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Publications Pattern and Collaborations Trend in Webology Journal during 2010-2019: A Bibliometric Analysis

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ABSTRACT

The present study analyses the papers published in Webology journal from 2010 to 2019. The parameters used in the study were: distribution of articles, Authorship Patterns, Collaboration Index (CI), Degree of Collaboration (DC), Collaboration Coefficient (CC), Modified Collaboration Coefficient (MCC), Growth Rate, Lotka's law, distribution of references and length of references. The study reveals that a total of 138 scholarly papers have been published by the LIS professionals across the world. Iran ranked first among the researchers of different countries. The study reveals that the highest number of articles appeared during 2019 and has the maximum Collaboration Index, Collaboration Coefficient, and Modified Collaboration Coefficient. Majority of the contributions received from two authored publications with 28.14% and have an average collaboration of 0.89 which means a presence of good collaboration. A total of 4097 references were observed, where the year 2019 has the highest references (914, 22.31%).

INTRODUCTION

Bibliometrics is one of the popular techniques or metric studies that help to evaluate the characteristics of subjects and the nature of citations in various forms and branches of knowledge. The meaning of Bibliometrics is simply considered to be *"the measurement of the book",* including both the printed and non-printed documents. The term Bibliometrics is derived from the sum of two different words *"Biblio"* and *"metrics"*. The word *Biblio* is derived from the combination of the Latin and Greek word *Biblion* meaning *book* or *paper* while the word *metrics* indicates the science of meter, i.e. measurement and is also derived either from the Latin word *metrics* or the Greek word *metrikon*, both meaning measurement (Santhi, 2008).

Although the term *"Bibliometrics"* is a recent origin but the techniques and the studies of Bibliometrics were performed much earlier from the beginning of the 20th century. Alan Pritchard introduced the term *"Bibliometrics"* in 1969 replacing the earlier term *"Statistical bibliography"* in his paper published in the *Journal of Documentation*. According

to him, the term *"Statistical Bibliography"* used by E. W. Hulme during 1923 is not at all satisfactory as he considered the term is "*very clumsy, not very descriptive and can be confused with statistics itself or bibliographies on statistics*".

Periodicals are the most important sources of current information for education and research (Kumbar, Hadagali and Seema, 2007). However, Journal articles are the final output of most research and a researcher's performance and productivity are judged largely on the number of publications as well as where they appear (Rallison, 2015). Webology is an online worldwide peer-reviewed journal in the English language. Moreover, it serves as a forum for discussion and interpretation of new ideas and research areas particularly for communication of information within the World Wide Web platform. Webology mainly concerns the incorporation of generation, collection, distribution, transmission, and dissemination of information. Since Webology is particularly based on the World Wide Web, it provides immediate access to all the journal articles to the definite user. Webology is a fully open access journal that disseminates its content to the user immediately after the publication. Whereas, if the author wants the contents can be permitted to utilize both in non-commercial and commercial medium but by providing proper credentials to the author and journal. Webology mainly encourages the authors to share their research articles, to cite other's work, and provides an appropriate repository to archive those works of literature. It also helps the authors on the retainment of copyright to their work; free access to all the worldwide users which in turn increases the visibility of the authors and acquires recognition with rapid publication.

Literature Review

Yadav, Singh and Verma (2019) evaluated the authorship and collaboration pattern in SRELS Journal of Information Management during 2008-2017. A total of 578 articles were published during the study time frame, out of which 196 articles were contributed by single authors and the remaining 386 articles were contributed either by two authors or more two authors. From this, it was obvious that multiple authorship pattern was more prevalent than single authorship pattern and where the average collaboration index is 1.86, average collaboration coefficient is 0.36, the average degree of collaboration is 0.66, the average relative growth rate is 0.32 and average doubling time is 3.40. The maximum activity index was observed for India in the year 2009 whereas the minimum activity index is seen in the year 2013.

Lavanya and Madhu (2018) conducted a bibliometric study on the Aslib Journal of Information Management for the period from 2008 to 2017. It is observed from the study that the highest number of articles i.e., 46 (11.59%) have appeared in the year 2017. The minimum number of contributions, i.e. 37 (9.32%) were published in the year 2015. The majority of the contributions were received from two authored publications with 280 (41.60%) records. The article 145 has page length between 16-20 pages. The Degree of Collaboration recorded was 0.83, with a clear indication of the dominance of the multi-authored publications.

Mondal and Jana (2018) evaluated the research publications of the three leading Indian LIS journals that is Annals of Library and Information Studies' (ALIS), 'DESIDOC Journal of Library & Information Technology' (DJLIT) and 'SRELS Journal of Information Management' (SRELS) during 2012-2017. By mapping the authorship pattern and collaboration trend, it is observed that two-authored papers are more dominant (48%); B. M. Gupta as the most prolific author; out of 900 articles, 2.18 average citation have been found.

It is found that the trends of collaboration are slightly fluctuating in the collaboration trend of Indian LIS publications by years.

The study conducted by Shukla, Yadav and Verma (2018) aims to analyze the publication pattern based on the bibliometric parameters of the Journal of Agricultural Extension from 2008 to 2017. The study reveals that a total of 303 articles have been published with 0.33% average author productivity and a maximum number of articles, i.e. 47 (15.51%) published in the year 2017. Nigeria was on the top list with 289 (95.38%) contributions, followed by Kenya with 3 (0.99%) contributions and occupied the second position in the list.

Verma, Yadav and Singh (2018) analyze the publication pattern of papers published in Library Philosophy and Practice (e-journal) from 2008 to 2017. During the period, a total of 1478 scholarly papers were published and observed a vibrant growth rate. Majority of the papers published with a collaborated authorship pattern with 0.61 average Degree of Collaboration. The geographical coverage of the journal was high with 35 countries coverage. Nigeria, India and the USA were respectively the topmost countries to contribute to this journal. There was a total of 34,907 references cited in 1478 articles and the majority of them were single-authored and most of the papers have less than 20 references.

Singh (2017) investigates the publication trends in Pearl: A Journal of Library and Information Science during 2011-2016. The study covers 223 research papers in Pearl that were published in 24 issues of 6 volumes. Maximum 43 (19.29%) papers were published in the volume number 5 papers in 2011. 97 (43.50%) papers were two-authored and 87 (39.02%) were single-authored, the average author productivity per author was 0.55 during 2011-2016. A great number of 81 (19.95%) authors from Karnataka State had contributed their papers in Pearl. 367 (90.40%) Indian and 39 (9.61%) foreign authors also contributed their papers in the journal.

Velmurugan and Radhakrishnan (2016) conducted a bibliometric study on Indian Journal of Biotechnology with 448 contributions for a period between 2007 and 2012. The results revealed that the highest number of contributions i.e., 87 (19.41 %) were published in 2007. The highest number, i.e. 436 (97.33 %) articles were contributed by joint authors and the rest i.e. 12 (2.67 %) articles contributed by single authors. The Degree of Collaboration was 0.97. The average length of the articles varied from a minimum of 5.94 pages in the year 2012. The highest i.e.13,645 visitors visited the website with 21.48% during 2010.

Mondal (2015) examined the bibliometric study of 115 articles published in the Journal of Indian Library Association from 2008 to 2014. From the study, it was found that the trend of authorship patterns of articles was towards collaboration and only two authors from foreign countries contributed one article during the study period. The maximum authors were from Delhi and most numbers of articles (53.04%) were with the page length of 4-6 pages.

Awasthi (2015) conducted a bibliometric study focused on the articles published in Library Trends Journal from 2008 to 2014. The author analyzed various parameters like year-wise publications, authorship patterns, length of articles, year-wise distribution of cited articles, and authorship pattern of cited articles. The results showed that 47 (18%) articles, the highest contributions were published in Volume No 62 and 21.94% of citations were received for the year 2013-2014; 55.34% single authors made the contributions in the articles published, followed by two authors with 25.19. 30 articles and 77.38% of citations involve contributions of single authors, followed by 14.74% of citations were of two authors.

Heidari and Safavi (2013) directed a survey to find the collaborative coefficient of the publications of Iranian journal of pathology during 2006-2012. It has been observed that 1078 contributors contributed to a total of 288 articles during the study period. 3.75±1.65 was the average number of authors and three authored authorship patterns had the highest publication.

The collaborative coefficient was higher in the year 2008 with 0.81 and the average collaboration coefficient was 0.69 during these 7 years study period.

Scope of the Study

The scope of the study is confined to assess the research contributions of LIS professionals published as full-text papers in the Webology journal. The publications for ten years' duration from 2010 to 2019 of Webology have been undertaken for the present study. A total of 138 articles published in ten years duration having two volumes per year make a total of twenty volumes altogether.

Objectives of the Study

The main objective of the present study is to analyze the publications published in Webology journal for a period of ten years from 2010 to 2019.

The specific objectives of the present study are to:

1. Examine the issue and year-wise distribution of articles growth of publication during the period of study;
2. Find out the authorship pattern; Collaboration Index (CI) and assess the Degree of Collaboration (DC) among the authors;
3. Determine the Collaboration Coefficient (CC) and Modified Collaboration Coefficient (MCC) of the publications;
4. Evaluate the implementation of Lotka's law productivity;
5. Know the geographical distribution of authors; and
6. Determine the average number of references per article, authorship pattern of the cited documents and the length of references of published articles

Methodology

The present study investigates the research contributions by the authors in Webology journal through the bibliometric analysis from 2010 to 2019 (ten years). The journal was retrieved from its website i.e. http://www.webology.org/index.php. A total of 138 full-text research articles were published during 2010-2019. The bibliographic details obtained from the publications were tabulated, organized, and analyzed by using MS-Excel. The data was organized and systematized to consider diverse perspectives relating to growth rate, Collaboration Index (CI), Degree of Collaboration (DC), Collaboration Coefficient (CC), Modified Collaboration Coefficient (MCC), and Lotka's law of productivity.

Data Analysis and Interpretation

Year-wise distribution of articles

Table 1 exhibits the number of articles published in 10 volumes in Webology journal for the period from 2010 to 2019 (138). The number of publications in both the volumes i.e. 1 and 2 were the same (69 each). The highest number of articles were published during 2019 (28, 20.29%), followed by the year 2018 (18, 13.04%) respectively and the least articles were

observed during 2010 (09, 6.52%). The journal is getting overwhelming response from the LIS professionals across the world.

Table 1: Year-wise distribution of articles

Year	No. of publications			Percentage	Cumulative Frequency (CF)
	Vol. 1	Vol. 2	Total		
2010	5	4	9	6.52	6.52
2011	6	5	11	7.97	14.49
2012	4	6	10	7.25	21.74
2013	6	6	12	8.70	30.43
2014	8	7	15	10.87	41.30
2015	7	5	12	8.70	50.00
2016	7	5	12	8.70	58.69
2017	5	6	11	7.97	66.66
2018	9	9	18	13.04	79.71
2019	12	16	28	20.29	100
Total	69	69	138	100	

Annual Growth of Publications

Table 2 and figure 1 display the growth rate of the publications during 2010-2019 of the journal Webology. The journal has published a total number of 138 articles with an average annual growth rate of 14.90%. Table 2 shows a positive growth rate for the periods i.e. 2010, 2011, 2013, 2014, 2018, and 2019, whereas, 2012, 2015, and 2017 have a negative rate while 2016 shows a different view with a neutral rate. The year 2018 (63.64%) shows the highest growth rate, followed by 2019 (55.56%), whereas, 2017 (-8.33%) has the lowest negative growth rate among all. The annual growth rate is calculated by using the formula by Santha and Kaliyaperumal (2015), as:

$$r = \frac{P1 - P0}{P0} \times 100$$

Where,
  r = Publication growth in percentage
  P1= Number of publications in the present year
  P0 = Number of publications in the base year

Table 2: Annual growth of publications

Year	Publications	Growth rate	Annual Growth Percent (%)
2010	9	0	0
2011	11	0.22	22.22
2012	10	-0.09	-9.09
2013	12	0.20	20.00
2014	15	0.25	25.00
2015	12	-0.20	-20.00
2016	12	0.00	0.00
2017	11	-0.08	-8.33
2018	18	0.64	63.64
2019	28	0.56	55.56
Total	138	3.93	Average = 14.90%
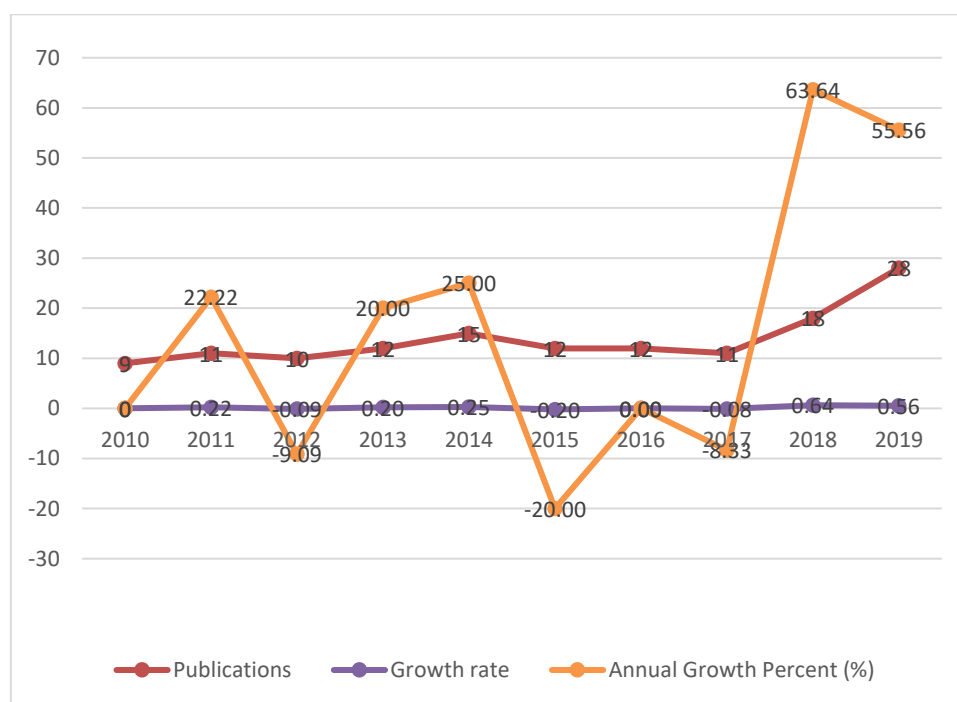
Figure 1: Annual growth of publications

Authorship Pattern

The tables 3A and 3B present the authorship pattern of the research articles published in Webology journal during 2010-2019. It is clear from table 3A that out of 334 total authors, 2019 has the highest contributors with 27.54 %, followed by 2018 (13.17%), 2014, and 2015 (9.28%) each. The years 2012 (5.09%) and 2010 (4.70%) have the least number of contributors. It can be concluded from table 3A and 3B that 26.81% of articles were published by single authors, whereas, 34.06% of the articles were two authored publications, followed by 21.74% articles were three authored publications, 9.42% articles by four authored publications respectively. It is observed from the study that two authored publications were prevailing in the journal followed by single-author publications.

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Table 3A: Year-wise authorship pattern of articles

Year	Single	Two	Three	Four	Five	Six	Seven	Sum of Articles	Total No. of Authors
2010	3	5	1	-	-	-	-	9	16 (4.79%)
2011	4	3	3	-	1	-	-	11	24 (7.19%)
2012	5	3	2	-	-	-	-	10	17 (5.09%)
2013	3	6	2	-	-	1	-	12	27 (8.08%)
2014	5	6	2	2	-	-	-	15	31 (9.28%)
2015	2	4	3	3		-	-	12	31 (9.28%)
2016	5	3	2	2	-	-	-	12	25 (7.49%)
2017	3	3	3	1	1	-	-	11	27 (8.08%)
2018	4	7	5	1	-	-	1	18	44 (13.17%)
2019	3	7	7	4	5	1	1	28	92 (27.54%)
Total	37	47	30	13	7	2	2	138	334 (100%)

Table 3B: Authorship pattern

Sl. No.	Authors	Total No. of articles	Total No. of Authors	% of Articles	% of Authors
1	Single	37	37	26.81	11.08
2	Two	47	94	34.06	28.14
3	Three	30	90	21.74	26.95
4	Four	13	52	9.42	15.57
5	Five	7	35	5.07	10.48
6	Six	2	12	1.45	3.59
7	Seven	2	14	1.45	4.19
	Total	138	334	100	100

Collaboration Index (CI)

Table 4 depicts the Collaboration Index (CI) of the publications of the journal between 2010 and 2019. The table discerns that the average Collaboration Index was 2.42 and the highest Collaboration Index was noticed in the year 2019 with 3.29, followed by the year 2015 with 2.58 while the least was observed in the year 2012 with 1.70. The Collaboration Index (CI) was calculated by using the following formula given by Lawani (1980);

$$CI = \frac{\sum_{j=1}^{A} jfj}{N}$$

Where,
j = the number authors in an article i.e. 1, 2, 3 ……
fj = the number of j authored articles
N = the total number of articles published in a year, and

A = the total number of authors per articles
Since Table 4 is calculated by the using above formula thus:
CI for 2010 is

$$
\begin{aligned}
CI &= \frac{\sum_{j=1}^{A} jfj}{N} \\
&= \frac{(1 \times 3) + (2 \times 5) + (3 \times 1) + (4 \times 0) + (5 \times 0) + (6 \times 0) + (7 \times 0)}{9} \\
&= \frac{(3) + (10) + (3) + (0) + (0) + (0) + (0)}{9} \\
&= \frac{16}{9} \\
&= 1.78
\end{aligned}
$$

Similarly, the value of CI was calculated for all the years.

Table 4: Collaboration Index (CI)

Year	Single	Two	Three	Four	Five	Six	Seven	Total	CI
2010	3	5	1	-	-	-	-	9	1.78
2011	4	3	3	-	1	-	-	11	2.18
2012	5	3	2	-	-	-	-	10	1.70
2013	3	6	2	-	-	-	-	12	2.25
2014	5	6	2	2		-	-	15	2.07
2015	2	4	3	3	-	-	-	12	2.58
2016	5	3	2	2	-	-	-	12	2.08
2017	3	3	3	1	1	-	-	11	2.45
2018	4	7	5	1	-	-	1	18	2.44
2019	3	7	7	4	5	1	1	28	3.29
Total	37	47	30	13	7	2	2	138	2.42

Degree of Collaboration among Authors

The Degree of Collaboration (C) of the contributors has been derived using the Subramanyam formula (1983):

$$
DC = 1 - \frac{f1}{N}
$$

Where,
f_1 = the number of single-authored articles
N = the total number of articles published in a year
Hence,
DC for the year 2010 is:

$$
\begin{aligned}
DC &= 1 - \frac{f1}{N} \\
&= 1 - \frac{3}{16} \\
&= 1 - 0.18 \\
&= 0.81
\end{aligned}
$$

Similarly, the value of DC is calculated for all the parallel years.

Table 5: Degree of Collaboration (DC)

Sl. No.	Year	Single Authored Article	Multiple Authored Article	Total	Degree of Collaboration
1	2010	3	13	16	0.81
2	2011	4	20	24	0.83
3	2012	5	12	17	0.71
4	2013	3	24	27	0.89
5	2014	5	26	31	0.84
6	2015	2	29	31	0.94
7	2016	5	20	25	0.80
8	2017	3	24	27	0.89
9	2018	4	40	44	0.91
10	2019	3	89	92	0.97
total		37	297	334	0.89

The Degree of Collaboration has been calculated for the period of ten years from 2010 to 2019 as shown in table 4. The total contribution of Single authors (Ns) was 37, whereas, the total contribution of the multiple authors (Nm) was 297. The Degree of Collaboration was the highest i.e. 0.97 during 2019, followed by 2015 (0.94) and 2018 (0.91) respectively. During 2013 and 2017 the DC was 0.89 respectively, followed by 2014 (0.84), 2011 (0.83). The lowest Degree of Collaboration (DC) was observed in 2012 (0.7). The Degree of Collaboration during the study period ranges between 0.71 and 0.97. The DC of the Webology journal for ten years was 0.89. It shows that the journal has a very good existence of collaborative research among the authors.

Collaboration Coefficient (CC)

Table 6 displays the Collaboration Coefficient of the publications during the period 2010-2019. The Webology journal has published a total number of 138 articles with an average Collaboration Coefficient of 0.45. The year 2019 has the highest Collaboration Coefficient i.e. 0.60, followed by 2015 (0.52) and 2018 (0.47) respectively. The year 2012 has the lowest Collaboration Coefficient with 0.28. The Collaboration Coefficient (CC) was calculated by using the formula devised by Ajiferuke et al. (1988) which is shown as below:

$$CC = 1 - \frac{\sum_{j=1}^{A} \left(\frac{1}{j}\right) fj}{N}$$

Where,
j = the number authors in an article i.e. 1, 2, 3 ……
fj = the number of j authored articles
N = the total number of articles published in a year, and
A = the total number of authors per articles
Thus, table 6 is calculated by the using above formula thus:
CC for 2010 is

$$CC = 1 - \frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}$$

$$= 1 - \frac{\left(\frac{1}{1}\times 3\right) + \left(\frac{1}{2}\times 5\right) + \left(\frac{1}{3}\times 1\right) + \left(\frac{1}{4}\times 0\right) + \left(\frac{1}{5}\times 0\right) + \left(\frac{1}{6}\times 0\right) + \left(\frac{1}{7}\times 0\right)}{9}$$

$$= 1 - \frac{(3) + (2.5) + (0.33) + (0) + (0) + (0) + (0)}{9}$$

$$= 1 - \frac{5.83}{9}$$

$$= 1 - 0.64$$

$$= 0.35$$

Similarly, the value of CC was calculated for all the years.

Table 6: Collaboration Coefficient (CC)

Year	Single	Two	Three	Four	Five	Six	Seven	Total	CC
2010	3	5	1	0	0	0	0	9	0.35
2011	4	3	3	0	1	0	0	11	0.39
2012	5	3	2	0	0	0	0	10	0.28
2013	3	6	2	0	0	1	0	12	0.43
2014	5	6	2	2	0	0	0	15	0.39
2015	2	4	3	3	0	0	0	12	0.52
2016	5	3	2	2	0	0	0	12	0.36
2017	3	3	3	1	1	0	0	11	0.46
2018	4	7	5	1	0	0	1	18	0.47
2019	3	7	7	4	5	1	1	28	0.60
Total	37	47	30	13	7	2	2	138	0.45

Modified Collaboration Coefficient (MCC)

Table 7 reveals the Modified Collaboration Coefficient of the publication during the 2010-2019 of Webology journal. The table discerns that the average Modified Collaboration Coefficient was 0.45 and the year 2019 has the highest Collaboration Coefficient with 0.62, followed by the year 2015 and 2017 with 0.57 and 0.51 respectively. While 2012 has the lowest Collaboration Coefficient with 0.31 value. The Modified Collaboration Coefficient (MCC) was calculated by using the formula suggested by Savanur and Srikanth (2010) as shown below:

$$MCC = \left(\frac{N}{N-1}\right)\left\{1 - \frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}\right\}$$

MCC for 2010 is

$$\text{MCC} = \left(\frac{N}{N-1}\right)\left\{1 - \frac{\Sigma_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}\right\}$$

$$= \left(\frac{9}{8}\right)\left\{1 - \frac{\left(\frac{1}{1}\times 3\right)+\left(\frac{1}{2}\times 5\right)+\left(\frac{1}{3}\times 1\right)+\left(\frac{1}{4}\times 0\right)+\left(\frac{1}{5}\times 0\right)+\left(\frac{1}{6}\times 0\right)+\left(\frac{1}{7}\times 0\right)}{9}\right\}$$

$$= (1.12)\left\{1 - \frac{(3)+(2.5)+(0.33)+(0)+(0)+(0)+(0)}{9}\right\}$$

$$= (1.12)\left\{1 - \frac{5.83}{9}\right\}$$
$$= (1.12)\{1 - 0.64\}$$
$$= 1.12 \times 0.35$$
$$= 0.40$$

Similarly, the value of MCC was calculated for all the years.

Table 7: Modified Collaboration Coefficient (MCC)

Year	Single	Two	Three	Four	Five	Six	Seven	Total	MCC
2010	3	5	1	0	0	0	0	9	0.40
2011	4	3	3	0	1	0	0	11	0.43
2012	5	3	2	0	0	0	0	10	0.31
2013	3	6	2	0	0	1	0	12	0.47
2014	5	6	2	2	0	0	0	15	0.42
2015	2	4	3	3	0	0	0	12	0.57
2016	5	3	2	2	0	0	0	12	0.39
2017	3	3	3	1	1	0	0	11	0.51
2018	4	7	5	1	0	0	1	18	0.50
2019	3	7	7	4	5	1	1	28	0.62
Total	37	47	30	13	7	2	2	138	0.45

Application of Lotka's Law of Scientific Productivity

Lotka's law of scientific productivity was used to evaluate and calculate the authors' productivity. The Lotka's law states that *"The number of authors making n contributions is about 1/n2 of those making one and proportion of all contributors that make a single contribution is about 60 percent. This means that out of all the authors in a field, 60% will have one publication, and 15% will be two publications, 7% of authors will have three publications, and so on"*.

Table 8 and figure 3 shows the application of Lotka's law of scientific productivity on the publication of papers on the data set of Webology journal during 2010-2019. The results indicate that the distribution of one article published was only 37, representing 26.81% authors which were both observed and anticipated. Two articles contribution i.e. 47 constituting 34.06%, while 19 constituting 13.45% authors were expected. Therefore, it is found that the numbers of authors observed are very different from the number of authors

expected, so it does not follow Lotka's law of productivity. The Lotka's law scientific productivity of authors was calculated using the following formula:

$$Y = \frac{C}{X^n}$$

Where,

X = Number of Publications

Y = Relative Frequency of Authors with X publications

C = Constants depending on the specified field

Table 8: Lotka's law of scientific productivity

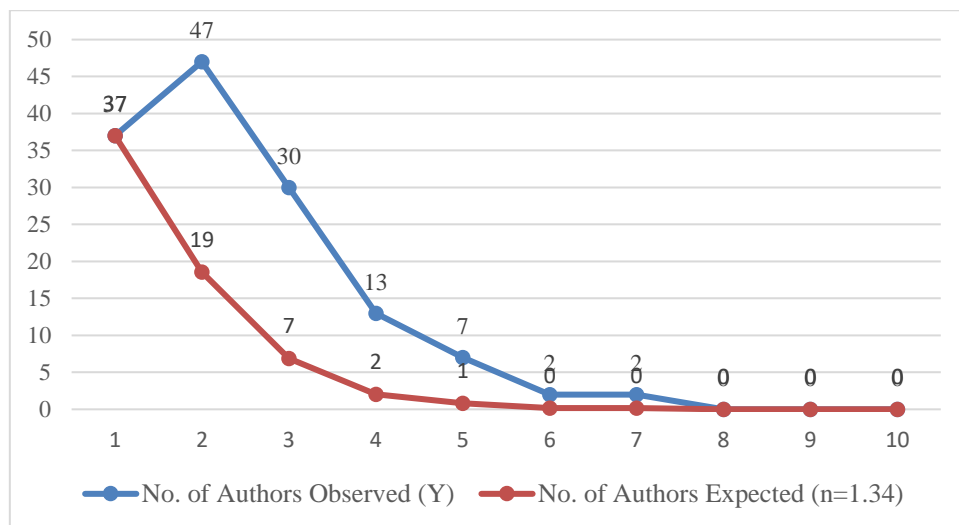| No. of Articles (X)	No. of Authors Observed (Y)	Percentage Observed	No. of Authors Expected (n=1.34)	Percentage Expected
1	37	26.81	37	26.81
2	47	34.06	19	13.45
3	30	21.74	7	4.99
4	13	9.42	2	1.47
5	7	5.07	1	0.59
6	2	1.45	0	0.13
7	2	1.45	0	0.11
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0

Figure 3: Lotka's law of scientific productivity

Geographical distribution of Authors

Table 9 shows the country-wise distribution of authors. From the study, it is clear that Iran has the highest number of contributors to Webology journal with a total of 135 authors (40.42%) out of 334 contributors. India with 49 (14.67) articles ranked second, Ukraine (25, 7.49%), United States of America (21, 6.29%), and Russia (15. 4.49%) ranked third to fifth respectively. Bulgaria, China, and Hungary have the least article (1 each).

Table 9: Geographical distribution of authors

Sl. No.	Geographical area	Number of articles	Percentage (%)	Rank
1	Iran	135	40.42	1
2	India	49	14.67	2
3	Ukraine	25	7.49	3
4	USA	21	6.29	4
5	Russia	15	4.49	5
6	Nigeria	11	3.29	6
7	UK	9	2.69	7
8	Finland	7	2.10	8
9	Germany	7	2.10	8
10	Indonesia	5	1.50	9
11	Pakistan	5	1.50	9
12	Australia	4	1.20	10
13	Italy	4	1.20	10
14	Syria	4	1.20	10
15	Estonia	3	0.90	11
16	Netherland	3	0.90	11
17	Oman	3	0.90	11
18	Saudi Arabia	3	0.90	11
19	Bangladesh	2	0.60	12
20	Iraq	2	0.60	12
21	Malaysia	2	0.60	12
22	Peru	2	0.60	12
23	Portugal	2	0.60	12
24	Serbia	2	0.60	12
25	Singapore	2	0.60	12
26	South Africa	2	0.60	12
27	Spain	2	0.60	12
28	Bulgaria	1	0.30	13
29	China	1	0.30	13
30	Hungary	1	0.30	13
	Total	334	100	

Reference distribution Pattern

Table 10 displays the average number of references per article. The authors have provided references at the end of each article. A total of 4097 references were observed in 138 articles constituting an average reference per article to approximately 30. During 2019 a total of 914 references were given in 28 articles (constituting an average of approximately 32 per article) with 22.31 %, followed by 2018 (18 articles, 487 total references with 11.89%), 2014 (15 articles, 435 references with 10.62%) respectively. During 2010 the least number of articles were published in Webology so also references (216, 5.27%). The other details are presented in table 10. The study shows that if the number of articles increases in a year then the number of references also increases.

Table 10: Reference distribution pattern

Sl. No.	Year	No. of Articles	No. of References	%	Cumulative frequency (Cf)
1	2010	9	216	5.27	5.27
2	2011	11	310	7.57	12.84
3	2012	10	377	9.20	22.04
4	2013	12	293	7.15	29.19
5	2014	15	435	10.62	39.81
6	2015	12	405	9.89	49.69
7	2016	12	247	6.03	55.72
8	2017	11	413	10.08	65.80
9	2018	18	487	11.89	77.69
10	2019	28	914	22.31	100
Total		138	4097	100	

Authorship Pattern in Article References

The tables 11A and 11B reveal the year-wise authorship pattern of the cited references from 2010 to 2019 in the journal of Webology. Out of 4097 references, single-authored publications found to be the highest, i.e. 1339 (32.68%), followed by two authored publications (1041, 25.41%), three authored (700, 17.09%) respectively. The study also reveals that there were seven authored publications with 45 references, followed by eight authored publications with 11 references. Out of 4097 references, 315 references belong to organizations. The study indicates that if the number of authors is less more documents were referred by the authors and vice-versa.

Table 11A: Year-wise authorship pattern of article references

Year	Single	Two	Three	Four	Five	Six	Seven	Eight	Organization	Total
2010	113	68	19	10	-	1	-	-	5	216
2011	152	71	40	12	3	1	-	1	30	310
2012	151	64	39	9	3	3	-	1	107	377

2013	117	70	47	19	6	3	1	1	29	293
2014	159	127	84	40	8	7	1	-	9	435
2015	78	131	86	50	21	7	5	-	27	405
2016	121	63	21	9	11	7	2	-	13	247
2017	77	98	102	58	36	12	10	1	19	413
2018	142	134	88	47	28	7	3	-	38	487
2019	229	215	174	130	61	37	23	7	38	914
Total	1339	1041	700	384	177	85	45	11	315	4097

Table 11B: Authorship pattern of reference articles

Sl. No.	Authors	No. of references	%	Cumulative frequency (Cf)
1	Single	1339	32.68	32.68
2	Two	1041	25.41	58.09
3	Three	700	17.09	75.17
4	Four	384	9.37	84.55
5	Five	177	4.32	88.87
6	Six	85	2.07	90.94
7	Seven	45	1.10	92.04
8	Eight	11	0.27	92.31
9	Organization	315	7.69	100
	Total	4097	100	

Length of References

Table 12 displays the length of the references per article published in Webology from 2010 to 2019. The table has been systematically arranged in five categories. It is observed from the study that there were 68 articles (out of 138 articles) with less than twenty references, whereas, 46 articles have references between 21 and 40, followed by 13 articles have references in the range from 41 to 60 respectively. There were 6 articles with more than eighty references.

Table 12: Length of references

Sl. No.	References	No. of Articles	Percentage (%)
1	Below 20	68	49.28
2	21-40	46	33.33
3	41-60	13	9.42
4	61-80	5	3.62
5	Above 80	6	4.35
	Total	138	100

Findings and Conclusion

   Bibliometrics study is one of the established areas of research in library and information science field and by using the bibliometrics techniques and laws various quantitative studies has been conducted across the world. In present study is an analysis of publications and collaborations pattern of Webology journal on the basis of bibliometric parameters. During the study period, Webology has published 138 research articles from 2010 to 2019 which covers 20 volumes and year 2019 founded as highest productive year for journal. By analyzing the authorship pattern of the authors, it is discovered that two authors and single authorship patterns have produced the highest contributions. The average collaboration index of the publications was 2.42. The degree of collaboration among authors during this period is 0.89 which is quite satisfactory with 0.45 average collaboration coefficient and the modified collaboration coefficient of the published articles. It was also found that the publication trends of webology do not follow the Lotka's law of author's productivity fully and there is no relation between the number of authors observed and the number of authors expected. In the geographical distribution of authors, it is seen that the country Iran has a maximum number of contributors followed by India and Ukraine. The reference analysis of published paper in Webology shows that 2019 and 2018 have acquired the maximum numbers of references and single and two authors were dominating in authorship pattern of cited authors in reference while about half of the papers having less than 20 references.

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