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Altmetric study of Indian Agricultural and Biological Sciences Publications Covered by Scopus Narrow Subject fields: special reference with Mendeley readership

Ashish Kumar Ahirwal[1], J. Shivarama[2]

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A B S T R A C T
This study examined Scopus-indexed articles in Agricultural and Biological Sciences from Scopus narrow subject fields, focusing on the relationship between citations and readership among Indian publications. The study retrieved 15,700 articles from the Scopus database, of which 83.25% with Digital Object Identifiers (DOI) were suitable for Mendeley readership. 99.96% of DOI articles matched the Mendeley API to measure readership. 94.39% of DOI articles had at least one reader, whereas 84.66% had at least one citation. The "Food Science" field had the highest citation and readership (18.51% and 19.72%, respectively) among all Agricultural and Biological Science narrow subject fields. The "Forestry" fields had the highest mean and standard deviation (SD) values for citation (18.27 and 29.78) and readership (49.05 and 69.39). Data skewness varied among subject fields, with "Food Science" and "Soil Science" showing the highest and lowest for both citations and readership. The geometric mean was similar to the mean value for the "Food Science" field for citation and readership variables. The mean normalization log-transforms citation score revealed that the "Plant Science" field had a higher value of 1.000124 with a group indicator for readership. Almost all narrow subject fields demonstrated strong positive correlations between citations and readership, ranging from 0.716 to 0.847.

1. Introduction

Alternative metrics offer a broader perspective on research impacts by considering more factors than traditional metrics, including social and public engagement. They measure public engagement with research outputs, like social media shares, helping researchers evaluate their work's relevance and impact on the public and policymakers(Dotti & Walczyk, 2022; Iyengar & Vaishya, 2023). Unlike citations, which take time to accumulate, alternative metrics provide real-time assessments of research impact. Altmetrics allow researchers to track immediate societal impacts, beneficial for increasing visibility and disseminating research(Taylor, 2023). The role of societal impact is increasingly significant in research assessments through alternative metrics(Bornmann, 2014; Thelwall, 2021). Although altmetrics are still developing, several studies have explored altmetrics and citation counts over the past decade, as introduced by Priem et al. (2011). Mendeley is a reference manager and social networking tool that uses user metadata to evaluate a metric called readership, quantifying how often an article is integrated, read, cited, or referenced in a user's Mendeley library(Sedighi, 2023; Thelwall et al., 2022). This metric differs from other altmetrics like Twitter or Facebook, which are public(Fang et al., 2022). Academicians use Mendeley and other tools like Zotero and EndNote. Mendeley readership reflects how often an article is read on Mendeley, considering its inclusion in user libraries for future reading or citing. In contrast, Scopus citations reflect multiple academic citations. Both metrics gauge research impact and influence in various fields(Wiechetek & Pastuszak, 2022).

This study investigates the relationship between citations and readership of Scopus articles from the Agricultural and Biological Science (ABS) narrow subject fields. These metrics assess research

[1] Ashish Kumar Ahirwal
Assistant Librarian, JRD Tata Memorial Library, Indian Institute of Science, Bangalore.
e-mail: ashisha@iisc.ac.in
[2] J. Shivarama
Assistant Professor, Centre for Library and Information Management, Tata Institute of Social Science, Mumbai.
e-mail: j.shivarama@tiss.edu

impact among ABS narrow subject fields to determine and explore the traditional and alternative metrics(Saikia et al., 2023). Narrower subject areas can be critical to understanding the societal implications and progress in any subject area. Several studies show Mendeley readership and Scopus citations indicate research impact and influence in different subject fields(Aduku et al., 2017; Maflahi & Thelwall, 2016; Mohammadi & Thelwall, 2014; Thelwall, 2017a; Thelwall & Wilson, 2016). Despite differences, both metrics are useful for assessing research effects(Basumatary et al., 2023).

2. Literature Review

Numerous studies find a strong correlation between citations and altmetric counts across fields, timeframes, publications, institutions, and countries. Examining relevant areas is crucial for understanding agricultural and biological science research and its social impact. This study focuses on Mendeley readership and Scopus citation counts of ABS narrow subject fields, as they are recognised indicators of research impact in the fields. Bibliometrics evaluates scholarly publications by examining research output, trends, authorship patterns, geographical distribution, and citation practices(Shah, 2016; Thanuskodi, 2012). Collaborative research is prevalent, and Agriculture 4.0(Shah, 2016), which integrates advanced technologies, is a crucial trend(Gupta et al., 2024; Mühl & de Oliveira, 2022). Bibliometric analyses explore agricultural value chains; identify significant institutions, authors, and countries(Analuisa-Aroca et al., 2021); provide insights into research trends, core journals, and influential contributors; guide future research; and identify focal areas. Recent studies have examined the impact of agricultural science publications using altmetrics. Research indicates highly cited articles have a significant social media presence, with 98.9% of top-nature papers mentioned on platforms(Ouchi et al., 2019). However, a study on Indonesian agricultural research found social media coverage below 30%, indicating limited online discussions(Ibrahim et al., 2019). Agricultural science publications have increased output and citations over time(Sagar et al., 2013). Although altmetrics offer insights into research impacts, their correlation with traditional citation metrics varies. Some studies found positive correlations between altmetric indicators and citations of highly cited articles(Ouchi et al., 2019). Singh et al. (2024) found that social media activity related to Indian research papers is lower than in developed countries, with higher activity in science-science connections (Mendeley) but lower in science-society connections (other social media and news). Banshal et al. (2019) reported that social media coverage of Indian research output (28.5%) is significantly lower than the global average (46.7%), particularly on Twitter and Facebook. Coverage varies by discipline, with medical sciences (MED) and biological sciences (BIO) having higher coverage than their publication volumes on the Web of Science. In contrast, engineering (ENG) and information sciences (INF) had the least. Vysakh (2021) found that Chinese articles have more readers across disciplines and locations, with Chinese LIS articles averaging 97 more Mendeley readers than Indian LIS articles, primarily consisting of PhD and master's students from diverse disciplines. Parabhoi et al. (2020) examined Mendeley readership counts of Sambalpur University publications in India and found a positive correlation between citation counts and Mendeley readership, although readership did not grow significantly over time.

Thelwall (2016) explored Mendeley readership as an early scientific impact indicator, effective across disciplines, growing faster than citations, aiding early impact evaluation. The correlation with citations strengthens over time, stabilising after five years. Lamba et al. (2021) found a strong positive correlation between Dimensions citations and Mendeley readership for computer science publications from Indian central universities. Jawaharlal Nehru University had the highest Altmetric score, Banaras Hindu University had the most Dimensions citations, and the University of Hyderabad had the largest Mendeley readership. Zahedi, Costas, et al. (2014) identified Mendeley as the predominant altmetric with a moderate correlation with traditional metrics, analysing 62.6% of publications and finding a moderate positive correlation (r=0.49). It emphasised Mendeley's broader scope compared to Scopus and Web of Science(Zahedi, Haustein, et al., 2014), beneficial for document types often excluded from citation analyses, especially in social sciences and humanities. Mendeley covered 23.5% of publications not indexed in WoS or Scopus within an 18,658-publication dataset. Mohammadi & Thelwall (2014) examined Mendeley's capacity for cross-disciplinary knowledge transfer and early impact evidence, finding stronger correlations with social science citations than with humanities. Fairclough & Thelwall (2015) demonstrated Mendeley data can calculate national research impact indicators earlier than

traditional citation-based indicators. Maleki (2015) used Mendeley data to assess the impact of Iranian scholarly articles, focusing on knowledge exchange, international paper popularity, and user interests. Li et al. (2012) identified a strong correlation between Mendeley readership and citation counts, with Spearman correlations of 0.54 and 0.60, analysing 1,613 articles from Nature and Science. Bornmann (2015) conducted a meta-analysis of altmetrics, finding a significant pooled correlation of 0.51 between Mendeley and citation counts, surpassing CiteULike and other altmetrics. Haunschild & Bornmann (2016) highlighted Mendeley's role in altmetric data and proposed normalization techniques for readership counts. Bar-Ilan et al. (2019) evaluated data accuracy from Mendeley, Altmetric, and PlumX for 2,728 JASIS&T articles, noting citation increases, readership, and temporal variations in altmetric and PlumX counts. Haunschild (2020) explored Mendeley readership and citation counts, considering reader counts as alternatives or complements to citations. Thelwall (2020) examined Scopus citation and Mendeley data for American authors in 11 computing fields (1996-2018), finding a strong correlation suggesting Mendeley benefits recent conference papers. Akella et al. (2021) identified Mendeley readership as a robust predictor of early citations. Bardus et al. (2020) found Twitter effective for research dissemination, noting articles shared on ResearchGate or Mendeley are more likely to be cited. Thelwall & Wilson (2016) observed a strong correlation between citations and Mendeley readership in 45 Scopus medical science areas, with 78% of articles having at least one reader. Asemi & Rasti (2023) reported a significant correlation between altmetric variables in 110 nursing journal articles at a 0.001 significance level. Studies in clinical medicine also demonstrated a significant correlation between citations and readership. Multiple studies across metrics, subjects, periods, and countries validated the relationship between citations and altmetric counts.

Several studies have been done in various subject areas and subject fields, but in the field of ABS, we didn't find any study to determine citation and readership correlations and research impact in this field, so this investigation addresses this gap in the literature. The current study focuses on the ABS publications and their reliability for Mendeley readership, the correlation between citation and readership, and various aspects of traditional and current metrics evaluations.

3. Objective of the Study

This study aimed to evaluate Mendeley readership activities in the narrow subject fields of ABS, focusing on Indian publications. The research design is a quantitative analysis to determine the relationship between citations and Mendeley readership in narrow ABS subject fields. It examines Scopus-indexed articles with Indian affiliations, aiming to fill a research gap in ABS(Nath et al., 2021). The study identifies the most active user groups and determines the correlation between citations and Mendeley readership. The following research questions were formulated:

RQ1. Is there Mendeley Readership presence in the narrow subject fields of ABS Scopus publications?

RQ2. Can ABS articles with appropriate Mendeley Readership presence be considered for research impact from an Indian perspective?

RQ3.Is there a significant relationship between citations and readership count in Scopus-indexed ABS Indian publications?

This study explores the nexus between citations and Mendeley readership in these disciplines, particularly Indian publications. We employed the Spearman correlation and Mean Normalised Log-Transformation Citation Score using world and group indicators to establish a correlation between citations and Mendeley readership(Maflahi & Thelwall, 2016; Thelwall, 2016, 2017b).

4. Methodology

The Scopus database was the primary source for data collection due to its extensive scholarly coverage. A systematic review was conducted on articles from Scopus ABS narrow subject field publications, focusing on Indian affiliations. Scopus categorises subjects into broader domains, with narrow subject fields as the most specific unit, using the "All Science Journal Classification" (ASJC) used and suggested in various studies(Meho & Sugimoto, 2009; Roto et al., 2021; Urdiales & Guzmán, 2024). Out of the 12 narrow subject fields within the ABS group, 11 were included, and one,

"Agricultural and Biological Sciences (miscellaneous)", was excluded to avoid duplicate records available in the other related fields(Thelwall & Wilson, 2016). Advanced search techniques using subject queries were applied on Scopus to collect bibliographic data. Distinct queries were created for each narrow subject field. Publications were limited to English-language journal articles with at least one author from an Indian institution, excluding articles from 2019 and other years. Data were collected in December 2023 using ASJC subject codes. The Mendeley API was used to acquire secondary readership data for each DOI article with the Webometrics Analyst tool. Articles without a DOI were excluded, as the Mendeley API required a DOI. Separate queries were created for each subject field(Fang et al., 2024).

- *AFFILCOUNTRY(india) AND SUBJMAIN(1100) AND (LIMIT-TO(PUBSTAGE,"final")) AND (LIMIT-TO(PUBYEAR,2019) AND (LIMIT-TO(DOCTYPE,"ar")) AND (LIMIT-TO(LANGUAGE,"English")) AND (LIMIT-TO(SRCTYPE,"j"))*
- *AFFILCOUNTRY(india) AND SUBJMAIN(1102) AND (LIMIT-TO(PUBSTAGE,"final")) AND (LIMIT-TO(PUBYEAR,2019) AND (LIMIT-TO(DOCTYPE,"ar")) AND (LIMIT-TO(LANGUAGE,"English")) AND (LIMIT-TO(SRCTYPE,"j"))*

This study explores the relationship between citations and readership within ASJC-classified narrow subject areas of ABS, focusing on Indian publications. This focus allows the inclusion of up to 20,000 bibliographic records from Scopus and supports future research in different regions or time periods.

5. Results and Analysis

The primary aim of this research was to investigate the connections between citations and Mendeley readership activities among ABS narrow subject fields with a specific focus on Indian publications. To accomplish the research objectives of our study, we analysed the data obtained from Scopus articles and presented the findings in detail in this section. Our study demonstrated that the presence of altmetrics tends to vary considerably based on social media platforms, such as Mendeley.

5.1. Scopus articles and their feasibility for Mendeley readership

Table 1 displays the primary Scopus data and their viability for Mendeley readership within ABS narrow subject fields. A total of 15,700 articles were retrieved for all ABS narrow subject fields, using an advanced subject query. Out of the 15700 Scopus articles, only 83.25% had DOI and were reliable for Mendeley's readership. "Insect Science" demonstrated the highest proportion of DOI articles (99.29%), followed by "Aquatic Science" (99.22%) and "Soil Science" (93.41%). "Forestry" exhibited the lowest proportion at 71.74%. We assessed Mendeley readership coverage for DOI articles across 11 narrow subject fields. Seven fields achieved 100% coverage, while the remaining four fields surpassed 99%.

Table 1, Primary data collection and its reliability for Mendeley readership among the ABS Narrow Subject fields

Narrow Subject Fields	Scopus Articles	Articles with DOI (N)	%	DOI Articles (N) Matched with Mendeley	%
General Agricultural and Biological Sciences	1323	1069	80.80	1069	100.00
Agronomy and Crop Science	3010	2321	77.11	2320	99.96
Animal Science and Zoology	1443	1107	76.72	1107	100.00
Aquatic Science	640	635	**99.22**	635	100.00
Ecology, Evolution, Behavior and Systematics	1975	1736	87.90	1734	99.88
Food Science	1644	1526	92.82	1525	99.93
Forestry	276	198	71.74	198	100.00
Horticulture	606	494	81.52	494	100.00

Insect Science	704	699	**99.29**	699	100.00
Plant Science	3032	2307	76.09	2307	100.00
Soil Science	1047	978	**93.41**	977	99.90

5.2. Citation and Mendeley readership Coverage of DOI articles

Table 2 presents a detailed analysis of citation and readership metrics for DOI articles within the ABS narrow subject fields. 84.66% of ABS articles have been cited at least once, while the readership rate for articles with at least one reader is 94.39%. The "Forestry" field leads in citation frequency, with 94.95% of its articles cited at least once. The "Aquatic Science" field exhibits the highest readership rate, with 98.90% of its articles being read at least once. The "Insect Science" field shows the lowest citation and readership rates, at 67.10% and 80.26%, respectively.

Table 2, Mendeley readership Coverage on Scopus articles with DOI of ABS Narrow Subject fields

Narrow Subject Fields	DOI Articles (N)	Articles with at least 1 Citation	%	Articles with at least 1 Readership	%
General Agricultural and Biological Sciences	1069	915	85.59	1030	96.35
Agronomy and Crop Science	2321	1947	83.89	2174	93.67
Animal Science and Zoology	1107	880	79.49	1019	92.05
Aquatic Science	635	594	93.54	628	**98.90**
Ecology, Evolution, Behavior and Systematics	1736	1422	81.91	1584	91.24
Food Science	1526	1400	91.74	1492	97.77
Forestry	198	188	**94.95**	194	97.98
Horticulture	494	380	76.92	446	90.28
Insect Science	699	469	67.10	561	80.26
Plant Science	2307	2014	87.30	2248	97.44
Soil Science	978	856	87.53	961	98.26

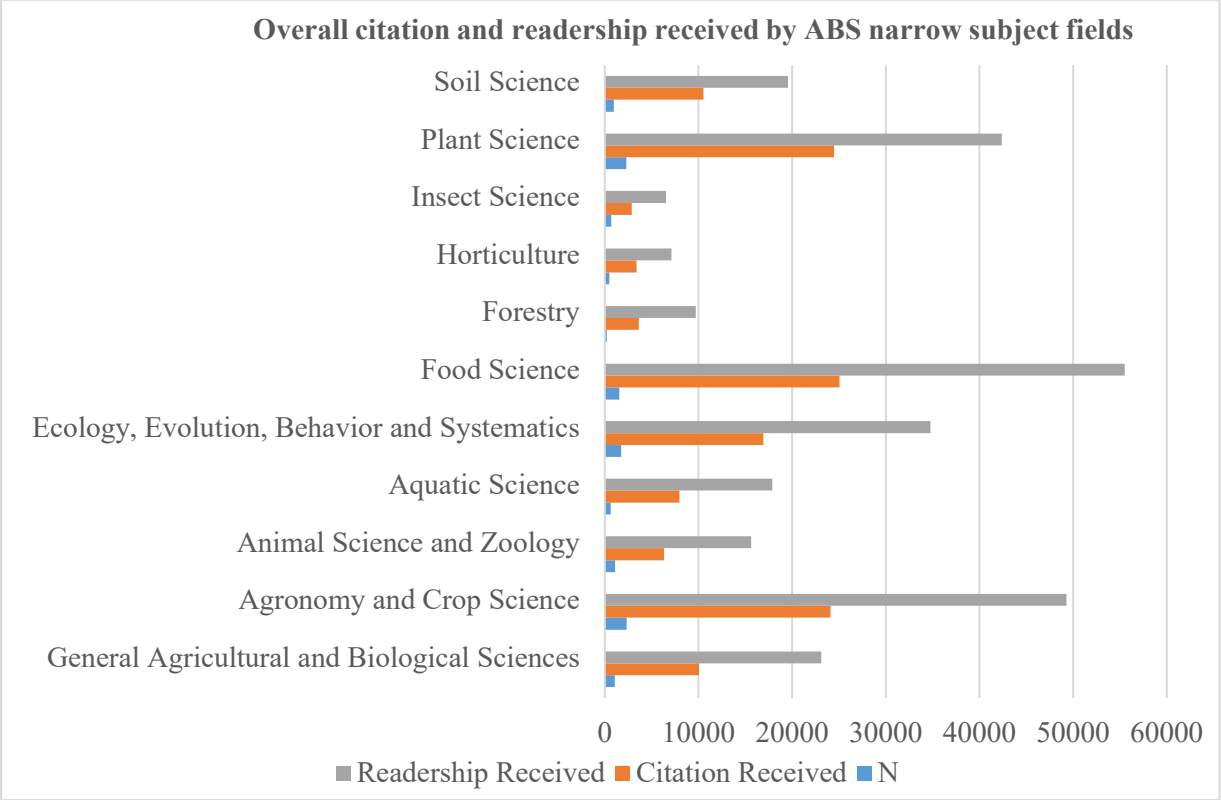
5.3. Overall citation and readership distribution

Table 3 shows the distribution of total citations (135330) and readership (281441) among the narrow subject areas of ABS. The narrow subject area “Food Science” had the highest citation and readership counts at 18.51% and 19.72%, respectively, based on the overall citation and readership. We observed that the “Insect Science” narrow subjects had the lowest citations, and readership counts of 2.11% and 2.32%, respectively (see Figure 1. with details about the proportion between the two variables among all narrow subject fields of ABS).

Table 3, Citations and Readership distribution of ABS narrow subject Fields

Disciplines	N	Citation Received	% from Total Citations	Readership Received	% from Total Readership
General Agricultural and Biological Sciences	1069	10054	7.43	23107	8.21
Agronomy and Crop Science	2321	24112	17.82	49269	17.51
Animal Science and Zoology	1107	6333	4.68	15616	5.55
Aquatic Science	635	7976	5.89	17878	6.35
Ecology, Evolution, Behavior and Systematics	1736	16917	12.50	34761	12.35
Food Science	1526	25047	**18.51**	55510	**19.72**
Forestry	198	3618	2.67	9711	3.45
Horticulture	494	3383	2.50	7128	2.53
Insect Science	699	2862	2.11	6516	2.32

Plant Science	2307	24485	18.09	42384	15.06
Soil Science	978	10543	7.79	19561	6.95



5.4. Statistical summary of citations and readership

Table 4 delineates the mean, standard deviation (SD), and skewness of data for citation and readership variables within ABS. The Forestry field exhibits the highest mean and SD values for both citation (18.27 and 29.78, respectively) and readership (49.05 and 69.39%, respectively). The pronounced SD indicates a greater dispersion of data values from the mean, suggesting substantial variability. The data indicate that the distribution of citations and readership is positively skewed, with higher values occurring less frequently. The citation data demonstrate the greatest skewness in Food Science (28.96) and the least in Soil Science (2.82) (refer to Figure 2). Similarly, the readership data reveal the highest skewness in Horticulture (9.66) and the lowest in Soil Science (2.59). This analysis suggests that the distributions of citation and readership are positively skewed, reflecting a broad range of values.

Table 4, Statistical distribution of citations and Mendeley Readership among the ABS narrow subject fields

Disciplines	N	Citations			Readership		
		Mean	SD	Skewness	Mean	SD	Skewness
General Agricultural and Biological Sciences	1069	9.41	14.40	4.19	21.62	32.21	4.60
Agronomy and Crop Science	2321	10.39	16.70	4.73	21.23	33.66	5.66
Animal Science and Zoology	1107	5.72	8.89	4.08	14.11	27.05	8.29
Aquatic Science	635	12.56	17.94	5.08	28.15	36.89	5.19

Ecology, Evolution, Behavior and Systematics	1736	9.74	23.36	8.98	20.02	38.21	6.63
Food Science	1526	16.41	43.73	**28.96**	36.38	49.87	7.13
Forestry	198	**18.27**	**29.78**	4.29	**49.05**	**69.39**	3.60
Horticulture	494	6.85	17.67	8.82	14.43	36.15	**9.66**
Insect Science	699	4.09	7.17	3.73	9.32	15.74	3.83
Plant Science	2307	10.61	19.65	8.90	18.37	27.65	7.28
Soil Science	978	10.78	15.15	2.82	20.00	25.79	2.59

5.5. Data normalization of citation and readership variables

Table 5 presents the geometric mean (geomean), mean normalized log-transformed citation score (MNLCS), and Spearman correlation between citations and readership in ABS narrow subject fields. We analysed ABS publications to compare the group indicator MNLCS with world indicators at the 95% confidence interval with their lower and upper sample and population size (see Table 6). The geometric mean is valuable for growth rates or multiplicative ratios. ABS narrow subject fields, particularly "Forestry," show significant geomean values for citation and readership at 8.69 and 24.53, respectively. Thelwall (2017b) introduced MNLCS to enhance comprehension of citation and readership data, including benchmarking against the global average. MNLCS is crucial in research evaluation, providing a sophisticated understanding of citation and readership impacts by encompassing average counts and applying a logarithmic transformation. The global MNLCS average was set to one, with group values differing based on field/year sample and population size. Values greater than one suggest a higher group average than the world average, while values below one indicate a lower group average. Plant Science had a higher readership MNLCS of 1.000124, while Agronomy and Crop Science, Ecology, Evolution, Behavior and Systematics, Food Science, and Soil Science showed the lowest average from group indicator compared to the world indicator. When calculating group and world indicators using the total ABS publications population size, the group indicator MNLCS (0.999920799) was lower than the world indicator average (Table 6).

5.6. Spearman correlation between Citation and Mendeley Readership

We examined Spearman's correlation to assess the robustness and relationship between citation and readership variables, revealing correlations across ABS narrow subject areas (See Table 5). Our analysis revealed a strong positive correlation between citation and readership variables in almost all subject fields, with values ranging from 0.716 to 0.847, to support and answer RQ3. Agronomy and Crop Science" exhibited the highest correlation between citation and readership counts (0.847), indicating strong positive correlations (see Figure A1 in the appendix, to illustrate correlations between citation and readership using a scatter plot for each ABS narrow subject fields presented combinedly from A to K sub-figures).

Table 5, Correlation between citation and readership with geomean and MNLCS value

Disciplines	Sample Size (N)	Citation		Readership		Spearman rho**
		Geomean	MNLCS	Geomean	MNLCS	
General Agricultural and Biological Sciences	1069	4.61	1	11.02	1	0.755
Agronomy and Crop Science	2321	4.71	1	10.12	0.99999	**0.847**
Animal Science and Zoology	1107	2.97	1	6.94	1	0.716
Aquatic Science	635	7.01	1	17.61	1	0.771
Ecology, Evolution, Behavior and Systematics	1736	3.98	1	8.49	0.999823	0.771
Food Science	1526	8.38	1	21.26	0.999536	0.839
Forestry	198	**8.69**	1	**24.53**	1	0.833
Horticulture	494	2.73	1	6.20	1	0.755

Insect Science	699	1.90	1	3.90	1	0.747
Plant Science	2307	5.06	1	10.34	**1.000124**	0.785
Soil Science	978	5.18	1	10.63	0.999711	0.823

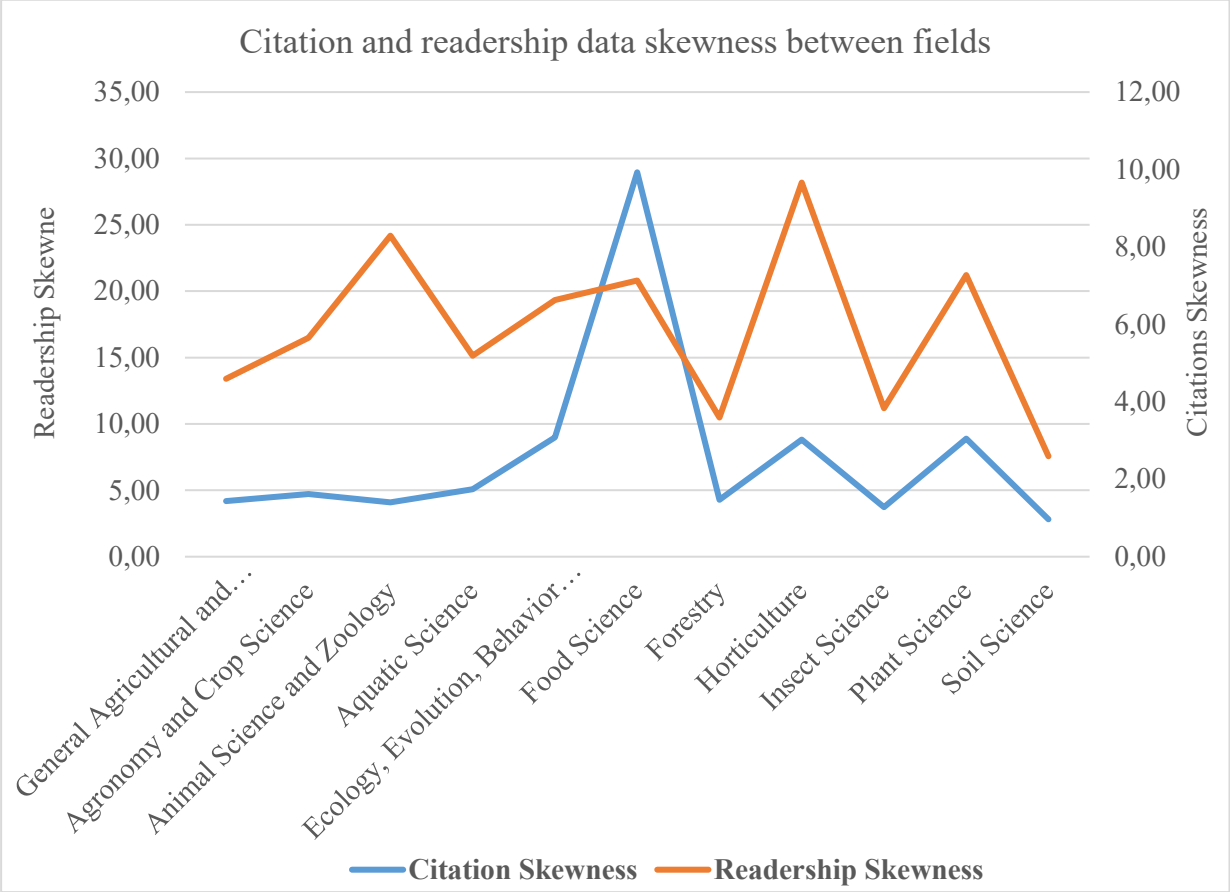


Table 6, MNLCS Proportion between the variables using 95% confidence interval of ABS narrow subject fields combindly for overall publications

Variables	Group	Sample Size (N)	MNLCS	Lower 95 Sample	Upper 95 Sample	Lower 95 Population	Upper 95 Population
Citation	World	13070	1	0.984228	1.016599	0.988547322	1.011452678
	India	13070	1	0.984228	1.016599	0.988547322	1.011452678
Readership	World	13070	1	0.988336	1.012106	0.991585919	1.008414081
	India	13070	**0.999920799**	0.988256	1.012027	0.991504818	1.00833678

6. Findings and Discussion

Our research involved a comprehensive examination to determine the extent of Mendeley reader usage in articles within the ABS narrow subject fields, explicitly focusing on Indian publications. This study aimed to explore the relationships between Mendeley readership and citation counts while acknowledging the limitations of the analysis. The results of each research question are described in detail below.

Obtaining information from social media networking sites is beneficial for researching altmetrics, with DOI serving as a valuable tool(Sugimoto et al., 2017; Thelwall, 2015). DOI and Mendeley metadata searches were used to integrate Scopus articles with Mendeley records, consolidating results for comprehensive coverage. Preliminary findings support RQ1 and indicate that most Scopus articles (83.25%) have DOIs that significantly influence readership and search metrics.

High-percentage DOI records are reliable for readership studies and applicable across disciplines. This is reflected in specific ABS areas, with "Insect Science" having the highest percentage of Scopus DOI articles at 99.29%, followed by "Aquatic Sciences" and "Soil Science" at 99.22% and 93.41%, respectively. The results suggest that many Scopus articles have DOIs, which are valuable for determining readership, making DOI articles trustworthy sources for studying different fields, topics or any other criteria.

The above findings regarding the reasonable percentage of DOI articles partially answer the second research question. The remaining picture of ABS articles referencing the Indian perspective focuses on other findings such as the overall citation and readership coverage of this specific article. As discussed in the results, 99.96% of DOI articles matched the Mendeley API and the probabilities of readership. Holmberg et al. (2019) examined the coverage of DOI articles concerning Finnish articles and various altmetric events. Another study by Nath et al. (2020) revealed differences between Scopus and Mendeley articles. This study can be considered appropriate, reliable, and suitable for monitoring Mendeley's readership of ABS articles from an Indian perspective. Most of the narrow subject fields received adequate citations and readership, which also applies to the answers to RQ1 and RQ2.

To facilitate the accumulation of mature citations and focus on correlations between the two variables, a minimum four-year gap from the publication year was maintained, as recommended(Kousha et al., 2011; Kousha & Thelwall, 2019). The readership ratio varied significantly across narrow subject areas, and the time window impacted citation and readership strength, showing a strong correlation between readership and citation ratio, reflecting user preferences in narrow fields. Previous studies(Akella et al., 2021; Zahedi et al., 2017) have shown older publications attract more citations, while recent ones garner higher readership (altmetrics). The articles exhibited high readership and similarities with diverse documents, and preliminary studies have shown the feasibility of readership for primary sources like journals, reviews, and conference articles. This study analysed the readership activities of ABS field articles in the Scopus database, focusing on Indian publications, and examined the feasibility of using impact metrics for selected narrow subject areas, particularly Mendeley readership. The mature ABS publications of all the narrow subject areas that were studied had sufficient readership activities and strongly correlated with citations that met with the research objective and answered RQ2.

Several studies found moderate to strong positive correlations between citation and readership, consistent with previous research(Bar-Ilan et al., 2012; Mohammadi et al., 2015). The analysis revealed strong positive correlations ranging from 0.716 to 0.847 from ABS narrow subject fields, with "Agronomy and Crop Science" demonstrating the strongest relationship, followed by "Food Science" and "Forestry". The study also evaluated arithmetic mean, geomean, SD, and MNLCS values, finding that the field "Forestry" had the highest mean and SD for both variables. Data skewness differed among subject fields, with "Food Science" having the highest skewness for citations and "Horticulture" for readership. The ABS publications' group indicator MNLCS (0.999920799) was lower than the world average. The analysis of Spearman correlation and statistical results from the study lend credence to the findings of RQ3, as previously mentioned.

7. Conclusion

It is crucial to recognise that the coefficients in this and previous studies must be strong enough to assert that citation counts and Mendeley readership accurately reflect the same aspects of research efficacy. Therefore, readership should be considered a supplement and alternative to citations. Altmetrics, like traditional citation indices, measure scientific impact differently. Research has indicated that Mendeley readership may reflect article usage and citation impact, but only if limited to readers who are also authors. Thus, Mendeley readership can indicate an article's scientific impact without the delays typical of citation analysis. Additionally, Mendeley readership counts may reveal the hidden impacts of research articles on non-author readers. Both Mendeley's readership and citation counts indicate research impact and influence. This study found a high correlation between these variables in most fields, suggesting that Mendeley readership offers significant advantages over citation counts. However, the study's limitations, focused on the Indian perspective, allow for future studies with broader

scopes, such as different geographical areas, multiyear publications, or other relevant perspectives within the ABS group of publications.

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Appendix: The scatter plot illustrates (Figure A1) Spearman correlation between citations and readership in different ABS narrow subject fields.

