



Research Output on Altmetrics during 2012-22: a scientometric assessment

Swapan Paul

Librarian, Tamralipta Mahavidyalaya, Tamluk, West Bengal

Dr. Bidyarthi Dutta

Assistant Professor, Department of Library and Information Science, Vidysagar University

Abstract

This paper presents a comprehensive examination of research output in altmetrics from 2012 to 2022, utilising data from the Scopus database. Analysing 1,253 publications, with an average of 113.9 annually. It scrutinises the trajectory of scholarly output, noting significant growth from 10 publications in 2012 to 174 in 2021, indicating increasing interest in altmetrics. Through a multifaceted approach, the study dissects characteristics of this literature, emphasising growth dynamics. The primary aim was a scientometric analysis of global altmetrics publications, including growth patterns, authorship, core journals, keywords, citations, and institutions. Methodologically, it identifies pivotal journals, core subjects, influential authors, geographical distribution, prolific institutions, language preferences, and citation-based metrics. Findings reveal core elements shaping altmetrics research, distribution patterns across regions, and influential contributors, enriching understanding of the scholarly landscape and enhancing scientometric methodologies within specialised domains.

Keywords: Altmetrics, Bibliometrics, Bradford's Law, Citation-based indicators, Doubling time, Lotka's Law, Scientometrics

1. Introduction

A scientometric study employs statistical methods to assess and quantify the development of a particular subject, offering insights into research trends and enabling predictive projections. This approach spans various domains, including physical science, chemical science, biological science, earth science, and social science. Many studies have quantitatively analysed literature in different fields, laying the groundwork for the current study's aim of contributing to the discourse on altmetrics publications globally. Altmetrics, or "alternative metrics," evaluate scholarly impact beyond traditional citations, leveraging online and social media sources

for a more comprehensive view. They offer valuable insights in fields where traditional metrics may fall short and aid in societal impact assessment, digital influence tracking, and trend identification. While altmetrics broaden perspectives, their interpretation should consider biases and be complemented by traditional metrics. By examining 1,253 publications, including articles, conference papers, reviews, book chapters, editorials, letters, notes, etc., from the Scopus database, the study explores growth patterns, authorship trends, core journals, subject areas, keywords, citation-based indicators, productive countries, and core institutions in altmetrics. Despite its thoroughness, the study has



limitations, including reliance on data up to February 2, 2023, and focus on Scopus-indexed literature, potentially missing other relevant sources and aspects of impact assessment.

2. Literature review

Several studies have contributed to the understanding of research trends and methodologies within the realm of altmetrics. Dutta and Rath (2013) examined 1198 articles on Cosmology research in India, collected from the Web of Science spanning 1999 to 2012. Das and Mishra (2014) analysed 70 altmetrics publications, focusing on growth, authors, contributing countries, institutions, and highly cited publications. Samanta and Dutta explored altmetric scores for top-cited papers across diverse subject domains. Baskaran (2020) investigated global publication trends in altmetrics research from 2012 to 2015, while Nath and Jana (2021) provided a scientometric review of altmetrics research globally from 2012 to 2019. Teli and Dutta (2016) demonstrated a correlation between article citations and retrievals from the Web of Science within specific astrophysics domains. Bornmann, Haunschild, and Mutz (2021) analysed scientific growth trends using various databases, contributing to understanding the evolution of scientific research. Gonzales et al. (2023) examined soil contamination treatment technology trends, highlighting increased research activity in Environmental Science. Damar and Koksalmis (2024) conducted a bibliometric analysis of healthcare metaverse research, establishing a thematic categorisation for future research in the field.

3. Objectives of the study

The study has aimed to conduct a comprehensive scientometric analysis of all altmetrics publications worldwide. The primary objectives of the study include:

- i. examining the growth pattern of literature
- ii. authorship pattern in this subject domain
- iii. identifying the core journals, subject areas, and keywords within the subject domain
- iv. analysis of citation-based indicators in this subject domain
- v. identifying the countries with the highest research productivity in this subject
- vi. recognising the core institutions actively researching in this subject domain.

4. Methodology

In this research, bibliographic data were gathered related to altmetrics from the Scopus database as of February 2, 2023, from the Central Library of Calcutta University. The 'TITLE-ABS-KEY' field was applied to retrieve scientific literature using the keyword 'altmetrics,' resulting in 1,253 publications. The Scopus database is renowned for its comprehensiveness in covering all aspects of science and technology. Subsequently, 1,253 publications were analysed, including articles (895), conference papers (168), reviews (69), book chapters (43), editorials (38), letters (23), and notes (11), others (6). Besides MS Excel and scientometrics tools like biblioshiny were used in this study.

5. Data analysis and interpretations

5.1 Growth pattern of this subject domain

Annual Growth (AG) of Publication

Table 1 and figure 1 show the literature's growth and cumulative growth over the years and the year-wise percentage of total publication share. These findings suggest a steady increase in the growth of literature over



the years, with a peak in 2021 in terms of year-wise % of total publication share. In 2020 and 2021, the percentage of full publication share is relatively high compared to the earlier

years. However, in 2022, there was a slight decrease in the year-wise % of total publication share.

Table 1: Year-wise distribution of number of publications

Year	Growth of Literature	Cumulative Growth of Literature	Year-wise % of total Publication Share
2012	10	10	0.80
2013	37	47	2.95
2014	54	101	4.31
2015	92	193	7.34
2016	102	295	8.14
2017	141	436	11.25
2018	151	587	12.05
2019	163	750	13.01
2020	171	921	13.65
2021	174	1095	13.89
2022	158	1253	12.61

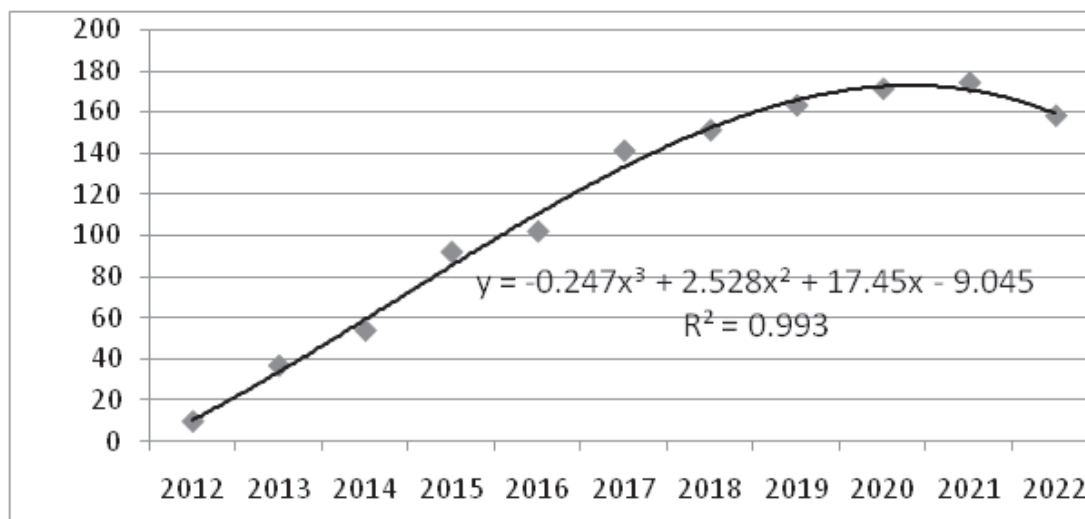


Figure 1: Cumulative growth curve of publication

**Annual Growth Rate (AGR) of publications**

To compute the Annual Growth Rate (AGR) of publications, Compound Annual Growth Rate (CAGR) formula can be employed. The CAGR formula is as follows:

$$\text{AGR} = \frac{\text{End Value} - \text{First Value}}{\text{First Value}} \times 100$$

Between 2012 and 2022, a total of 1,253 publications focused on altmetrics research were published. The peak in publications, reaching 174, occurred in 2021, while the lowest number, at just 10, was recorded in 2012. On average, approximately 113.91 publications were published each year. Table 2 illustrates a consistent upward trend in research publications on altmetrics throughout the study period from 2012 to 2022.

Table 2: Annual Growth Rate (AGR) of publications

Year	Growth of Literature	Cumulative Growth of Literature	First Value	End Value	Annual Growth Rate
2012	10	10	-	10	-
2013	37	47	10	47	370.00
2014	54	101	47	101	114.89
2015	92	193	101	193	91.09
2016	102	295	193	295	52.85
2017	141	436	295	436	47.80
2018	151	587	436	587	34.63
2019	163	750	587	750	27.77
2020	171	921	750	921	22.80
2021	174	1095	921	1095	18.89
2022	158	1253	1095	1253	14.43

Table 2 also offers year-wise calculations for total publications' annual growth rate (AGR). The AGR indicates a decline from 370.00 in 2012 to 14.43 in 2022, signifying a downward trend in the growth rate.

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

The Relative Growth Rate (RGR) signifies the rise in publications or pages within a specific time frame. This definition is derived from the concepts of relative growth rates used to analyse growth in altmetrics. The average relative growth rate (R) over the specified interval can be computed using the

following equation.

In contrast,

- 1-2 R represents the mean relative growth rate over a specific interval.
- Log W1 indicates the natural logarithm of the initial number of publications.
- Log W2 signifies the natural logarithm of the final number of publications after a specified interval.
- T2-T1 denotes the time difference between the initial time and the final time, with the year as the unit of time.



- The Relative Growth Rate (RGR).
- Doubling Time (DT) can be calculated as $0.693/R$.
- The formula for 1-2 R is $\text{Log } W_2 - \text{Log } W_1 / (T_2 - T_1)$.

Table 3: Relative Growth Rate (RGT) and Doubling Time (DT)

Year	Growth of Literature	Cumulative Growth of Literature	W1	W2	Relative Growth Rate	Doubling Time
2012	10	10		2.3		
2013	37	47	2.3	3.85	1.55	0.45
2014	54	101	3.85	4.62	0.77	0.90
2015	92	193	4.62	5.26	0.64	1.08
2016	102	295	5.26	5.69	0.43	1.61
2017	141	436	5.69	6.07	0.38	1.82
2018	151	587	6.07	6.37	0.30	2.31
2019	163	750	6.37	6.62	0.25	2.77
2020	171	921	6.62	6.82	0.20	3.47
2021	174	1095	6.82	7.00	0.18	3.85
2022	158	1253	7.00	7.13	0.13	5.33

Table 3 reveals that the Relative Growth Rate (RGR) declined from 1.55 in 2012 to 0.13 in 2022. The peak value of 1.55 corresponds to 2012, while the lowest value

of 0.13 is observed in 2022. In parallel, the Doubling Time of publications gradually increased, moving from 0.43 in 2012 to 5.33 in 2022.

5.2 Authorship pattern of this subject domain

Table 4: Distribution of authorship pattern

SL. No.	No. of Author	No. of publications	Percentage
1	1	294	23.46
2	2	362	28.89
3	3	242	19.31
4	4	150	11.97
5	5	89	7.10
6	6	46	3.67
7	7	26	2.08
8	8	13	1.04
9	9	5	0.40
10	10	8	0.64
11	11	1	0.08
12	12	3	0.24
13	13	1	0.08
14	14	1	0.08
15	15	1	0.08
16	>15	11	0.88



Analysis of authorship patterns reveals distinct trends, with the majority of publications involving two authors (28.89%), followed by single authors (23.46%) and three authors (19.31%). There's a consistent decrease in percentage as the number of authors per publication increases, highlighting a preference for fewer authors. Solo-authored publications contribute significantly (23.46%), while collaborations

with 3 and 4 authors collectively contribute 31.28%, indicating a notable mid-range authorship category. Duet collaborations (2 authors) are the most common (28.89%), and very small teams (3-4 authors) contribute 31.28%. Larger teams (>15) are infrequent, collectively contributing only 1.44%, emphasizing a preference for smaller teamwork patterns, with teams of 10 or fewer authors contributing 75.09% of publications.

Table 5: Relative distribution of publications over team size

Team size	No. of Authors	No. of Publications	Percentage
Solo	1	294	23.46
Duet	2	362	28.89
Very small	3--4	392	31.28
Small	5--10	187	14.92
Medium	11--15	7	0.56
Large	>15	11	0.88

Table 6: Core authors of this subject domain

SL. No.	Rank	Author	No. of Publications	Percentage	Total Citation	Citation per Paper	H-index	PY_start
1	1	Thelwall, M.	46	3.67	3257	70.80	29	2013
2	2	Bornmann, L.	38	3.03	1487	39.13	17	2014
3	3	Haunschild, R.	31	2.47	710	22.90	13	2015
4	4	Costas, R.	26	2.08	1597	61.42	14	2013
5	5	Peters, I.	25	2.00	1597	63.88	14	2013
6	5	Haustein, S.	25	2.00	2095	83.80	18	2013
7	6	Torres-Salinas, D.	15	1.20	339	22.60	7	2013
8	6	Holmberg, K.	15	1.20	766	51.07	11	2013
9	7	Bowman, T.D.	14	1.12	588	42.00	11	2014
10	7	Alhoor, H.	14	1.12	180	12.86	7	2013

Thelwall emerges as the leading contributor with 46 publications (3.67% of the total), showcasing a significant impact with substantial total citations (3257) and a high citation per paper (70.80) since 2013. Bornmann follows with 38 publications (3.03% of the total), exhibiting a reasonable citation per paper (39.13) and growing influence since 2014. Haunschild holds the third position with 31 publications (2.47% of the total), showing moderate impact since

2015. Costas ranks fourth with 26 publications (2.08% of the total), demonstrating a strong impact with notable total citations (1597) and a high citation per paper (61.42). Peters and Haustein tied for fifth place, each with 25 publications (2.00% of the total), showcasing consistent impact since 2013. These authors, especially Thelwall, Costas, Peters, and Haustein, shape the field with their high citation numbers and ratios, highlighting individual impactful works and the dynamic



evolution of the field with a blend of seasoned and emerging influences.

Author productivity and Lotka's Law of this subject domain

Table 7: Author productivity

Sl. No.	Documents written	No. of Authors	Proportion of Authors
1	1	1835	0.787
2	2	289	0.124
3	3	81	0.035
4	4	52	0.022
5	5	18	0.008
6	6	16	0.007
7	7	5	0.002
8	8	7	0.003
9	9	5	0.002
10	10	5	0.002
11	11	4	0.002
12	12	2	0.001
13	13	1	0
14	14	2	0.001
15	15	2	0.001
16	23	1	0
17	25	2	0.001
18	26	1	0
19	31	1	0
20	38	1	0
21	46	1	0

Lotka's Law of author productivity, often represented by an inverse square law, reveals a distinct distribution in authors' document output. Table 7 confirms that 78.7% of authors contribute only one document, consistent with Lotka's expectation of a predominantly minimally productive majority. As the document count per author increases, the proportion of authors decreases, illustrating a skewed distribution where a few authors are highly productive while most contribute fewer documents. This pattern strongly supports Lotka's Law, underscoring the significance of highly productive individuals in scholarly publishing and its relevance for

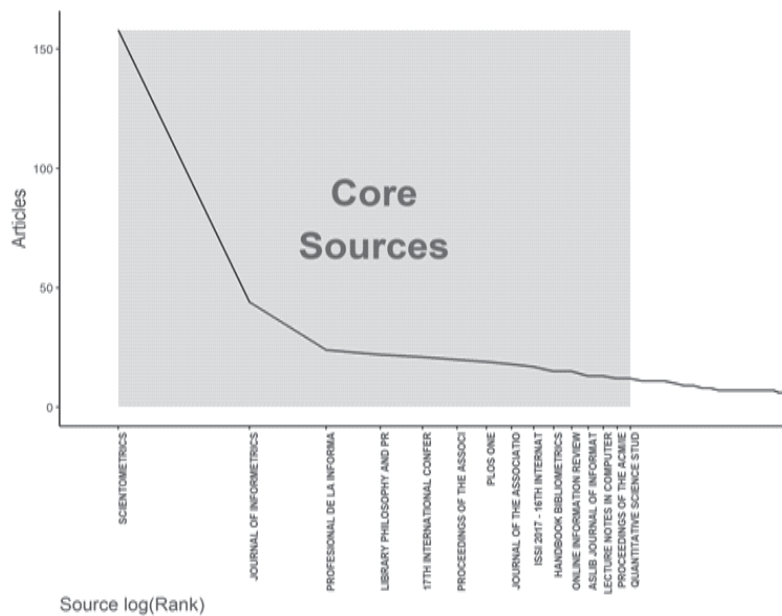
understanding bibliometric patterns and research evaluation methodologies.

5.3 Core journals (Sources) and Bradford's Law

Bradford's Law is a bibliometric principle describing the distribution of journal articles in a particular field. A small core of journals (Bradford core) will contain most articles on a specific subject. The law is often expressed as a three-zone model, where journals are classified into core, middle, and fringe zones based on productivity. Table 8 shows the list of core journals along with their rank, frequency, and cumulative frequency.

**Table 8: Core journals (Sources) of this subject domain**

Sl. No.	Core journals	Rank	Frequency	Cum. Freq
1	Scientometrics	1	158	158
2	Journal Of Informetrics	2	44	202
3	Profesional De La Informacion	3	24	226
4	Library Philosophy And Practice	4	22	248
5	17th International Conference on Scientometrics And Informetrics, Issi 2019 – Proceedings	5	21	269
6	Proceedings Of The Association For Information Science And Technology	6	20	289
7	Plos One	7	19	308
8	Journal Of The Association For Information Science And Technology	8	18	326
9	ISSI 2017 - 16th International Conference On Scientometrics And Informetrics, Conference Proceedings	9	17	343
10	Handbook Bibliometrics	10	15	358
11	Online Information Review	11	15	373
12	Aslib Journal Of Information Management	12	13	386
13	Lecture Notes In Computer Science (Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics)	13	13	399
14	Proceedings Of The Acm/Ieee Joint Conference On Digital Libraries	14	12	411
15	Quantitative Science Studies	15	12	423

**Figure 2: Sources and Bradford's Law**



Let's analyse the findings using Bradford's Law:

Bradford's Law suggests that a minority of journals will dominate publications in a field. To identify core journals, examine the top-ranked ones and assess if their distribution aligns with Bradford's Law. Typically, leading journals like "Scientometrics" should exhibit markedly

higher frequencies. In this case, "Scientometrics", with a frequency of 158 out of 423, conforms to Bradford's Law, highlighting the dominance of a select few journals. Evaluate if the table reflects middle and fringe zones, characterised by decreasing frequency. The cumulative frequency column pinpoints where core, middle, and fringe zones diverge, a key aspect of Bradford's Law.

5.4 Core subject area of this subject domain

Table 9: Core subject area of this subject domain

SL No.	Subject	No. of Publications	Percentage
1	Social Sciences	743	36.98
2	Computer Science	570	28.37
3	Medicine	222	11.05
4	Decision Sciences	119	5.92
5	Mathematics	107	5.33
6	Arts and Humanities	75	3.73
7	Engineering	50	2.49
8	Business, Management and Accounting	47	2.34
9	Multidisciplinary	38	1.89
10	Biochemistry, Genetics and Molecular Biology	38	1.89

Table 9 presents the breakdown of publications across the top 10 subject categories within the altmetrics domain. The data reveals that Social Sciences, with 36.98% of the publications, holds the most extensive share among the listed subject categories, making it the largest category. Computer

Science follows closely with a substantial share of 28.37%, securing its position as the second-largest contributor. Medicine also accounts for a significant portion at 11.05%. Additionally, Decision Sciences and another subject category hold a substantial share of publications at 5.92% and 5.33%, respectively.

5.5 Core keywords of this subject domain

Table 10: Core keywords of this subject domain

SL No.	Subject	No. of Publications	Percentage
1	Altmetrics	824	32.25
2	Human/ Humans	382	14.95
3	Bibliometrics	312	12.21
4	Social Media	300	11.74
5	Article	154	6.03
6	Journal Impact Factor	131	5.13
7	Twitter	118	4.62
8	Publication	117	4.58
9	Citation Analysis	111	4.34
10	Social Networking (online)	106	4.15



Table 10 presents the top 10 high-productivity keywords associated with over 1,253 publications. Altmetrics dominates with 824 publications (32.25%), followed by human-related topics like digital humanity with 382 publications (14.95%). Bibliometrics, involving quantitative analysis of bibliographic information, ranks third with 312 publications (12.21%). Significant contributions come from social media,

Twitter, and social networking, highlighting the role of online platforms. Articles and journal Impact Factor with 154 and 131 publications respectively underscore the focus on publication impact, while citation analysis represented by 111 publications explores scholarly impact through citations. The broader "Publication" category with 117 publications covers diverse aspects within the altmetrics domain.

5.6 Analysis of citation based indicators in altmetrics

Table 11: Analysis of citation based indicators

Particulars	No.
Total No. of Publications	1253
No. Cited Publications	1050
No. of Uncited Publications	203
Total Citation	21410
h-Index	66
h-core Citation	4356
Upto h-Citation	9938
h-excess Citation	5582
h-tail Citation	11472
Net Excess Citation	17054
Onesies	131
Twicies	102
Thricies	85
i10 index	445
e-Index	130.57
R-Index	146.32
a-Index	324

Table 11 displays data on 1,253 publications, with 1,050 cited and 203 uncited, accumulating 21,410 citations. Onesies (131), Twicies (102), and Thricies (85) signify publications with one, two, and three citations respectively, showcasing diverse citation patterns. The h-index of 66 indicates 66 publications with at least 66 citations each, reflecting robust citation impact. Metrics such as h-core citation

(4,356), upto h-citation (9,938), h-excess citation (5,582), h-tail citation (11,472), Net Excess Citation (17,054), i 10 index (445), e-index (130.57), R-index (146.32), and a-index (324) further delineate citation trends and impact. The dataset suggests growing publication numbers and impact, with citations becoming more widespread, illustrating the multifaceted nature of altmetrics.



5.7 Highly productive countries carrying out research in this subject

Table 12: Highly productive countries carrying out research in this subject

SL No.	Country	No. of Publications	Percentage
1	United States	273	21.79
2	United Kingdom	159	12.69
3	China	119	9.50
4	Germany	112	8.94
5	Spain	108	8.62
6	India	79	6.30
7	Iran	72	5.75
8	Canada	71	5.67
9	Netherlands	62	4.95
10	Brazil	55	4.39

Table 12 provides insight into the distribution of publications among the top 10 productive countries in the altmetrics field. While 71 countries were engaged in altmetrics research, the United States claimed the leading position with the most substantial

share, contributing 21.79% of the publications. The United Kingdom secured second place with a share of 12.69%, followed by China at 9.50%, Germany at 8.94%, and Spain at 8.62% in terms of their respective shares of publications.

5.8 Core institutions carrying out research in this subject

Table 13: Core institutions carrying out research in this subject

Sl. No.	Institutions	No. of Publications	Percentage
1	University of Wolverhampton	49	3.91
2	Administrative Headquarters of the Max Planck Society	37	2.95
3	Wuhan University	34	2.71
4	Max Planck Institute for Solid State Research	31	2.47
5	Universiteit Leiden	30	2.39
6	Universidad de Granada	27	2.15
7	Leibniz-Informationszentrum Wirtschaft	25	2.00
8	Nanyang Technological University	24	1.92
9	Consejo Superior de Investigaciones Científicas	20	1.60
10	University of Montreal	20	1.60

A total of 161 organisations contributed to the comprehensive research output of this study. The scientometric profile of the top 10 institutions is outlined in table 13. The findings reveal that the University of Wolverhampton stands as the most productive

institution in the field of altmetrics research, with 49 publications, accounting for 3.91% of the total. Following closely is the Administrative Headquarters of the Max Planck Society with 37 publications (2.95%), Wuhan University with 34 publications



(2.71%), Max Planck Institute for Solid State Research with 31 publications (2.47%), Universiteit Leiden with 30 publications (2.39%), and Universidad de Granada with 27 publications (2.15%).

6. Discussion

The study illustrates a notable increase in altmetrics research publications from 2012 to 2022, peaking in 2021 but showing a slight decrease in 2022, indicating a downward trend in growth rate. The prevalence of publications with two authors, followed by single and three authors, suggests a preference for fewer authors per publication. Influential contributors such as Thelwall, Costas, Peters, and Haustein shape the field with high citation numbers, reflecting varying citation patterns and emphasising individual impactful works. A concentrated number of journals, led by "Scientometrics," dominate publication frequency, aligning with Bradford's Law. Social Sciences and Computer Science emerge as leading subject categories, with other categories contributing variably. Top keywords like altmetrics, human/humans, and bibliometrics underscore the diverse focus within the field. Citation impact metrics such as the h-index, h-core citation, and net excess citation signify robust impact and the growing influence of altmetrics research, complemented by indices like the i10 index and e-index. Productivity is notably led by the United States and the University of Wolverhampton, followed by other prominent contributors like the United Kingdom and the Max Planck Society.

7. Conclusion

The study provides comprehensive insights into the growth, authorship patterns, core authors, journals, subject areas, keywords, citation-based indicators, highly productive countries, and institutions in altmetrics research. Future research could delve deeper into specific subdomains within

altmetrics, analyse the impact of emerging technologies on research dissemination, and explore interdisciplinary collaborations to address complex societal challenges. Additionally, longitudinal studies tracking the evolution of altmetrics research over time could offer valuable insights into its trajectory and potential future developments.

References

- Bornmann, L., Haunschild, R., & Mutz, R. (2021). Growth rates of modern science: a latent piecewise growth curve approach to model publication numbers from established and new literature databases. *Humanities and Social Sciences Communications*, 8(1), 1-15.
- Bradford, S. C. (1934). Sources of information on specific subjects. *Engineering*, 137, 85-86.
- de Solla Price, D. J. (1965). Networks of scientific papers. *Science*, 510-515.
- Damar, S., & Koksalmis, G. H. (2024). A bibliometric analysis of metaverse technologies in healthcare services. *Service Business*, 1-32.
- Dutta, B., & Rath, D. S. (2013). Scientometric study of carbon nanotube research in India. *SRELS Journal of Information Management*, 50(5), 639-55.
- Gonzales, L. G. V., Castaneda-Olivera, C. A., Cabello-Torres, R. J., Ávila, F. F. G., Cerrón, R. V. M., & Paredes, E. A. A. (2023). Scientometric study of treatment technologies of soil pollution: present and future challenges. *Applied Soil Ecology*, 182, 104695.
- Gupta, R., Ahmed, K. M., Gupta, B. M., & Bansal, M. (2016). Lung cancer in India: a scientometric study of publications during 2005-14. *International Journal of Medicine and Public Health*, 6(4).
- Kumar Patra, S., & Chand, P. (2005). Biotechnology research profile of India. *Scientometrics*, 63(3), 583-597.
- Laksham, S., Surulinathi, M., Balasubramani, R., & Srinivasaragavan, S. (2020). Mapping the



- research output on Coronavirus: a scientometric study. *Gedrag & Organisatie Review*, 33(2), 163-186.
- Lotka, A. J. (1926). The frequency distribution of scientific productivity. *Journal of the Washington academy of sciences*, 16(12), 317-323.
- Nath, A., & Jana, S. (2021). A scientometric review of global altmetrics research. *Science & Technology Libraries*, 40(3), 325-340.
- Samanta, D., & Dutta, B. (2017). Altmetrics: six years of changing scholarly appraisal. *SRELS Journal of Information Management*, 54(2), 64-77.
- Stanhill, G. (2001). The growth of climate change science: a scientometric study. *Climatic Change*, 48(2-3), 515-524.
- Straub, D. (2006). The value of scientometric studies: an introduction to a debate on IS as a reference discipline. *Journal of the Association for Information Systems*, 7(5), 241-245.
- Teli, S., & Dutta, B. (2016). Study of citation distribution in astrophysics: an empirical approach. *Journal of Information and Knowledge*, 255-269.
- Tunga, S. K. (2013). Application of Bradford's Law of Scattering to the horticulture literature: a citation study of doctoral dissertations 1991-2010. *Journal of Information and Knowledge (Formerly SRELS Journal of Information Management)*, 305-316.
- Wikipedia. (2022). Retrieved from <https://en.wikipedia.org/wiki/Altmetrics>