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Altmetrics for large, multidisciplinary research groups: A case study of the Leibniz Association

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Abstract

This explorative case study uses ImpactStory and Webometric Analyst to download altmetric indicators for publications of institutes of the multidisciplinary Leibniz Association. The analysis shows that Mendeley is most heavily used across disciplines, that further social media is preferred by different disciplines, and that altmetrics can complement traditional measures of research impact (e.g., citation counts) where data is sparse. Lessons learned of altmetrics studies which may assist others when faced with similar questions regarding usefulness of altmetrics for research evaluation are also presented.

Keywords: altmetrics, research evaluation, social media, scholarly communication.

Introduction

Since it has been estimated that 114 million English-language scholarly documents are available on the Web

(Khabsa & Giles, 2014) we know that to a great extent scholarly communication happens online.

Thus, libraries, research institutes, and universities have been increasingly confronted with discussions on how to properly review this situation and whether it makes sense to establish Web-based, alternative metrics for research evaluation. So-called “altmetrics” (Priem, Taraborelli, Groth, & Neylon, 2010) aim at considering all products developed during the research process (e.g., data sets) and for the communication of research (e.g., blogs) for the evaluation of research excellence. They have also been discussed as approach to measure impact of research on the society (Bornmann & Lutz, 2014). Complementing the traditional approach of judging a journal article by its number of citations altmetrics want to draw a more holistic picture of research and a researcher’s output. Usually altmetrics are strongly linked to social media platforms which allow for user engagement on the Web. Since many venues are at hand to either publish (e.g., blogs or Twitter) or measure influence of research products (e.g., when cited

in Wikipedia) there is a plethora of metrics which forms the altmetrics tool box (e.g., mentions or followers on Twitter, bookmarks on CiteULike, etc.) that can be used to describe the impact a researcher or a publication has or - in other words - how popular he/she/it is on the (social) Web. They also provide information additional to traditional bibliometric indicators. As such, altmetrics are always platform-dependent and vary in depth (i.e. value of a blog article vs. a tweet) and breadth (i.e. number of users registered with a platform or number of resources on the platform, e.g., bookmarks). Since altmetrics have included extremely new modes and tools of scholarly communication evidence for appropriateness still needs to be provided and then evaluated against the requirements of decision makers as well as disciplines although usefulness of altmetrics has been confirmed by survey participants (Bar-Ilan et al., 2012). For example, studies on research impact on social bookmarking systems (Haustein & Siebenlist, 2011), on Mendeley (Mohammadi & Thelwall, 2013), and Twitter (Haustein et al., 2013; Holmberg & Thelwall, 2013) showed that there are strong disciplinary differences between the extent to which publications can be found on social media platforms and the impact they have on the users. Hence, when using altmetrics for evaluation purposes those effects have to be considered. These disciplinary differences (e.g., in terms of publication and citation behavior) also have to be regarded in traditional bibliometric studies. Especially the comparison of disciplines or institutes of different fields is problematic and researchers and decision makers are strongly discouraged from performing such studies (if not applying discipline-normalization methods; Kaur, Radicchi, & Menczer, 2013; van Raan, 2006; van Raan, 2003).

Although we argued, that bibliometric comparisons across disciplines are questionable, we apply current altmetrics research methods and tools to a large group of multidisciplinary research institutes, i.e. the Leibniz Association. We want to stress that present study is not aimed at discipline- or institute-based comparisons of research impact as reflected by altmetrics but rather at evaluating methods and tools for such analyses. Since results of present study are of limited generalizability, due to the nature of an explorative case study, it is also our aim to share our experience with conducting studies of this sort, to point to problems we encountered and solutions we found. We also want to show how large amalgamations of multidisciplinary research groups can use altmetrics for research evaluation in particular and social media platforms for information dissemination and enhancement of visibility of research products (e.g., publications, data sets, blog articles) in general.

The Leibniz Association

The Leibniz Association encompasses 89 non-university research institutes that carry out applied as well as

knowledge-driven research on societal, ecological, and economic issues. Some institutes also function as scientific infrastructure providers and developers of research-based services. Each institute falls into a particular section that describes the area of research and expertise: A) humanities and educational research, B) economics, social sciences, spatial research, C) life sciences, D) mathematics, natural sciences, engineering, and E) environmental sciences. Exchange within and between sections as well as with other bodies of academia, business, politics, and public shall guarantee excellent research. The Leibniz Association is also home of the Leibniz Research Alliance Science 2.0¹ which is a multidisciplinary amalgamation of Leibniz institutes and universities. Its aim is to combine forces in researching the (social) Web-driven changes of research workflows and products (e.g., open access and open data). Newly emerging technologies, scholarly work habits, and user studies are of particular interest to the research alliance. The present study can be situated in the context of that Science 2.0 research alliance.

The Leibniz Association, however, applies comprehensive guidelines for the periodic evaluation of its member institutes. Those guidelines are publicly available on the website². Regarding the evaluation of the institutes' research output and their excellence the evaluation guidelines ask following basic questions (cited from footnote 3):

- What does an assessment of work performance indicators yield (in terms of number of publications [depending on the publication culture of the subject area, in particular in peer-reviewed journals, at peer-reviewed conferences, in monographs]; the number of commercial property rights and patents, the number of consulting contracts and expert reviews; amount of third party funds raised for research, consulting, services, etc.; income from commercial activity)?
- Is the quality of consulting or other services, exhibition or collection management, as well as the transfer of knowledge and technology good, and are they adequately supported by the institution's own research? Does the institution utilise all necessary, state-of-the-art methods and techniques?
- Are the institution's consulting or other services, exhibition or collection management, as well as the transfer of knowledge and technology relevant for its users and others concerned, and are the latter satisfied with its performance? Does it succeed in reaching its respective target groups? Does it

¹ <http://www.leibniz-science20.de>.

² http://www.leibniz-gemeinschaft.de/fileadmin/user_upload/downloads/Evaluierung/Attachment_3_-_Criteria_for_evaluating_institutions.pdf.

maximise its reach in terms of potential users and other addressees?

- Is the institution's public outreach appropriate? Does the institution engage in public discourse to which it can contribute?

Given that, nowadays, especially point 3 and 4 are directly concerned with social media activities and altmetrics institutes of the Leibniz Association need to know which indicators they can use and where they can find them in order to properly answer the questions in the evaluation guidelines.

Therefore, we use the institutes and sections of the Leibniz Association as source of an explorative study to gain a more detailed view on disciplinary (across sections) and institute-specific (within sections) differences in provided altmetrics. We especially want to look at the outlets where publications and alternative impact metrics can be found on what scales. Hence, our study is guided by following research questions:

1) Where and to what extent are the publications of the institutes of the Leibniz Association covered on social media platforms?

2) What impact do publications of the members of the Leibniz Association have on users (i.e., altmetrics)?

Related Work

Research similar to our study has been carried out by Bar-Ilan et al. (2012), Haustein et al. (2013), and Haustein, Peters, Bar-Ilan, et al. (2014) who studied the coverage of and altmetrics to a set of publications of the bibliometrics community. 82% and 28% of publications had at least one reader on Mendeley and CiteULike respectively. On Mendeley every article had 9.5 bookmarks on average. Priem, Piwowar, and Hemminger (2012) showed that Mendeley covers 80% of a set of articles published by the Public Library of Science (PloS) whereas only 31% and 10% of those papers could be found on CiteULike and Delicious respectively. Mohammadi and Thelwall (2013) searched in Mendeley for all English research articles in social sciences and humanities from 2008 indexed by the Web of Science. They found that 44% of articles from the social sciences and 13% from the humanities had at least one Mendeley reader. Psychology was the most prominent discipline in the social sciences (54%) and linguistics in the humanities (34%). When searched for all 2008 articles indexed by the Web of Science (Mohammadi, Thelwall, Haustein, & Larivière, in press) publications from clinical medicine had the highest coverage on Mendeley (62.1%) and physics the smallest (29.7%). Twitter is assumed to be of great value in scholarly communication, particularly regarding information dissemination (Mahrt, Weller, & Peters, 2014). For a set of 1.4 million articles published in PubMed Haustein, Peters, Sugimoto, Thelwall, & Larivière (2014) found a coverage of 9.4% on Twitter with an

average of 2.5 tweets per paper. The same set of biomedical articles resulted in a 66.2% coverage on Mendeley with an average of 9.7 readers per paper (Haustein, Larivière, Thelwall, Amyot, & Peters, in press). Although coverage rates in Mendeley are found to be substantial there is also an age bias towards more recent publications. According to Haustein et al. (2013) 88% of papers published since 2000 have at least one Mendeley bookmark whereas only 44% of papers published before 1990 have readers on Mendeley. This is in line with results of Zahedi, Costas, and Wouters (2014) as well as Costas, Zahedi, and Wouters (2014).

Since it is not only interesting to know where and to what extent scientific publications can be found on social media platforms, altmetrics can also be compared against traditional measures of impact assessment, e.g., citation counts. Zahedi, Costas, and Wouters (2014) and Costas, Zahedi, and Wouters (2014) presented that the presence of altmetrics for publications has a positive effect on the presence and number of citations in general. Also, tweets are shown to predict future citations (Eysenbach, 2011). Mohammadi and Thelwall (2014) found that there are moderate correlations between Mendeley reader counts and citations for publications from the social sciences ($r=.52$) and from the humanities ($r=.43$). The highest correlations could be detected for Business and Economics (social sciences, $r=.57$) and linguistics (humanities, $r=.45$). These results are in line with those of Mohammadi et al. (in press) who also found weak to moderate correlations for physics ($r=.31$), engineering and technology ($r=.33$), chemistry ($r=.37$), and clinical medicine ($r=.46$). Moderate correlations ($r=.45$) were also detected by Haustein et al. (2013) for readers of bibliometrics publications and Scopus citations. For PubMed articles of the field of biomedicine altmetrics are strongly associated with citation counts (Thelwall, Haustein, Larivière, & Sugimoto, 2013). Here, correlations between Mendeley readers and Web of Science citations are moderate ($r=.47$; Haustein et al., in press) whereas they are very low for Web of Science citations and tweets ($r=.11$; Haustein, Larivière, et al., 2014). Positive correlations between Mendeley reader counts and citations have also been detected for genomics and genetics (Li & Thelwall, 2012). However, correlations between readers and citations that do not focus on a particular discipline are shown to be weak (Gunn, 2013).

Wikipedia has been expected to be a fruitful source for altmetrics since it is widely used for reference and allows for citing scholarly articles. Research in this area, however, is sparse. In terms of coverage Shuai, Jiang, Liu, and Bollen (2013) found only few Computer Science papers from the ACM Digital Library on Wikipedia. Nielsen (2007) could show that Wikipedia articles often link to multidisciplinary journals like Nature or Science and that the number of links correlates positively with the citation

counts for these journals obtained from Thomson's Journal Citation Reports.

Waltman and Costas (2014) studied the relationship between f1000 recommendations and Web of Science citations. They found that every article in f1000 receives 1.3 recommendations on average although 81.1% of articles have been recommended only once. More than 80% of articles get a recommendation two to four months after their publication. The most recommendations can be found for publications in biological and medical fields (e.g., developmental biology and anesthesiology). Pearson correlation between Web of Science citations and number of recommendations showed a weak but positive relationship between both indicators ($r=0.26$).

Shema, Bar-Ilan, and Thelwall (2014) asked whether articles mentioned in blog posts would receive more Web of Science citations. They found that most of the articles found in blogs come from the biological and medical disciplines with PLoS ONE, PNAS, Science and Nature being the most popular journals cited in blogs. The authors also found that articles being cited in blogs accumulate more citations over time than articles not being mentioned in blogs.

Overall, Mendeley is found (Zahedi et al., 2014) to be the social media platform where the majority (up to 82%; Bar-Ilan et al., 2012) of scholarly publications is indexed. Twitter comes next, since coverage rates range between 9% (Haustein, Peters, Sugimoto, et al., 2014) and 13% (Costas et al., 2014). Coverage rates on blogs, Facebook, Wikipedia, Google+ and other platforms range between small one-digit numbers (Costas et al., 2014). All social media platforms have in common that coverage of publications varies strongly across disciplines (e.g., between 22.8% for biomedical and health sciences and 5.4% for mathematics and computer science; Costas et al., 2014). Low or moderate correlations between altmetrics and citation numbers reveal that altmetrics do not reflect exactly the same impact as shown by citations but something different which is not covered by traditional citation-based indicators. Hence, more research is needed to understand the characteristics of altmetrics and their usefulness for research evaluation.

Methods

Two to three institutions of each section of the Leibniz Association were chosen as sources for our case study³. The institutions were comparable in the number of employees and publications (see Table 1) and we aimed at having about 500 publications for each section as starting

³ We decided to not publish the institutes' names analyzed in the study since we mostly aimed at testing available altmetrics tools and concepts for multidisciplinary research groups and not at drawing general conclusions on the findings of the altmetric analyses.

Table 1: Overview on publication output and employees for each institute.

| disciplines | institutes | # publications (2011-2012) | # employees* |
|--|------------|----------------------------|--------------|
| humanities/ educational research | A1 | 340 | 347 |
| | A2 | 59 | 146 |
| economics/ social sciences/ spatial research | B1 | 161 | 180 |
| | B2 | 118 | 151 |
| | B3 | 141 | 193 |
| life sciences | C1 | 186 | 337 |
| | C2 | 628 | 232 |
| mathematics/ natural sciences/ engineering | D1 | 205 | 185 |
| | D2 | 164 | 140 |
| | D3 | 130 | 180 |
| environmental sciences | E1 | 509 | 381 |
| | E2 | 193 | 149 |

* according to institutes' websites (May 2014).

set for our analysis. The download of bibliographic information from institutions' websites was conducted in June 2013 and was restricted to publications in conferences and journals and to book chapters published in 2011 and 2012 (for institute A2 we only retrieved journal publications). We only considered those publication types since they are most often linked to DOIs which were crucial for processing altmetrics data with ImpactStory⁴.

ImpactStory automatically compiles alternative impact statistics for publications or datasets based on their unique identifiers (e.g., DOI, PubMedID, MendeleyID). ImpactStory data was successively downloaded in 2014 on April 30, May 5, and May 10 in order to obtain comparable results for altmetrics to publications and avoid time advantages in accumulating impact metrics. Webometric Analyst⁵ (Thelwall, 2009) was used for the retrieval of missing DOIs. Only publications where DOIs could have either been found manually or by using Webometric Analyst were used for the analysis. It has also been checked whether Webometric Analyst's results were correct. In sum we found 1.762 correct DOIs (62.2%) for 2.834 papers of 12 institutions. For 1.739 out of the searched 1.762 (98.6%) publications at least one metric was found by ImpactStory. Hence, the results of our study are based on the 1.739 publications since publications with a zero score in one of the altmetric indicators have been discarded from analyses.

Webometric Analyst and ImpactStory

Webometric Analyst is software that can be used for webometric analyses of website collections, e.g., link

⁴ <http://impactstory.org>.

⁵ <http://lexiurl.wlv.ac.uk>.

structures or term analyses. It also assists in downloading data from social web-platforms like YouTube, Mendeley, or Twitter. Moreover, it uses bibliographic information (i.e. author name, title of publication, journal name, publication year, journal volume, and issue) to search for DOIs via CrossRef⁶. In advance extensive cleaning (i.e. removal of special characters) of input data is needed for DOI search.

ImpactStory is an open source web tool aiming at providing personal research impact profiles and returning a variety of indicators reflecting the attention a publication, website (e.g., a blog post), data set, presentation, or software receives on various social media and publication platforms. Altmetrics data compiled by ImpactStory in .json- or .csv-format can be downloaded for free according to the regulations of the metrics providers. For example, citation data provided by Elsevier's bibliographic database Scopus can be viewed on the ImpactStory-website but not downloaded. Also, ImpactStory will not release metrics where their value is zero. Metrics which are provided by ImpactStory include Wikipedia mentions, Mendeley readers and their career stage, country, and discipline, mentions in Twitter, blogs, Facebook, and Google+ (all provided by the company altmetrics.com⁷ that sells article level metrics), HTML and PDF views (provided by PLOS Article Level Metrics only for PLOS publications⁸), and citations (provided by PubMed Central⁹ which is focused on journals of biomedicine and life sciences). Given that some metrics are based on particular publishers or disciplines we are confronted with a serious limitation of ImpactStory which just cannot cater particular metrics to most of the publications entered. We also have to bear that in mind for the analyses presented in the results section.

ImpactStory differentiates between the audiences that are responsible for the impact metrics. There is scholarly impact when the platform where the indicator is derived from is considered scholarly (e.g., Scopus, Mendeley) or public impact when the platform is considered to be of wider interest to the public (e.g., Wikipedia, Twitter). The type of platform also determines how the impact is labelled: discussed (e.g., Twitter), saved (e.g., Mendeley), viewed (e.g., PLOS Pdf views), recommended (e.g., f1000), and cited (e.g., Scopus, PubMed Central citations). To help users determine what the raw number of views or citations actually means in comparison to other publications ImpactStory also puts compiled metrics into context: for example, when considering a scholarly platform ImpactStory gives information on in which percentile (Leydesdorff & Bornmann, 2011) relative to all publications indexed in the Web of Science that year the questioned publication can be found. Hence, users might learn that the particular publication has more citations than

93% of all other publications of that year. It also tracks changes in metrics over weeks, displays gains, and sends emails informing about those changes to profile owners.

Although ImpactStory is a convenient tool for gathering altmetrics data to various types of publications it has limitations which affect reproducibility of studies relying on it. First, there is the indispensable need for DOIs or other unique identifiers when working with it. A search with bibliographic information (e.g., author names or publication years) is not possible. Since publications can have more than one identifier and collecting all of them is laborious the completeness of altmetrics provided for one publication is questionable¹⁰. Likewise, entered identifiers do not always return all information that is needed to download raw numbers from the metrics providers so that entire metrics can be missing in ImpactStory although they are actually available for the publication. Moreover, metrics providers (e.g., Mendeley) can change access rules that affect data download with ImpactStory. Not to forget that data on platforms can be noisy (e.g., spelling errors in DOIs) or store multiple records for one publication so that erroneous impact metrics could be supplied in the first place. Similar to ImpactStory Webometric Analyst only compiles raw numbers for searched publications and suffers from the same problems of changing data access points or noise.

Results

Our first research question is concerned with the coverage of publications of the Leibniz institutes on the different platforms. How many of the publications with DOIs can be found on which platform? The highest coverage of articles is provided by Mendeley: 22.2% of publications of institute A2 and up to 96.7% of publications of institute C1 are saved here (see Table 2). Overall, the most publications found on Mendeley come from the life sciences, then mathematics, natural sciences, engineering and economics, social sciences, and spatial research. These results correspond to the findings of Mohammadi et al. (in press) and Haustein et al. (in press). Publications from those disciplines are also well-covered on Twitter, with the life sciences and the institute C1 being the most prominent producers of content found on Twitter.

As mentioned earlier we can see institute- or discipline-specific advantages for citations and html- and pdf-views (especially for life sciences) since all of them only depend on either PLoS- or PubMed Central-articles. ImpactStory also retrieves f1000 recommendations for publications. As already shown by Waltman and Costas (2014) f1000 is especially popular in biology and medicine which could be confirmed by our results although coverage is low. There are further neglectable rates of coverage on blogs, Facebook and Google+ for all institutes and disciplines.

⁶ <http://www.crossref.org>.

⁷ <http://www.altmetric.com>.

⁸ <http://article-level-metrics.plos.org>.

⁹ <http://www.ncbi.nlm.nih.gov/pmc>.

¹⁰ <https://impactstory.org/faq>.

Table 2: Coverage of publications of each institute on various social media platforms in percent (%).

| institutes | n (absolute) | blog | Facebook | Google+ | tweets | Mendeley | f1000 | html views | pdf views | citations |
|------------|--------------|------|----------|---------|--------|----------|-------|------------|-----------|-----------|
| A1 | 110 | 0.91 | 0.91 | 0.91 | 9.09 | 69.09 | 0.00 | 1.82 | 1.82 | 17.27 |
| A2 | 18 | 0.00 | 0.00 | 0.00 | 0.00 | 22.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| B1 | 150 | 0.00 | 0.00 | 0.00 | 12.67 | 87.33 | 0.00 | 0.67 | 0.67 | 5.33 |
| B2 | 113 | 0.88 | 0.88 | 0.00 | 5.31 | 80.53 | 0.00 | 0.88 | 0.88 | 0.88 |
| B3 | 124 | 0.00 | 0.81 | 0.81 | 12.90 | 70.16 | 0.00 | 0.00 | 0.00 | 0.81 |
| C1 | 182 | 2.20 | 2.20 | 2.75 | 24.73 | 96.70 | 6.59 | 8.79 | 8.79 | 81.32 |
| C2 | 272 | 1.10 | 0.37 | 0.37 | 12.50 | 81.99 | 0.74 | 4.78 | 4.78 | 38.60 |
| D1 | 170 | 0.59 | 0.00 | 0.00 | 6.47 | 77.65 | 1.18 | 0.59 | 0.59 | 12.35 |
| D2 | 129 | 0.78 | 0.78 | 0.78 | 10.08 | 73.64 | 0.00 | 0.78 | 0.78 | 3.88 |
| D3 | 130 | 0.77 | 0.00 | 0.77 | 16.92 | 93.08 | 2.31 | 2.31 | 2.31 | 40.00 |
| E1 | 206 | 0.49 | 0.00 | 0.00 | 6.31 | 76.70 | 0.00 | 0.00 | 0.00 | 4.37 |
| E2 | 135 | 0.74 | 1.48 | 0.00 | 12.59 | 80.74 | 0.74 | 4.44 | 4.44 | 8.89 |

Having seen to what extent publications of the Leibniz institutes can be found on which social media platforms we now want to investigate how much effect the publications have on the users of these platforms, e.g., in terms of readership or tweet numbers. Figure 1 shows that the 454 publications from the life sciences attracted in sum the most Mendeley readers (5,483 readers) as well as the most tweets (329 tweets). Hence, in that discipline every article is read 12 times on average and 3 out of 4 articles are tweeted at least once. Interestingly, the publications of the environmental sciences receive fundamentally more readers than tweets which might indicate that environmental scientists more likely use Mendeley than Twitter. For the other disciplines the share of readers and tweets is proportionally distributed. Figure 2 displays the number of blogs posts regarding the articles of the data set, their mentions on Facebook and Google+ as well as how often

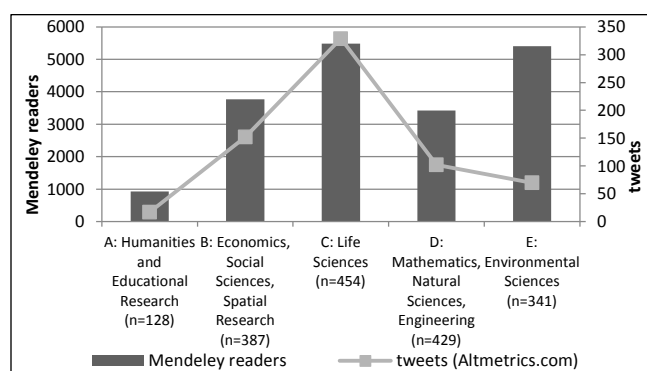


Figure 1: Sum of Mendeley readers and tweets for all publications of each discipline (absolute numbers for readers and tweets; n=number of publications in discipline).

they have been recommended on f1000. Again, the life sciences outperform the other disciplines in terms of altmetric activity (although absolute numbers are very low in all disciplines and for all altmetrics). For example, only every 32nd article of the life sciences has received a recommendation. Publications from mathematics, natural sciences, and engineering, however, receive the most attention on Google+, whereas the humanities and educational research are almost not mentioned at all on blogs, Facebook, Google+, and f1000. Which disciplines are proportionally most prominent on which social media platform can be seen in Figure 3. Life science is dominant on each platform, except for Mendeley where shares of disciplines are almost equally distributed. Such overviews, as provided by Figure 3, visual well where scientists of different disciplines can find their readers. A direct comparison of the altmetrics for two institutes of the same discipline is shown in Figure 4. Both institutes come from the life sciences, the subject with substantial reader

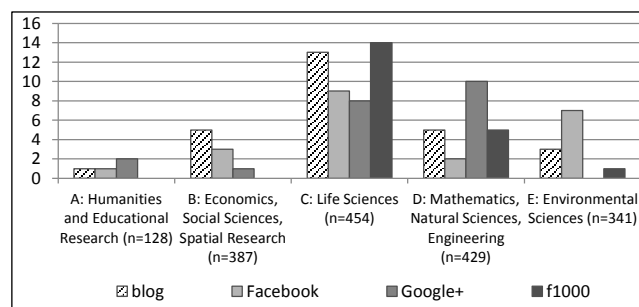


Figure 2: Sum of other altmetrics for all publications of each discipline (absolute numbers for altmetrics; n=number of publications in discipline).

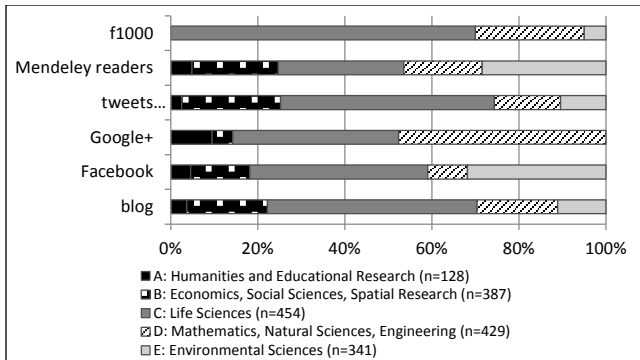


Figure 3: Share of discipline-specific activity per social media platform (relative numbers for discipline; n=number of publications in discipline).

numbers on Mendeley and citation counts on PubMed Central. Institute C1 has 182 articles with DOIs of which 176 have at least one reader and 148 have been cited at least once. The total number of readers is 3,324 and the total number of citations is 891. On average each article has been read and cited 18.9 and 6 times respectively. The second institute C2 has 272 articles with DOIs of which 223 and 105 have been read and cited at least once respectively. Reader numbers sum up to 2,159 (9.68 readers on average) and citations to 303 (1.36 citations on average). Figure 4 displays that readership numbers and citations not necessarily correlate (as has also been found in former studies¹¹). Articles that are often cited might attract only few readers whereas articles which only have low scientific impact might be popular on Mendeley (e.g., institute C1). We can also see that far more articles may get attention from readers as they would otherwise receive by scholars (e.g., institute C2). In this case altmetrics could really be considered “alternative metrics” since they provide information on the impact of articles where citations have failed.

Discussion and Future Work

Since traditional bibliometric indicators have been criticized because of neglecting most products developed in the research process (e.g., data sets or blog posts; DORA, 2014) as well as only measuring impact of publications on other authors, altmetrics aim at complementing the traditional toolbox of bibliometric analyses. It wants to shed light on how research is used and perceived on the web, especially on various social media platforms (Priem et al., 2010). Our case study on multidisciplinary research institutes of the Leibniz Association followed that vein and yielded at exploring where and to what extent altmetrics

¹¹ We consciously waived the calculation of correlations between altmetrics and other indicators since our sample only provided small n which would not result in substantial values.

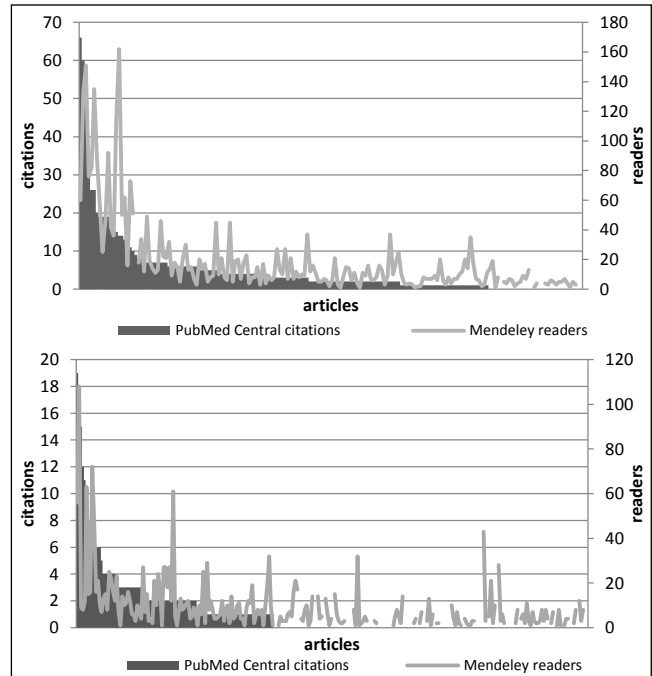


Figure 4: Comparison of Mendeley reader counts and PubMed Central citation numbers for institutes C1 (top) and C2 (bottom) (absolute numbers).

could be found and which conclusions might be drawn from findings. These aspects are of high relevance for the Leibniz institutes since regular evaluation processes ask for critical reflection of the institutes’ work and output.

The study showed that across disciplines Mendeley is the social media platform that attracts an extraordinary high number of users. Those users are also responsible for the good coverage of publications in certain fields which makes Mendeley almost as complete as other bibliographic databases (e.g., Web of Science or Scopus; Hausteijn et al., 2013). In our data set life sciences is the most popular discipline since it is well covered and also produces a lot of activity around publications (e.g., number of tweets or users). We assume that it is because the discipline (includes medicine and fields related to biology) is of general interest to a wider public. Also, the share of life science-related scholarly documents on the web is also the largest (Khabsa & Giles, 2014) which greatly enhances the chance of posting those publications on social media platforms. The type of publications may also play a role as Gunn (2013, p. 34) points out: „The greater representation of the sciences in Mendeley is thought to be primarily a reflection of its PDF-centric workflow and the journal article-centric communication in sciences“.

Further, the analysis revealed that there are discipline-specific preferences on the use of social media platforms (e.g., publications from mathematics, natural sciences, and engineering are well used on Google+). This also shows

that the social media platforms are populated with users having different interests. This finding has practical implications for the institutes of the Leibniz Association: if using the “wrong” platforms for research evaluation the actual impact of research on the users is not correctly reflected and may result in misleading interpretations. Hence, institutes need to know on which platforms they can find a critical mass of users and where altmetric studies make sense (i.e., where coverage and activity around publications is substantial). Also, for some institutes altmetrics provide a real alternative for bibliometric evaluations since more publications can be found on social media platforms than in databases traditionally used for research evaluation (e.g., Scopus).

Since our analysis heavily relied on ImpactStory and Webometric Analysis for data collection our results might be an underestimation of the actual coverage and activity around publications found on social media platforms (e.g., since DOIs could be erroneous, many publications do not have DOIs, etc.). However, the small data set is a severe limitation of present study and the conclusions drawn are restricted to an arbitrary chosen set of institutes and publications. Although we cannot generalize results the study showed how altmetrics tools could be used for research evaluation and detection of platforms with large amount of users interested in certain disciplines.

Future work should extend the case study to all institutes of the Leibniz Association in order to provide them with guidelines on how to use altmetrics tools and interpret findings. Moreover, we want to cater some preliminary altmetrics which they can use in the evaluation process. In order to better understand altmetrics and the role of social media in the research ecology more qualitative information on the users of social media platforms is needed. For example, we might want to look at the demographics of Mendeley readers (Mohammadi et al., in press) or people who tweet scholarly publications. Comparisons with more traditional indicators of research impact, like citation counts as provided by Web of Science or Scopus, will help assessing the value of altmetrics.

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