

# ISSI Newsletter

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## CONTENTS

### CONFERENCE REPORTS

12<sup>th</sup> National  
Conference of the CSSI  
page 32

18<sup>th</sup> ISSI Conference  
Leuven – 2021  
page 35

Advanced Methods  
in Departmental  
Evaluation  
page 46

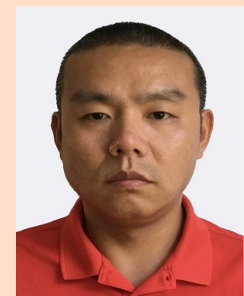
Report on  
Workshop III “Cited  
References Analysis  
Using CRExplorer”  
at the ISSI2021  
Conference  
page 52

### ARTICLES & SHORT COMMUNICATIONS

J.E. Fuchs &  
R. Rousseau:  
How to Calculate  
the Relative  
Intensity of  
Collaboration (RIC)  
for Countries from  
Web of Science  
Data.  
page 55

## 12<sup>th</sup> NATIONAL CONFERENCE OF THE CHINESE SOCIETY FOR SCIENTOMETRICS AND INFORMETRICS

The Chinese Society for Scientometrics and Informetrics (CSSI) is the only national society representing around 400 scientometricians and bibliometricians in China. The biennially CSSI Conference was started in 1996 to offer an academic platform for Chinese scientometricians and bibliometricians. The 12th CSSI Conference was held on June 17-19 at Hangzhou, China, hosted by Hangzhou Dianzi University. Over 300 participants attended the conference, reaching the historical record of attendance. This short conference report will summarize the conference and introduce the new elected board of CSSI.



**FEI SHU**

Hangzhou Dianzi  
University, China

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## INTERNATIONAL KEYNOTE

The CSSI Conference started with two international keynotes, virtually presented by Dr. Cassidy Sugimoto and Dr. Ludo Waltman. As the president of International Society for Scientometrics and Informetrics (ISSI), Dr. Cassidy Sugimoto from Georgia Institute of Technology (USA) detailed the relationship between scientometrics and science policy from the historical view. Dr. Ludo Waltman from Leiden University (Netherlands) demonstrated the evolving system of academic communication as well as its implications for scientometrics. Following the two international keynotes, 12 keynote reports were also presented by Chinese scholars. In addition to the keynote reports, 141 papers were presented in the conference, grouped into 4 tracks as Research Evaluation, Theory of Scientometrics, Academic Discourse, Patent, and Information Network, which demonstrate the landscape of current scientometric research in China.

## NEW BOARD OF CSSI

On June 18, CSSI held a general assembly meeting to elect the new board of CSSI for the next five years. Prof. Junping Qiu from Hangzhou Dianzi University, the past president of CSSI was honored as the honorary president for acknowledging his contribution in the past dec-





*The past and the present presidents of the Chinese Society – Prof. Junping Qiu and Dr. Siluo Yang, respectively*

ade. Dr. Siluo Yang from Wuhan University was elected as the new president of CSSI. A new board of CSSI consists of the following 7 members:

- ▶ President: Siluo Yang (Wuhan University)
- ▶ Vice President: Jiang Li (Nanjing University)
- ▶ Vice President: Liying Yang (Chinese Academy of Science)
- ▶ Vice President: Lin Zhang (Wuhan University)
- ▶ Vice President: Danqun Zhao (Peking University)
- ▶ Vice President: Fei Shu (Hangzhou Dianzi University)
- ▶ Secretary-general: Yanhui Song (Hangzhou Dianzi University)

## DSI JOURNAL

As the newly official English journal of CSSI, Data Science and Informetrics (DSI), was introduced in the conference. DSI adheres to international standards for scholarly journals with the goal to become an internationally recognized scholarly journal. DSI employs a double-blind peer review process and emphasize originality and quality of research. DSI is truly open access and does not charge any APCs to authors. Prof. JunPing Qiu (Hangzhou Dianzi University), Dr. Dangzhi Zhao (University of Alberta, Canada) and Dr. Fei Shu (Hangzhou Dianzi University) were appointed as the co-editor-in-chief of the DSI. The journal editorial board consists half international members and half Chinese members.



# 18<sup>th</sup> ISSI CONFERENCE LEUVEN – 2021

## A VIRTUAL CONFERENCE REPORT



**WOLFGANG  
GLÄNZEL**  
ECOOM,  
KU Leuven,  
Belgium



**SARAH  
HEEFFER**  
ECOOM,  
KU Leuven,  
Belgium



**KOENRAAD  
DEBACKERE**  
ECOOM,  
KU Leuven,  
Belgium

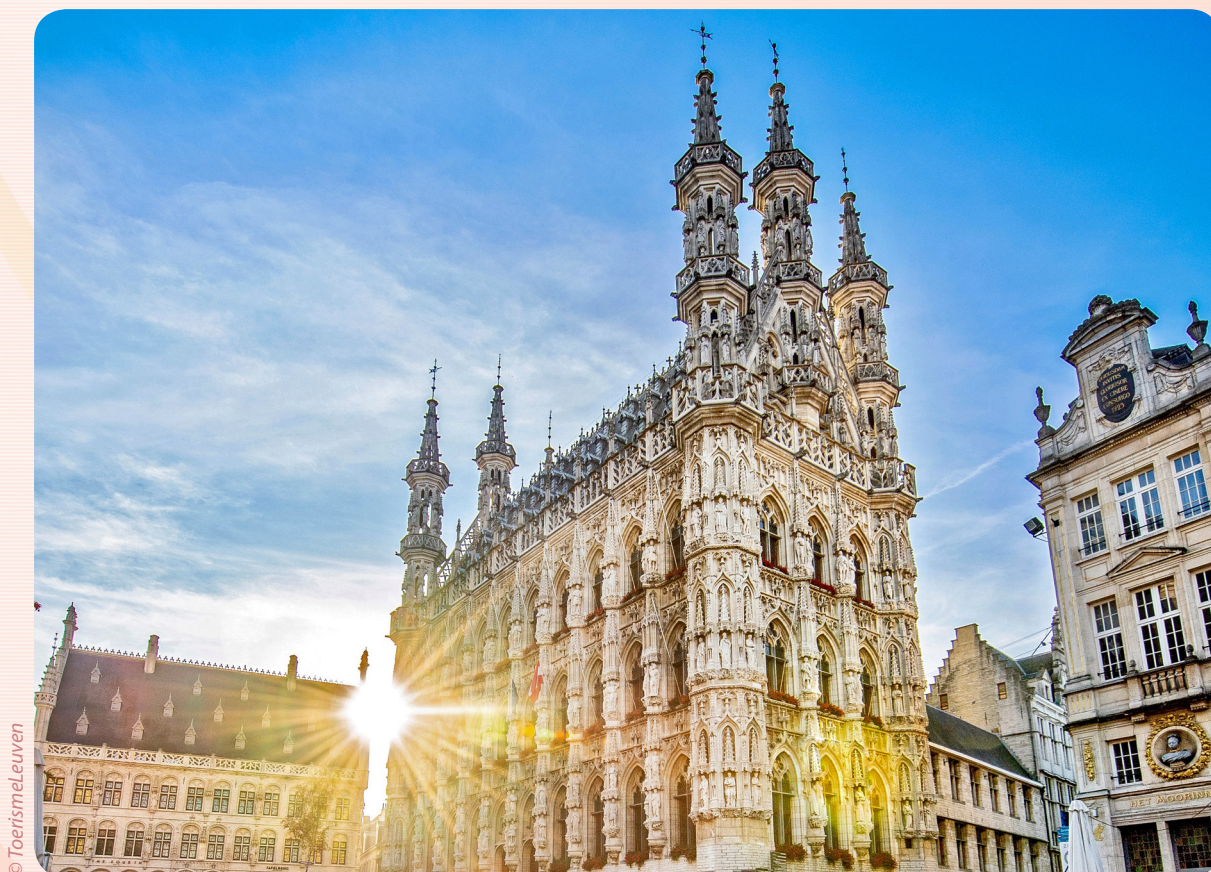
## INTRODUCTION

The 18<sup>th</sup> International Conference on Scientometrics and Informetrics was organised by KU Leuven in close collaboration with the University of Antwerp under the auspices of ISSI – the International Society for Informetrics and Scientometrics and took place 12–15 July 2021. The organisation of this event was a long and winding road paved with many challenges. When we started the preparation in early 2020, we had already reserved the conference rooms for the plenary and parallel sessions, the ceremonies, the workshops and poster exhibition. The

locations for the reception and the conference dinner were reserved and also social events and an excursion were planned.

However, due to the continuing constraints imposed by the COVID-19 pandemic and the resulting risks for planning and organising a full-fledged conference with physical presence of attendees, the organisers had to revise their plans. The first idea was to hold at least a hybrid conference with a limited number of physically present attendees and a larger number of online participants. The emergence of new COVID-19 waves, new mutants of the coronavirus and the unpredictability of the evolution of the





The historical city hall of Leuven.

pandemic with the related risk of frequent cancellations and of being forced to replace organisation by improvisation, persuaded us to go fully virtual. In the summer of 2020, we decided to organise the conference as a virtual event and dropped the possibility of any in-person or hybrid meetings. We expected that this decision would warrant more predictability and a smooth organisation without unnecessary modifications and adjustments during the preparation process. At that time, we thought so, at least...

## CONFERENCE PREPARATION

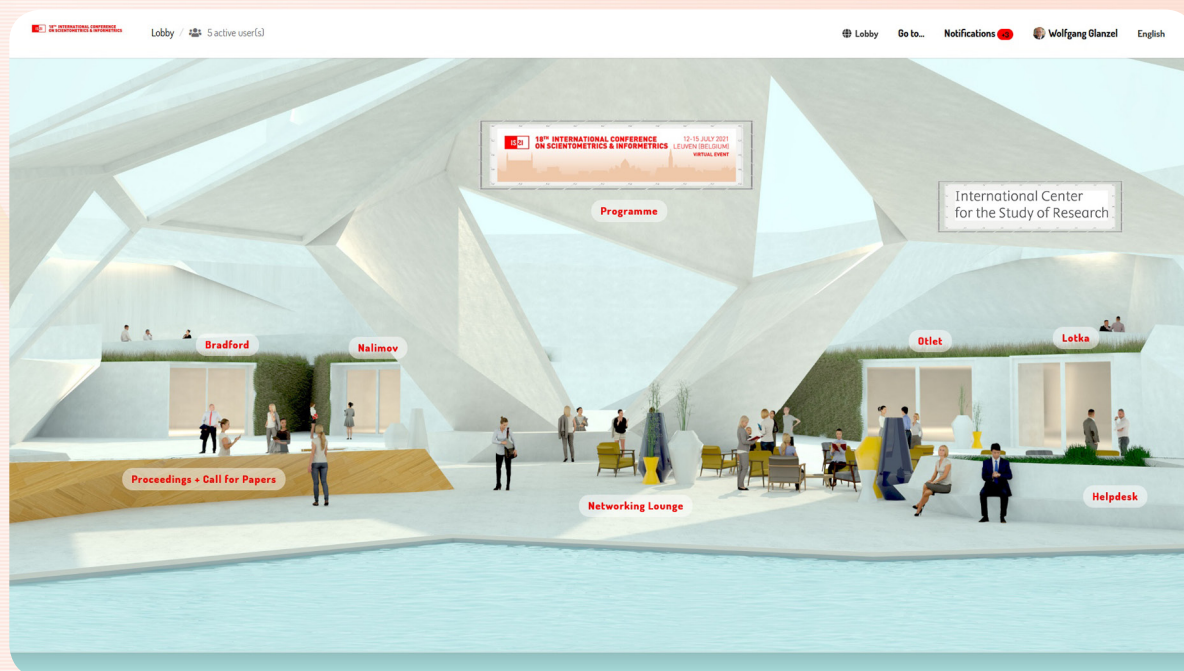
The organisation in Leuven enjoyed the professional support by KU Leuven Conference Office. We started the preparation of the conference with looking for an appropriate digital platform and with the development of several scenarios. We wanted to have the maximum look and feel of a physical conference, and, at the same time, take

advantage of the opportunities provided by a virtual event. Therefore, we planned interactive online sessions, professional video streams and pre-recorded individual presentations. After a careful selection process, we finally chose the virtual platform MEEPLE provided by Sylvester in order to simulate a live event as much as possible, also considering the different time zones in the countries across the five continents. We organised the conference as a mixture of interactive live sessions, professional video streams and presentations that have been individually pre-recorded by the presenters of the accepted oral and poster papers. In this way, we could, for instance, offer the presenters of posters the possibility of short enlightenment talks as well, which brought poster papers closer to oral presentations.

In the scenario as selected finally, we could invite three keynote and four invited speakers. Their talks were delivered in live sessions. Furthermore, out of the accepted oral presentations, six premium talks were



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The virtual conference lobby of ISSI 2021 with the entrances to the conference rooms

selected for live presentation. The main criterion for selection was the topic, of course besides the quality. All other presentations have been uploaded for access via the platform.

We decided to start the live events each day at noon to make sure that the broadest possible audience was able to view the presentations, live events and ceremonies. Unfortunately, this meant that attendees from East Asia and Australia had to stay up until midnight or even later, but this way we could prevent participants from the Americas from getting up around 3 a.m. local time.

The virtual venue also offered the opportunity of naming the conference rooms after famous scientometricians and information scientists. The main hall, in which all plenary sessions took place, was called “Otlet” to honour the Belgian pioneer and father of information science Paul Otlet (1868–1944). The “Lotka” room served as the break-out room of the conference, the “Bradford” room was the room for the interactive sessions, and the “Nalimov” hall, finally, hosted all pre-recorded talks, including the special tracks, the full and research-in-progress presentations and the posters. By choosing the Nalimov hall for pre-recorded talks and posters, we could make a virtue out of ne-

cessity: nobody had to make the selection of which presentations to attend in otherwise parallel sessions and was thereby forced to miss interesting talks. Of course, we could not offer a reception, coffee/tea and lunch breaks, or social events with the opportunity for many informal discussions among participants, for professional or private networking activities or just for conversations in the margins of the conference. Instead, chat rooms for private and public communication and a break-out room have been established as one of the many opportunities provided by the platform.

The complete conference was recorded and the livestreams are available for registered participants until 15 October 2021 on [issi2021.digital-event.be](https://issi2021.digital-event.be).

## PARTICIPATION AND CONTRIBUTIONS

Many participants have expressed their regret about missing out on the opportunity to meet colleagues and friends in person and, of course, to visit the wonderful city of Leuven with its centuries-old cultural heritage and hosting the largest Belgian university, which



was founded as early as 1425 and is one of the oldest and well renowned universities in Europe. On the other hand, participation was, in many respects, eased by going virtual.

In total, 411 participants from five continents registered for the conference, the largest group from China (17%), followed by Germany (10%), the Netherlands (9%), the US (9%) and Belgium (7%). The table below gives more details on the distribution of attendees by country.

All submissions were peer reviewed. The final decision was taken by the programme committees for the oral and poster presentations on the basis of the reviews. The committees provided the opportunity for revisions, whenever the reviewers recom-

mended this. Out of more than 300 submissions, we were able to accept 230 papers, whereof 155 full and shorter so-called Research-in-Progress (RIP) papers and 75 poster papers, respectively. The (co-)authors of these contributions represented *44 countries across five continents*.

We have published all full papers, Research-in-Progress and poster papers in the conference proceedings with Leuven University Press. The Open Access proceedings material is available only electronically in PDF format, in one volume of 1590 pages (<https://iss2021.org/proceedings/>). The copyright is shared both by the authors and by the ISSI Society, the patron of the conference.

The conference organisers and the editors of the international journal “*Scientometrics*” agreed on organising a conference *special issue* in the journal on the basis of substantially extended versions of full and RIP papers. The project has been approved by the journal publisher (Springer Nature). This special issue will be published in 2022.

Table 1: Distribution of conference participants

COUNTRY	PARTICIPANTS
CHINA	70
GERMANY	42
NETHERLANDS	35
USA	35
BELGIUM	29
UNITED KINGDOM	20
SPAIN	15
BRAZIL	14
ITALY	13
FRANCE	11
CANADA	10
RUSSIAN FEDERATION	10
JAPAN	9
AUSTRIA	6
CZECH REPUBLIC	6
FINLAND	6
INDIA	6
TAIWAN	6
NEW ZEALAND	5
POLAND	5
SOUTH AFRICA	5
SWEDEN	5
SWITZERLAND	5
NORWAY	4
ARMENIA	3
AUSTRALIA, COLOMBIA, CROATIA, CYPRUS, DENMARK, ESTONIA, GREECE, HONG KONG, HUNGARY, INDONESIA, IRAN, IRELAND, KENYA, LITHUANIA, LUXEMBOURG, MEXICO, MOROCCO, NIGERIA, OMAN, PAKISTAN, PORTUGAL, SAUDI ARABIA, SERBIA, SINGAPORE, SLOVENIA, SOUTH KOREA, TURKEY, UKRAINE	1–2

## SCIENTIFIC PROGRAMME

### KEYNOTES AND INVITED SPEAKERS

We have invited three internationally renowned scientists to speak about relevant topical issues in our research field. Keynotes were presented as the first speeches on each conference day. The first keynote delivered by *David Sweeney* (Research England, Bristol, UK) on Monday focused on “Scientometrics and Responsible Research Assessment”. David explored the value of scientometrics in addressing issues around research culture, drawing on recent ‘People and Culture’ work in the UK and ‘Responsible Research Assessment’ at the Global Research Council.

The second keynote was presented by *Katy Börner* (Indiana University, Bloomington, IN, USA). She spoke about advanced data visualisations that can be used to optimise different types of computational



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David Sweeney speaking about responsibilities and objectives in building a healthy and sustainable research system

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Katy Börner speaking about "Modeling and Mapping Science, Technology, and Education"

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Albert-László Barabási reporting on "Quantifying Outcomes in Individual Careers, from Science to Art"

models and to demonstrate how model results can be used to inform effective decision-making.

The last keynote was given on Wednesday by *Albert-László Barabási* (Central European University, Budapest, Hungary and Northeastern University, Boston, MA, USA). The topic of his speech was model-

ling and measuring performance and success in individual careers from a physicist's perspective, in whose domain performance and networks are the drivers of success. The talk was illustrated by several examples.

The four invited speakers provided reflections on a broad scope of topics: "Fighting COVID-19 using science of science" by Ying Ding (Indiana University, IN, US), "Ontology-Based Semantic Design" by Cinzia Daraio, (Sapienza University of Rome, IT), "Normalization of Percentile Ranks" by Loet Leydesdorff (University Amsterdam, NL) and "Metrics and science communication" by Isabella Peters (ZBW and Kiel University, DE).

## SPECIAL TRACKS

Two topical themes have been singled out and formed the framework for two special tracks. The first one on "Interdisciplinary Research" organised by KU Leuven comprised 12 presentations on conceptual, theoretical, methodological and application-related questions to better understand what interdisciplinarity covers, how to quantify and measure interdisciplinary research and how to design funding and assessment systems that take the specificity and the recognition of interdisciplinary science into account.

The second track was organised by the University Antwerp. Its topic was "Research in the Social Sciences & Humanities". The track comprised nine presentations and posters and was closely linked to the presentation of the forthcoming *Handbook for Research Assessment in the Social Sciences*, which is to be published with Edward Elgar Publishing.

## CONFERENCE TOPICS

All oral and poster presentations have been assigned to topics and subtopics organised around six major themes covering the most relevant topics in contemporary quantitative science and technology studies. These are listed below.



- ▶ Research evaluation and science policy
  - Bibliometrics in support of science policy
  - Effects of research funding
  - Individual-level bibliometrics
  - Gender and equality studies
- ▶ Data sources and data processing
- ▶ Methodology and application
  - Advanced methods in citation analysis
  - Collaboration and mobility
  - Domain studies and regional issues
  - Document and journal analysis
- ▶ Network analysis, visualisation, mapping of science
- ▶ Patent analysis
- ▶ The broader impact of research
  - Open Science, Open Access and editorial impact
  - Webometrics, altmetrics and media impact

## WORKSHOPS AND TUTORIALS

In addition to the regular sessions and the two tracks, we allowed participants to apply for workshop organisation within the framework of the conference programme. We could accept proposals for five workshops, in particular,

### *1. Bibliometric tracing of epistemic change*

Bibliometric studies often claim to have successfully identified topics, thematic change, emerging topics, or scientific innovations. In this workshop, the organisers and contributors reviewed the assumptions underlying the tracing of epistemic change and the bibliometric tools available for tracing epistemic change and they discussed the assumptions and the ways in which these can be tested and validated.

### *2. Advanced Methods in Departmental Evaluation*

This workshop focused on evaluative aspects of bibliometric methods applied to the

assessment of research activities of research units and departments. Six contributors shared and discussed their experiences, initiatives, approaches and insights concerning best practices in departmental evaluation. The workshop highlighted appropriate tools and metrics used in departmental evaluation, to identify obstacles and pitfalls encountered during evaluation processes and how to point out possible solutions and new opportunities. A detailed report of this workshop can be found in this number of the ISSI Newsletter, Volume 17(3), 2021, p. 46-51.

### *3. Cited references analysis using CRExplorer*

The workshop was based on a method using cited references analysis to reveal the historical roots of research fields, topics, and researchers. The method was called Reference Publication Year Spectroscopy (RPYS). The workshop organisers explained the functionalities of the program CRExplorer. The organisers and co-workers illustrated how to conduct RPYS. The aim was to provide other researchers the opportunity to present their own studies with empirical results produced by the program. A report of this workshop can be found in this issue of the ISSI Newsletter, Volume 17(3), 2021, p. 52-54.

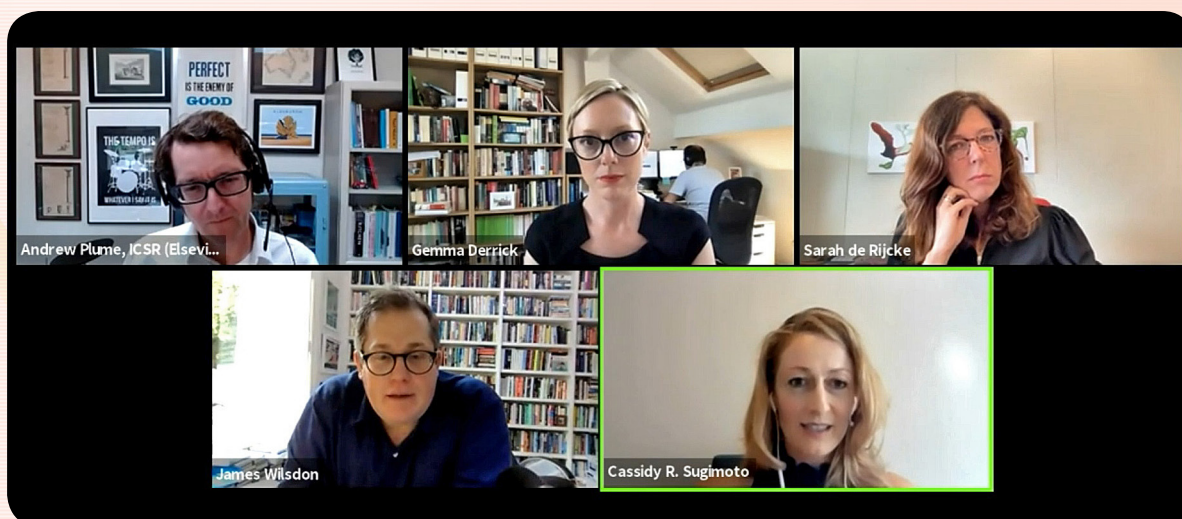
### *4. Models in quantitative science studies*

Modelling quantitative aspects of scholarly and scientific communication has a long tradition and was always inspired by the experience in information science and various other disciplines in the sciences and social sciences. The main purpose of the workshop was to contribute to bridging the still existing gap between theoretical research our field and the application of theory and metrics in an evaluative context.

### *5. China's research evaluation reform: The impacts and implications for global science*

China contributes one fifth of international publications and one quarter of Open-Access





A snapshot taken from the panel discussion organised by Andrew Plume and Fei Shu

papers worldwide. Any reform or change of China's research evaluation policies will consequently influence research activities, not only locally but also on a global scale. The workshop introduced the principles and background of policy reform, and analysed the possible impact on global science.

The live discussion during the workshops proved lively and productive so that the organisers of three workshops asked for the organisation of special journal issues on these workshops. The workshops were complemented by two tutorials, (1) "CADRE: A Platform for Enabling Research via Shared Data, Resources, and Community" organised by Filipi N. Silva from Indiana University Network Science Institute (IN, USA) and his colleagues, which is a follow-up event of the CADRE workshop and tutorial presented at ISSI2019 in Rome and (2) "Studying migration and mobility among scholars using bibliometric data" organised by Samin Aref from the Max Planck Institute for Demographic Research (Rostock, Germany).

In addition to the workshops and tutorials, we were able to provide space for one panel discussion "Towards a Common Discourse and Agenda for Research on Research" organised by Andrew Plume (Elsevier, The Netherlands) and Fei Shu (Hangzhou Dianzi University, China).

## SPONSORED SESSIONS

We could provide space for several sponsored sessions on database and platform related issues in providing relevant data and information to researchers in our science field. These sessions were held as webinars and presentations on Monday afternoon.

## CEREMONIES

As in all the important conferences the scientific programme is complemented with a number of ceremonies. In addition to the canonical sessions with the opening and closing ceremonies, we could give room to several awarding ceremonies as well.

### OPENING

The conference was opened by the Conference Chair, Koenraad Debackere (KU Leuven), with speeches by the Vice Rector of Research Policy of the university, Reine Meylaerts (KU Leuven), the Secretary-General of the Department of Economy, Science & Innovation, Flanders, Johan Hanssens (EWI, Flanders, Belgium), the President of our ISSI society, Cassidy Sugimoto (School of Public Policy, Georgia Tech, Atlanta, GA, USA), and the Secretary-Treasurer ISSI, Wolfgang Glänzel (KU Leuven, Belgium).



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**Koenraad Debackere**  
Conference Chair ISSI 2021

Opening speech by Koenraad Debackere, the Conference Chair of ISSI2021

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**Ludo Waltman**  
Recipient Price Award 2021

The Derek de Solla Price awarding ceremony with the winner's invited talk

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**Anthony van Raan**  
Price Medal Laureate 1995

Anthony van Raan delivers the laudation on the winner of the 2021 Price Medal



## DEREK DE SOLLA PRICE AWARD

The awarding ceremony of the *Derek de Solla Price Memorial Medal* is traditionally an essential part of the programme of ISSI conferences for many years. The Price Medal was conceived and launched by Tibor Braun, founder and former Editor-in-Chief of the international journal *Scientometrics*, and is biennially awarded by the journal to scientists with outstanding contributions to the fields of quantitative studies of science.

The recipient of the Price Medal 2021 is Ludo Waltman from CWTS, Leiden University (the Netherlands). The laudation was given by his former PhD supervisor, Anthony van Raan (CWTS, Leiden University). An interview with the new-fledged Price awardee has recently been published in the *ISSI Newsletter*, Volume 17(2), 2021, p. 27–32, and the laudation can be found in the journal *Scientometrics* (DOI: 10.1007/s11192-021-04127-2).

## THE EUGENE GARFIELD DOCTORAL DISSERTATION AWARD

A further highlight of the ISSI conference series is the *Garfield Dissertation Scholarship Award*. The ceremony was chaired by Nees Jan van Eck (CWTS, Leiden University (the Netherlands) on behalf of the awarding committee. This year, Joshua Eykens from University Antwerp (Belgium) received this prestigious award, which is donated by the Eugene Garfield Foundation. The topic of Joshua's work

was “How to approach interdisciplinarity in the social sciences and humanities?”.

## THE ISSI PAPER-OF-THE-YEAR AWARD

The third traditional awarding ceremony regards the ISSI Paper-of-the-Year award. The committee responsible for the selection decided to bestow this award to Allison Morgan, Samuel F. Way, Michael J. D. Hoefer, Dan Larremore, Mirta Galesic and Aaron Clauset for their paper entitled “The unequal impact of parenthood in academia” recently published in *Science Advances*. The paper was presented by the first author, Allison Morgan from University of Colorado (Boulder, CO, USA).

The runner-up-paper, was entitled “Mapping scholarly publications related to the Sustainable Development Goals: Do independent bibliometric approaches get the same results?”. It was co-authored by Caroline Armitage, Marta Lorenz and Susanne Mikki (University of Bergen, Norway) and was published in *Quantitative Science Studies*.

The session was moderated by the chair of the awarding committee Vincent Larivière. A detailed report of this event has recently been published in our *ISSI Newsletter*, Volume 17(2), 2021, p. 20–21.

## HONOURING WOLFGANG GLÄNZEL

Before closing the conference Koenraad Debackere and Cinzia Daraio honoured Wolfgang Glänzel for his long, outstanding scientific career in the fields of bibliometrics, scientometrics and informetrics as well as for the significant contributions he has made to the ISSI community as a whole and the deep values of scientific inquiry and integrity that he has instilled in many young colleagues. Cinzia Daraio referred to the quote by Michel Zitt from the Festschrift “Wolfgang65” as a concise and sharp summary of Wolfgang's scientific and human values: “*Wolfgang belongs to the narrow group of people, within the bibliometric*



The Eugene Garfield dissertation awarding ceremony with the winner presenting his work



*community, with the gift of ubiquity: one can hardly imagine a topic where he was not, is not or will not be active; one whose collection of works represents an outstanding scientific oeuvre, along with an indefatigable gatekeeping activity at the highest level. Last but not least, his rigor, ethical sense and his availability for truly friendly advice all add to the esteem deserved by his intellectual excellence."*

## CLOSING

The conference was closed by Koenraad Debackere with special thanks to the funder (Research Foundation – Flanders (FWO)) and the sponsors, including Elsevier, Digital Science, RISIS, JDIS, MIT Press, Clarivate ISI, Springer Nature and FRONTIERS. The organisers expressed their thanks to Sylvester and the KfU Leuven Congress Of-



The representatives of the ISSI2021 organising committee at the closing ceremony in the Museum hall of the university's historical building



Conference video introducing the venue of the upcoming ISSI conference in 2023





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*Making-of ISSI2021 Leuven – Calibrating Wolfgang for the Derek de Solla Price Awarding ceremony*

fice for their professional support in the organisation and the implementation of the virtual event. This was followed by a conference summary by the Programme Chair of ISSI 2021, Ronald Rousseau (KU Leuven), and concluded by the official transfer to the ISSI 2023 conference in Bloomington (Indiana University, IN, USA).

## EPILOGUE

The online availability of the complete conference with the option of further networking of participants until 15 October is considered an added value of the virtual meeting and a contribution to the sustainability of its impact. While in-person conferences, after closure, live on in personal memories, photographs, written documents and in contacts and networks established and maintained during the meeting, the virtual organisation enabled us to preserve a full video documentation of the complete event, and even more...



© Sarah Heeffner

*Making-of ISSI2021 Leuven – Wolfgang above the city roofs recording his speech for the conference opening*



# ADVANCED METHODS IN DEPARTMENTAL EVALUATION



**JUAN  
GORRAIZ**  
University Library,  
University of  
Vienna, Austria



**URSULA  
ULRYCH**  
University Library,  
University of  
Vienna, Austria



**WOLFGANG  
GLÄNZEL**  
ECOOM,  
KU Leuven,  
Belgium

**ABSTRACT:** The workshop on “Advanced Methods in Departmental Evaluation” was organised by the Department for Bibliometrics and Publication Strategies of the Vienna University Library in conjunction with the KU Leuven group of ECOOM. The event was held virtually on 13 July, 2021, hosted by the 18th International Conference on Scientometrics and Informatics (ISSI2021). The aim of the workshop was to discuss the specific topical issues emerging from the use of metric tools and the demand for strengthening qualitative methods in the context of departmental research evaluation. Representatives of six organisations have presented and discussed their experience and views. In the following we present a concise report of this meeting.

## INTRODUCTION

Bibliometric methods in institutional research assessment has become routine. Although their opportunities are contrasted by severe limitations, the use of metrics are nowadays an indispensable component of evaluation. Likewise, individual-level bibliometrics has attracted attention notwithstanding that the limitations of the metric approach outweigh the opportunities. At the ISSI 2013 conference in Vienna, the lat-

ter topic was already considered extremely important and was therefore tackled at a plenary session (see also the associated report in the ISSI Newsletter by Wouters et al., 2013). The following urgent debate and manifold responses have opened the door for detailed studies, a broader discussion and profound understanding.

The ISSI 2021 now offered a good opportunity to address this issue again focusing on the specific conditions at the departmental level.



The need for advanced methods in departmental evaluation has already led to the use of often home-made and, by and large, non-standardised implementation of tools at institutions. These tools are frequently based on ready-made solutions developed by database providers or non-profit organisations. However, the increasing variety of such “ready to use” bibliometric tools currently available on the market and the raising demand for short-term and rapid analyses easily lead to malpractice in bibliometrics, which can have direct consequences for both institutions and researchers. The fact that the universities or the umbrella organisations have issued their own specific guidelines, makes the approach to this delicate task even more difficult. Nonetheless, the assessment of research at the departmental level (i.e., of research teams, units, divisions at universities, hospitals and research institutions) offers more possibilities for the application of bibliometrics than the level of individual scientists, but still has to respond to the challenges of individual-level evaluation. This means, bibliometrics should preferably be combined with methods based on qualitative assessment, such as peer review, expert opinion and surveys, as already recommended and even demanded at the ISSI 2013 session in the context of individual researchers’ assessment.

By analogy, one of the central issues is the difficulty of the determination of research profiles at departmental level. Such profiles are usually more specific in comparison with higher aggregation levels and often deviate from “standard” subjects and disciplines due to the fact that research conducted at these research units is often strongly determined by the profiles and academic work of a few department members or scientists. This assignment has proven to be difficult not only due to the structural peculiarities of each center, department or institution but, in particular, as a result of lacking standards as well. Furthermore, the growing interdisciplinarity, the constant increase of authorships and author groups in the emerging e-science, and many other factors, make these tasks even

more tricky. On the other hand, the size of the published research output usually allows for statistically reliable studies at this aggregation level, which may facilitate meaningful use of bibliometric indicators as well as benchmarking exercises. However, a suitable and relevant publication output also implies a corresponding workload for cleaning, disambiguation and processing of data, which can be tremendous. This should in any case not be dismissed since bibliometric practices in conjunction with the coverage and quality of the underlying data have a strong effect on the validity and reliability at the meso-level.

In addition, there is a general call for the responsible and thoughtful use of metrics especially when used for evaluation purposes. Thus, the increasing number of declarations published over the last years, such as the “DORA” declaration, the Leiden Manifesto, the Honk Kong Principles, etc., underlines the great interest of the whole scientific and especially the scientometric community and is a mandate to seek best practices and curb misuse. Nevertheless, the formal observance of these principles does not guarantee informed application of methods, proper handling of data and correct interpretation of results and an intensive exchange of experience should be initiated.

The workshop organisers have therefore invited scientometricians from six organisations of different countries to share their experiences, initiatives, projects, policies or other insights concerning best practices in departmental evaluation by presenting and critically discussing those issues, which they consider most relevant. In the next section, we attempt to highlight and summarize the different and highly interesting contributions.

## PRESENTATIONS AND DISCUSSION

JUAN GORRAIZ

The workshop was opened by Juan Gorraiz from Vienna University Library. In his short introduction, he immediately addressed sev-



eral central and burning questions, above all, the *lack of standards* in both the methodology and the evaluation process. The second issue concerned the *fast evaluation of most recent results* often demanded by the research management. This may be to the detriment of quality and even questions the feasibility. The third issue concerned the context of evaluation depending on the *framework*. The purpose of evaluation may, for instance, be an internal, institutional exercise for funding or even an exercise in a broader context. Finally, the question of the role of *stakeholders and commissioners* in the process was raised.

URSULA ULRYPCH & JUAN GORRAIZ

In their presentation, which was based on their experience at the University Vienna, Ursula Ulrych and Juan Gorraiz highlighted a three-step model for evaluation processes that is currently applied. As a *prerequisite*, interviews with the concerned faculty/departamental representatives are conducted to determine what *is to be* assessed and what *can be* assessed. The peculiarities of the discipline and the research profile need to be clarified, which is closely related to the selection of data sources and the validation of data used for the assessment process. The second step relates to the *bibliometric report*, which needs to be customised on the basis of a close interaction with both users and contracting entities. The same applies to the third phase, the *validation* of the report. Limitations and constraints must be clearly addressed and assistance must be provided in the use and interpretation of reported quantitative results.

CINZIA DARAIO

The second talk, delivered by Cinzia Daraio from Sapienza University, Rome, focussed on the identification of *objective reference units for benchmarking*, i.e., for appropriate multidimensional benchmarking to compare homogeneous units. Above all, it is necessary to clarify the question of what a department is and how it is composed.

Against this background, she proposes an evaluation process that is based on a doubly conditional model aiming at an optimum balance between internal and external conditioning. The model traditionally implies to proceed in two steps, where the parameters of the first stage become variables for the second one. In this approach, the evaluation is conditioned twice, on available information and on information that is not available. The first step of the implementation is the development of an appropriate shared and distributed multidimensional *information system* that comprises all departmental activities, outputs and impacts, and which requires the implementation of the resources and demands a strategic commitment.

LIN ZHANG

Lin Zhang from Wuhan University, China, talked about the *Chinese perspective* on the basis of the planned education evaluation reform in China. This revision sets the path for a new way of evaluation moving away from metrics, towards more qualitative assessment. Representative work is to be peer-reviewed at all levels of evaluation. In this context, also the possibility of long-term evaluation and the combination of individual evaluation and team evaluation is explored. Furthermore, new priority is given to local relevance. The new roadmap extends to all departmental activities and includes education, staff and resources, research performance and societal outreach. Regarding the implementation, the question arises of what is to be considered *representative work* and how to benchmark it for the evaluation.

ROBIN HAUNSCHILD

Robin Haunschild reported on the practice at the Max Planck Society in Germany. He stressed that the Max Planck institutes structurally differ from the university environment and that science fields and mission have a strong effect on evaluation practice, for instance, on the evaluation time periods.



Education needs longer perspectives than the research-oriented departments at Max Planck institutes, notably when considering basic research. The Max Planck Society covers all branches of sciences and bibliometric approaches are not applicable to all of them. Referring to the use of metrics in evaluation practices he focused on following main issues. First, transparency is required and he recommends the use of open data. In this context, the question arises if classical data providers like Clarivate Analytics' Web of Science and Elsevier's Scopus are adequate for this purpose. Second, data collection and processing are crucial for the evaluation process, and normalised indicators need to be used. Finally, only the correct combination of *qualitative and quantitative* assessments lead to substantial findings. Coinciding results may serve as conformation, deviating results, however, require further investigation.

NICOLAS ROBINSON-GARIA

Nicolas Robinson-Garia (University Granada, Spain) reported on *decision processes and how quantitative evaluation can be validated* using the example of the University Granada. Bibliometric indicators play a major role in the Spanish scientific system and they are used at different levels of aggregation and for different purposes. These reports combine internal and external databases and are primarily used for monitoring and decision support, not affecting researchers. Additionally, indicators are used to assess the different institutional strategic plans and allocate funding for institutional calls. Finally, departments use rating scales to recruit new members, using bibliometric indicators in a questionable manner. In the context of the 2011 National Call for creation of centres of excellence, he pointed to serious issues in the practical implementation. The criteria set as well as the handling and documentation of indicators resulted in inconsistencies and problems, notably, the use of indicators for taking decisions but also to justify decisions that have already been made. On the

other hand, there are inconsistencies arising from the lack of metrics as well, as negotiating without "hard" criteria and managing researchers' expectations may become frustrating. Therefore, bibliometrics need to be used in a correct environment respecting their limitations. Decision-making is a complex process comprising many factors in which bibliometrics is only one component. In particular, decision-making involves strategic planning and risk, while bibliometrics has only the potential to provide transparency in non-strategic actions.

Last but not least, it is necessary to study and understand how decision processes take place in science policy and to identify ways in which metrics can be used responsibly.

BART THIJS & WOLFGANG GLÄNZEL

In their presentation, Bart Thijs and Wolfgang Glänzel from ECOOM KU Leuven, Belgium, positioned the evaluation of departments and research units between the meso and the micro level and concluded that this requires a specialised approach combining both quantitative and qualitative methods. These methods may be based on self-evaluation, expert opinion, peer review on the *qualitative* part and Key Performance Indicators, bibliometric screening with profile determination, and benchmarking on the *quantitative* side. Departments at universities have a specific spectrum of activities, comprising education (teaching and training), project-related work, scientific research, third-stream activities and the broad scope of societal-economic activities. Bibliometrics proved to be useful for the evaluation of research activities and their outcomes and impacts, but bibliometrics may still be partially used for project evaluation and the assessment of societal-economic activities. Even research assessment is challenged by field-specific peculiarities that become apparent at the departmental level (e.g., publication types and communication behaviour in computer science and arts and humanities). Along with the well-known op-



portunities and limitations, the bibliometric screening and benchmarking is faced with challenges, notably the identification and selection of *reference units* based on a proper delineation of profiles. While the research output of a department under study can be entirely validated, a complete validation of the reference units is not possible. Finally, there is no “absolute” evaluation, all assessments need to be mapped against the department’s mission and strategies.

The presentations were followed by a lively and stimulating discussion by presenters and participants. In the following, we highlight several important arguments that have been put forth in the course of the discussion.

**Maxim Kotsemir** (National Research University Higher School of Economics, Moscow, Russia) stressed the necessity of the inclusion of all publications based on both national and international databases in the evaluation process not only relying on a set of selected publications as suggested in the new education evaluation in China.

**Koenraad Debackere** (KU Leuven, Belgium) raised three issues, firstly, he stressed the crucial importance of the mission and structure of the unit under study, and that the structure may differ in different areas. His second comment related to the importance of the inclusion of expert opinion in general, notably in special situations and fields as, for instance, in assessment exercises in the humanities. In his third comment, he reinforced the importance of the argument and question by Lin Zhang regarding the representative work.

**David Hubbard** (Texas A&M University, TX, USA) pointed out that representativeness of work may be linked to individuals.

**Arlette Jappe-Heinze** (University of Wuppertal, Germany) raised the question of the extent to which evaluation may be shaped or influenced by an organisation’s objectives.

Finally, **Gunnar Sivertsen** (NIFU, Norway) confirmed that departmental evaluation may easily bring us down to the individual level.

## WRAP-UP OF THE WORKSHOP

Concluding the discussion, **Wolfgang Glänzel** provided a short wrap-up of the presentations and the subsequent discussion. He highlighted several issues, which he considered of paramount importance for research evaluation at this level of aggregation. He stressed that the available time of 90 minutes allowed only to *scratch the surface*, nonetheless, the outcomes of this workshop exceeded, in his opinion, the expectations by far. In the first place, it is important to clarify some conceptual questions, particularly,

- ▶ What is a department, what is its mission, what are its objectives, and what is its structural composition?
- ▶ What is the context of evaluation and how is the evaluation positioned within the organisation’s objectives?
- ▶ Is the evaluation part of strategic planning or non-strategic actions?
- ▶ Is the evaluation part of output monitoring and measurement, or is it part of the assessment of research performance? The two exercises require different approaches.
- ▶ What is the period covered by the evaluation and in how far is this affected by structural changes?

The second issue regards the profile of the department or research unit under evaluation.

- ▶ All participants agreed that the identification of representative work is a crucial issue.
- ▶ There is a certain danger that the identification of representative work and the decisive contribution of the department heads and individual PIs may reduce the evaluation to a more individual-level exercise, notably in smaller departments. This may have an effect on the unit’s profile and may even



be amplified by intensive internal collaboration and co-authorship.

- ▶ External collaboration and staff mobility may become an issue at this level in general and may have an effect on the selection of reference units at this level as well.

The third main issue concerns the selection of both data sources and methods that are closely connected with, and effected by, the departmental activities, in particular its research profile.

- ▶ The choice and the quality of the input for both quantitative and qualitative parts is crucial, as it is an initial criterion that cannot be corrected in the course of the exercise. In some fields, non-indexed literature and specific output types (catalogues, exhibitions, annotated corpora, encyclopaedias, excavations, videos, etc.) play an important part.
- ▶ The question arises of what material can or cannot be quantified, and how non-quantifiable material can be included in the assessment or at least included accordingly in the restrictions.
- ▶ Quantification and measurement should be applied as far as possible, even in components that are based on qualitative assessment criteria.
- ▶ Ensuring commensurability and replicability of results are imperative for all comparative studies and benchmark exercises.
- ▶ Peer review, expert opinion with broader scope, interviews, self-evaluation are indispensable parts of departmental evaluation.

Regarding the evaluation process, Wolfgang Glänzel finally, pointed to the necessity of close interaction with both users and representatives of the subject of evaluation. Also, otherwise personally perceived publication pressure and frustration may be reduced by implementing a healthy evaluation concept.

Finally, he concluded the workshop with the appeal not to “throw the baby out with the bath water”, by completely moving away from metric approaches in departmental evaluation. Bibliometrics has often proved its usefulness in evaluative contexts. It is up to us bibliometricians to *help* elaborate appropriate frameworks and concepts and to provide clear guidelines for use, interpretation and limitations of the results.

## CONCLUDING WORDS

The aim of the workshop was to highlight appropriate tools and metrics used in departmental evaluation, to identify obstacles and pitfalls encountered during evaluation processes and to point out solutions and new opportunities. These examples and “lessons learned” may also contribute to refrain from bad practices that are discrediting bibliometrics. The live-stream of the workshop is still accessible for participants of the ISSI 2021 conference until 15 October.

## ACKNOWLEDGEMENT

We would like to thank the conference organisers and workshops chair, Kevin Boyack, for giving us the opportunity to hold this event as part of the ISSI 2021 conference. Of course, our special thanks are due to the speakers and the participants – with their presentations and comments they have contributed to the great success of this lively virtual meeting.

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# REPORT ON WORKSHOP III “CITED REFERENCES ANALYSIS USING CRExplorer” AT THE ISSI2021 CONFERENCE



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We have organized Workshop III entitled “Cited References Analysis Using CRExplorer” at ISSI2021. Here, we report and reflect on this workshop. The aim of this workshop was to bring beginners, practitioners, and experts in cited references analyses together. A mixture of presentations and an interactive part was intended to provide benefits for all kinds of scientometricians with an interest in cited references analyses.

Cited references analyses complement the traditional times cited analyses. Cited references analyses offer the possibility to focus the impact analysis on specific publication sets (e.g., research fields, topics, journals, or oeuvres of researchers). In contrast to the usual times cited analysis that measures citation impact on the complete

bibliographic database, cited references analyses measure citation impact on the selected publication set only. A specific form of cited references analysis was proposed by Bornmann and Marx (2013). This new form of cited references analysis has been named reference publication year spectroscopy (RPYS, Marx, Bornmann, Barth, & Leydesdorff, 2014). One of the main areas of application of RPYS is the search for historical roots of research fields, topics, journals, or researchers. RPYS analyses are performed in different stages: In the first stage, the publication set of interest is collected with the references cited therein. In the second stage, the cited references are counted for every referenced publication year. In the third and final stage, the early



referenced publication years with a rather large number of cited references are investigated. These “peak” years frequently point to single (or few) often referenced publications that can be interpreted as origins or historical roots of research fields. The program CRExplorer (see [www.crexplorer.net](http://www.crexplorer.net)) was introduced by Thor, Marx, Leydesdorff, and Bornmann (2016) for simplifying and supporting the latter two stages. Two years later, advanced indicators that provide new cited references analysis opportunities were included in the capabilities of CRExplorer (Thor, Bornmann, Marx, & Mutz, 2018).

► In the second part, two researchers presented RPYS analyses: (1) Peter Kokol (who unfortunately could not participate in the live session) contributed his study entitled “Identifying historical roots in paediatric echocardiography using RPYS” (Kokol, Zavrsnik, & Blazun Vosner, 2021) in a pre-recorded video. He presented empirical RPYS results and – most interestingly – a comparison of the results with the opinion of echocardiography experts as a validation approach. Although the experts were surprised by a few identified historical roots, they

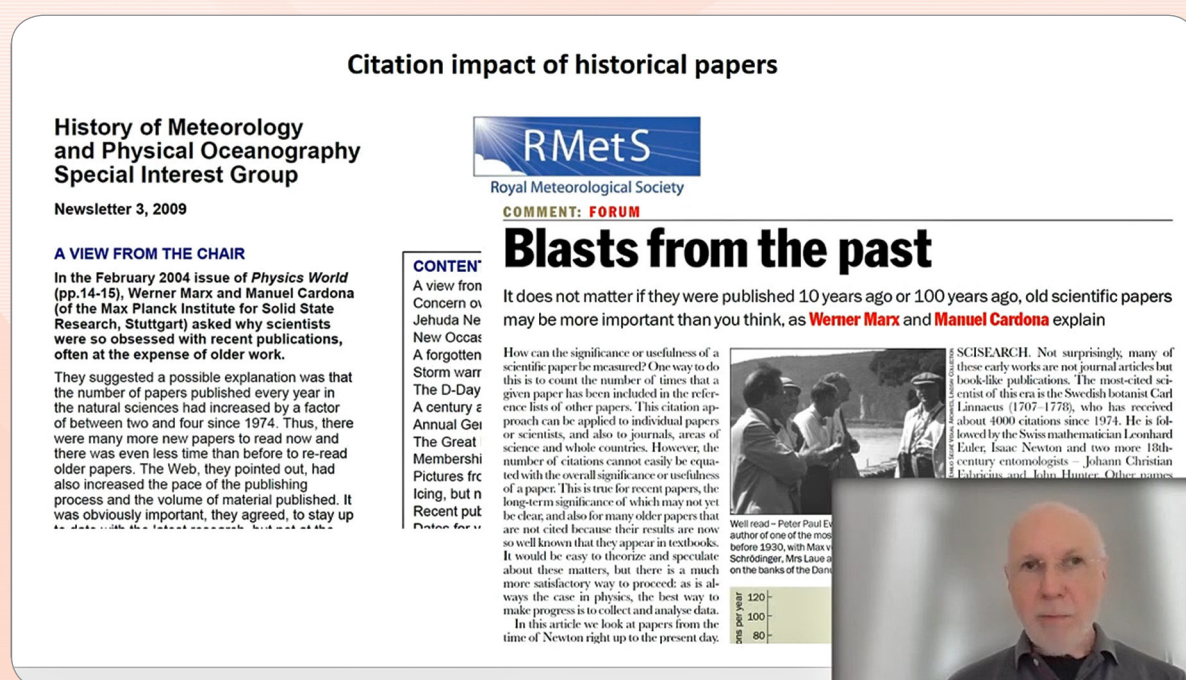


Figure 1: Screenshot of the pre-recorded video by Werner Marx telling the story of how RPYS evolved

Our workshop was structured as follows:

► In the first part, we provided an introduction into the topic of the workshop. As an example RPYS analysis, we analyzed the publications of Lutz Bornmann (n=324). We discussed the most pronounced peaks in the referenced publication years 1965, 1968, 2000, 2005, and 2008. Afterwards, Werner Marx told the story about how RPYS began in a pre-recorded video (see Figure 1). A more detailed version of this short story of RPYS can be found on Figshare (Marx, 2021).

agreed upon reflection that those cited references are indeed important publications in the field. Some publications that were judged by the experts as important historical roots were not found by this RPYS study. A follow-up study is planned by Peter Kokol to resolve such differences. (2) Rüdiger Mutz presented his contribution entitled “How to identify different segments of the growth development of cited references statistically? The Higgs boson research as an example” (see also Barth, Marx, Bornmann, & Mutz, 2014). He identified five seg-



ments with different growth rates in the cited literature of Higgs boson research and suggested a segmented regression approach that could give some additional objective insights into the empirical structure of the sequence of cited reference counts. Within the five segments, he identified the historical roots (landmark papers that were very frequently referenced) of Higgs boson research.

- In the third and final part, we performed an interactive RPYS analysis on the papers published in the *Journal of Informetrics*. We explained the basic functionalities of CRExplorer as well as the more advanced features. The participants could ask their questions throughout the workshop that we answered and discussed.

We thank all participants and speakers for participating in and contributing to this workshop. Their interest in our workshop was indispensable for the success of our workshop. We hope that we were able to spark more interest in RPYS for future studies.

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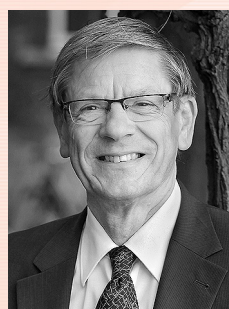


# HOW TO CALCULATE THE RELATIVE INTENSITY OF COLLABORATION (RIC) FOR COUNTRIES FROM WEB OF SCIENCE DATA



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**ABSTRACT:** We describe how to obtain the data, from the Web of Science, to calculate the RIC indicator. Besides the main application, based on collaboration links, we also show how to obtain data for a version of the RIC based on collaborated publications.

## INTRODUCTION

This explanation is written for those colleagues, like ourselves, who are not professionals and do not have access to a dedicated database. Besides sets and numbers of publications and citations, it is also possible to retrieve collaboration data from

the Web of Science (WoS). We explain here how to obtain the data necessary for the calculation of the Relative Intensity of Collaboration (*RIC*) of two countries/regions.

The *RIC* indicator has been introduced by Fuchs, Rousseau, and Sivertsen (2021). In their article, the authors show that this indicator has properties that may make it prefera-



ble compared to the traditional collaboration indicator introduced in (Luukkonen et al., 1992). We recall from (Fuchs et al., 2021) that  $RIC(X,Y)$  is defined as

$$RIC(X,Y) = \left( \frac{C_{XY}}{C_X} \right) / \left( \frac{C_Y - C_{XY}}{T - C_X} \right) = \frac{C_{XY} \cdot (T - C_X)}{C_X \cdot (C_Y - C_{XY})} \quad (1)$$

where  $X$  and  $Y$  denote countries/regions;  $C_{XY}$  denotes the number of publications under consideration in which countries  $X$  and  $Y$  participate (and possibly other countries);  $C_X$  ( $C_Y$ ) denotes the number of collaboration links of country/region  $X$  (respectively  $Y$ ) with at least one country/region. Finally,  $T$  is the overall number of pairwise collaboration links in the network under consideration.

Consequently, if we need the value  $RIC(X,Y)$  we have to collect the values  $C_{XY}$ ,  $C_X$ ,  $C_Y$ , and  $T$ . For illustrative purposes, we assume that we want to calculate the  $RIC$  within the set  $S$  of all items in the WOS, classified as belonging to the subject Psychology ( $SU = \text{Psychology}$ ), finally published in the year 2020 ( $FPY = 2020$ ), and of 'article' type.

Underlying this set, there is a weighted country-collaboration network with countries as nodes. Two countries,  $X$  and  $Y$ , are linked if there exists at least one article in set  $S$  with an address in country  $X$  and an address in country  $Y$  (and maybe also addresses in other countries). The weight of this link is equal to the number of times that this happens.

## TWO INTERPRETATIONS

Yet, reflecting on this we see that besides for collaboration links one could also use the same formula ( $RIC$ ) for collaborated articles or, more generally, publications. This leads to two different  $RIC$ s, referred to as  $RIC_{pub}$  and  $RIC_{link}$ . In the pub case, the value  $C_X$  is the number of publications of country/re-

gion  $X$  in which this country collaborates with at least one other country. In the link case, every collaborating country in the same article counts as one link, and  $C_X$  is the sum of all these links involving country  $X$ . Let us demonstrate these two counting models by the example of an article involving authors from the USA, China, and Japan. On the one hand, the publication-based approach will count this as one publication for the USA, one publication for China, and one publication for Japan. On the other hand, the link-based approach counts two links for each country. We further note that adding these links (giving the number 6), yields double the number of links involved in this article (3 links). These two counting methods influence the numbers  $C_Y$  and  $T$  in a similar way.

Of course, if we have only bi-collaborations in our set of publications, both counts are identical. Because of that, the value  $C_{XY}$  is identically for both counting methods. In the following, we will explain how to obtain all needed values  $C_{XY}$ ,  $C_X$ ,  $C_Y$ , and  $T$  for both counting methods.

Assume we use the query  $SU = \text{Psychology}$  AND  $FPY = 2020$ , restricted to article type. This query yields a set of articles. Using the *Analyze Results by country/region* feature of the WoS, this set yields for each country the number of articles in which this country, say  $X$ , is mentioned in the address field. Yet, if an article has only one country in its address field (no matter how often) this article does not contribute to the country-collaboration network we are interested in. This illustrates the problem of how to keep only articles that contribute to the collaboration network (or equivalently, how to remove single-country articles)?

We proceed as follows. In a first step, we obtain  $C_{XY}$  for a certain country  $X$ , e.g., Japan, and every collaborating country  $Y$ . The search engine delivers these values, if we use the search term (again adapted to our example):  $(FPY = 2020 \text{ AND } SU = \text{PSYCHOLOGY AND } CU = (\text{JAPAN}))$ . Showing the results (SET #1) WoS offers the opportunity to analyze them by countries/regions. The



resulting table shows all numbers of collaboration links of Japan with other countries. This is  $C_{XY}$  with Japan as X and every collaborating country Y.

Now it is easy to obtain  $C_X$  for the link-based count, because  $C_X$  is the sum of all links connected to X, i.e.,

$$C_X = \sum_Y C_{XY},$$

with Y a collaborating country.

For the publication-based count, we need some more work to retrieve  $C_X$  the number of publications of country X (here: Japan) containing collaborations with other countries. The first entry of the previous table shows Japan itself with its numbers of publications in the set S. This number includes all publications – also those with authors only from Japan ( $C_{XX}$  or – as we call them – non-collaborating publications). Referring to this number as  $N_X$ , we see that  $N_X = C_X + C_{XX}$ , or,  $C_X = N_X - C_{XX}$ . So,  $C_X$  is known once  $C_{XX}$  is known.

$C_{XX}$  is obtained through a second search. This time, we search for the same articles as the first time, but now exclude all other countries. We can use the following standard template, and adapt it to the concrete situation:

```
(FPY = YEAR AND SU = FIELD AND CU =
(COUNTRYX NOT (A* OR B* OR C* OR D*
OR E* OR F* OR G* OR H* OR I* OR J*
OR K* OR L* OR M* OR N* OR O* OR P*
OR Q* OR R* OR S* OR T* OR U* OR V*
OR W* OR Y* OR Z*)) ).
```

We already remark that there is no real-world country starting with the letter X, hence we did not include  $X^*$  in this template. In a concrete case, the search term COUNTRYX must be replaced by the name of country X, and the OR-term referring to the first letter of this country must be replaced by another OR-term which contains the countries that have the same first letter as X (and collaborated with country X, which we know from SET #1).

In the case of Japan, a search request would look like this:

```
(FPY = 2020 AND SU = PSYCHOLOGY AND
CU = (JAPAN NOT (A* OR B* OR C* OR D*
OR E* OR F* OR G* OR H* OR I* OR Ja-
maica OR Jordan OR K* OR L* OR M* OR
N* OR O* OR P* OR Q* OR R* OR S* OR
T* OR U* OR V* OR W* OR Y* OR Z*)) ).
```

This time, after we analyzed the results of this SET #2, by countries/regions, we get only publications with authors from Japan (as a check). Moreover, in this concrete case, Japan did not collaborate with Jordan, nor with Jamaica. These countries were only added as an illustration of what one might have to do. The number of items in SET #2 is equal to  $C_{XX}$  and hence we know  $C_X$  for the publication-based method.

After repeating these steps for each country in the network underlying the set S, we obtain  $C_{XY}$  and  $C_X$  for all countries X and Y (in the set S). The only missing value to calculate all  $RIC(X,Y)$  is T. This number is easy to obtain for both counting methods. For the link-based counting, we add the  $C_X$ -values for all countries X and divide the result by two, because T is just the sum of all links of our network. Observe that all collaboration links are included twice, first in the publications of X, and a second time in the publications of Y. This is the reason, why we have to divide the total sum by 2.

For the publication-based counting, we have to do a little more work. We need the overall count of publications retrieved by the query

```
FPY = YEAR AND SU = FIELD
```

or, adapted to our example,

```
FPY = 2020 AND SU = PSYCHOLOGY.
```

From this query, we will get the number of all publications in the year 2020 and about the subject Psychology (this result includes collaborating and non-collaborating publications). So, finally, we have to subtract from this number, the values  $C_{XX}$  (the number of non-collaborating publications)



for all countries X. This results in the value for the publication-based T.

Now, all  $C_{XY}$ ,  $C_X$ ,  $C_Y$ , and T are determined and we have all information necessary to compute  $RIC(X,Y)$  for each pair of countries X and Y.

In this concrete example, there were 171 other countries/regions involved, and hence the search has to be repeated 171 times.

## THE ACTUAL CALCULATIONS

Now we continue with a concrete example<sup>1</sup>. Therefore, we want to calculate the  $RIC$  (two approaches) for Japan and the USA for articles in the field Psychology and the year 2020. If we want to calculate  $RIC(X,Y)$  with  $X = \text{Japan}$  and  $Y = \text{USA}$ , we need to determine the concrete  $C_{XY}$ ,  $C_X$ ,  $C_Y$ , and T.

First, we will calculate the link-based  $RIC$ , which will already deliver some preliminary data for the second approach.

The first query we do in the WoS interface yields  $C_{XY}$ :

FPY = 2020 AND SU = PSYCHOLOGY AND  
CU = (JAPAN)

By the “Analyzing Results” Interface, the search results can be assigned to countries or regions. For the above query we get the following list (presented incompletely):

COUNTRIES/REGIONS	RECORDS
JAPAN	995
USA	171
ENGLAND	84
PEOPLES R CHINA	73
⋮	⋮
SLOVENIA	1
SRI LANKA	1
UGANDA	1

From this list, we get directly the number of links between Japan and the USA, i.e.

$C_{XY} = 171$ . Also, we get the number of links between Japan and England (84), Japan and the Peoples Republic of China (73), and so on. Summing all these numbers up, we get the total number of links including Japan, that is  $C_X = 1,124$ .

In the next step, we have to repeat the query for the USA. The first query is

FPY = 2020 AND SU = PSYCHOLOGY AND  
CU = (USA)

leading to the list

COUNTRIES/REGIONS	RECORDS
USA	26974
CANADA	1370
⋮	⋮
JAPAN	171
⋮	⋮
UZBEKISTAN	1
VATICAN	1

Again, we sum up all numbers except the first one (that are links to the USA) and retrieve  $C_Y = 11,727$ .

Still, the fourth term T is missing, that is the one with the most extra work, at least in our example as we are only interested in the  $RIC$  of two countries. As mentioned above, T is the sum of all links, so we have to calculate each  $C_X$  for all 172 countries and regions in our queries. Done that, we can sum them up to  $T = (1,124 + 11,727 + \dots) / 2 = 93,950 / 2 = 46,975$ .

Finally, we can calculate the  $RIC$ : We recall that this result is based on the WoS.

$$RIC_{link}(X,Y) = \frac{C_{XY} \cdot (T - C_X)}{C_X \cdot (C_Y - C_{XY})} = \frac{171 \cdot (46,975 - 1,124)}{1,124 \cdot (11,727 - 171)} = 0.604$$

Another database would lead to another value. Moreover, we will show that calculating  $RIC_{pub}$  gives a totally different result.

Fortunately,  $C_{XY}$  is identical to the link-based case. So, we can continue with re-

<sup>1</sup> All data were collected from <https://www.webofscience.com/> on June 2nd, 2021. Data collected on a later date may differ from the presented ones.



trieving  $C_X$ , the number of collaborating publications of Japan. Remember from our first query, that Japan has 995 publications (we ignored this line for the link-based  $RIC$ ). But this number,  $N_X$ , includes collaborating and non-collaborating publications (as a formula:  $N_X = C_X + C_{XX}$ ). That means, we have to calculate  $C_{XX}$  to find  $C_X$ .

The next query determines the articles of Japan exclusively with no collaborations from other countries ( $C_{XX}$ ):

```
(FPY = 2020 AND SU = PSYCHOLOGY AND
CU = (JAPAN NOT (A* OR B* OR C* OR D*
OR E* OR F* OR G* OR H* OR I* OR JA-
MAICA OR JORDAN OR K* OR L* OR M* OR
N* OR O* OR P* OR Q* OR R* OR S* OR
T* OR U* OR V* OR W* OR Y* OR Z*)))
```

After analyzing by countries/regions, the result of this query is just one entry:

COUNTRIES/REGIONS	RECORDS
JAPAN	601

Now we can calculate  $C_X = 995 - 601 = 394$ , meaning that Japan collaborated on 394 publications with other countries.

From the above we already know, that  $N_Y = 26,974$ . The following query

```
(FPY = 2020 AND SU = PSYCHOLOGY AND
CU = (USA NOT (A* OR B* OR C* OR D*
OR E* OR F* OR G* OR H* OR I* OR J*
OR K* OR L* OR M* OR N* OR O* OR P*
OR Q* OR R* OR S* OR T* OR UGANDA OR
UKRAINE OR URUGUAY OR UZBEKISTAN OR
V* OR W* OR Y* OR Z*)))
```

presents the list

COUNTRIES/REGIONS	RECORDS
USA	19314

This gives  $C_Y = 26,974 - 19,314 = 7,660$ .

Finally,  $T$  is still missing. Again, it is the one with the most extra work. To retrieve the number of all publications under consideration, we use the query

```
(FPY = 2020 AND SU = PSYCHOLOGY).
```

We find that we are studying 61,877 publications of 172 countries. Again, these are collaborating and non-collaborating publications and we have to subtract the number of collaborating publications. This means we have to calculate  $C_{XX}$  for all countries  $X$  and subtract these numbers from the overall number of publications. We get  $T = 61,877 - 601 - 19,314 - \dots = 61,877 - 44,977 = 16,900$ .

Now we have all elements we need to calculate the  $RIC$ , this time using publication-based counting:

$$RIC_{set}(X,Y) = \frac{C_{XY} \cdot (T - C_X)}{C_X \cdot (C_Y - C_{XY})} = \frac{171 \cdot (16,900 - 394)}{394 \cdot (7,660 - 171)} = 0.96$$

## A POSSIBLE INTERPRETATION OF THESE RESULTS

Why do these two numbers differ so much? Of course, they express two different views on collaboration. On the one hand,  $RIC_{pub}$  makes a statement about how important US-collaborating publications are for Japan in comparison to the importance of US-collaborating publications for the rest of the world. This is nearly 1 ( $RIC_{pub}(Japan, USA) \approx 1$ ) meaning that the USA plays a similar role in Japan as in the rest of the world. Considering absolute numbers, we see that for 394 Japanese papers collaborated with other countries, the USA is collaborating on 171 papers (this is 43%).

On the other hand,  $RIC_{link}$  makes a statement about how important the USA is for the collaboration network of Japan in comparison to the importance of the USA for the network excluding Japan. This is rather low ( $RIC_{link}(Japan, USA) < 0.7$ ) meaning that in comparison to the rest of the world, the USA does not play an important role in the Japanese network. Again, we can have a look at the absolute numbers and we see, that of



the 1,124 links that Japan has, only 171 are between Japan and the USA (this is 15%).

Finally, we propose a real-world interpretation of these numbers. The publication-based count only looks at the actual publications. From this point of view, 171 USA-collaborating publications of Japan are a lot. Would all these publications vanish (hypothetically), Japan would certainly lose importance. Statistically, the USA is engaged in every second publication – from Japan or from the rest of the world. So, the publications with USA-collaboration are important for every country and the importance for Japan and for the rest of the world balance each other (resulting in  $RIC_{pub}(Japan, USA) \approx 1$ ).

The situation in the associated link network is completely different. Most of Japan's collaborating publications are multi-collaborations. Suppose, that not the 171 USA-collaborating publications of Japan would vanish, but the USA as a collaboration partner (or as a node in the network). Because most publications are multi-collaboration publications, they would still count after we excluded the USA as a collaborator and would contribute to the network. With 171 links between the nodes Japan and the USA out of the 1,124 links that are connected

to the node Japan, the USA is not that important for the Japanese network and probably the USA is more important for the network of the rest of the world because the link-based RIC value is rather low ( $RIC_{link}(Japan, USA) < 0.7$ ).

## CONCLUSION

This ends our practical example of the calculation of the *RIC* indicator in case one does not have access to a dedicated database. We have, moreover, shown how the *RIC*-formula can be interpreted in a different way than proposed in Fuchs et al. (2021). It is shown that these two interpretations may lead to very different results.

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