JISTaP http://www.jistap.org
Journal of Information Science Theory and Practice

RESEARCH PAPER
J Inf Sci Theory Pract 9(4): 75-84, 2021

eISSN : 2287-4577 pISSN : 2287-9099

https://doi.org/10.1633/JISTaP.2021.9.4.6

Who Reads Indian and Chinese LIS Articles on Mendeley? Scoping and Comparing User Categories Through Altmetrics

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ABSTRACT

Mendeley reader count is good evidence of the early impact of scientific output since it appears before citations. This paper aims to scope and compare Mendeley readers of Library and Information Science (LIS) articles published from India and China. Mendeley readership data for the highly cited 1,000 articles in Web of Science are extracted using Webometric Analyst for both countries and are analysed using Excel and SPSS. The findings reveal that LIS articles that are published from China got more readers as compared to LIS articles published from India with an excess of 97 readers per paper on Mendeley. The occupational status of readers tells that PhD students are the top readers for both the countries' publications, followed by masters students. Discipline-wise readership shows that readers were spread across 29 different fields, with the highest readers from business, management and accounting, followed by computer science for both countries' publications. Location-wise readership depicts that the top engaged readers are from the United States for both the countries' publications. Finally, the study reports a positive association between citations and Mendeley bookmarks, justifying that Mendeley readership can be used to measure the early research impact of LIS scholarship in both countries.

Keywords: Library and Information Science, Altmetrics, Mendeley, Mendeley bookmarks, Mendeley readers, readership analysis

Received: August 18, 2021 **Revised:** December 4, 2021
Accepted: December 5, 2021 **Published:** December 30, 2021

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1. INTRODUCTION

Assessing research impact is of utmost importance, for career advancement for authors, funding decisions for institutions, and policymaking for countries (Nath et al., 2020). Statistics and citation indices are traditionally used as a way of measuring the value of scientific artefacts (Mohammadi & Thelwall, 2014). However, the same has latterly been heavily criticised for its limitations, including the inability to measure the impact of individual articles and the delay in accruing citations (Aksnes et al., 2019). Further, a significant concern raised by the research community is the inability of traditional metrics to gauge the societal and non-academic impact of research (Bornmann, 2014; Thelwall, 2017). Thus the emergence of new metrics has been highly sought, and in 2010, Jason Priem introduced altmetrics (Verma & Madhusudhan, 2019). It has proposed supplementing traditional metrics since the newly emerged social media metrics were found to remove one or more limitations of the traditional citation metrics (Nath et al., 2021, p. 415). It has gained popularity for its power to measure the early and broader impact covering non-academic audiences and divergent research outputs and sources, consisting of social platforms, policy documents, and reference managers, including Mendeley (Aung et al., 2019).

1.1. Mendeley and Readership

Mendeley is a top-rated social referencing site that lets users store and share references online (Haunschild et al., 2015). The number of users who bookmark or save a paper in Mendeley depicts the readership count, which is possible to extract by the Application Programming Interface (API) offered by Mendeley (Mohammadi & Thelwall, 2014). Before citing an article, the reader must have read it, and thus the counting the number of readers will aid in knowing the early impact of the research (D'Angelo & Di Russo, 2019). Furthermore, analysing Mendeley readership of articles helps to know the specific bookmarking trend of articles, geographically and demographically. Apart, it assists in tracking the knowledge transfer and percolation of scholarly communication across disciplines (Eldakar, 2019). Moreover, it lets the research community gauge the early and invisible effects of the articles that the citations database cannot measure.

Studies assessing the Mendeley readership of specific domains have taken place, including Library and Information Science (LIS). For instance, Pooladian and Borrego (2016) tried to measure the readership statistics of LIS articles indexed in Web of Science (WoS), but failed to sketch the academic and geographic status of the readers. In the same instance, Verma and Madhusudhan (2019) explored the readership of top-cited digital library articles published from India and China, but missed in providing a comprehensive picture of the readership of the LIS domain as a whole. The present study has taken itself up to fill these gaps by finding answers to the following research questions.

1.2. Research Questions

RQ1: What are the common categories of readers for LIS articles on Mendeley for Chinese and Indian scholarly articles?

RQ2: What are the top countries in terms of Mendeley readership counts of Chinese and Indian publications?

RQ3: Is there any association between citations and Mendeley bookmarking for Chinese and Indian LIS articles?

2. REVIEW OF LITERATURE

Altmetric studies aim to validate social media metrics complement traditional metrics, by associating citations with various altmetric indicators, including Mendeley (Chi et al., 2019; Schlögl et al., 2014). Mendeley is one of the significant sources of altmetrics (Chen et al., 2018). Researchers explore various aspects of Mendeley, including article coverage, readership counts and their association with citations, reader's demographics and geographic features, and discipline-wise readership. Eldakar (2019) studied the Mendeley readership of academic articles indexed in Scopus from Egypt and found that PhD students were the top patrons, followed by masters and postgraduate students. Users from the United States comprised the most readers for the articles and showed a positive association between Mendeley bookmarks and citations. Nath et al. (2020) measured the Mendeley readership of PLOS articles and found that significant readers were PhD and postgraduate students. The United States registered as the top country in terms of highest number of reader registration. The study findings reported a positive correlation between the Scopus citation with Mendeley readership. Thelwall and Wilson (2016) measured and reported Mendeley readership altmetrics of medical articles indexed in Scopus in 2009 with a positive correlation between readership and citations. Zahedi et al. (2017) carried out a study to measure the Mendeley readership score over ten years

 https://doi.org/10.1633/JISTaP.2021.9.4.6

across five major science disciplines by analysing the citation and Mendeley readership of articles published from 2004 to 2013 in the WoS database. The study divulged that 86.5% of all the publications were Mendeley-indexed and had at least one reader. In another study, Chen et al. (2018) discovered that majority of the Mendeley users were youngsters, especially masters and PhD students. Parabhoi et al. (2020) investigated the Mendeley readership of Sambalpur Universities publications from 1971 to 2018 indexed in Scopus and found a positive correlation between the citations and readership (r=0.33). The study exhibited that the growth of Mendeley readership was not stable over the years.

Pradhan (2016) explored the Mendeley readership of 366 LIS articles published from India and reported 7,607 total readers for the articles, excepting 36 publications. PhD and masters students were the top engaged readers for the articles and were from the computer science discipline. The study reported a positive association between Mendeley readership and citations for the articles (r=0.619). Pooladian and Borrego (2017) discovered that PhD and postgraduate students were the top readers for LIS articles when they analysed 54,655 articles and reviews indexed in WoS. These findings were in opposition to the study finding of Parabhoi and Verma (2020), who reported higher readership by students and librarians for LIS articles published in the DESIDOC journal by analysing the Mendeley readership of digital library publications. The study discovered that it took seven years for LIS articles to attract as many Scopus citations as Mendeley readers. In the same instance, Thelwall and Sud (2016) found that Scopus citations and Mendeley readership stabilised after five years when articles from five various fields (agriculture, business, decision science, pharmacy, and social science) were analysed. Both Scopus citations and Mendeley readership were positively correlated in LIS and humanities, as reported in another study conducted by Thelwall (2019). The same findings were outlined when conference papers in computer science fields were analysed, indicating the closeness of computer science with library science (Thelwall, 2020). Later, Mohammadi and Thelwall (2014) clarified that there was no disciplinary difference in the reading of articles in Mendeley except for IS & LS subjects, based on the analysis of 27,558 social science and 1,914 humanities articles indexed in WoS. Even though many studies have tried to measure the Mendeley readership of LIS articles published from India (Pradhan, 2016; Verma & Madhusudhan, 2019), a comprehensive analysis has not been conducted so far, especially by comparing with other countries' publications. Thus, the current study is carried out to fill this gap.

3. DATA EXTRACTION AND METHODOLOGY

Among Asian countries, China and India are top in scientific research, globally, with third and ninth rank, respectively, with 92 and 63 H index (Scimago, 2021). A comparison between these two countries offers a clear picture of the value of research scholarship through the Mendeley microscope. The entire study consists of two steps, i.e., selecting the highly cited articles for each country and extracting the Mendeley readership of the articles. First, the WoS database was chosen for selecting the papers since it is one of the popular databases and previous studies showed promising results when correlated with Mendeley bookmarks (Thelwall & Wilson, 2016). Then, we used the advanced search feature of the database to select the highly cited articles. The reason for choosing highly cited articles is based on the assumption that well-cited pieces fetch good readership, and thus the results will be convincing if correlated (Thelwall, 2018). The keyword "WC=(Information science and Library science)" was searched, and 307,221 results were produced. Later, we set the refinement to China and India in the countries/region option to filter articles from each country. The results were again refined to language as English, document type as articles (journal, book, conference proceeding, generic), the period from 1989 to 2021, and indexes as Science Citation Index-Expanded, Social Science Citation Index, and Arts and Humanities Citation Index. Finally, a total of 5,539 and 1,357 articles indexed from China and India in WoS were retrieved. These results were further sorted according to the highest to lowest citations, and the top 1,000 articles with bibliometric details were exported to Excel. Articles with proper Digital Object Identifier (DOI) (See Table 1 for statistics) from each country were separately saved in the first column in the Excel sheet and saved as a plain text file to extract the Mendeley readership using the Webometric Analyst 4.1 software. Compared to other previous studies conducted by Nath et al. (2021) and Eldakar (2019), which employed the search query format as 'article title, the surname of the first author and publication year,' this study used DOI for extracting the reader information through the Mendeley API search tab (Search for Publications [API v1]). The reason behind this was that only the DOI search was found successful to extract the readership during the trial extraction after exercising both methods.

After uploading the files (separately for China and In-

Table 1. Summary statistics for the data collected

Country	Articles indexed in WoS	Sampled articles	Articles with DOI	Articles covered in Mendeley	Articles with readership	Total readership score	Total citations	RPP	CPP	CPR
China	5,539	1,000 (18.05)	958 (95.8)	480 (50.10)	480 (100)	78,365	62,653	163	131	0.79
India	1,357	1,000 (73.69)	950 (95)	467 (49.15)	467 (100)	30,921	14,634	66	31	0.47

Values are presented as number only or number (%).
Wos, Web of Science; DOI, digital object identifier; RPP, readers per paper; CPP, citations per paper; CPR, citations per reader.

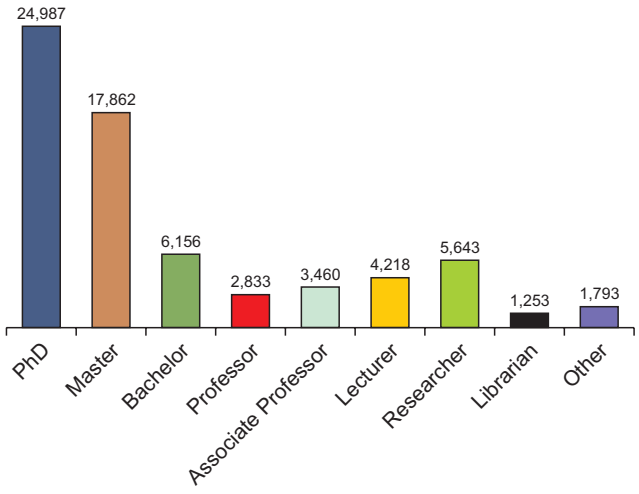

Fig. 1. Occupational-wise readers for Chinese LIS articles. LIS, Library and Information Science.

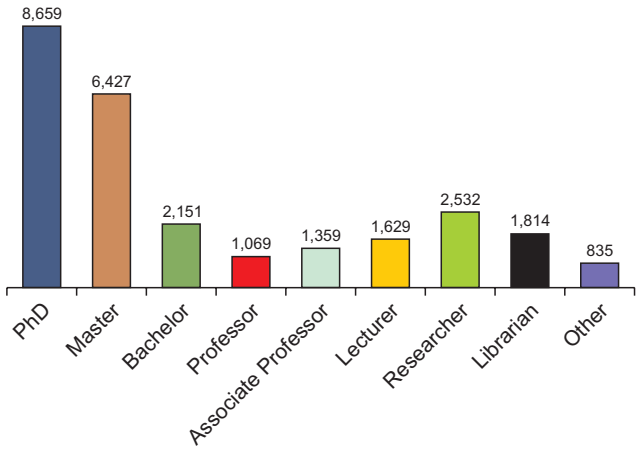

Fig. 2. Occupational-wise readers for Indian LIS articles. LIS, Library and Information Science.

dia), the software asked for the data source and selected Web of Science by indicating '1' in the corresponding location (1 was the default number for WoS, 2 for Scopus Web or email, 3 for Scopus API, and 4 for Dimensions API). In the next step, the software looked for the input file column information and we selected the DOI option by hitting '1' in the corresponding column. The software also asked permission to authorise Mendeley to execute the query and gave the authorization. Later, the data extraction was carried out, and the result was reported for China and India within 15 and 16 minutes, respectively. For data accuracy, the complete data extraction process was done on a single day, i.e., April 3, 2021, since the database undergoes daily updating. The results included duplicate records and were later removed by deleting repeated articles with the same Mendeley ID. The results consisted of demography-wise, geography-wise, and discipline-wise readership information, and all were self-reported by Mendeley users. The reader categories of Mendeley were further merged for easy analysis (Appendix). Articles without readership were shown as 0 to -1 in the retrieved data file. The Spearman correlation test was applied to match the correlation between citations and readership because of the data skewness (test applied for both zero and non-zero value of Mendeley readership) done using IBM SPSS ver. 21 (IBM Co., Armonk, NY, USA).

4. RESULTS

4.1. Summary Statistics for the Data

Table 1 summarises the statistics of the data collection. Of 1,000 highly cited articles, 958 or 95.8% (China) and 950 or 95% (India) articles had a DOI. Of the sample articles with DOIs, 480 (50.10%) from China and 467 (49.15%) from India showed presence in Mendeley and got readers on Mendeley. Chinese LIS articles received a high readership (78,365) and citations (62,653) as opposed to India. For each Chinese LIS article, there were 163 readers, while it was 66 for Indian articles. Chinese LIS articles had the highest citation per paper (CPP, 131) and citation per reader (CPR, 0.79), compared to India, which accounted for 31 CPP and 0.47 CPR, respectively. Thus, for both countries' publications, Mendeley reader-

ship was high compared to its citations.

4.2. Occupation-wise Readers for LIS Articles

Figs. 1 and 2 show the query results for extracting the categories of the readers on Webometric Analyst. After the grouping of some categories as detailed in the methodology section, there were mainly nine categories of readers, including PhD, masters, and bachelors (students), professor, associate professor, and lecturer (faculty/academics), researcher (independent), librarian (professionals), and others. The doctoral students were the active readers of LIS articles on Mendeley, with 24,987 and 8,659 readers for China and India, respectively. The second highest reader category was comprised of masters students with 17,862 (China) and 6,427 (India). In contrast, bachelor students were the third-highest readers for Chinese articles with 6,156 readers and researchers for Indian papers with 2,532 readers. Interestingly, Indian articles got a good readership (1,814) among the librarians compared to Chinese (1,253) articles. Regarding readership among the faculties or academics, it was clear that lecturers were more active readers than professors and associate professors. The articles from both countries got many readers identified as 'Other,' indicating the interest in reading LIS articles among the non-academic community.

4.3. Discipline-wise Readers for LIS Articles

Data in Figs. 3 and 4 show the discipline-wise readers for the LIS articles of China and India. The top 10 disciplines were selected as per the highest number of readers from 29 different fields (including the discipline identified as 'Unspecified' in Mendeley). It indicates the broad interest in LIS scholarship apart from the parent discipline. Interestingly, readers who belong to the business, management, and accounting disciplines were the top readers for both countries' publications with 22,837 (29.14%) and 7,360 (23.80%) readers, respectively. Out of the total readers, 14,772 (18.85%) readers were from computer science for China and 5,520 (17.85%) readers for India were the same, which stood as the second-highest discipline in terms of readership. On the other hand, social science readers held 12.36% of the total readership for Chinese publications while they were 16.79% for Indian ones. Thus, although the number of readers was different, both countries had readers from the same discipline in the top 10 list.

4.4. Country-wise Readers for LIS Articles

Mendeley readership is varied geographically, and there were 100 countries recording readership for Chinese publications and 88 countries for Indian ones, with

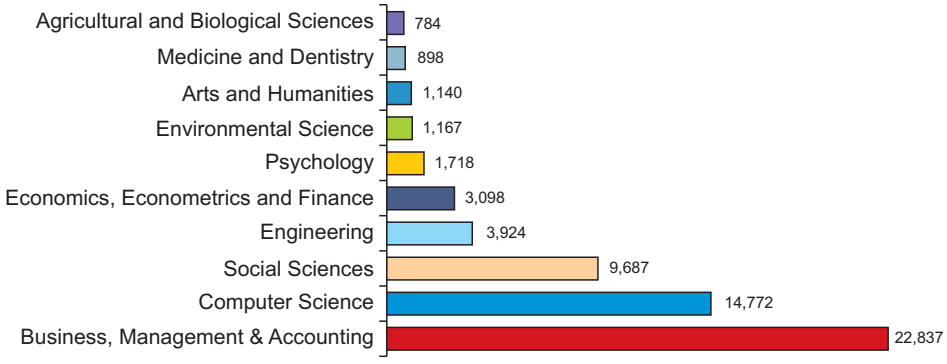

Fig. 3. Discipline-wise readers for Chinese LIS articles. LIS, Library and Information Science.

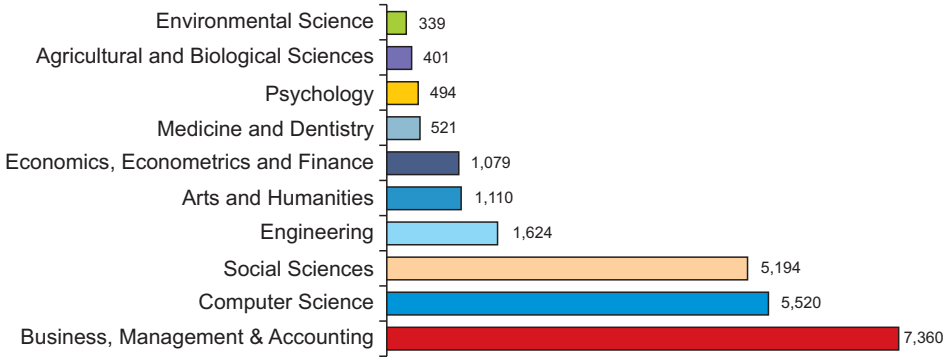

Fig. 4. Discipline-wise readers for Indian LIS articles. LIS, Library and Information Science.

at least one reader. Data in Figs. 5 and 6 depict the top 10 countries in terms of the highest readership. For both countries, the readership was the highest from the United States with 718 and 224 readers, respectively, followed by Germany (with 383 for China and 144 for India) as the second-highest country-wise readers. The third-highest country was Brazil, with 280 readers for Chinese articles and 105 for Indian ones. The majority of the readership (China, 2,222 or 2.83%, and India, 765 or 2.47%) in the top 10 for both countries were from outside Asia, which implies the influence of LIS scholarship beyond the Asian continent.

4.5. Correlation Between Citations and Mendeley Readership Based on Academic Status

The extent to which Mendeley bookmarking correlates with citations in terms of academic status was also analysed. Articles without Mendeley readership but having citations were also considered for the analysis. Since the data was skewed, Spearman's correlation was applied. The correlation value (rho) ranges from 0.1+, 0.3+, and 0.5+ (whether positive or negative), indicating small, medium, and large, respectively (Cohen, 1988). Medium and highest correlations were considered substantial (Eldakar, 2019). According to Table 2, the associations were recorded low for associate professors (0.180), lecturers (0.179), doctoral students (0.171), and librarians (0.047) for Chinese publications. For India, associations ranged from medium (researchers [0.211]) to low (associate professors [0.168], lecturers [0.160], and librarians [0.064]), respectively. The overall association between citations and Mendeley readership in terms of academic status for both countries' publications was positive. The highest rho value was observed for those who authored articles frequently as opposed to authors who did not (librarians).

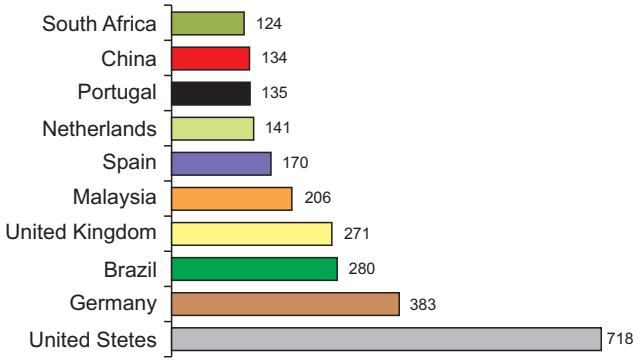

Fig. 5. Readers from top 10 countries for Chinese LIS articles. LIS, Library and Information Science.

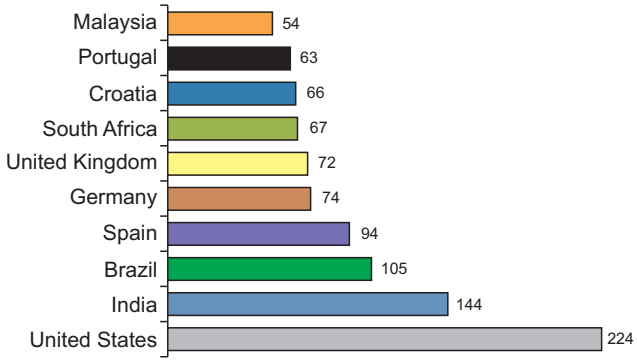

Fig. 6. Readers from top 10 countries for Indian LIS articles. LIS, Library and Information Science.

Table 2. Correlation between citations and Mendeley readership based on academic status

Academic status	Correlation	China (n=958)	India (n=950)
PhD Student	Spearman's rho	0.171	0.136
Master Student	Spearman's rho	0.167	0.143
Bachelor Student	Spearman's rho	0.152	0.147
Professor	Spearman's rho	0.155	0.139
Associate Professor	Spearman's rho	0.180[a)]	0.168
Lecturer	Spearman's rho	0.179	0.160
Researcher	Spearman's rho	0.164	0.211[a)]
Librarian	Spearman's rho	0.047[a)]	0.064[a)]
Others	Spearman's rho	0.169	0.140

[a)]Correlation is significant at the 0.01 level (2-tailed).

 https://doi.org/10.1633/JISTaP.2021.9.4.6

Table 3. Correlation between citations and Mendeley readership

Country	Association between citations and readership	Correlation	Citations	Readers
China (n=958)	Citations	Spearman's rho	1.000	0.172[a)]
	Readers	Spearman's rho	0.172[a)]	1.000
India (n=950)	Citations	Spearman's rho	1.000	0.123[a)]
	Readers	Spearman's rho	0.123[a)]	1.000

[a)]Correlation is significant at the 0.01 level (2-tailed).

4.6. Correlation Between Citations and Mendeley Readership

The overall association between the citations and Mendeley bookmarks, including non-zero values, were also measured. The data in Table 3 proved that the correlation was low for both countries with higher rho value for China (0.172), followed by India (0.123).

5. FINDINGS & DISCUSSION

This study made an occupational, discipline-wise, and country-wise comparison of the Mendeley readership of top-cited LIS articles from China and India. The study also attempted to associate the citations with the readership to know whether early Mendeley readership relates to later citations. The study reveals that out of the sampled articles with DOIs, only half of the Chinese (50.10%) and nearly half of Indian (49.15%) publications were covered on Mendeley. Thelwall (2017) traced out the reason behind this low coverage, as people use research scholarship but do not use Mendeley for referencing, or they use the incorrect DOI either in WoS or Mendeley. The readership was revealed high for Chinese articles compared to Indian ones, with a dominance of 47,444 readers. Further, Chinese articles tend to get cited more than Indian ones, with 0.79 CPP. Thus, for both countries, LIS articles attracted more Mendeley readers than WoS citations. The same was reported for Scopus as well (Maflah & Thelwall, 2016).

Concerning the first research question, the study found that students (PhD, masters, bachelors), faculties/academics (professor, associate professor, lecturer), researchers, librarians, and others were the significant categories of readers of LIS articles. Moreover, Mendeley readership varied according to the user categories/demography for LIS articles. However, the PhD and masters students were reported for the highest inclusion of articles for both countries. The possible reason for the highest readership by this particular community is that youngsters were more tech-savvy and thus inclined to use Mendeley more than faculties/academics who rarely use the same, which is confirmed in a previous study conducted by Chen et al. (2018). Another possible reason is that researchers use more references than others in their work, and they search the literature more comprehensively regarding their research (Nath et al., 2020).

Discipline-wise analysis of readership showed that twenty-nine varied disciplines read LIS articles with higher readership recorded from business, management, and accounting, followed by computer science. Readers registered in Mendeley from the business domain frequently read scholarly publications through Mendeley, which has been ratified in a previous study conducted by Nuredini and Peters (2015). Besides this, LIS is closely related to computer science, and thus the interest in reading LIS articles among users from computer science might be significant (Parabhoi & Verma, 2020; Pradhan, 2016). Readers' interest from other disciplines in reading LIS scholarship is visible and shows knowledge transfer across twenty-nine various scientific fields for scholarly communication (Mohammadi & Thelwall, 2014). Although the number of readers was varied, they were from the same discipline when sorted according to the top 10 domains.

Country-wise analysis of the readership depicted that LIS articles were better penetrated among different nations, especially Chinese papers, which got readership from one hundred countries. The highest readership for both countries' publications was recorded from the United States and Brazil, as the third-highest country in readership distribution. Interestingly, a higher bookmarking of articles was recorded in India for Indian LIS papers. Still, Chinese LIS articles did not get much readership from Chinese readers (which dipped to the ninth position—Fig. 5) (RQ2). It is also noted that non-native English-speaking countries read the LIS articles more than those countries where English is a vernacular language.

The association between readership and citation in

terms of academic status proved that for China, the higher rho value was observed for associate professors and for Indian researchers. For both countries, a lower rho value was logged for librarians. This finding goes in line with the discovery of Eldakar (2019), in that the highest correlation was observed for those who authored articles frequently. In short, those who read the papers were the ones registered in Mendeley (Thelwall, 2017). The study revealed a positive association between Mendeley bookmarks with citations for both countries, with an increased association for China (RQ3). The possible reason for this increase is that the readership and citations were more prevalent for Chinese publications as opposed to Indian ones. The same was justified by Eldaker (2019) in his study. The reason for including articles with zero readerships was to compare against a previous study by Thelwall and Wilson (2016). They discovered that zero Mendeley readership did not lead to a negative association when medical articles and their Scopus citations were checked for correlation. Our findings also correspond to their conclusions that the correlation was weak but significant. Since the association is positive, it is worth noting that Mendeley readership showed similar characteristics to traditional citation for LIS, which contributes to the existing discussion taking place in other disciplines (Costas et al., 2015; Thelwall & Wilson, 2016).

CONCLUSION

Mendeley has become a rich source of altmetrics data. The study findings discovered that Mendeley bookmarks help to explore different aspects of readership. The reader-wise category of the LIS articles from both countries showed that both academic (students and faculties), and non-academic communities (librarians, researchers, others) had a particular interest in reading LIS articles, confirming that LIS research has an impact on people inside and outside academia. Mendeley readership analysis helps identify the potential reader category, discipline, and country. It can be ideal for the publishers to display the readership symbol of Mendeley separately on the publisher's page to show the social impact of the articles, thereby attracting potential readers. Since many countries have banned social media and cannot display the social research impact in a figure, stakeholders can think of 'Mendeley readership statistics,' i.e., the social impact measured in Mendeley readership, as a proxy for funding evaluation, recruitment, and policymaking. Since the correlation between citations and readership is weak, we cannot say that Mendeley readership can fully replace traditional citation metrics. However, it is suggested as a good proxy for measuring the immediate impact and apt for those fields that tend to attract citations later to their readership. In addition, it can inform peer review when contrasting recent articles published by various research groups or funded by divergent research streams.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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APPENDIX

Table 1. Merge of reader categories

Mendeley reader categories before merging	After merging
Student>PhD Student Student>Doctoral Student	PhD Student
Student>Master Student>Postgraduate	Master Student
Lecturer Lecturer>Senior Lecturer	Lecturer
Student>Bachelor	Bachelor
Professor	Professor
Professor>Associate Professor	Associate Professor
Researcher	Researcher
Librarian	Librarian
Other	Other

 https://doi.org/10.1633/JISTaP.2021.9.4.6