CONTENTS

"STRUCTURE AND TAXONOMY OF SCIENCE" RESEARCH GROUP LAUNCHED

The *Centre for Research & Development Monitoring* (ECOOM) at KU Leuven (Belgium) and the *Department of Science Policy & Scientometrics* (MTAK–TTO) at the Library and Information Centre of the Hungarian Academy of Sciences in Budapest have launched a joint research group beginning this year. The foundation of the "Structure and Taxonomy of Science" (STS) research group goes back to a joint initiative by Sándor

SÁNDOR SOÓS[1]

WOLFGANG GLÄNZEL[1,2]

[1] Department of Science Policy and Scientometrics, Library and Information Center of the Hungarian Academy of Sciences, Budapest, Hungary

[2] Centre for R&D Monitoring (ECOOM) and Department of MSI, KU Leuven, Leuven, Belgium

Soós (MTAK–TTO) and Wolfgang Glänzel (ECOOM–KU Leuven). The kick-off meeting was hold in Leuven on 18 February 2019.

The objective of the planned activities of the new research group is providing a platform for urgent and relevant research tasks that are otherwise beyond the scope of mainstream activities in research evaluation and information science and services. With that, the initiators take the responsibility to contribute to bridging the still existing gap between these two fields of research and application. The basic idea is not to develop specific techniques for application and services but to foster overarching research that creates the fundament for improved applications in both fields. In particular, the group aims at doing research and planning activities and events in three topics that it considers a relevant to achieve their objective.

The first one deals with *Classifications and taxonomies of scientific research*. This often underestimated issue, the complex issue of research classification, proved crucial in the context of various applications. Research policy and evaluation heavily relies on existing taxonomies of science, and the corresponding attribution of scientific output to research areas, fields or subjects. However, the nature and proper use of these taxonomies, the selection of the appropriate schemas relative to policy goals is highly challenging and often unjustified. Classification schemes based on the cognitive or institutional organisation of the sciences are often confounded or inadequately utilized for, e.g., field-based comparisons of performance or university rankings. This line of research aims to establish the systematic relationship between research classification approaches, schemes and applications for various scientific and practical purposes.

The second topic is devoted to *Bibliometric methods in information retrieval (IR)*. This forms the very interface between information science and services, on the one hand, and evaluative bibliometrics requiring proper subject and topic delineation, on the other hand. In particular, the research direction addresses a theme that is of outstanding importance for practicing researchers, scientific librarians and, in general, for providing scientific information services: identifying and retrieving the scholarly literature relevant for a research field, subject of research question. Given the current size and dynamics of scientific literature, information retrieval is an essential part of conducting any kind of scientific research. Bibliometric methods, although somewhat neglected in this context, have proven to be of great value in this task, greatly improving the precision and coverage of literature searches. This line of research aims to investigate innovative bibliometric methods for scientific IR, both by synthetizing existing results and developing new tools.

The third topic, finally, deals with structural science studies, most notably with *Novel methodologies of science mapping*. In the foreground thereby is the further development of the methodological toolkit of mapping and visualising the structure of science. Bibliometrics has developed a variety of methodologies, based on various aspects, such as citation relations, co-authorship, textual descriptors of publications etc. that enable the large-scale mapping of how research fields, research areas or even the whole science system are being organised, or of how and in what direction these aggregates are developing. These capabilities include, among others, the detection of research fronts, identification of emerging topics or even predicting future scenarios of the evolution of fields. This line of research aims to further elaborate on the toolkit of science mapping in order to arrive at even more effective and validated methods that can significantly improve the sensitivity and precision of mapping research fields and support the discovery of research directions in big data contexts.

The outcomes of research in these three topics are expected to closer connect research and application in both evaluative bibliometrics and information science. The members of the STS research group, Wolfgang Glänzel, Bart Thijs, Pei-Shan Chi (ECOOM) and Sándor Soós, Anna Kiss (TTO), sincerely hope that their activities, which are based on the long standing experience of the two involved institutes, will be able to contribute to the advancement of our research field.

LATIN AMERICAN SYMPOSIUM ON THE METRIC STUDIES OF SCIENCE AND TECHNOLOGY

MEXICO CITY, MEXICO, AUGUST 28–30, 2019

CALL FOR PAPERS
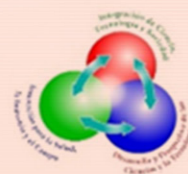
This meeting is a follow-on to the International Seminar on the Quantitative and Qualitative Studies of Science and Technology which has been held in Havana, Cuba, every two years since 2002. The scientific program will include topics and issues associated with the metric studies of information: bibliometrics, informetrics, patentometrics, webmetrics, technical indicators on science and technology, etc. Invited speakers will present their talks in plenary sessions. We are happy to announce that both Dr. Wolfgang Glänzel and Dr. Hebe Vessuri have confirmed their participation. Contributed papers will be presented in parallel sessions. The meeting will be open to all those interested in this research area. The working languages will be English, Spanish and Portuguese, no simultaneous translation.

MEETING VENUE

The Latin American Symposium on the Metric Studies of Science and Technology (LASMSST) will be hosted by the National Autonomous University of Mexico (UNAM). All activities will take place in the Ignacio Chávez Seminar Unit which is located on the periphery of the UNAM campus in Mexico City (Ciudad Universitaria), in the setting of its Botanical Garden. The Symposium will be organized jointly with the Division of Particles and Fields of the Mexican Physical Society (DPF-MPS) and the PhD Program of Science, Technology and Society (Desarrollo Científico y Tecnológico para la Sociedad, DCTS) of the Center for Research and Advanced Studies of the National Polytechnic Institute (Cinvestav-IPN).

REGISTRATION AND FEES

Those interested in attending LASMSST are requested to fill in the registration form on the website of the meeting: https://indico.fis.cinvestav.mx/e/indico.fis.cinvestav.mx/SLEMCyT

The registration fees are $200 US dollars for faculty members and $100 US dollars for students and postdoctoral researchers, when paid before July 31, 2019 (4,000/2,000 Mexican pesos, respectively). After that date the respective fees will be $250/$150 US dollars (5,000/3,000 Mexican pesos, respectively). It covers admission to all scientific sessions, welcome cocktail, lunch vouchers, refreshments, official dinner of the Symposium and a guided tour to the archeological site of Teotihuacan on the morning of Saturday 31, 2019 (see social program) https://www.visitmexico.com/es/destinos-principales/estado-de-mexico/san-juan-teotihuacan-y-san-martin-de-las-piramides).

The registration fee may be paid by bank transfer (or deposit) to the accounts of two banks in Mexico, Banamex (Citigroup) or Santander. More details on the Seminar website. It will be possible to pay by cash, credit card or cheque directly to the Sociedad Mexicana de Física, A.C. at the meeting.

HOTEL ACCOMODATION AND TRANSPORTATION

A block of rooms has been reserved for symposium participants and guests at the Hotel Radisson Paraiso Perisur (Calle Cúspide No. 53, Parque del Pedregal, Tlalpan, C.P. 14010, Ciudad de México, México (https://www.radisson.com.mx/en/) which is located one mile from the Ignacio Chávez Seminar Unit. A reduced rate of $1,380.00 Mexican pesos (about $70 USA dollars) for single or double rooms (BB basis) has been assigned for 40 rooms on a first come first served basis. Please follow the instructions on the symposium web page if you require accommodation in this hotel. Information on other hotels in the area can be found at

Hotel Diplomático (https://www.eldiplo-matico.com.mx/en), Hotel Pedregal Palace (https://www.pedregalpalace.com.mx/), Camino Real Pedregal (https://www.cami-noreal.com/Hotels/Details/CR/PED), Royal Pedregal (https://www.hotelesroyal.com.mx/), Fiesta Inn (https://www.fiestainn.com/es/web/fiesta-inn-periferico-sur).

CONTRIBUTED PAPERS

Researchers and students interested in presenting their work at the LASMSST should submit an abstract via our indico e-mail address **slemcyt@gmail.com**, with the following information:
- Title of the research.
- Name of authors, institutional adscription, e-mail addresses.
- The abstract should not exceed 1,500 words.
- The text may be written in English, Spanish or Portuguese.
- Deadline for the reception of abstracts: **May 15, 2019.**
- The authors of the accepted contributions will be requested to send an extended text before **June 30, 2019.** Specifications – Word (2003-2016) file, letter size, 2.5 cm margins and 1.5 line spacing, with a maximum extension of 15 pages.

These will be scheduled in the parallel sessions of the Symposium.

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INVESTIGATING THE SOCIETAL IMPACT OF RESEARCH:
PAST ACHIEVEMENTS AND FUTURE DEVELOPMENTS

ECOOM VRIJE UNIVERSITEIT BRUSSEL (VUB) – BRUSSELS DAYS
28–29 NOVEMBER 2019

CALL FOR PAPERS

CONTEXT

Recently Friesike et al. (2018) acknowledged in Nature that societal impact should be part and parcel of evaluating research, and this comes in the context of a growing appreciation for broader perspectives on the importance of 'having an impact'. This trend has emerged as dissatisfaction for narrow, economistic approaches, which negates other types of impacts. The discussion on the societal impact research (and related institutions) intends to broaden the scope of evaluation studies beyond the mainstream indicators such as patents, spinoffs and scientific publications, to address the grand societal challenges. On the other hand, broadening too much the definition of impacts risks being vague and inconclusive (Bornmann 2013).

Some scholars judge the debate on societal impact a way to jeopardise academic freedom (Colley 2014); whereas, others hail the idea behind it as a guarantee to direct (publicly-funded) research efforts to benefit society (Evans 2016). Accordingly, public funders should broaden their perspectives besides the mere counting of publications and citations. They should also acknowledge other important outputs such as developments of scientific products and services, important data sets, platforms and software as well as their influence on policymaking (Dotti 2018). Finally, other scholars argue that it is very complex, if not impossible, to measure the societal impact of university and HEI (Brereton et al. 2017).

OBJECTIVES

We invite submissions of papers that address the current state-of-the art, definitions and methodical issues on the societal impact of research. The aim is to collect a variety of insights debating the societal challenges, contributing to the understanding and assessing societal impacts with an emphasis on the implications for evaluation theory and policy practices. Contributions do not need to refer to only one thematic area but can be cross-cutting; contributions can be theoretical, methodological as well as applied to case studies. Academic as well as policy- and practice-based submissions are strongly encouraged. Papers from all academic disciplines and policy fields which deal with mission-orientation and societal

Brussels, Mont des Arts   *Photo courtesy of © Balázs Schlemmer / :: schlemmerphoto.com ::*

impact evaluation are explicitly welcomed. Three main sub-themes are identified.

1) THE NATURE OF SOCIETAL IMPACT

A key question in the debate on societal impact, first and foremost, revolves around reflections on the definition and implementation of the notion of societal impact. What is societal impact? Impact on what? Impact on whom? What does impact mean at different levels and scales (e.g. global challenges, concrete missions, combination of different impact dimensions such as economic or environment issues)? How are missions and challenges framed and decided upon? How are impacts defined?

2) THE MEASUREMENT OF SOCIETAL IMPACT

Another main question on societal impact concerns its measurement, especially for the purpose of evaluation. The mainstream indicators usually consider economic and academic impacts which, however, are insufficient to capture the broader societal impact of universities and HEI (Perkmann et al. 2013). The development of a measurement system is an inevitable phase towards the appreciation of whether societal impacts can be achieved. How can societal impact be traced and measured? How can evaluation methodologies be further developed to measure outcomes (instead of outputs only)? Which new indicators (and data sources) are available or needed to assess societal impact of research? How to identify and assess non-intended societal impacts of research?

3) THE POLICY IMPLICATIONS OF SOCIETAL IMPACT

How do university and HEI deliver societal impact? Research can be appreciated as an efficient way to achieve societal goals such as improve public health, reduce the challenges for the ageing population, fight climate change and reduce poverty. Setting up a bi-directional relationship between non-academic stakeholders and university requires installing incentives (both intrinsic as well as extrinsic) for both parties. Which inspiring practices of learning from impact-oriented evaluation should be enhanced to increase the use of evaluation findings and recommendations? What is the relationship between impact-oriented 'policy controlling' (e.g. impact-oriented budgeting) and impact assessment focused on societal expectations? What does impact-

oriented policy controlling (e.g. impact-oriented budgeting) want in terms of impact measurement and what does society want?

SUBMISSION PROCEDURE

Deadline	Milestone
1 Jun	Submit Expression of Interest as abstract of around 300 words. Contact: Dr. Nicola Francesco DOTTI, Nicola.Dotti@vub.ac.be
20 Jun	Notification of acceptance
1 Oct	Submission of the full paper
28-29 Nov	Workshops in Brussels
15 Dec	Submissions of the full papers for the Special Issue in Scientometrics

POSSIBLE PUBLICATIONS

The best papers accepted for the conferences will be considered to be included for a special issue on this theme for Scientometrics.

The special issue in Scientometrics is also open for those who are not participating in the ECOOM Conference.

PROGRAMME

Thu 28 Nov 2019: Academic Workshop
Fri 29 Nov 2019: Research-Policy Workshop
Both events to be held in Brussels
Organised by ECOOM – Vrije Universiteit Brussel (VUB). More information on the ECOOM website soon (www.ecoom.be)

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  (Vrije Universiteit Brussel),
‣ Florian Hendrik J VAN LEE
  (Vrije Universiteit Brussel)

CONTACTS

‣ Dr. Nicola F. Dotti
  Nicola.Dotti@vub.be and
‣ Florian Vanlee
  florian.hendrik.j.vanlee@vub.be

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DRIVING FACTORS IN ACCELERATING SCHOLARLY COMMUNICATION: A MULTIPLE-INDICATOR VIEW ON PREPRINT PUBLISHING

ZHIQI WANG
WISE Lab, Institute of Science of Science and S&T management,
Dalian University of Technology, Dalian, China &
ECOOM, KU Leuven, Belgium
Zhiqi_wang90@126.com

ABSTRACT

Preprints play an important role in scholarly communication in many fields, most notably in Physics, Mathematics and Computer Science. Electronic communication, above all, internet technology facilitate a fast dissemination of research results provided in these open-access documents, all the more as preprint publishing gives authors the opportunity to update their work. Although it is widely believed that preprint publishing brings various benefits for individual authors and the respective scientific communities, the actual citation advantage of preprint publishing is not yet sufficiently studied. The present piece gives account of my research on the driving factors of preprint publishing within the framework of scholarly communication, which is part of my PhD project. I am using a multiple-indicator approach that includes traditional bibliometric measures as well as new metrics including *citations, usage metrics* and *altmetrics*.

INTRODUCTION – PREPRINTS IN SCHOLARLY COMMUNICATION

The preprint culture has a quite long history. Initially disseminated on paper, preprint

publishing experienced a sharp rise with electronic publication and access. The first preprint server, arXiv, was launched in the early 1990s, and has efficiently transformed the communication infrastructure in several fields like *physics, mathematics,* and *computer science*. A range of services now exist to take advantage of the growing infrastructure building on preprint publication. These include discipline-specific platforms, e.g., SSRN (since 1994), RePEc (since 1997), PeerJ Preprints (since 2013), bioRxiv (since 2013), ChemRxiv (since 2017), and generic platforms like preprints.org (2016). The latter hosts articles from across a range of different disciplines. The enormous growth of preprint literature can been seen using the example of bioRxiv, which has grown to currently 1000 submissions an month and with a total of more than ten thousand preprints already archived (cf. Carà et al., 2017). In addition, PLOS and bioRxiv announced a partnership where PLOS authors can also opt to share their articles on bioRxiv[1]. Preprints are primarily intended to convey most recent research results to the relevant target group in a highly efficient and fast way and they can be considered an important step toward a more open and transparent peer review process as well (Li et al., 2015; Bornmann & Haunschild, 2015). Although the role of preprints has changed during the emergence of preprint archives and self-archiving repositories, their basic function has not changed but has been extended by important new features, namely the increased visibility and the possibility of open access and post-prints.

Another important function of preprints is to bridge the time gap between the preparation of a manuscript and its publication in a scientific journal. They can be circulated immediately among scholars to make research quickly available but also to claim priority. Speeding up publication has become crucial in scholarly communication and a global phenomenon.

Furthermore, with the preprint repositories, preprints are recognised as to advance democratisation of scholarly communication. Preprints are both free of charge for the authors and freely available for anyone with access to the Internet. Major preprint servers such as arXiv and bioRxiv are comprehensively indexed in Google Scholar, which enhances retrievability. Comments can be received from a much wider community and even be included in the final version published as journal article.

Finally, preprints increase the visibility and impact of research results. Once the preprint is deposited on a preprint sever, it becomes available to be read, cited, and reported in social media such as Tweets, Blog posts, etc.

MEASUREMENT AND ASSESSMENT OF PREPRINTS IMPACT

In order to study the role of preprints in scholarly communication, first appropriate data on how preprints are used, published and cited needs to be identified and collected. Bibliometrics with its proven tools for the measurement and evaluation of the impact of journal articles could also be used for the assessment of the impact of preprints. In the following, I will summarise the main recent findings of my doctoral project focusing on publication delay, that is the time lag between the upload date on a preprint sever and the online publication date in a journal, traditional citation indicators and new alternative indicators, based on *usage metrics* and *altmetrics*.

PUBLICATION DELAY OF PREPRINTS

One of the main benefits from preprints publishing is probably the time advantage. Authors can upload their research results on preprint severs as soon as they have completed a manuscript ready for publication, before or simultaneously with submitting it to a scientific journal. The "publication delay" of preprints is here defined as the

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[1] PLOS. (2018, May 1). *Power to the preprint*. Retrieved from https://blogs.plos.org/plos/2018/05/power-to-the-preprint/

time span between the upload of a paper on a preprint sever (*arXiv submission time*) and the time of the first publicly available version on the publishers' website (*online publication time*). In a previous study by Wang, Glänzel & Chen (2018) of preprint publishing in the field of Information Science and Library science (LIS), about 8.7% of all papers published in three selected journals between 2005 and 2017 were deposited on arXiv, and among those, 80% were preprints (arXiv submission date is earlier than online publication date). Authors are more likely to post the pre-version of a paper to arXiv, when they submit it to a journal, or when the paper is accepted by a journal, and about 40% of the authors update it with a new version during the peer-review process of a journal. The patterns are shown in Figure 1.

By contrast, publication delay in Mathematics is longer than that in LIS. About 20% of the about 50,000 journal papers indexed in WoS in the year of 2013 are deposited in arXiv, and approximately 94% are preprints, with more than 16-months pub-

lication delay. Most of the authors submit the first version of arXiv papers 7-8 months prior to the online publication date, which actually coincides with the journal received time. About 50% of the arXiv papers in Mathematics are updated, and among these, more than 50% are updated immediately after being accepted by journals.

CITATION IMPACT OF PREPRINTS

Citations in scientific literature reflect the use of information within the framework of scholarly communication and are therefore used to "metrically" support research assessment. Since Lawrence (2001) found that freely available online conference articles in Computer Science were more cited than off-online articles, the effect of use and access on citations are widely discussed. By comparing the citation impact between WoS indexed journal papers with and without an arXiv version (pre- or post- full-text), Brody et al. (2004) found there was a citation advantage for arXiv papers, suggesting an
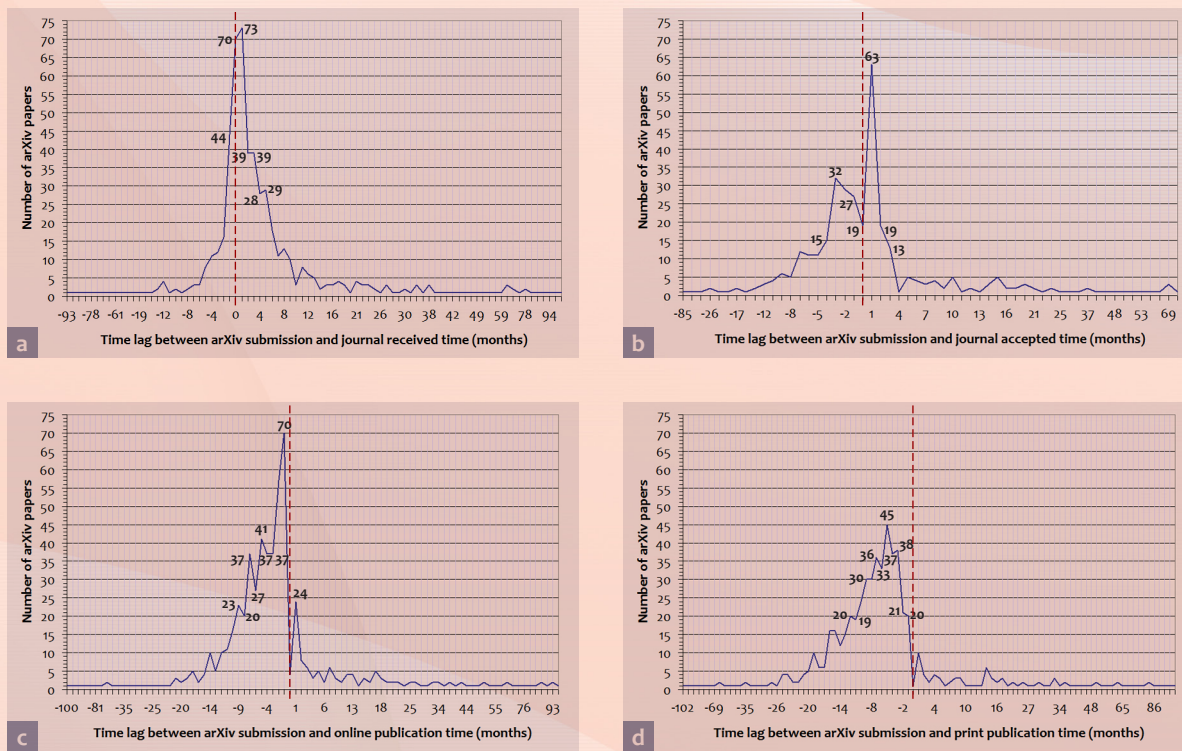

Figure 1. Distribution of the time lag between arXiv submission and journal received (a), journal accepted (b), online publication (c) and print publication time (d) for the LIS sample.
Figure is sourced from: Wang et al. (2018)

Open Access (OA) effect of arXiv papers. This observation could be confirmed by others. Kurtz et al. (2005) proposed three possible, and non-exclusive, explanations for the citation advantage of arXiv papers: *open access* (fully freely access online), *early view* (early access online before publishing in a jounral) and *quality bias* (authors preferentially tend to post the most important article). Further literature on the background of the citation advantage of OA and preprint publishing, in particular, is reviewed and discussed in my earlier papers (Chen et al., 2017; Wang, Glänzel & Chen, 2018). Changes in scholarly communication brought by growing importance of the preprint culture are recently also witnessed in LIS (Wang et al., 2018). Here we could give three evidences:

1. Both the absolute number of arXiv papers and their authors increased, especially during the most recent years.

2. The "early-view" and "open-access" effect of arXiv papers yielded the advantage of a high visibility and more citations.

3. Preprint versions were cited in WoS-indexed articles before they were published in a journal, while the citations to pre-print versions quickly declined after journal publication, indicating a faster ageing of preprint literature.

Here I have to mention that analysing citations to preprints not published in journals is difficult, since documents on preprint servers are not indexed in WoS and Scopus. Although Google Scholar has the potential to fill this gap to a certain extent (cf, Halevi et al., 2017), automatic data harvesting in Google Scholar is restricted to author-based queries.

USAGE AND SOCIAL ATTENTION OF PREPRINTS

The emergence of online scholarly communication with different forms of fast and free access for a broad user communities resulted in the demand for new and alternative indicators for monitoring and measuring the variety of information use and impact within and beyond the framework of traditional scholarly communication. *Usage metrics* and *altmetrics* represent the most prominent attempts to meet these information needs (Glänzel & Gorraiz, 2015). *Usage metrics* reflect a variety of different aspects of information usage of an article, including abstract or full-text views, article downloads, indicating usage preference in a direct manner although information about the actual users and their motivation is usually not available. There is evidence that usage metrics correlate with traditional indicators, although this phenomenon does not always allow unambiguous conclusions: Early downloads could, for instance, help to predict later citations (Brody et al., 2006). Wang et al. (2015) observed that OA papers enjoyed a more enduring attention from readers than non-OA papers published in the same journal. View counts of articles uploaded on ResearchGate were reported to have low positive to moderate positive correlations with Scopus citations and Mendeley readers (Thelwall & Kousha, 2017).

Since September 2015, the WoS provides the daily-updated usage counts of indexed publications allowing measure the level of interest in a specific document. Although positive correlation between usage counts and citations in WoS was observed for several disciplines, usage patterns cross fields proved more diverse than citations (Chi & Glänzel, 2017, 2018). The term of "altmetrics" was introduced later than "usage metrics" (Priem & Hemminger, 2010), aiming to capture new and previously invisible aspects of impact of scholarly publications. *Altmetrics* are metrics for measuring diverse group of actives in social web platforms, having the advantages of being available before citations and recognizing a wider audience than publishing scholars (Priem et. al., 2010). According to Moed (2016), three drivers have motivated the emergence of altmetrics.

1. increasing awareness on the multidimensionality of research performance,

2. changes in the scientific communication system due to computational advancements, and

3. the emergence of the Open Science movement.

Compared with other altmetric indicators, Mendeley readership seems to be an interesting indicator to supplement citation impact of preprints, because, similarly to citations, it provides profile information of readers, such as country, research area and academic status, and thus provides more detailed information on knowledge flow (Mohammadi & Thelwall, 2014). Furthermore, Mendeley seems to have a broader coverage and to provide more information than other sources (Haustein et al., 2014). Just to give an example, we found that the percentage of Mendeley coverage for arXiv and non-arXiv papers published in

Scientometrics, JASIST and *Journal of Informetrics* between 2005 and 2017 amounted to about 97%, while the percentage in Twitter was about 30%. Moreover, Mendeley supports searching by arXiv identifiers. Finally, Mendeley readership can be used for identifying *early impact* (Maflahi & Thelwall, 2018), which is important for preprints (Thelwall, 2018). While Mendeley seems to mirror the use of papers by a broader but still largely academic audience, which currently consists to a large extent of students and postdocs (Mohammadi et al., 2015), Twitter is a microblogging platform used by a general audience to disseminate information, reflecting a heterogeneous spectrum of scholarly and public attention. The different extent of impact advantage in the light of *usage* (WoS usage), *capture* (Mendeley readers) and *social media attention* (Twitter) is shown in Figure 2. The broader visibility and full open access of preprints boosts an enormous impact advantage through Mendeley readership, not reflected in a similar manner by usage counts and
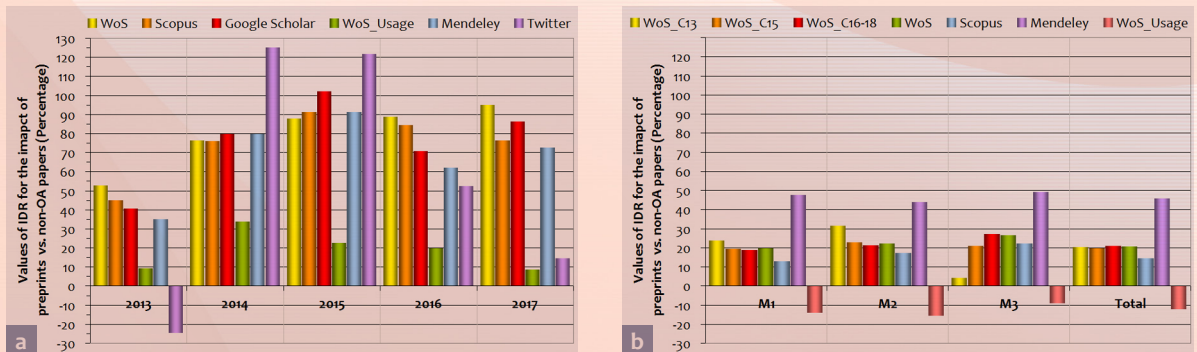
Figure 2*. The impact of preprints in LIS (a) and Mathematics (b)**

* *Impact Differential Ratio (IDR):* An optimised function, which is based on the function "arXiv CID" proposed by Moed (2007) and has already been applied in my earlier paper (cf. Wang et al., 2018). Here it is used for quantifying and measuring the impact differential of preprints versus non-OA papers, and is defined as

$$IDR = 200 \times \frac{ID_{pre} - ID_{nOA}}{ID_{pre} + ID_{nOA}}$$

(ID_{pre} and ID_{nOA} refer to the mean values of the measuring metrics, including *usage* (WoS usage), *capture* (Mendeley readers) and *social media attention* (Twitter) of preprints and non-OA papers, respectively.

** *Sub-discipline codes:* M1–'Mathematics', M2–'Mathematics Applied' M3–'Mathematics Interdisciplinary Applications'.

Citation indicators: "WoS_C13"/"WoS_C15"/"WoS_C16-18"/"WoS". The number of citations the document received from WoS until Dec. 2013/until Dec. 2015 /from Jan. 2016 to Oct. 2018/until Oct. 2018. The IDR for *Tweets* is not calculated, since the small number of papers in Mathematics mentioned in Twitter does not allow statistically reliable analysis.

Tweets, which actually proved very sparse. The gap between usage counts in WoS and Mendeley readers is larger in Mathematics (Figure 2b) than in LIS, reflecting the well-developed preprint culture in the scholarly communication in Mathematics.

DISCUSSION

Preprints are important means to speed up scholarly communication. Traditional bibliometric indicators supported by new, alternative metrics, could help improve measurement and assessment of the role of preprint publishing in scientific communication. However, we have to stress that the general applicability of altmetrics for evaluative purposes is still under debate (Glänzel & Chi, 2016) and many questions still remain to be answered, for example, what the added value of further available altmetric indicators (*mentions, social media, policy citations,* etc.) in measuring and evaluating the impact of preprints could be. Furthermore, the function of preprints could change with the further evolution of open access publishing and the change of preprint publication cultures in the individual research fields. Studying this will be part of my future research within the framework of my doctoral project.

ACKNOWLEDGEMENTS

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