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Collaborative Measures and Authorship Pattern of Current Science Journal – A Scientometric Analysis

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Abstract

The study examined the collaborative measures and authorship pattern of current science journal during 2014 to 2018. Data retrieved from Web of Science (WoS) bibliographical database. A total of 4298 publications appeared in current science journal during the study period. The aim of the study to illustrates various significant aspect of collaborative measures like collaborative index, degree of collaboration, collaborative coefficient, modified collaborative coefficient and authorship pattern. Relative growth rate and doubling time also analysed to find the growth of publications. Finding of the study states that 1440 (33.50%) papers contributed by single author, average value of collaborative index are 3.39, degree of collaboration was 0.90, overall collaborative coefficient was 0.78 and there is no change in the value of modified collaborative coefficient. It also concluded that relative growth rate decreased where doubling time increased during the study period. There is a strong positive correlation found between the publications and authors and between single author and multiple authors in current science journal.

Keywords: Current Science, Collaborative measures, Authorship pattern, Collaborative index,

Degree of collaboration.

Introduction

The concept of collaborative measures and authorship pattern is an important factor in bibliometric analysis. Generally collaborative measures and authorship pattern of research articles or document are most important to the researchers and scientists of the country. In order to find out the author productivity collaborative measures such as collaborative index, degree of collaboration, collaborative coefficient and modified collaborative coefficient are essential for the research activities. It shows the trend of the particular subject, topics, journal publications etc.

Price[1] conducted a survey on Chemical Abstracts; he observed that there is a steady trend towards multiple authorship. Fox and Feaver[2] concluded that multi authored paper increase by collaboration of various scientists to enhanced quality research. Collaborative measures use to find the contribution of author in the same subject, interdisciplinary, nature of investigation, expanse of cost, instrumentation and laboratory facilities.

Current science[3] journal published fortnight from Indian Academy of Science. It is one of the leading interdisciplinary science journals in India. It stated in 1932 by the Indian Scientists such as CV Raman, Birbal Sahni, Meghnad Saha, Martin Foster and S.S. Bhatnagar. The journal completed one hundred volumes on 2011. It mainly focussed on science and scientific activities which is communicating through research articles, shorter research communication, review articles, scientific correspondence and commentaries, news and views, comment. It act as a forum to interact, discuss and communicate their issues and problem faced by science and scientists in the country and abroad.

The topical themes such as remote sensing, waves, nanomaterials, AIDS, Cancer, Monsoon etc acknowledged and highlighted in the journal. It indexed by Web of Science, Scopus, Geobase, Chemical Abstract, IndMed and Current Contents. 0.756 is the impact

factor for the year 2018.

The present study deals with bibliometric analysis of current science journal during the study period of 2014 to 2018. Aim of the study to find out the collaborative measures, authorship pattern, relative growth rate and doubling time of the journal. Data downloaded from Web of Science (WoS) database.

Review of Literature

Gaud, Singh and Singh (2019)[4] analyzed the authorship pattern and collaboration coefficient of competency publications of library professionals. Data downloaded from Scopus database. A total of 433 articles published in the particular topic found in the database. The study concluded that majority of the articles published from single author (171) during the study period. Highest (11.78%) of the articles published in the year 2015. The highest growth rate recorded in the year 2000 and lowest in 1999. United States published 174 articles and ranked as first in the top five countries contribution.

Verma, Shukla and Yadav (2019)[5] analysed the researchers world journal of arts, science and commerce (RW-JASC) during 2010 – 2017. The aims of the study to analysis authorship pattern, collaboration pattern, relative growth rate and doubling time. A total of 662 research papers published during the study period. Findings of the study shows that highest number of articles (16.31%) published in the year 2017. 1.92 is the overall collaborative index value. 0.43 and 0.45 is the highest CC and MCC value recorded in the year 2010. 386 publications contributed by multi authored. 1.75 and 4.08 is the highest relative growth rate and doubling time recorded in 2011 and 2017 respectively.

Neelamma and Anandhalli (2018)[6] highlights the authorship pattern and collaborative measures in the field of Crystallography. Data retrieved from Web of Science (WoS) bibliographical database from the year 1989 to 2013. The finding of the study reveals that multiple authored contributed more research articles in the field of Crystallography.

Collaborative index was in increased trend, degree of collaboration in the fluctuating trend, collaborative coefficient and moderate coefficient are in increased trend. It also concluded that Lotka's law was applicable for the field of Crystallography.

Waghmode and Urkudkar (2016)[7] examined the Indian Journal of Biotechnology to find authorship pattern and collaborative research for the period of 2002-2013. The study concluded that 96.60% of the papers contributed by multi authored. Multi authorship trend is gradually increased during the study period. 0.96 is the mean value of degree of collaboration for overall research papers.

Biradar and Tadasad (2015)[8] conducted a study to find the authorship pattern and collaborative research in economics. The result shows that 2.06 collaborative index, 0.58 degree of collaboration and 0.30 collaborative coefficients. It also concluded that there is a collaborative trend in economics.

Objectives

1. To find the authorship pattern of current science journal during the study period.
2. To study the collaborative measures of current science journal.
3. To find out the relative growth and doubling time of the current science journal.

Hypotheses

1. Relative growth rate decreased where doubling time increased during the study period.
2. There is a strong positive correlation found between the publications and authors.
3. There is a strong positive correlation found between single author and multiple authors.

Methodology

This study deals with the collaborative measures like collaborative index, degree of collaboration, collaborative coefficient, modified collaborative coefficient and authorship pattern of current science journal. Data retrieved from Web of Science (WoS) bibliographical database from the year 2014 to 2018 by using the keyword "Current Science" in the publication field [accessed on 20.10.2019]. A total of 4298 records downloaded and analyzed with the help of software's such as M.S. Excel and SPSS.

Analysis and Interpretation

Table 1: Authorship Pattern of Current Science Journal (2014-2018)

Year	**Single**	**Two**	**Three**	**Four**	**Five**	**>Five**	**MAP**	**TA**	**Total Paper**
2014	248	138	95	81	39	70	2584	2832	671
2015	252	178	132	79	55	108	2222	2474	804
2016	272	195	129	123	69	86	2270	2542	874
2017	372	180	156	81	58	154	2925	3297	1001
2018	296	157	140	117	70	168	2996	3292	948
Total	**1440**	**848**	**652**	**481**	**291**	**586**	**12997**	**14437**	**4298**
%	**33.50**	**19.73**	**15.17**	**11.19**	**6.77**	**13.63**			

MAP – Multiple Authored Paper; TA – Total Authored

Table 1 shows the authorship pattern of current science journal for the period (2014-2018). Out of 4298 papers, 1440 (33.50%) paper contributed by single author, 848 (19.73%) two authors, 652 (15.17%) by three authors, 586 (13.63%) papers contributed by more than five authors, 481 (11.19%) by four authors where 291 (6.77%) contributed by five authors. Hence it concluded that contribution of single author is high compare to the two, three, four,

five and more than five authors in the current science journal during the study period.

Collaborative Measures in Current Science Journal (2014-2018)

Collaborative measures like collaborative index, degree of collaboration, collaborative coefficient and moderate collaboration calculated using the formula derived from by Lawani (CI)[9], Subramanyam (DC)[10] and Ajiferuke, Burell and Tague (CC)[11].

Collaborative Index (CI)

The formula was derived by Lawani (1986)[9] as below:

$$\sum = \frac{A}{f} \quad \frac{1/fi}{N}$$

Where, f1, f2, f3..... = number of authors

N = Number of publications on that year

Table 2: Authorship Pattern and Collaborative Index

Year	Single	Two	Three	Four	Five	>Five	Total Paper	CI
2014	248	138	95	81	39	70	671	4.22
2015	252	178	132	79	55	108	804	3.08
2016	272	195	129	123	69	86	874	2.91
2017	372	180	156	81	58	154	1001	3.29
2018	296	157	140	117	70	168	948	3.47
Total	**1440**	**848**	**652**	**481**	**291**	**586**	**4298**	**3.39**
%	**33.50**	**19.73**	**15.17**	**11.19**	**6.77**	**13.63**	**100.00**	

CI – Collaborative Index

Table 2 reveals the authorship pattern and collaborative index of current science

journal for the period (2014-2018). There is some fluctuation between the study periods. In 2014 it is 4.22 which decreased in 2015 and 2016 as 3.08 and 2.91 respectively and increased as 3.29 in 2017 to 3.47 in 2018. The average collaborative index is 3.39 during the study period.

Degree of Collaboration (DC)

Degree of Collaboration (DC) was proposed by Subramanyam, K (1983)[10] as below:

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

Where,

Nm = Number of multi authors publications during the year.

Ns = Number of single author publications during the year.

Table 3: Authorship Pattern and Degree of Collaboration

Year	**Single**	**Two**	**Three**	**Four**	**Five**	**>Five**	**Total Paper**	**DC**
2014	248	138	95	81	39	70	671	0.91
2015	252	178	132	79	55	108	804	0.90
2016	272	195	129	123	69	86	874	0.89
2017	372	180	156	81	58	154	1001	0.89
2018	296	157	140	117	70	168	948	0.91
Total	**1440**	**848**	**652**	**481**	**291**	**586**	**4298**	**0.90**
%	**33.50**	**19.73**	**15.17**	**11.19**	**6.77**	**13.63**	**100.00**	

DC – Degree of Collaboration

The degree of collaboration shows as 0.91 in 2014. then it decreased as 0.90 to 0.89 in

the year 2015, 2016 and 2017 and it increased as 0.91 in 2018. The average value of degree of collaboration was 0.90. Hence it concluded that there is no change in the trend of authorship pattern and degree of collaboration.

Collaborative Coefficient (CC)

Ajiferuke et al.[11] derived a formula to measure the collaborative coefficient. In that derivation they told that a publication has a single author, one credit receive to that author; if two authors, each received as 1/2 credit. Then n authors each received as 1/n credit. E [1/n] denoted that the average credit received to each author of a random publications and the value which lies "Between" 0 to 1.

$$CC = \frac{1 - E}{n}$$

$$= 1 - \sum [1/j]p = (N=j)$$

$$= 1 - \frac{f1 + (1/2)\, f2 + (1/3) f3 .... (1/k) fk}{N}$$

Where

fj = The number of j authors research publications in a discipline during the study period.

N = The total number of research publications.

K = The greatest number of authors per paper in a discipline.

Table 4: Authorship Pattern and Collaborative Coefficient

Year	Single	Two	Three	Four	Five	>Five	Total Paper	CC
2014	248	138	95	81	39	70	671	0.80
2015	252	178	132	79	55	108	804	0.80

2016	272	195	129	123	69	86	874	0.79
2017	372	180	156	81	58	154	1001	0.75
2018	296	157	140	117	70	168	948	0.76
Total	**1440**	**848**	**652**	**481**	**291**	**586**	**4298**	**0.78**
%	**33.50**	**19.73**	**15.17**	**11.19**	**6.77**	**13.63**	**100.00**	

CC – Collaborative Coeficient

The values of collaborative coefficient for 2014, 2015, 2016, 2017 and 2018 calculated and displayed in the Table 4. CC values decreased from 0.80 to 0.75 during the study period. The overall collaborative coefficient was 0.78 which shows that high collaboration observed in current science journal.

Modified Collaborative Coefficient (MCC)

Modified collaborative coefficient is almost the same as collaborative coefficient which is given by Ajiferuke et al. The formula derived from them is given below

$$MCC = \frac{A}{A-1}\left\{\frac{\sum_{j-1}^{A}[1/j]fj}{N}\right\}$$

Table 5: Authorship Pattern and Modified Collaborative Coefficient

Year	**Single**	**Two**	**Three**	**Four**	**Five**	**>Five**	**Total Paper**	**MCC**
2014	248	138	95	81	39	70	671	0.80
2015	252	178	132	79	55	108	804	0.80
2016	272	195	129	123	69	86	874	0.79
2017	372	180	156	81	58	154	1001	0.75

2018	296	157	140	117	70	168	948	0.76
Total	**1440**	**848**	**652**	**481**	**291**	**586**	**4298**	**0.78**
%	**33.50**	**19.73**	**15.17**	**11.19**	**6.77**	**13.63**	**100.00**	

Modified Collaborative Coefficient (MCC)

Table 5 shows that the modified collaborative coefficient of current science journal. It is the resemblance of collaborative coefficient. Hence, it concluded that high collaboration observed in current science journal during the study period.

Relative Growth Rate (RGR) and Doubling Time (DT)

The relative growth rate was defined as the increase in number of publication per unit of time. RGR formula is given below as

$$RGR = \frac{[\log eW2 - \log eW1]}{T2 - T1}$$

Where,

log e W2 = log of initial number of articles.

log e W1 = log of final number of articles.

T2 – T1 = Difference between initial and final time.

Doubling time defines as the period of time required for the publication to double in number in 1 year. DT calculated from the below formula.

$$DT = \frac{0.693}{RGR}$$

Table 6: Relative Growth Rate (RGR) and Doubling Time (DT)

Year	**No. of papers**	**Cumulative papers**	**Log W1**	**Log W2**	**RGR**	**DT**
2014	671	671	0.000	6.509	0.000	0.000

2015	804	1475	6.509	7.296	0.788	0.880
2016	874	2349	7.296	7.762	0.465	1.489
2017	1001	3350	7.762	8.117	0.355	1.952
2018	948	4298	8.117	8.366	0.249	2.781

The relative growth rate of current science journal decreased from 0.788 to 0.249 during the study period whereas doubling time was increased from 0.880 to 2.781. Hence it concluded that relative growth rate decreased and the doubling time increased for the study period.

Hypothesis 1:

Ho: Relative growth rate decreased where doubling time increased during the study period.

It states that null hypothesis accepted and proved that relative growth rate decreased where doubling time increased during the study period shown in Table 6.

Hypothesis 2:

Ho: There is a strong positive correlation found between the publications and authors.

Table 7: Correlation between the Publications and Authors

Variables	**Correlation**	**Publications**	**Authors**
Publications	Pearson Correlation	1	0.598
	Sig. (2-tailed)		0.286
	N	5	5
Authors	Pearson Correlation	0.598	
	Sig. (2-tailed)	0.286	
	N	5	5

There is a strong positive correlation between the publications and authors (r=0.598, df=4, p<0.05). Hence it concluded that null hypothesis accepted and indicates that there is a strong positive correlation found between the publications and authors during the study period of current science journal.

Hypothesis 3:

Ho: There is a strong positive correlation found between single author and multiple authors.

Table 7: Correlation Between the Single Author and Multiple Authors

Variables	Correlation	Single Author	Multiple Authors
Single Author	Pearson Correlation	1	0.687
	Sig. (2-tailed)		0.199
	N	5	5
Multiple Authors	Pearson Correlation	0.687	
	Sig. (2-tailed)	0.199	
	N	5	5

There is a strong positive correlation between the single author and Multiple authors (r=0.687, df=4, p<0.05). Hence it concluded that null hypothesis accepted and indicates that there is a strong positive correlation found between the single author and multiple authors for the five years (2014-2018).

Findings

Present study deals with the bibliometric attributes such as collaborative measures and authorship pattern of current science journal for the five years (2014 – 2018). The findings are given below as

1. Single author's contribution is high compare to the two, three, four, five and more than

five authors in the current science journal during the study period.

2. In 2014 collaborative index is 4.22 which decreased in 2015 and 2016 as 3.08 and 2.91 respectively and increased as 3.29 in 2017 to 3.47 in 2018.
3. Degree of collaboration shows as 0.91 in 2014. Then it decreased as 0.90 to 0.89 in the year 2015, 2016 and 2017 and it increased as 0.91 in 2018.
4. Collaborative coefficient values decreased from 0.80 to 0.75 during the study period.
5. There is no change in the value of modified collaborative coefficient of current science journal during the study period.
6. The relative growth rate of current science journal was decreased from 0.788 to 0.249 during the study period where doubling time increased from 0.880 to 2.781.

Hypotheses

1. Null hypothesis accepted and proved that relative growth rate decreased where doubling time increased during the study period.
2. There is a strong positive correlation ($r=0.598$, $df=4$, $p<0.05$) found between the publications and authors during the study period of current science journal.
3. There is a strong positive correlation ($r=0.687$, $df=4$, $p<0.05$) found between the single author and multiple authors for the study period.

Conclusion

Current science is one of the leading inter disciplinary science journal in India. It focussed on science and technology so it taken as the study of research. The study concluded that single author dominating in the journal. There is some fluctuating trend in collaborative index, degree of collaboration and Collaborative coefficient. Relative growth rate decreased and doubling time increased in the study period. There is a strong positive correlation between the publications and authors and authorship pattern. It also concluded that collaborative research is needed for the upcoming issues of the current science journal.

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