Guidelines and checklist for the responsible use of bibliometric indicators at the Technical University of Munich

On June 21, 2022, the TUM Board of Management decided to sign the San Francisco Declaration on Research Assessment (DORA). The globally recognized position paper calls for the responsible use of bibliometrics for publication-based performance evaluation of individuals and institutions.

In academia, it is common practice to use bibliometric indicators such as the Journal Impact Factor or the h-index for research evaluation. Quantitative performance measurement in this area puts significant pressure on institutions and individuals. This is often intensified by an inappropriate use of bibliometric indicators and the reduction of complex scientific achievements to a few measurable values.

At the same time, proper use of bibliometrics enhances the potential of quantitative citation analyses: if used responsibly, bibliometrics can help to make research performance visible in the disciplinary context, increase the impact of publications and strengthen the reputation of both TUM and its authors. Correctly determined, appropriately used and well-communicated bibliometric indicators help to make performance visible and comparable - improper use of bibliometric indicators, on the other hand, is misleading or, in the worst case, damaging for both scientists and institutions.

The San Francisco Declaration on Research Assessment (DORA) addressed this problem in 2012 and presented the now internationally accepted concept of Responsible Metrics. It contains recommendations for a fair and transparent use of bibliometrics with regard to the assessment of research performance. DORA is aimed at funding agencies, authors, institutions and editors of scientific publications. [1]

What does signing DORA mean for TUM?

The Technical University of Munich is one of the strongest research universities nationally as well as internationally. It develops and publishes research results that have an impact on global, national, and regional challenges and that influence culture, society and the economy.

By signing DORA, TUM expresses:

- that it is committed to the responsible use of bibliometrics and is committed to designing its own performance evaluation procedures accordingly,
- that the responsible and ethical use of metrics in research assessment can help drive world-leading research and improve the visibility and impact of research,
- that the use of metrics can be complex and that the utility varies across disciplines and even sub-disciplines, and
- that improperly used metrics reinforce existing biases and compromise the goal of promoting diversity and equity in the academic workforce.

The compliance with DORA principles is binding at TUM. The implementation of DORA requirements is also in line with the principles of good scientific practice as laid down in the respective TUM bylaw[2].

[1] See https://portal.mytum.de/ccc/newsletter/intern/2022_05/07 (TUM-internal document). Full text of DORA see https://sfdora.org/read/

[2] See TUM bylaw "Statute of the Technical University of Munich on Safeguarding Good Academic Practice and Procedures in Cases of Academic Misconduct (TUM-SGwP)" https://portal.mytum.de/archiv/kompendium_rechtsangelegenheiten/sonstiges/TUM_SGwP_en.pdf

The TUM Board of Management has mandated the Bibliometrics Team of the University Library to coordinate the implementation of DORA requirements at TUM. Together with representatives from university administration, schools, faculties, departments and other units, the task is to compare the practice of performance evaluation at TUM with DORA principles, identify deviations, and develop alternative approaches. The Presidential Team for Strategy and Excellence Development will accompany the entire process.

Problems with the application of bibliometric indicators

The value of research cannot be expressed in a single number. The impact of research can take many forms. This also applies to the supporting evidence that is used to prove it.

Bibliometric indicators are used to quantitatively describe scientific publications and their impact in the scientific community. Primarily, the number of publications and the number of citations are counted.

Bibliometric analyses can be used to identify research trends, collaboration networks, and institutions with particularly strong research and publication activities. Bibliometric indicators can also help scientists to present their work appropriately and to make their own contribution visible in a professionally relevant context.

The best-known bibliometric indicators are journal metrics such as the Journal Impact Factor from the Web of Science or person metrics such as the h-index. There is a large number of other indicators that, among other things, take into account subject-specific differences.

What problems can typically arise when using bibliometric indicators?

- Lack of knowledge about the metrics: Those who work with bibliometrics must understand the metrics and be able to contextualize them to ensure their appropriate use in evaluating research programs, scholars, and impact.
- Use of inappropriate metrics: Indicators must be appropriate and meaningful with respect to their intended use. For example, journal metrics such as the Journal Impact Factor must not be used to evaluate individual articles or individuals.
- Non-transparent metrics: The calculation of all indicators used must be standardized and their origin transparent.
- Use of metrics without consideration of their context: Many metrics need to be contextualized or weighted with respect to a researcher's field or age.

Checklist for the implementation of DORA requirements at TUM

How can you proceed if you want to check the use of bibliometric indicators in your field of work for DORA conformity? In the following, you will find a checklist consisting of two parts:

- List of DORA requirements with explanation
- Questions to check the DORA conformity in the concrete working environment

List of DORA requirements with explanations

The DORA statement makes 18 recommendations on how and under which conditions bibliometric indicators may be used and which uses do not comply with the principle of Responsible Metrics. In the following, the points relevant for the work at TUM are presented and explained with examples. The numbering of the recommendations in the first column follows the numbering in the DORA declaration.

Recommendation 1	Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions. *Usage context / examples:* • *When making statements about articles or people, do not refer to the Journal Impact Factor. If a journal has a high Journal Impact Factor, it cannot be derived that an article published in that journal has a high impact.*
Recommendations 2 and 3	Are addressed to funding agencies.
Recommendation 4	Be explicit about the criteria used to reach hiring, tenure, and promotion decisions, clearly highlighting, especially for early-stage investigators, that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published. *Usage context / examples (see also recommendation 15):* • *Do not use journal metrics in evaluations of the research performance of individuals or research groups.* • *Use bibliometric indicators only in a secondary role when making personnel decisions, and make this clear to the individuals being evaluated.* • *Review your own publication habits and, even when supervising junior researchers, make it a point to select a publication outlet that takes into account visibility in the relevant field of discourse and not just general metrics.*
Recommendation 5	For the purposes of research assessment, consider the value and impact of all research outputs (including datasets and software) in addition to research publications, and consider a broad range of impact measures including qualitative indicators of research impact, such as influence on policy and practice. *Usage context / examples (see also recommendation 17):* • *Be aware of the blind spots of the bibliometric view: bibliometrics do not capture all forms of publication and are based on citation analyses. For example, software code and architectural designs escape bibliometric analysis.* • *Always use a set of indicators to avoid inappropriate reduction.* • *Consider using altmetrics, even if their methodologies and validity are still the subject of scientometric research.*
Recommendations 6 – 10	Are addressed to publishers.

Recommendation 11	Be open and transparent by providing data and methods used to calculate all metrics. *Usage context / examples (see also recommendation 18):* • *Always indicate where (in which database) and when (time) an indicator was collected, which search terms in which database were used to generate a literature list, what the uncertainties were in generating an author profile, etc., and disclose the data to those being evaluated.* • *Do not use self-calculated or methodologically unclear indicators such as the so-called cumulative impact factor.*
Recommendation 12	Is addressed to organizations providing / publishing indicators.
Recommendation 13	Be clear that inappropriate manipulation of metrics will not be tolerated; be explicit about what constitutes inappropriate manipulation and what measures will be taken to combat this. *Usage context / examples:* • *As a member of a doctoral and postdoctoral committee or an appointments committee, do not allow journal metrics such as the Journal Impact Factor or self-calculated or methodologically unsound indicators such as the so-called cumulative impact factor to be used. It does not matter from which side the use of such metrics is introduced.* • *Make sure that comparisons use metrics that compensate for differences in subject cultures, CVs, and/or ages.* • *Question metrics for their provenance, transparency, and appropriateness; if in doubt, have competent parties re-survey the indicators. There are subject-weighted metrics that allow comparisons across subjects or between older and younger researchers.* • *Be aware that authors may attempt to boost metrics using inappropriate small-scale publishing practices (salami-slicing) or by including individuals in the author pool that do not conform to the rules of good scientific practice.* • *Include metrics that reveal anomalies in the number of self-citations.*
Recommendation 14	Account for the variation in article types (e.g., reviews versus research articles), and in different subject areas when metrics are used, aggregated, or compared. *Usage context / examples:* • *Be aware of influencing factors that may lead to higher or lower citation counts. Review articles are cited much more frequently than primary literature.* • *Review your own citation habits and also emphasize proper citation when mentoring junior scientists.* • *Make sure that comparisons use metrics that compensate for differences in subject cultures, CVs, and/or ages (e.g., Field Weighted Citation Impact in Scopus/SciVal). The h-index, for example, increases with age or length of scientific career. Articles with a very high number of authors (hyperauthorship) are cited much more frequently than publications with few or one author only.*
Recommendation 15	When involved in committees making decisions about funding, hiring, tenure, or promotion, make assessments based on scientific content rather than publication metrics. *Usage context / examples (see also recommendation 4):*

	• *When making decisions about funding projects or promoting individuals, use bibliometric indicators only in a secondary role and make this clear to individuals being evaluated.*
Recommendation 16	Wherever appropriate, cite primary literature in which observations are first reported rather than reviews in order to give credit where credit is due. *Usage context / examples:* • *Through your own citation practices, help to ensure that citations as the "currency" of science benefit the actual authors and that citation analyses better represent the actual impact of an article.* • *Also, when mentoring junior scientists, emphasize that primary literature is cited.*
Recommendation 17	Use a range of article metrics and indicators on personal/supporting statements, as evidence of the impact of individual published articles and other research outputs. *Usage context / examples (see also recommendation 5):* • *Be aware of the blind spots of the bibliometric perspective: bibliometrics only capture certain forms of publication. Always use a set of indicators to avoid inappropriate reduction.*
Recommendation 18	Challenge research assessment practices that rely inappropriately on Journal Impact Factors and promote and teach best practice that focuses on the value and influence of specific research outputs. *Usage context / examples (see also recommendation 11): The Journal Impact Factor (JIF) is well known, widespread, and often used inappropriately, so it is explicitly mentioned here.* • *Be aware that the JIF is a metric of the Web of Science (WoS). It is only calculated for journals. Only journals that are listed in this database do have a JIF. Journals with content of regional relevance are not referenced in the WoS. Younger journals do not have a JIF, because several years must pass before the JIF is calculated in the WoS. There are subject areas that are underrepresented in the WoS and whose journals never get a JIF. Whether a journal has a JIF or not does not directly reflect on its quality.* • *Be aware that the JIF does not take into account the expected citations of a subject. JIFs are not comparable across disciplines (a JIF of 4 may be extremely high in one subject and extremely low in another).* • *Do not use self-defined or methodologically disputable indicators such as the so-called 'cumulative impact factor'. There is no standardized method for calculating this indicator. Problems of the JIF itself, such as the lack of normalization of citation rates in the respective subject, would also be amplified in the 'cumulative impact factor'.* • *In most cases, there are subject-weighted or otherwise normalized indicators that can be used in your specific use case in conformity with DORA. Subject-normalized indicators such as the SNIP or the JCI for journals or the FWCI or the outputs in the Top Citation Percentiles for authors or the FWCI for single publications reflect visibility much better than a simple mean value.*

Questions for checking DORA compliance in the specific work environment

The following is a list of questions that can help you examine the use of bibliometric methods in your area of work and determine whether your practices are DORA-compliant or not.

Particularly relevant for a check for DORA compliance are all processes that involve evaluations of the scientific work of individuals and groups, including those related to **appointments, promotions, peer review, evaluations, mentoring of junior scientists, and evaluations of publications**.

One important information in advance: **There are usually bibliometric indicators that are DORA-compliant and allow a more precise answer to the question relevant for you**.

For example, if you want to compare research performance across disciplines in the context of an evaluation, you can use subject-weighted metrics. If you are comparing researchers of different ages, you may want to use metrics that are normalized for age. If you want to estimate the citation frequency of a journal, subject-weighted metrics are also available here, which take into account the different citation habits of the subject cultures and enable comparisons.

In all cases, please contact us! The Bibliometrics Team will discuss your requirements with you and advise you on which bibliometric indicators are suitable for your context.

For an outline of the criteria to be used when considering the appropriateness of bibliometric indicators, particularly when evaluating individuals, please refer to the Personal Impact Guide[3].

1. Do you use bibliometric indicators, e.g., h-index, journal impact factor, number of publications and citations? If yes, which ones?
    - *Background: There are metrics for which no obligatory methodology exists, such as the so-called cumulative impact factor. They may not be used because it is not clear how they are calculated.*
      There are metrics for journals, for individuals (working groups) and for individual publications (see point 6). Only metrics that have been developed for the entities you are analyzing and that allow valid analyses may be used.
2. Where do the data and indicators you use come from?
    - *Background: Databases must meet some requirements to be eligible to calculate bibliometric indicators. For example, they must have an adequate size, the quality of the data must be sufficiently high and the references and citations must be included completely. By default, Web of Science and Scopus / SciVal can be used. Google Scholar is possible, but caution is required here with regard to data quality and reliability of the bibliometric values.*
3. Do you have standardized procedures for indicator determination?
    - *Background: Do you have specific areas where you repeatedly use metrics (appeal processes, analysis of research trends, etc.)? Have you defined standardized workflows for*

[3] Team Bibliometrie (2022): Persönlicher wissenschaftlicher Impact: Verfahren zur Bestimmung des wissenschaftlichen Impacts von Personen https://mediatum.ub.tum.de/doc/1695490

these use cases? Defining workflows is important because it is the only way to make metrics and results comparable.

4. Is the use of metrics made reproducible or transparent?
   - *Background: It must be transparent at all times on which data basis, at which moment in time and with which methodology the bibliometric indicators were researched. The h-index, for example, can be very different depending on the database and the date.*
5. Do you make decisions on personnel or promotion measures using bibliometric indicators?
   - *Background: If yes, increased caution is needed here when using bibliometric indicators. Subject areas, age of researchers, publication culture, etc. must be taken into account. Bibliometrics should only be used as a supplement and never as a decisive factor.*
6. If decisions are made about personnel or funding measures: Who or what is being evaluated (articles, journals, individuals, institutions, research groups, etc.)? What metrics do you use for this? Are the metrics you use appropriate?
   - *Background: See criterion 1 - Metrics must be appropriate to their object of assessment (i.e., journal metrics for journals, people metrics for people/groups, article metrics for articles).*
7. Are the persons/entities concerned informed about the use of metrics? Do they have the opportunity to initiate corrections or provide explanations?
   - *Background: Evaluated persons should be informed as far as possible and should themselves be able to contribute to ensuring that the bibliometric search is based on the correct underlying data (e.g. analyzed publication list). Bibliometric searches often reveal inconsistencies in the author profiles, of which the authors should be informed so that they can correct them.*
8. Do you plan a comparison with other scientists or groups?
   - *Background: See criterion 9 - If yes, increased caution applies. Age of researchers, life histories, etc. must be taken into account. Bibliometrics should only be used as a supplement and never as a determining factor.*
9. Do you plan a comparison be made between individuals or groups from different disciplines?
   - *Background: See criterion 8 - If yes, increased caution applies. Subject areas, publication culture, etc. must be taken into account. Bibliometrics should only be used as a supplement and never as a decisive factor.*
10. Does the topic of quantitative research evaluation play a role in teaching or in the supervision of young scientists in your field of work?
    - *Background: If so, make sure that everyone who works with bibliometric indicators has bibliometric knowledge. The Bibliometrics Team at the University Library (bibliometrie@ub.tum.de) will be happy to assist you in this.*

If you are not sure about the DORA compliance of your approach or find inconsistencies with DORA requirements, feel free to contact the Bibliometrics Team (bibliometrie@ub.tum.de) to discuss alternative approaches.

Contact persons and further information

General introduction to academic identity management and bibliometrics

In the University Library's course "Visibility and Impact of Research: Bibliometrics, Scholarly Communication and Publication Strategies", you will get an overview of the most important bibliometric indicators and learn how to improve the visibility of your research through academic identity management and effective publication strategies. For more information, dates and registration, please visit https://www.ub.tum.de/en/course/visibility-and-research-impact.

Consulting bibliometrics and impact

If you need further explanation of bibliometric metrics or assistance, or have any other questions, please feel free to contact the Bibliometrics Team at the TUM University Library.

The team will help you to fine-tune your author profiles and improve the visibility of your publications. Make an appointment for an individual consultation online via Zoom or on-site.

Find further information, appointments and registration here https://www.ub.tum.de/en/consultation-bibliometrics-impact.

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