SUMMARY RECORD OF THE OECD-EXPERTS DIALOGUE ON SCIENTOMETRICS: IMPROVING THE QUALITY AND USE OF INDICATORS FOR POLICY-MAKING

1. Introduction

1. The OECD has begun exploring the rich potential of bibliometric indicators and how these indicators can help advance today's science and technology policy agenda. This document summarizes the discussion and insights gained at the OECD-Experts Dialogue on Scientometrics hosted by the OECD Directorate for Science, Technology and Industry on 25 March, 2014. The meeting brought together leading researchers, data providers, and OECD experts in scientometrics and bibliometrics in an effort to see how the OECD can help bring forward the policy and measurement agenda and collaborate with leading practitioners in the field.

2. Topics covered included: Applications of scientometrics and selected new developments in the field; standards and best practices for scientometrics; and the production and use of scientometric indicators for science policy makers. The workshop agenda, comprising links to all of the presentations, can be found at http://www.oecd.org/sti/inno/Agenda_OECD-expert%20scientometrics%20dialogue.pdf, under a newly created webpage on scientometric work: www.oecd.org/sti/inno/scientometrics.htm

3. This report provides a summary account of the dialogue and the responses obtained from a follow up survey conducted shortly afterwards.

2. Workshop introduction: OECD Work on S&T Indicators

4. Fernando Galindo-Rueda (OECD, Economic Analysis and Statistics Division, Directorate for Science, Technology and Industry) gave a brief introduction on the role of the OECD in developing and disseminating statistical guidelines, indicators and analysis on science, technology and innovation. He shared examples of scientometric and bibliometric indicators in use at OECD such as those published in the *Scoreboard 2013* or *OECD Regions at a Glance 2013* including measures of collaboration and impact, mobility of scientists, dynamics of emergent science areas, links between science and technology, spatial analysis of scientometric data, and knowledge flows. He referred to the promotion of micro level analysis through the OECD Micro-Data lab and the engagement in partnership with leading organisations and research institutes to work in this area.

5. Key challenges and questions comprise:

- Promote quality adjusted indicators.
- Addressing topics of relevance to policy makers, such as links between science and technology, mobility and collaboration, tracing of knowledge flows in the science and innovation system.
- How can the interoperability of scientometric and other S&T data sources be improved?
- What positive and negative effects do indicators have on the behavior of scientists and science policy makers?

6. He concluded by pointing out the value of this workshop as a step towards bringing more closely together different communities of practice, including producers and users of data and analysis; showcase

new developments that address some of the shortcomings of traditional indicators; seek external suggestions as to where OECD can add more value, helping co-develop a policy research agenda which might include agreeing on basic principles or use available OECD fora, such as the Blue Sky Indicators Conference that is scheduled to take place in 2016.

3. Applications of scientometrics: An overview of selected new developments in the field

7. Presenters in this session gave brief, 10-minute expositions of selected developments they have been recently involved in and will be asked to identify what the potential implications are for policy makers' evidence base.

Mining Funding Acknowledgments – Daniel Sirtes (iFQ, Germany)

8. Using acknowledgments data provided in the Thomson Reuters database since August 2008 (see slides for the percentage of papers with acknowledgements per discipline), publications with funding acknowledgements for the German Research Foundation (DFG) were retrieved and linked to DFG funding amounts. DFG has 5,746 single item aliases making extensive manual cleaning (ca. 100h per year for one funding agency) necessary. The data will be used for the portrayal of funding agencies; input-output-analyses (see slides for a scatter plot showing the number of publications per funding amount for major German universities); comparison of funding agencies and funding programs with basic funding, and to compute the effect of funding, co-funding, and joint funding.

9. In the discussion, the challenges of attributing scientific outputs to funding streams and problems with timing were acknowledged. The relevance of this work was noted, including the potential to replicate such analyses for other organisations (e.g. NIH).

Monitoring Science Dynamics – David Chavalarias (CNRS/ISC-PIF, EHESS/CAMS, France)

10. The work presented applies co-word analysis to extract multi-scale topical structures and their temporal evolution from different types of text with different temporal dynamics such as Google queries (seconds), Tweets (minutes), blogs (hours), news (days), and publications (months). The goal is to characterize different periods of science development and to visualize the development of future and emerging technologies. Scholars and other units of analysis can be overlaid onto these evolving topical landscapes to understand their evolving expertise profiles. Details and diverse visualization examples can be found in the slides and at http://sciencemapping.com.

Measuring the Links between Science and Technology – Mari Jibu (Japan S&T Agency / OECD)

11. In this presentation, citation links from patents to scientific publications are extracted to understand how patents refer to prior scholarly work, see citation percentages for 35 technology areas in *Scoreboard 2013* and a visualization of the topic space in slides. Identified linkages can also be used to study delays in the system, e.g., the number of months it takes between publishing a scientific publication and patents citing them or to identify knowledge diffusion pathways from academic research teams to industry.

12. The discussion highlighted the potential relevance of indicating the time-lags involved between the publication of a scholarly document and its citation in a patent. Long time-lags would also warrant extending the citation windows in the analysis. Some participants noted the need to be cautious about the scientific production generating knowledge relevant for final uses other than patents and to pay particular attention to the way in which these results are presented to policy users.

Altmetrics and Scientometrics – Paul Wouters (CWTS-Leiden, Netherlands)

13. This presentation illustrated the expanding field of Altmetrics. Altmetrics use new data sources such as blogging, tweeting, etc. to understand the diffusion of S&T results via social media as potential (and more timely) proxies for dimensions of the social and economic impact of science that are not captured by traditional bibliometric indicators. CWTS is creating an Open Access Laboratory with usage, readership, and download data and metrics to capture non-traditional influence and activity. Initial analyses show a rather weak correlation between citation metrics and altmetrics.

14. Participants recognised this is an increasingly active research area where the quality of indicators still needs to be thoroughly assessed and some debate is required to promote a better understanding of what altmetrics actually represent. Some participants asked for example to disentangle the concepts of popularity (or public attention) from actual science relevance and longer-term impacts, considering what different types of sources show. Altmetrics data sources were also highlighted as useful indicators to assist in the communication of science.

Controversy Mapping in Climate Diplomacy - Tommaso Venturini (Sciences-Po, Médialab, France)

15. This presentation provided an illustration of methods to visualise linguistic aspects of public debates, which may span a wide range of domains and not necessarily focused on science, using the EMAPS project. Pairing pdf files with meeting notes from UNFCCC meetings, key discussion topics as well as the dominance of different countries in the discussion can be identified and visually communicated. In the visualization, different meetings are represented by vertical bars labelled on top with meeting title and venue. The bars are sorted in time from left to right. Each colored band represents an evolving topic. The vertical thickness of the band corresponds to the total number of paragraphs in the UNFCCC documents. Bands are sorted by importance, top ones are on top. Participants speculated on the possibility of applying these techniques to describe other types of debates and discussions.

Summary

16. This session provided an overview of some key trends in the development of indicators, such as the utilization of micro data, new data inter-linkages (papers-patents, papers-funding), exploration of social media data, textual and dynamic analyses and visualizations. Some of these new developments need to be accompanied by higher levels of indicator literacy among users and guidance regarding the underlying validity of their assumptions and the extent to which they actually complement or challenge more traditional indicators. The context in which indicators are presented was considered to be of extreme importance as well as the ultimate use of the indicators. The distinction between metrics and indicators was also noted, with the latter requiring some hypotheses and model. The point was also made that scientometrics had been a data-driven domain.

4. The case for and against standards in scientometrics. Are there "best practices" that require promotion?

17. In this section, discussants were invited to express their views on the desirability and feasibility of standards, either formal or informal, in the production and use of scientometric analysis, from the way in which data are recorded in databases all the way to the practices used by public agencies and ministries to commission and publish results. They were also invited to state how standards in scientometrics can assist to facilitate the inter-operability of scientometric and other S&T data and indicators such as those collected and reported by OECD.

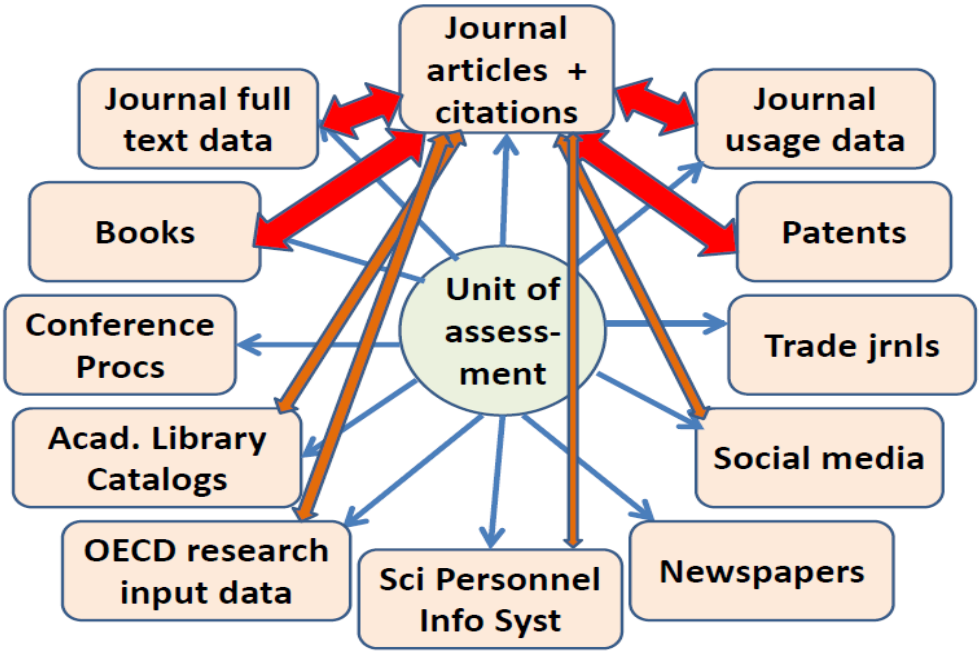
Bibliometric Evaluation Standards – Wolfgang Glänzel (KU Leuven, Belgium)

18. This presentation recalled past efforts to consider standards in the field. The "Chicago Workshop" on Bibliometric standards (1995) identified a number of key issues that remain unsolved. Among them are terminology and definitions; structure and organisation of papers; proper documentation of methods; replicability and validation of results; commensurability and comparability; and appropriate level of aggregation. A number of important questions were posed, reflecting on more recent discussions including at Berlin in 2013[1]:

- Advantages and disadvantages of standardisation
- Feasibility of standardisation
- Organisation of the process towards bibliometric standards
- Possible need of a professional code of conduct (whether designed and implemented) for providers of bibliometric analyses
- Who should elaborate standards?
- To what level should standardisation apply (research, indicator design, reporting, end-user level)?

Scientometrics as Big Data Science – Henk Moed (Elsevier and Leiden University)

19. Henk Moed indicated in his presentation that the nature of scientometrics/ biliometrics/ informetrics research is changing rapidly as more (large) datasets become electronically available; large datasets are interlinked and combined; the interest in and need for metrics, comparisons, benchmarking, and research assessment increases; multi-dimensional approaches and integral views are applied; and components within a S&T system are linked. Emphasis is on accountability, productivity, societal impact.



Source: Moed, Luwel and Daraio (2014), presentation at OECD. See http://www.oecd.org/sti/inno/4.2.%20Henk%20Moed.pdf

1. Relevant references are: Glänzel, *Scientometrics*, 35(2), 1996, p. 167. And Glänzel, Bibliometric Evaluation Standards Debate. Berlin, 2013.

20. He also pointed out the need for concordance of different classification systems, e.g., journal (WoS, Scopus) – input stats (OECD); funding data (for example as used by the NSF); research-teaching subject concordance tables; journal-patent classification; journal-industrial sector of application.

Beyond technical standards: Behavioural changes, policy effects and the uses of metrics in science - Ismael Rafols (Ingenio, CSIC-UPV, Spain and SPRU, University of Sussex, United Kingdom), with Ghislaine Filliatreau (OST, France)

21. Ismael Rafols pointed out that S&T metrics do much more than measure: they signal desired outcomes, produce behavioural changes and have policy effects. They have normative effects. There is a need for guidelines on the use of metrics (Barré, 2010[2]): From justification (closing down the debate) … to deliberation (opening up the debate). It is possible and desirable to design indicators that foster plural reflection rather than justifying or reinforcing dominant perspectives, examples are given in the slides.

Challenges for bibliometric standards – Vincent Larivière (Université de Montréal, Canada)

22. Over the last ten years, there has been a major increase in the use of bibliometrics in research evaluation; in the size of the bibliometric community; in the variety of actors involved in bibliometrics (e.g. no longer limited to Library Information Systems or the Science & Technology Studies community); in the variety of existing metrics for measuring research impact: H-index (with its multiple varieties); Eigenfactor, SNIP and Scimago impact indicators, etc.; and ISI is no longer a monopoly but other databases exist such as Scopus, Google Scholar, Microsoft Academic, Disciplinary database, etc. He discussed the rationale for standards, primarily needed to ensure comparable, reproducible results but pointing out that principles should be based on evidence, clarity and level of needs. In his presentation, he also mentioned the existence of peer review as a standard underpinning the data used and the dissemination of analytical results.

5. The production and use of scientometric indicators for science policy makers

23. The next session sought to gather a range of views and experiences from different actors in the production-use chain, from data providers through to final policy users, including organisations involved in the generation of added value information and indicator services in the area of scientometrics.

The Experience of Scientometrics Data Providers

Web of Science (WoS) by Thomson Reuters - Evangelia Lipitakis (Thomson Reuters)

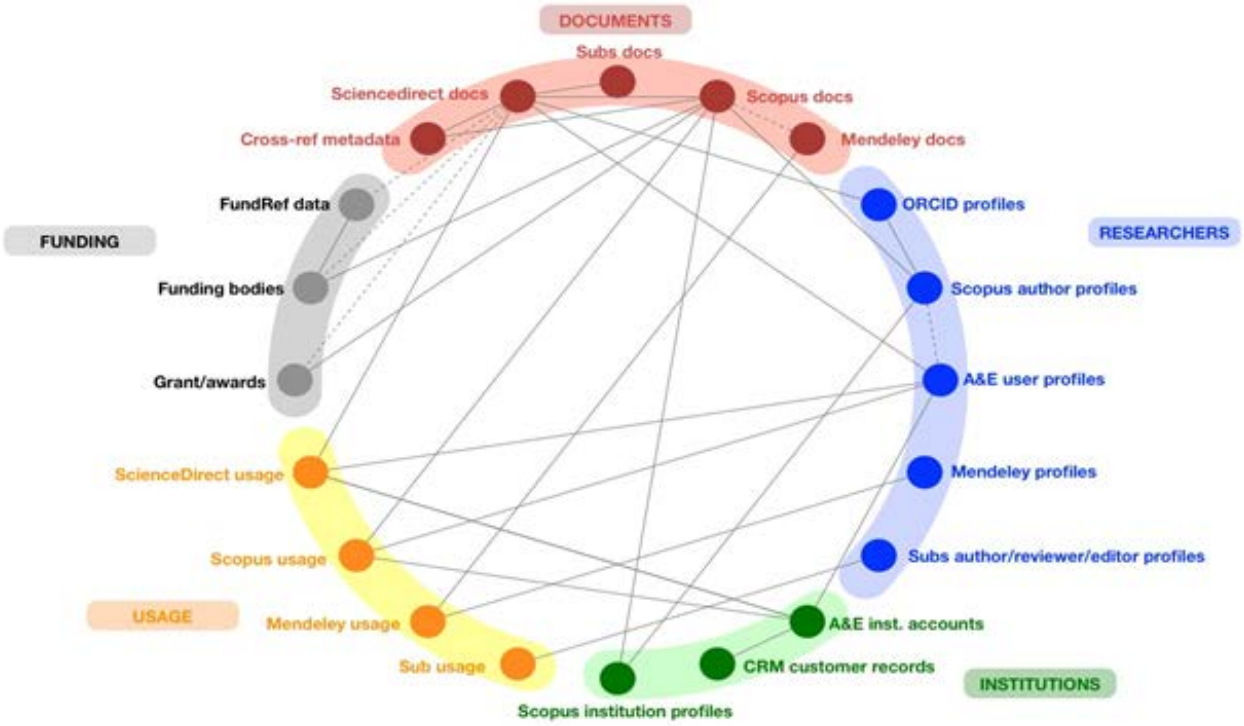
24. Evagelia Lipitakis described the WoS Platform. The WoS Platform is used by 7,000+ institutions in over 100 countries. It provides for-pay access to 24,700 journals, 50,000 books, 6.5M+ conference proceedings, 51.8M+ patents, and 3.7M+ data studies and data sets together with a Subject Area Classification Scheme with more than 250 fields and sub-fields. Currently, it includes Latin America, Spain, Portugal, South Africa, China (SCIELO, Chinese CI). There are plans to include Korea, Russia, Middle East, and Turkey. The data is used by many government bodies in national research evaluations, the U.S. National Institutes of Health Electronic Scientific Portfolio Assistant, Times Higher Education world university ranking, and the Academic Ranking of World Universities (Shanghai Jiao Tong University) among others.

---

2. Barre, R. (2010), "Towards socially robust ST indicators: indicators as debatable devices, enabling collective learning", *Research Evaluation*, 19 (3), pp 227–231.
http://www.sussex.ac.uk/Users/ir28/IDR/Barre2010.pdf

Strategic Research Insights & Analytics by Elsevier – Judith Kamalski (Elsevier)

25. As reported by Judith Kamalski, Elsevier serves 30 million+ scientists, students, health and information professionals in 180+ countries. Publishes 2,000 E journals, 2,000 E books each year, and dozens of research databases. About 20,000+ journals, and 2 million articles are tracked in Scopus. SciVal Analytics processes terabytes of data to provide insights into collaboration, knowledge exchange, and migration as tools for research assessment. The Elsevier infrastructure uses the data and content assets contained in the chart below, extracted from the presentation slides.



Source: Elsevier, 2014.

26. Elsevier has recently started work to define institutional-level indicators in close collaboration with the university data managers and members of the scientific community, as part of the Snowball Metrics initiative (http://www.snowballmetrics.com).

SCImago Institution Rankings – Carmen López-Illescas (SCImago, U. of Extremadura, Spain) with Félix de Moya (SCImago, CSIC, Spain).

27. Scimago institution rankings (SIR) are freely available at http://www.scimagoir.com. They support filtering by country, subject area, sector, and year and support a wide range of indicators. The team has spent much time cleaning institution names. The interface is easy to use (tables, bar graphs, timelines, geomaps) and data can be downloaded (see slides for details). Institutions are using the interface to understand how they can improve their performance.

The Use of Analysis on S&T Activities: The Experience in Japan - Masatsura Igami and Ayaka Saka (National Institute of Science and Technology Policy, Japan)

28. Bibliometric research at NISTEP focuses on Japanese Science and Technology Indicators (1991-), Science map (2003-), Country level benchmarking of scientific research (2008-), Benchmarking R&D capacity of Japanese universities (2012-), and Analysis on research funding systems (2012-). The presentation and additional supporting slides cover a range of NISTEP activities including science maps that are used for (1) Observation of national or organization level activities such as the coverage of research areas on the science map, inter/multi-disciplinary research areas, diversity in research, networking of organizations, etc. and information for university management- to identify strength and weakness in research; (2) Evaluation at program or initiative level such as outcomes of the MEXT's initiative or the development of indicators in collaboration with young policymakers; (3) Identification of promising future research areas based on science dynamics and the identification of emerging research areas.

29. Country-level benchmarking of scientific research, the benchmarking of Japanese universities and analysis of research funding are also important areas of work. These highlight increasing needs for data integration as foundation for more "rational" policy-making, accountability, and science studies. Since 2011, NISTEP has been developing a data and information infrastructure as part of MEXT's "SciREX: Science for RE-designing Science, Technology and Innovation Policy" program.

Lattes Platform, Brazil – Roberto de Pinho (Ministry of Science, Technology and Innovation, Brazil)

30. Roberto de Pinho's presentation on the S&T data infrastructure focused on describing the Lattes Platform as an example of an inter-linked database used for several purposes. Lattes covers CVs, research groups, and institutions and links to CrossRef, Scopus, WoS, ResearcherID, JCR, SciELO. With +2.5M CVs, +150k PhDs it is widely used for policy purposes. Brazil has also built an information system on doctorate and master degree graduates, linked to other statistical data sources, particularly useful in monitoring efforts to promote a more qualified S&T workforce. Mr. de Pinho also explained ongoing collaboration on scientometrics with the OECD, exemplified in the brief on *Researchers on the move: The impact of brain circulation* and recent work on scientific and technological bursts.

6. Challenges and opportunities

31. This session aimed to identify, through an open discussion, the main challenges and opportunities faced when aiming to improve the quality and use of indicators for policy-making. The discussion was introduced by a short presentation by Katy Börner reflecting on some of the points raised throughout the day. Specifically, participants were invited to reflect on the day's discussions and share their views on how the OECD should be involved in (1) Production and use of indicators, (2) Standards and recommended practices, (3) Engagement with policy makers and work with experts and practitioners in this field.

32. A number of key challenges and opportunities were noted throughout the discussion:

- Invite and publish a dictionary of terminology and definitions—in many languages.
- Promote open access to (micro)data and validated tools in support of replicability.
- Publish existing unique lists of institutions, funding agencies, etc. for different countries.
- Lead development of S&T, engineering, and education classifications and cross-walks/concordances.
- Promote and showcase evaluation and validation of metrics, indicators, models.
- Promote the production of user-oriented state of the art reports.
- Publish key meetings, efforts, projects, e.g., via listverv or web sites.

- Help bridge the gap between those who develop indicators and those who use them.
- Facilitate a more continuous, systematic dialogue via a *Scientometrics "Task Force"* that involves key producers and users of publication and other data, drawing on the experience of the equivalent group in the domain of patent statistics.
- Promote *Scientometrics* (particularly the usage of micro-S&T data, visualizations, S&T indicators cooperation and communication) at the Blue Sky Conference 2016, which is expected to take place in Ghent, Belgium.
- Explore opportunities for collaboration with other supranational organisations.

7. Results from the follow-up survey of dialogue participants

33. A follow survey was launched shortly after the workshop using an online tool to take stock of the main takeaway lesson from the workshop and the preferences of participants with respect to potential future activities.

In Question 1, the participants were asked what they considered the main takeaway from the dialogue.

34. One key takeaway was that bibliometric databases provide an invaluable source of information. The IT and visualization tools at our disposal imply that bibliometric indicators are gaining increasing importance not only within the scientometrics community but also for the S&T policy making community. These indicators are used for monitoring and evaluating the outcome of science, at both the national and international levels. Their use will continue to expand including wider user communities such as government and public funders as well as innovation agencies. The conclusion was that there is a need to place bibliometric indicators in the broader system of established S&T indicators such as R&D and innovation statistics, education and doctorate holders' statistics etc. Co-ordination action needs to be undertaken to address standardization and to start a systematic dialogue among the different actors.

35. The majority of participants agreed in noting that standardising bibliometric measures is a difficult task. The participants felt that the varied nature of sources and tasks often associated with scientometrics could not be dealt with traditional standards building approaches often adopted for survey based data collection endeavours. However, providing general guidelines could prove useful. These guidelines could support better use of science metrics. Of critical importance is replicability of results. Efficiency could require wiki-like approaches for sharing data, data cleaning efforts, and algorithms.

In question 2 the participants were asked to prioritise a list of ten follow-up actions, by rating them on a scale from Not Valuable (1) to Extremely Valuable (5).

Ranking	Action	Sum of scores
1	*Promote discussion of scientometrics at OECD 2016 Blue Sky conference*	*64*
2	*Help bridge the gap between those who develop indicators and those who use them*	*63*
3	*Facilitate a more continuous, systematic dialogue via a Scientometrics group or Task Force that involves key producers and users of publication and other data.*	*59*
4	*Promote open access to (micro) data and validated tools in support of replicability*	*57*
5	*Develop open S&T, engineering and education classifications and cross-walks/concordances*	*55*
6	*Promote and showcase evaluation and validation of metrics, indicators, models*	*53*
7	*Compile and publish a dictionary of terminology and definitions in many languages*	*51*
8	*Publish existing unique lists of institutions, funding agencies, etc. for different countries*	*48*
9	*Publish key meetings, efforts, projects, e.g., listverv, web sites*	*47*
10	*Develop templates for user-oriented state of the art reports*	*45*

36. A majority of participants felt that OECD could help promote the discussion of scientometrics and provide strategies to help bridge the gap between those developing indicators and their intended users.

In the final question, question 3, the participants were asked to suggest potential follow-up actions.

37. The participants felt that the OECD has an important role to play in helping to bridge the dialogue between the producers and consumers of bibliometric indicators as well as establishing guidelines for bibliometric evaluation.

PARTICIPANTS LIST

Katy BÖRNER, Indiana University, United States, katy@indiana.edu

David CHAVALARIAS, CNRS/ISC-PIF, EHESS/CAMS, France, chavalarias@gmail.com

Roberto DE PINHO, Ministry of Science, Technology and Innovation, Brazil, roberto.pinho@mct.gov.br

Wolfgang GLÄNZEL, KU Leuven, Belgium, wolfgang.glanzel@kuleuven.be

Masatsura IGAMI, National Institute of Science and Technology Policy, Japan, igami@nistep.go.jp

Judith KAMALSKI, Elsevier, j.kamalski@elsevier.com

Vincent LARIVIERE (by Webex), Université de Montréal, Canada, lariviere.vincent@ugam.ca

Evangelia LIPITAKIS, Thomson Reuters, evangelia.lipitakis@thomsonreuters.com

Carmen LOPEZ-ILLESCAS, SCImago, University of Extremadura, Spain, carmlopz@gmail.com

Henk MOED, Elsevier/Leiden University, The Netherlands, h.moed@elsevier.com

Ismael RAFOLS, Ingenio, CSIC-UPV, Spain and SPRUm University of Sussex, United Kingdom
i.rafols@ingenio.upv.es

Ayaka SAKA, National Institute of Science and Technology Policy, Japan, saka@nistep.go.jp

Daniel SIRTES, iFQ, Germany, sirtes@forschungsinfo.de

Tommaso VENTURINI, Sciences-Po, France, tommaso.venturini@sciencespo.fr

Paul WOUTERS, CWTS-Leiden, The Netherlands, p.f.wouters@cwts.leidenuniv.nl

Derek HILL (by Webex), National Science Foundation, United States, dhill@nsf.gov

Agne M. LARSSON (by Webex), Karolinska Institut, Sweden, agne.m.larsson@ki.se

Eleni MALLIOU (by Webex), EKT, Greece, nmalliou@ekt.gr

Catharina REHN (by Webex), Karolinska Institut, Sweden, catharina.rehn@ki.se

OECD

Giulia AJMONE MARSAN, Country Studies and Outlook Division, OECD Directorate for Science, Technology and Industry giulia.ajmone-marsan@oecd.org

Silvia APPELT, Economic Analysis and Statistics Division, OECD Directorate for Science, Technology and Industry, silvia.appelt@oecd.org

Mario CERVANTES, Country Studies and Outlook Division, OECD Directorate for Science, Technology and Industry, mario.cervantes@oecd.org

Alessandra COLECCHIA, Economic Analysis and Statistics Division, OECD Directorate for Science, Technology and Industry, alessandra.colecchia@oecd.org

Hélène DERNIS, Economic Analysis and Statistics Division, OECD Directorate for Science, Technology and Industry, helene.dernis@oecd.org

Kathleen D'HONDT, Science and Technology Policy Division, OECD Directorate for Science, Technology and Industry, kathleen.dhondt@oecd.org

Fernando GALINDO-RUEDA, Economic Analysis and Statistics Division, OECD Directorate for Science, Technology and Industry, fernando.GALINDO-RUEDA@oecd.org

Eric GONNARD, Regional Development Policy Division, OECD Directorate for Public Governance and Territorial Development, eric.gonnard@oecd.org

Mari JIBU, Country Studies and Outlook Division, OECD Directorate for Science, Technology and Industry, mari.jibu@oecd.org **(visiting from Japan Science and Technology Agency)**

Sandrine KERGROACH, Country Studies and Outlook Division, OECD Directorate for Science, Technology and Industry, sandrine.kergroach@oecd.org

Alistair NOLAN, Science and Technology Policy Division, OECD Directorate for Science, Technology and Industry, alistair.nolan@oecd.org

Asako OKAMURA, Economic Analysis and Statistics Division, OECD Directorate for Science, Technology and Industry, asako.okamura@oecd.org

Mariagrazia SQUICCIARINI, Economic Analysis and Statistics Division, OECD Directorate for Science, Technology and Industry, mariagrazia.squicciarini@oecd.org

Brigitte VAN BEUZEKOM, Economic Analysis and Statistics Divison, OECD Directorate for Science, Technology and Industry. brigitte.vanbeuzekom@oecd.org