Publications Pattern and Collaboration Trend in Physical Review Accelerators and Beams Journal: A Bibliometric Analysis

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Abstract- *The current study analyzes papers published in the journal Physical Review Accelerators and Beams from 2018 to 2022. The parameters used in the study were the distribution of articles, authorship patterns, degree of collaboration (DC), collaboration index (CI), collaboration coefficient (CC), and modified correlation coefficient (MCC). The study revealed that 1113 scholarly research papers were published by scientific professionals worldwide. The United States ranks first among researchers from various countries. The study showed that 2020 had the highest number of articles and had the highest collaboration index, collaboration coefficient, and improved collaboration coefficient. The maximum majority of contributions came from single-author publications with 272 articles and their average collaboration is 0.24, meaning the presence of good collaboration. A total of 23793 references were observed, with 2020 having the highest number of references at 5674 (21.82%).*

I. INTRODUCTION

Bibliometrics is a popular technique or metric study that helps in evaluating subject characteristics and citation patterns in various types and disciplines of knowledge. Bibliometrics simply means "book measurement", which includes both printed and non-printed documents. The term Bibliometrics is derived from the combination of two different words "Biblio" and "metrics". The word biblio comes from a combination of the Latin and Greek words biblion meaning book or paper while the word metrics refers to the science and technology of meter, meaning measurement, and the Latin word metrics and the Greek word metricon (Santi, Santi, 2008). Although the term "Bibliometrics" is of recent origin, the technique and practice of bibliometrics have been practiced since the early 20th century. Alan Pritchard coined the term "bibliometrics" to replace the term "statistical bibliography" in his paper published in the Journal of Documentation in 1969. According to him, the term "statistical bibliography" used by Hulme in 1923 E. W. is not at all satisfactory as it is "too awkward, not very descriptive,

and may be confused with reference to statistics or bibliographies." (Verma, Deori, and Hadgali 2020)

Journals are the most important source of current information for society as well as for education and research (Kumbar, Hadgali & Seema, 2007). However, journal articles are the final output of most research, and a researcher's performance and productivity are largely based on the number of publications as well as where they appear (Ralison, 2015). Physical Review Accelerators and Beams is a monthly open-access peer-reviewed scientific journal published by the American Physical Society. The journal focuses on accelerator physics, chemistry, and engineering. Its editor-in-chief is Frank Zimmerman (CERN). The journal was published in 1998 as Physical Review Special Topics Accelerators and Beams, acquiring its current title in 2016. Journals sponsored by academic and industrial organizations do not require article processing fees. The present journal covers the full spectrum of accelerator science, technology, and applications, including subsystems, component technology, beam dynamics, and the design, operation, and improvement of all types of scientific and industrial accelerators.

II. OBJECTIVES OF THE STUDY

The main objective of the present study is to analyze the publications published in the journal Physical Review Accelerators and Beams for the ten-year period from 2018 to 2022.

The specific objectives of the present study are:
1. Check the annual distribution of articles and citation publications during the study period;
2. Find authorship patterns;
3. Evaluate collaboration index (CI) and degree of collaboration (DC) between authors;
4. Determine the Collaboration Coefficient (CC) and Modified Collaboration Coefficient (MCC) of publications;
5. Evaluate the productivity implementation of Lotka's law

6. To find the most writer productivity:
7. Know the geographical distribution of authors

III. METHODOLOGY

The present study investigates the research contributions of authors in Physical Review Accelerators and BEMS journals through bibliometric analysis during the period 2018 to 2022 (five years). The journal is retrieved from its website, i.e. https://journals.aps.org/prab/. A total of 1113 full-text research articles were published between 2018-2022. Bibliographic details obtained from the publications were tabulated, organized, and analyzed using MS Excel. Data were arranged and arranged to consider different perspectives related to growth rate, collaboration index (CI), degree of collaboration (DC), collaboration coefficient (CC), modified collaboration coefficient (MCC), and Lotka's law of productivity.

IV. SCOPE OF THE STUDY

The scope of the study is limited to evaluating the research contributions of scientific professionals published as full-text papers in Physical Review Accelerators and BEMS journals. Publications of Physical Review Accelerators and BEMS for the five-year period 2018 to 2022 are taken up for the present study. A total of 1113 articles were published over a period of five years totaling Five volumes.

V. DATA ANALYSIS AND INTERPRETATION

5.1.Year-wise distribution of articles

Table 1: Year-wise distribution of articles

Sr. No	Year	Article	Percentage	Total Citations	CPP
1	2018	180	16.17	4231	23.51
2	2019	209	18.78	4042	19.34
3	2020	260	23.36	5674	21.82
4	2021	258	23.18	4902	19.00
5	2022	206	18.51	4944	24.00
Total		1113	100.00	23793	

Table 1 displays the number of articles published in the 5 volumes of the journal Physical Review Accelerators and BEMS for the period from 2018 to 2022 (1113). The most articles were published in 2020 (260, 23.36%), followed by 2021 (258, 23.18%), and the least in 2018 (180, 16.17%). The journal is receiving tremendous responses from scientific professionals worldwide.

5.2. Document Types

Types of documents Table 2 below shows the types of publications retrieved in Journal of Physical Review Accelerators and Bems during 2018-2022**.**

Table 2: Document -wise distribution of articles

Sr. No	Document Type	Article	Percentage
1	Article	1086	97.57
2	Erratum	20	1.80
3	Editorial	5	0.45
4	Letter	2	0.18
Total		1113	100.00

The findings showed that most of the publications retrieved were in the form of articles with 1086 (97.57%), followed by errata with 20 (1.80%), editorials with 5 (0.45%), and a letter with 2 (0.18%), indicating that most scholarly publications are published as articles and the least publication is the letter.

5.3 Geographical Distribution of Contributors

Table No. 3: Country-wise distribution of publications-Top 20

Sr. No	Name of Country	No. of contributors	Percentage	Rank
1	United States	458	13.09	1
2	Switzerland	244	6.97	2
3	Germany	489	13.98	3
4	China	129	3.69	4
5	United Kingdom	123	3.52	5
6	Italy	100	2.86	6
7	Japan	94	2.69	7
8	France	81	2.31	8
9	Russian Federation	63	1.80	9
10	Sweden	39	1.11	10
11	Spain	25	0.71	11
12	South Korea	24	0.69	12
13	Canada	22	0.63	13
14	Israel	19	0.54	14
15	India	13	0.37	15
16	Portugal	13	0.37	15
17	Malta	12	0.34	16
18	Poland	11	0.31	17
19	Belarus	10	0.29	18
20	Greece	10	0.29	18
Truncated				
Total		3499	100.00	

Table 3 represented country wise distribution of publications published in the Journal of Physical Review Accelerators and Bems. It would be too much for the researcher to mention all the countries, that's why she pointed out the top 20 countries as indicated above in Table 3. United State had the highest number of publications 458 (13.09%) followed by Switzerland with 244 (6.97%) publications and thirdly Germany with 489 (13.98%). China with 129 (3.69%) publications, United Kingdom with 123 (3.52%), and Italy with 100 (2.86%) publications. Respectively

5.4. Most productive author in the Journal of Physical Review Accelerators and Bems.

Table 4: Shows the ranking of 20 top most productive author

Sr. No	Name of Author	No. of publications	Percentage	Rank
1	Tomás, R.	21	0.60	1
2	Métral, E.	15	0.43	2
3	Stupakov, G.	14	0.40	3
4	Migliorati, M.	13	0.37	4
5	Osterhoff, J.	13	0.37	4
6	Redaelli, S.	13	0.37	4
7	Huang, X.	12	0.34	5
8	Huang, Z.	12	0.34	5
9	Buffat, X.	11	0.31	6
10	Burrows, P.N.	11	0.31	6
11	Di Mitri, S.	11	0.31	6
12	Tang, C.	11	0.31	6
13	Wuensch, W.	11	0.31	6
14	Calviani, M.	10	0.29	7
15	Chiggiato, P.	10	0.29	7
16	Chung, M.	10	0.29	7
17	Giovannozzi, M.	10	0.29	7
18	Grudiev, A.	10	0.29	7
19	Hemsing, E.	10	0.29	7
20	Power, J.G.	10	0.29	7
Truncated				
Total		3499	100.00	

Table 4 above reveals the contributions of the top 20 most productive authors. Different contributors authored 1113 publications. Tomás, R. from the United States was the most effective author with 21 (0.60%) publications followed by Métral, E. from the United States with 15 (0.43%) publications. Stupakov, G was in the third position as the most productive author with 14 (0.40%) publications each. The rest is Migliorati, M.; Osterhoff, J., and Redaelli, S. all with 13

(0.37%) publications each. Tomas R. Guilarte is the most productive author and also the most prolific author with an H-Index of 65 as well as an i10-Index of 135.

5.5. Institution-Wise Distribution of Publication

Table 5: Institution-Wise Distribution of Publication-Top 20

Sr. No	Name of Affiliation	No. of Contributors	%	Rank
1	European Organization for Nuclear Research, Switzerland	207	5.92	1
2	SLAC National Accelerator Laboratory, United States	130	3.72	2
3	Deutsches Elektronen-Synchrotron DESY, Germany	76	2.17	3
4	Brookhaven National Laboratory	71	2.03	4
5	Chinese Academy of Sciences	57	1.63	5
6	High Energy Accelerator Research Organization, Tsukuba	52	1.49	6
7	Argonne National Laboratory	52	1.49	6
8	Lawrence Berkeley National Laboratory	49	1.40	7
9	Fermi National Accelerator Laboratory	49	1.40	7
10	The Cockcroft Institute	47	1.34	8
11	CNRS Centre National de la Recherche Scientifique	45	1.29	9
12	Paul Scherrer Institut	38	1.09	10
13	University of Chinese Academy of Sciences	35	1.00	11
14	GSI Helmholtz Centre for Heavy Ion Research GmbH	34	0.97	12
15	INFN, Laboratori Nazionali Di Frascati	33	0.94	13
16	Cornell University	32	0.91	14
17	Thomas Jefferson National Accelerator Facility	32	0.91	14
18	University of California, Los Angeles	32	0.91	14
19	John Adams Institute for Accelerator Science	32	0.91	14
20	University of Oxford	31	0.89	15
Truncated				
Total		3499	100.00	

Table 5 above revealed institutional-wise distribution of publications in the Journal of Physical Review Accelerators and Bems during the period of 2018-2022. Out of 3499 institute publications, European Organization for Nuclear Research, Switzerland is the highest contribution with 207 (5.92%) followed by SLAC National Accelerator Laboratory, United States with 130 (3.72%) Publications each. The Third position is Deutsches Elektronen-Synchrotron DESY, Germany with 16 (9.25%), Brookhaven National Laboratory with 71 (2.03%), Chinese Academy of Sciences with 57 (1.63%) publications as indexed by Scopus. Respectively.

5.6. Analysis of Collaboration factors and Authorship Patten

Table 6 : Analysis of Collaboration factors in the Journal Physical Review Accelerators and Bems Publication at Global Level

Sr. No	Year	2018	2019	2020	2021	2022	Total
1	Single Author	46	52	67	62	45	272
2	Second Author	38	48	56	52	58	252
3	Third Author	27	31	45	47	48	198
4	Fourth Author	21	28	33	37	18	137
5	Fifth Author	17	27	24	19	11	98
6	Sixth Author	13	9	16	17	10	65
7	Seven Author	8	6	10	11	9	44
8	Eight Author	6	5	6	8	5	30
9	Nine Author	4	3	3	5	2	17
10	Total Articles	180	209	260	258	206	1113
11	Total Author	590	651	807	838	613	3499
CI		3.278	3.115	3.104	3.248	2.976	15.720
DC		0.256	0.249	0.258	0.240	0.218	1.221
CC		0.744	0.751	0.742	0.760	0.782	3.779
MCC		0.190	0.187	0.191	0.183	0.171	0.922
CC-MCC		0.554	0.564	0.551	0.577	0.611	2.857

Table No. 6 attempts to analyze the various collaboration factors for a period of 10 years (2018-2022). The tabular analysis includes CI, DC, CC, and MCC. The Collaborative Index shows the lowest level in 2022. The association index is highest in 2018 and the average CI is 3.10 during the study period. According to Subramaniam a DC measure to quantify the number of single and multi-author papers and interpret it as a degree. DC varies from 0 when all papers have a single author to 1 when all papers have more than one author. It can be easily drawn and its meaning can also be easily deduced.

The study found that DC was lowest at 0.22 in 2022 and highest at 0.26 in 2018 and 2020. There is a steady increase in multi-authored papers in all years, but it is the lowest in 2022 and hence shows a study duration of 0.22 during the average DC. The CAI value starts at 95.43 in the first year and increases progressively with respect to other proceedings years as multi- and mega-authored papers increase. This means that in the first year of study, single-authored papers are more common in the scenario. This judgment is supported by the judgment of CC. In this study, CC is also showing the lowest 0.74 in 2018 and 2020. It peaked at 0.78 in 2022. The average CC is 0.7558. The study found that the MCC was the lowest in 2020 at 0.1707. In 2020 it was at its highest value of 0.1913. The average MCC during the study period was 0.1843. The table also shows that the mean difference between CC and MCC is 0.5715. The lowest difference between CC and MCC, i.e. 0.5510 was observed in the year 2020. The highest difference between CC and MCC, which is 0.6108, was observed in 2022. It can be concluded that CC values do not show any significant difference. and MCC values and this variation decreases when the number of authorships increases. Of the 1113 articles published, the share of single authorship is 272 and the share of multiple authorship is 841. This indicates that the contribution of a single paper is less than that of a multi-authored paper. It can be summarized from the above discussion that very high collaborative research activity is observed in the global artificial intelligence literature.

VI. CONCLUSION

The study quantitatively identified the research productivity in the Journal Physical Review Accelerators and Beams search from a Scopus database period of Five years (2018-2022). A total number of 1113 documents were retrieved following the Journal Physical Review Accelerators and Beams. It was revealed that 2020 had the highest publication of 260 with a percentage of (23.36%), and the lowest number of publications was produced in 2018 with 180 (16.17%) publications. While the country-wise distribution of publications was also considered. It was indicated that the United States was the most productive country with 458 documents (13.09%) followed by Switzerland with 244 (6.97%) publications. The institutional distribution was also considered and it was revealed that European Organization for Nuclear Research was the most productive institution with 207

(5.92%) followed by SLAC National Accelerator Laboratory with 130 (3.72%) publications. It was further noted from the study that Tomás, R. was the most productive author with 21 (0.60%) publications followed by Métral, E. with 15 (0.43%) publications. It was further revealed that Tomas R. Guilarte was the most productive author and also the most prolific author with an H-Index of 65 as well as an i10-Index of 135.

The year-wise category was also considered and it was noted that 2020 had the highest number of publications 260 (23.36%) followed by 2021 with 258 (23.18%) publications. The study further revealed an increase in publications between 2018 to 2022 while there was a registered decline in the number of publications in 2021 yet another decrease occurred in 2022. In relation to publication types, it was revealed that the article category had the most number of publications 97.57% followed by Erratum 1.80%, and Editorial 0.45%, etc. whereas in the most minor class was Letter categories with both 0.18%.

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