8.74%)	71 (3.9%)	180 (9.89%)	84 (4.61%)	110 (6.04%)	1819

Table 5: UK: Gender and Cited/Uncited Cross tabulations

Count					Test Statistics
		Cited/Uncited		Total	Pearson Chi-Square=3.063
		Uncited	Cited		
Gender	Male	446	578	1024	$df=1$
	Female	379	416	795	
Total		825	994	1819	Asymp. Sig. (2-sided)= .044

*Significant at 0.05 level

with a vast margin of difference compared to other journals. When considered at individual level the Journal of Information Literacy shows female supremacy with 44.25% citations. The Journal of Documentation tabulated maximum citations in favour of male-male co-authorship with 33.31% and further by male solo papers (27.01%). The Electronic Library exhibits highest share of percentage in the category of male-male (MM) co-authorship accompanied by

male as first authors (MF) i.e. 18.19 %articles. While Library Management exposit 24.92% female single author with highest citations and next comes male only (M) authored papers with 22.85% citations.

H_{03} : Number of citations to publication is independent of gender make up of authorship patterns in the journal literature of the country UK.

Table 6: UK: Gender combinations and citations received

Journal Name	M	MM	MF	F	FM	FF	Total
Journal of Information Literacy	53 (30.45%)	5 (2.87%)	7 (4.02%)	77 (44.25%)	16 (9.19%)	16 (9.19%)	174 (2.5%)
Journal of Documentation	467 (27.01%)	576 (33.31%)	88 (5.08%)	289 (16.71%)	200 (11.56%)	109 (6.3%)	1729 (24.87%)
The Electronic Library	719 (18.02%)	1069 (26.79%)	726 (18.19%)	436 (10.92%)	501 (12.55%)	539 (13.5%)	3990 (57.39%)
Library Management	242 (22.85%)	97 (9.15%)	185 (17.46%)	264 (24.92%)	95 (8.97%)	176 (16.61%)	1059 (15.23%)
Total	1481 (21.3%)	1747 (25.12%)	1006 (14.47%)	1066 (15.33%)	812 (11.68%)	840 (12.08%)	6952

Table 7: Kruskal-Wallis Test: The Comparison of Citation to Publication and author gender combinations in UK

Ranks				Test Statistics
	Collaboration_recode	N	Mean Rank	Citation
Citation	M	447	862.33	Chi-Square=23.088
	MM	384	959.71	
	MF	199	1014.71	
	F	364	845.41	Df=5
	FM	178	932.35	
	FF	247	913.70	Asymp. Sig.= .000
	Total	1819		

*Significant at 0.05 level

The table 7 renders chi square value = 23.088 and p value is less than 0.05 so at 95% confidence interval we reject null hypothesis and conclude

that number of citations to publications varies according to different author-gender teams of authorship patterns.

MANN-WHITNEY TEST

The mean rank of male-male authorship pattern is high than Male solo author and the p value is less than 0.05 so at 95% confidence interval we reject the null hypothesis and conclude that there is significant difference in number of citation to publication between Male-Male and Male only authorship patterns. The results on

Mann-Whitney test for citation data across author collaborations has found significant difference between the following authorship affiliations and the citations received by MM and F ($U=61030.500$, $p=.002$); M and MM ($U=76616.500$, $p=.005$) and M and MF ($U=36967.500$, $p=.000$) MF and F ($U=29300.500$, $p=.000$) and MF and FF ($U=21842.500$, $p=.036$)

Table 8: UK: Gender-wise designation of authors

	Teaching		Non-Teaching		Research Scholars		Student		Others		
Journal Name	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
The Electronic Library	215 (34.46%)	132 (21.15%)	127 (20.35%)	78 (12.5%)	42 (6.73%)	24 (3.85%)	3 (0.48%)	3 (0.48%)	0	0	624
Journal of Documentation	270 (50.47%)	103 (19.25%)	58 (10.84%)	37 (6.92%)	24 (4.49%)	20 (3.74%)	0	0	15 (2.8%)	8 (1.49%)	535
Journal of Information Literacy	9 (6.12%)	23 (15.65%)	39 (26.54%)	72 (48.98%)	0	0	0	0	1 (0.68%)	3 (2.04%)	147
Library Management	68 (13.26%)	88 (17.15%)	13 (2.57%)	203 (39.57%)	15 (2.92%)	5 (0.97%)	1 (0.19%)	1 (0.19%)	0	0	513
Total	562 (30.90%)	346 (19.02%)	356 (19.57%)	390 (21.44%)	81 (4.45%)	49 (2.70%)	4 (0.22%)	4 (0.22%)	16 (0.88%)	11 (0.60%)	1819

The table 8 depicts a non-consistent trend with 270 (50.47%) contributions in Journal of Documentation and in Electronic Library 215 (34.45%) articles from male teaching category has shown high involvement but in Journal of Information Literacy 72 (48.98%) and in Library Management 203 (39.57%) female non-teaching contributions are prominent.

H_{04} = Productivity of male and female authors is not independent of their professional status in UK.

UK: Professional Designation and Gender Cross tabulation

The table 9 represents productivity of male and female authors' is not independent of their

Table 9: UK: Professional Designation and Gender Cross tabulation

Count					
		Gender		Total	
		Male	Female		
Professional designation	Teaching	562	346	908	Pearson Chi-Square= 39.027
	Non-Teaching	356	390	746	
	Research Scholar	81	49	130	
	Others	25	10	35	
Total		1024	795	1819	Asymp. Sig. (2-sided)=.000

*Significant at 0.05 level

UK: Gender wise national and international collaboration

The table 10 reveals that in UK journal literature males collaborates in high numbers at both levels within the country 75(57.69%) and outside the native country 531(56.97%) but less number of female collaborations within UK 55(42.3%) and with other international countries 401(43.02%) are witnessed.

Table 10: UK: Gender wise national and international collaboration

	National	International
Male	75(57.69%)	531(56.97%)
Female	55(42.30%)	401(43.02%)
Total	130(12.24%)	932(87.76%)

CONCLUSION

The study observed that the gender gap still persists in the publication productivity of the total male and female author population among LIS professionals in UK. The study proved gender differences in the dataset of UK though the difference is marginal Male as solo author as well as a co-author in the same gender co-authorship pattern is the most common author gender combination partially in UK. In the area of citation received by articles published in UK periodicals, the author population shows a balanced approach with 50:50 ratio i.e. in two journals male authors supersedes and in the other two female author population. The research output in the journals studied does not depend on the gender with marginal differences in cited and citation pattern in different co-author collaborations. The publication patterns of men and women LIS

researchers in the four studied journal has been almost equal with no gender bias. Further studies in the LIS field should be undertaken considering academic status, work experience and social cultural background of both the gender to draw in-depth conclusions.

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