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Scientometric Analysis of Contributions to the Journal College and Research Libraries (1997-2011)

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Abstract:

In this study an attempt is made to investigate the scholarly communications in College & Research Libraries journal during the period of 1997-2011 and to study the key dimensions of its publication trends. For the analysis of the study 15 volumes containing 90 issues have been taken up for evaluation. Necessary bibliometric measures are applied to analyse different publication parameters. It is found that, contributions of articles to each volume of College & Research Libraries is nearly consistent and on an average 32 articles have been published every year. Single authored articles are found to be the highest followed by two and three authored articles. The average degree of collaboration in College & Research Libraries is 0.57. The average author per article is 1.88 for 479 articles. Lotka's law is tested and confers to a value of n=3.22. In all 12893 citations have been appended to 479 articles during the period 1997-2011. Journals (59.95 per cent) are the top form of source used by authors followed by books (17.32 per cent), webpages (7.44 per cent) and reports (3.95 per cent). Ranked list of prolific authors and ranked list of journals is prepared and presented in respective tables. Deborah D Blecic and Stephen E Wiberley have topped the ranked list of prolific authors with 6 articles each. College & Research Libraries which is also the source journal of this study has topped the ranked list of journals with 1311 (16.96 per cent) citations. USA has topped the list of ranking of country productivity with 93.24 per cent contributions followed by Canada and China.

Keywords:

Scientometrics, Bibliometrics, Authorship Pattern, Lotka's Law, Author Productivity, Degree of Collaboration

Introduction:

The term Scientometrics is coined by Vassily V Nalimov and Z M Mulchenko in 1969 which is the Russian equivalent of 'naukometriya'. According to Tague-Sutcliffe Scientometrics is the study of the quantitative aspects of science as a discipline or economic activity. It is part of sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities, including, among others, publication and so overlaps bibliometrics to some extent. The focus of Scientometrics is the measurement of science and is therefore concerned with the growth, structure, interrelationship and productivity of scientific disciplines (Hood & Wilson, 2001). Scientometrics is also defined as the quantitative study of science, communication in science and science policy.

Source Journal:

College & Research Libraries is the bi-monthly peer reviewed scholarly research journal of the Association of College & Research Libraries, a division of the American Library Association. Founded in 1939, College & Research Libraries is the "premier scholarly journal for the publication of empirical research in academic librarianship." College & Research Libraries publishes original research on all aspects of academic librarianship, including academic library collections and services, digital libraries, emerging technologies in libraries, library assessment, library leadership, libraries and information technology in higher education, scholarly and professional publishing in library and information science, and library and information science education. Apart from articles, College & Research Libraries also publishes guest editorials and book reviews. It was Quarterly for first 18 years and bi-monthly since 1956. College & Research Libraries became an Open Access publication in 2011. This journal can be accessed from the URL: crl.acrl.org

Objectives of the Study:

- To map year-wise distribution of articles
- To find the average length of articles
- To examine the authorship pattern of the contributions
- To study author productivity
- To test Lotka's inverse square law of scientific productivity
- To study the range and percentage of references per article
- To determine degree of collaboration among single and multiple authors
- To study type and number of citations
- To analyze the use of various types of documents by the authors

- To identify and prepare ranked list of authors
- To identify and prepare ranked list of journals

Methodology:

The data required for the study was collected from the electronic version of the journal for the period 1997-2011. The references appended to each article were carefully scanned and tabulated in respective tables using Microsoft Excel. The details regarding number of articles, authorship pattern, author productivity, range of length of articles etc., are collected to fulfill the objectives of the present study. The authorship pattern has been analysed by using K Subramanyam's degree of collaboration in quantitative terms. Average author per paper and productivity per author have been calculated using formula given by Yoshikane et al…. Required bibliometric measures were employed to carryout this study. Following section discusses the analysis of the data collected and presented under different table headings as per the objectives of the study.

Analysis:

Distribution of Contributions:

Table 1 – Volume-wise distribution of contributions

Year	Vol. No.	Issues	Total Publications	%
1997	58	6	34	**7.10**
1998	59	6	37	**7.72**
1999	60	6	37	**7.72**
2000	61	6	36	**7.51**
2001	62	6	34	**7.10**
2002	63	6	36	**7.51**
2003	64	6	26	**5.43**
2004	65	6	26	**5.43**
2005	66	6	28	**5.84**
2006	67	6	32	**6.68**
2007	68	6	31	**6.47**
2008	69	6	29	**6.05**
2009	70	6	30	**6.26**
2010	71	6	33	**6.89**
2011	72	6	30	**6.26**
15 years	15 Vols	90 Issues	479 articles	

Table 1 depicts the number of research papers published from 1997 to 2011. The study shows that the highest number of 37 papers are published in the years 1998 and 1999 followed by 36 papers in the years 2000 and 2002. The lowest number of 26 papers are published in the years 2003 and 2004 followed by 28 papers in the year 2005. In all, 497 research articles were published during the period 1997-2011. The journal on an average published 5 papers per issue. The number of papers published each year is nearly consistent.

Length of articles:

Table 2: Length of the articles

Year	0-5	6-10	11-15	16-20	21-25	>=26	Total
1997	1	12	17	4	0	0	34
1998	0	19	16	1	1	0	37
1999	1	14	18	2	2	0	37
2000	2	20	13	1	0	0	36
2001	0	15	14	4	0	1	34
2002	0	13	15	8	0	0	36
2003	1	5	9	7	2	2	26
2004	0	3	13	3	1	6	26
2005	1	4	10	9	3	1	28
2006	0	9	11	7	5	0	32
2007	0	5	15	8	2	1	31
2008	0	5	12	7	5	0	29
2009	0	6	12	6	6	0	30
2010	0	6	16	5	4	2	33
2011	0	4	10	10	5	1	30
Total	6	140	201	82	36	14	479
%	**1.25**	**29.23**	**41.96**	**17.12**	**7.52**	**2.92**	

The length of articles is shown in Table 2 where it is found that 201 (41.96 per cent) articles had page length in the range of 11-15 pages followed by 140 articles (29.23 per cent) in the page range of 6-10. There are 14 (2.92 per cent) articles having more than or equal to 26 pages.

Authorship pattern:

Table 3: Authorship pattern of contributions (Volume-wise)

Year	Vol. No.	Single	Two	Three	Four	Five	Six	Seven	Total
1997	58	13	14	5	2	0	0	0	34
1998	59	19	13	3	0	0	2	0	37

1999	60	17	12	5	2	1	0	0	37
2000	61	18	12	5	1	0	0	0	36
2001	62	18	12	4	0	0	0	0	34
2002	63	13	18	3	2	0	0	0	36
2003	64	10	14	2	0	0	0	0	26
2004	65	11	8	7	0	0	0	0	26
2005	66	9	12	5	1	0	0	1	28
2006	67	11	12	5	4	0	0	0	32
2007	68	13	7	6	1	1	2	1	31
2008	69	17	9	3	0	0	0	0	29
2009	70	12	8	7	1	1	0	1	30
2010	71	17	9	5	2	0	0	0	33
2011	72	9	14	3	3	0	0	1	30
Total		207	174	68	19	3	4	4	479
%		**43.21**	**36.32**	**14.2**	**3.97**	**0.63**	**0.84**	**0.84**	

The authorship pattern was analysed to determine the percentage of single and multiple authors. From above Table 3 it is revealed that single authored contributions have dominated this journal. Single authored contributions accounts for 207 papers (43.21 per cent), two authored papers are 174 (36.32 per cent), three authored papers are 68 (14.20 per cent), four authored papers are 20 (4.18 per cent) and more than four authored papers are 10 (2.09 per cent). In all, multiple authored papers have contributed 272 papers (56.78 per cent) of total publications during the period 1997-2011.

Author Productivity:

Table 4: Author Productivity

Year	Total Number of Papers	Total Number of Authors	AAPP	Productivity per author
1997	34	64	1.88	0.53
1998	37	66	1.81	0.56
1999	37	69	1.86	0.53
2000	36	61	1.69	0.59
2001	34	54	1.59	0.63
2002	36	66	1.83	0.54
2003	26	44	1.69	0.59
2004	26	48	1.84	0.54
2005	28	59	2.11	0.47
2006	32	66	2.06	0.48
2007	31	73	2.35	0.42
2008	29	44	1.52	0.66

2009	30	65	2.17	0.46
2010	33	58	1.76	0.57
2011	30	65	2.17	0.46

Yoshikane et al (2009) in their paper published in Scientometrics journal have given a formula to calculate Average Author Per Paper (AAPP) and Productivity Per Author. The formula is mathematically represented as below:

Average Author Per Paper = No. of Authors/No. of Papers
Productivity Per Author = No. of Papers/No. of Authors

Table 4 depicts the data pertaining to author productivity and average author per paper. It is revealed from Table 4 that the average number of authors per article is 1.88 for 479 articles published between the period 1997-2011. It is also clear from above Table 4 that for the years 2000 & 2003 and 2009 & 2011 equal average number of authors per article is recorded i.e., 1.69 and 2.17 respectively.

The average productivity per author for the period 1997-2011 is 0.53. The years 2000 & 2003, 2002 & 2004 and 2009 & 2011 have recorded equal productivity per author i.e., 0.59, 0.54 and 0.46 respectively.

Study of Lotka's Law:

Lotka's law describes the frequency of publication by authors in a given field by using the formula:

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

Where, Y is the number of authors credited with X (1, 2, 3, 4……) papers
C is the number of authors contributing one paper
And n is rate (usually n=2)

In the present study 739 authors have contributed 479 articles published during the publication phase of 1997-2011. There are 634 (85.80%) authors contributing one article, 68 (9.20%) authors contributing two articles, 23 (3.11%) authors contributing 3 articles, 9 (1.22%) authors contributing 4 articles, 3 (0.40%) authors contributing 5 articles and 2 (0.27%) contributing 6 articles.

To study the Lotka's law to confirm author productivity following table is prepared.

Table 5: Number of Authors Vs. Articles

No. of Articles, X	No. of Authors (Observed)	Observed %	No. of Authors (Expected)	Expected %
1	634	85.80	634	86.61
2	68	9.20	68	9.30
3	23	3.11	18	2.46
4	9	1.22	7	0.95
5	3	0.40	3	0.41
6	2	0.27	2	0.27
	739	100.00	732	100.00

To calculate the value of n, data from observed authors is used and is found to be 3.22 i.e. n=3.22

It is clear from Table 5 that the observed and expected authors are nearly same with n=3.22. Author productivity pattern of College and Research Libraries complies with Lotka's law at a value of n=3.22.

Degree of Collaboration:

Table 6: Degree of Collaboration among Co-authors

Year	No. of co-authors publications	%	Degree of collaboration
1997	21	61.76	0.62
1998	18	48.65	0.48
1999	20	54.05	0.54
2000	18	50.00	0.50
2001	16	47.06	0.47
2002	23	63.90	0.64
2003	16	61.54	0.61
2004	15	57.70	0.58
2005	19	67.86	0.68
2006	21	65.62	0.65
2007	18	58.06	0.58
2008	12	41.40	0.41
2009	18	60.00	0.60
2010	26	51.51	0.51
2011	21	70.00	0.70

The Degree of Collaboration (DC) among authors in College and Research Libraries is presented in Table 6. In order to calculate the Degree of Collaboration (DC) among the authors in College & Research Libraries the formula given by Subramanyam (1983) is used which is expressed mathematically as;

$$\text{Degree of Collaboration, DC} = \frac{Nm}{Nm+Ns}$$

Where,

Nm= No. of Multi-author publications during a specific period in a discipline

Ns= No. of single-authored publications in a discipline during a given period of time

Table 6 reveals that the value of the higher Degree of Collaboration (DC) was 0.70 for the year 2011 followed by 0.68 for the year 2005. The Degree of Collaboration is less because of the fact that single authored papers have dominated this journal. It is clear from Table 6 that Degree of Collaboration (DC) among multiple authors was 0.72 maximum for the two author publications.

Table 7: Degree of Collaboration among different categories of authors

Year	Two-authors publications	Three-authors publications	Four-authors publications	Five or more - authors publications
1997	0.41	0.15	0.06	-
1998	0.72	0.08	0.05	-
1999	0.32	0.13	0.05	0.02
2000	0.33	0.14	0.03	-
2001	0.35	0.12	-	-
2002	0.50	0.08	0.05	-
2003	0.54	0.07	-	-
2004	0.31	0.27	-	-
2005	0.43	0.18	0.03	0.03
2006	0.37	0.15	0.09	0.03
2007	0.22	0.19	0.03	0.13
2008	0.31	0.10	-	-
2009	0.27	0.23	0.03	0.06
2010	0.27	0.15	0.03	-
2011	0.47	0.10	0.10	0.03

Year-Wise Appearance of Citations:

Table 8: Year-wise appearance of citations

Year	No. of citations	%
1997	782	6.07
1998	698	5.41
1999	778	6.03
2000	939	7.28
2001	810	6.28
2002	823	6.38
2003	735	5.7
2004	974	7.56
2005	793	6.15
2006	878	6.81
2007	748	5.8
2008	829	6.43
2009	915	7.1
2010	1138	8.83
2011	1053	8.17
Total	12893	100.00

For the period under study (1997-2011), in all 12893 citations were found appended to 479 articles. From Table 8 it is clear that highest number of 1138 citations were appended in the year 2010 (8.83 per cent) followed by 1053 (8.17 per cent) citations for the year 2011. The year 1998 recorded least number of citations i.e., 698 (5.41 per cent). It is worth mentioning here that, though highest number of papers are published in the year 1999, it hasn't resulted in maximum number of citations. The average number of citations per paper is almost 27 (i.e, 26.92). This also shows that authors have used different types of resources in writing papers.

Distribution of Citations:

Table 9: Study of citations

Year	1-5	6-10	11-15	16-20	21-25	26-30	31-35	>=36	Total
1997	1	4	6	4	4	1	7	7	34
1998	4	5	7	7	3	3	5	3	37
1999	1	5	5	11	6	4	0	5	37
2000	3	4	8	8	3	1	1	8	36
2001	1	7	4	4	9	0	2	7	34
2002	0	4	8	3	10	3	3	5	36
2003	1	1	6	4	2	5	1	6	26

2004	0	3	0	4	4	2	2	11	26
2005	0	2	6	4	1	7	3	5	28
2006	1	2	4	3	7	6	2	7	32
2007	0	3	7	5	5	2	5	4	31
2008	0	2	4	6	4	2	3	8	29
2009	2	0	5	5	1	2	5	10	30
2010	0	1	5	5	3	4	2	13	33
2011	0	1	3	5	2	2	4	13	30
Total	14	44	78	78	64	44	45	112	479
%	**2.92**	**9.19**	**16.28**	**16.28**	**13.36**	**9.19**	**9.4**	**23.4**	**100**

Table 9 presents data on the range and percentage of references per paper. It is to be noted here that all the 479 articles have cited references. Total 12893 citations were found appended to 479 articles published during the period 1997-2011. The papers having references ranging from >=36 form the largest group i.e. 112 (23.40 per cent) followed by the range 11-15 and 16-20 which accounted to 78 articles (16.28 per cent). It is also interesting to note that the range of 6-10 and 26-30 citations have same number of articles i.e. 44 (9.19 per cent). The average number of citations per article is 26.92. This could be because of the fact that the majority of i.e. 112 articles have references in the range of >=36.

Form-Wise Distribution of Citations:

Table 10: Form-Wise Distribution of Citations

Type	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	%
Journals	488	447	502	610	493	469	445	565	493	547	429	473	487	681	601	7730	59.95
Books	176	145	153	187	152	143	122	134	120	113	113	142	170	177	187	2234	17.32
Web Pages	6	34	17	54	48	76	40	103	67	91	72	60	106	83	102	959	7.44
Reports	22	23	24	15	31	25	39	35	14	25	36	37	59	44	80	509	3.95
Comm.	23	11	21	9	16	32	15	31	34	40	20	41	29	31	15	368	2.85
Conf. Proc.	21	13	7	23	22	23	24	25	28	4	23	19	13	29	34	308	2.39
Unpublished	21	8	14	11	15	12	18	20	13	15	21	17	23	16	12	236	1.83
Thesis	5	4	16	7	12	8	5	20	2	6	3	11	9	17	5	130	1.01
Standards	-	1	4	-	7	11	4	7	4	3	13	14	9	16	4	97	0.75
Encyclopedias	4	1	4	10	2	2	-	5	1	1	3	1	3	6	3	46	0.36
Catalogue	3	-	3	4	-	3	3	6	2	13	6	1	1	-	1	46	0.36
Newsletters	5	-	4	1	3	2	5	1	2	3	2	2	2	9	2	43	0.33
Newspapers	2	3	2	1	5	4	2	6	1	10	-	1	-	1	2	40	0.31
Archives	-	1	-	-	-	12	3	1	-	4	-	-	2	8	2	33	0.26
Others		1	1	1	2	1	2	4	3	1		3	2	2		23	0.18
Directories	4	2	-	2	-	-	1	1	5	-	4	2	-	-	2	23	0.18

Monographs	2	3	-	-	-	-	1	-	-	-	-	-	-	16	1	23	0.18
Dictionary	-	-	2	1	2	-	2	7	2	2	1	2	-	1	-	22	0.17
Manuals	-	1	4	3	-	-	4	1	1	-	2	3	-	-	-	19	0.15
Reprints	-	-	-	-	-	-	-	2	1	-	-	-	-	1	-	4	0.03
Total	782	698	778	939	810	823	735	974	793	878	748	829	915	1138	1053	12893	100

Table 10 gives the year-wise break-up of various forms of resources used by the authors. Among the cited references, journals (59.95 per cent) are the heavily used resources followed by books (17.32 per cent). Journal articles carry nascent information which could be the reason for the highly preferred source of information among the authors contributed to this journal. Webpages (7.44 per cent) are also increasingly been cited by authors. The remaining resources in the form of reports, personal communications, thesis/dissertations, conference proceedings, standards, reference materials, newsletters, manuals, reprints etc. have least attracted the attention of the authors.

Ranked List of Prolific Authors:

Table 11: Ranked List of Authors

Sl. No.	Name	Number Of Papers	Rank
1	Deborah D. Blecic	6	1
2	Stephen E. Wiberley	6	1
3	Gregory A. Crawford	5	2
4	Mark D. Winston	5	2
5	Peter Hernon	5	2
6	Ann C. Weller	4	3
7	Betty Galbraith	4	3
8	Charles A. Schwartz	4	3
9	Charles Martell	4	3
10	Debra Engel	4	3
11	John M. Budd	4	3
12	Lynn Silipigni Connaway	4	3
13	Scott Seaman	4	3
14	Thomas E. Nisonger	4	3
15	Alice Harrison Bahr	3	4
16	Arthur P. Young	3	4
17	Beverly P. Lynch	3	4
18	Bradley L. Schaffner	3	4
19	Brian J. Baird	3	4
20	Eileen E. Brady	3	4

21	Eileen L. McGrath	3	4
22	Gloria J. Leckie	3	4
23	Jennifer E. Knievel	3	4
24	Joan B. Fiscella	3	4
25	John V. Richardson, Jr.	3	4
26	Joseph Fennewald	3	4
27	Josephine L. Dorsch	3	4
28	Julie Brewer	3	4
29	Julie M. Hurd	3	4
30	Juris Dilevko	3	4
31	Karen Antell	3	4
32	Mickey Zemon	3	4
33	Paul Metz	3	4
34	Ronald R. Powell	3	4
35	Sarah Anne Murphy	3	4
36	Susan Davis Herring	3	4
37	Xue-Ming Bao	3	4
38	68 authors Contributing 2 each	136	-
39	634 authors Contributing 1 each	634	-

Table 11 represents the list of top authors who have contributed at least 3 or more articles during the period of the study. There are 739 authors contributing 479 articles to College and Research Libraries during the period 1997-2011. The most leading authors are Deborah D Blecic and Stephen E Wiberley with 6 articles each followed by Gregory A Crawford, Mark D Winston and Peter Hernon who have contributed 5 articles each. There are 9 authors contributing 4 articles each followed by 23 authors contributing 3 articles each. As many as 68 authors have contributed 2 articles each and 634 authors have contributed 1 article each during the period 1997-2011.

Country-Wise Contribution:

Table 12: Country-wise contribution

Sl. No.	USA	Canada	China	Australia	Spain	Israel	Sweden
1997	63	1	-	-	-	-	-
1998	65	-	1	-	-	-	-
1999	65	3	1	-	-	-	-
2000	59	1	1	-	-	-	-
2001	51	3	1	-	-	-	-
2002	61	2	2	-	-	-	-
2003	39	5	-	-	-	-	-

2004	41	7	-	-	-	-	-
2005	55	-	1	2	-	-	1
2006	66	-	-	-	-	-	-
2007	73	-	-	-	-	-	-
2008	36	1	2	-	5	-	-
2009	53	2	7	2	-	-	-
2010	56	2	-	-	-	-	-
2011	58	-	5	2	-	1	-
Total	841	27	21	6	5	1	1
%	93.24	3.00	2.33	0.66	0.55	0.11	0.11
Rank	1	2	3	4	5	6	7

An attempt has been made to study the geographical distribution of contributions. It is revealed from Table 12 that majority of contributors are from U.S.A with 841 (93.24 per cent) contributors followed by Canada with 27 (3.00 per cent) and China with 21 (2.33 per cent). Authors from Australia, Spain, Israel and Sweden have also contributed articles to this journal.

Ranked List of Journals:

Table 13: Ranked List of Journals

Sl. No.	Journals	No. of Citations	%	Rank
1	College and Research Libraries	1311	16.96	1
2	The Journal of Academic Librarianship	520	6.73	2
3	Library Journal	175	2.26	3
4	Library and Information Science Research	168	2.17	4
5	Library Trends	142	1.84	5
6	Portal: Libraries and the Academy	140	1.81	6
7	College and Research Libraries News	131	1.69	7
8	Reference Services Review	130	1.68	8
9	Journal of the American Society for Information Science	129	1.67	9
10	Research Strategies	122	1.58	10
11	Journal of Library Administration	118	1.53	11
12	Library Quarterly	116	1.5	12
13	Library Resources and Technical Services	91	1.18	13
14	Information Technology and Libraries	86	1.11	14
15	Journal of the American Society for Information Science and Technology	86	1.11	14
16	The Serials Librarian	83	1.07	15
17	The Chronicle of Higher Education	80	1.03	16

18	RQ	75	0.97	17
19	Library Administration and Management	73	0.94	18
20	Journal of Documentation	71	0.92	19
21	Scientometrics	67	0.87	20
22	American Libraries	63	0.82	21
23	The Reference Librarian	63	0.82	21
24	Collection Management	61	0.79	22
25	Library Hi Tech	60	0.78	23
26	Cataloging and Classification Quarterly	56	0.72	24
27	Bulletin of the Medical Library Association	54	0.69	25
28	Library Acquisitions: Practice and Theory	52	0.67	26
29	D-Lib Magazine	48	0.62	27
30	Reference and User Services Quarterly	48	0.62	27
31	Issues in Science and Technology Librarianship	42	0.54	28
32	Jewish Political Studies Review	42	0.54	28
33	Journal of the Medical Library Association	40	0.51	29
34	Science and Technology Libraries	40	0.51	29
35	Journal of Library Services for Distance Education	39	0.50	30

Table 13 provides the rank list of top 30 journals preferred by the authors during the publication phase of 1997-2011 of College and Research Libraries. The 7730 articles in periodicals were scattered in 928 periodicals. The top 30 journals account for 4622 (59.80 per cent) of the journals cited by the authors. College and Research Libraries which is also the source journal of this study topped the ranked list with 1311 (almost 17.00 per cent) citations followed by Journal of Academic Librarianship 520 (6.73 per cent), Library Journal 175 (2.26 per cent) and Library and Information Science Research 168 (2.17 per cent) citations.

Conclusion:

From the above discussions it can be concluded that the journal has published papers mostly authors from USA. The journal self citation is 16.96 per cent which brings it to the 1st rank in the ranked list of journals preferred by the authors. Authors have mainly depended on journals (59.95 per cent) and books (17.32 per cent) as their preferred choice of information sources. It is observed that the degree of collaboration in College & Research Libraries ranged from 0.41 to 0.70. Lotka's law is tested and confers to a value of n=3.22. This study has also highlighted the variety of bibliometric measures that can be used to understand the characteristics or portrait of the journal which in turn reflect the characteristics of the literature and the communication behaviour. This study will also be helpful to the library staff in collection

development, weeding out of journals and to the researchers in identifying the core authors and core journals.

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