

Use of Bibliometrics-Related Terms, their Evolution, and the Growth of Metrics in Science

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ABSTRACT

This article analyses the evolution of the most-used terms referring to the (broad) field of bibliometrics. It compares the number of publications on bibliometrics, scientometrics, informetrics, web(o)metrics, altmetrics, and the science of science, in three international databases, the Web of Science, Scopus, and Dimensions. We found that the relative number of documents using one of the metrics-related terms is showing a more than exponential increase. This illustrates the increasing importance of metrics in the world of science. While most terms separately show a clear increase in use, web(o)metrics and perhaps, informetrics, seem to have reached their top. Bibliometrics and scientometrics are the most-used terms, with, nowadays, the term bibliometrics being used about five times more than the term scientometrics. Any comprehensive bibliometric study should make use of a combination of related keywords to cover the whole field of study.

Keywords: Bibliometrics, Scientometrics, Informetrics, Webmetrics, Altmetrics, Science of science, Quantitative science studies, Database queries.

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INTRODUCTION

Being bibliometricians, be it as a second choice, we wondered what to call our field. When I (RR) was introduced to the information sciences by Leo Egghe (around 1984), we used the term bibliometrics. Yet, when we learned more about the field, we preferred the term informetrics (since 1988), although we were not followed in this by the majority of colleagues. In the 21st century, things became even 'worse' in the sense that for most outsiders, the term bibliometrics refers to the subdomain of indicator studies and their use for research evaluation. In my eyes, this is an unfortunate development as it focuses on a small part of 'our field'. Again, by learning more about 'our field'.^[1] I conclude that what I do (or at least like to do) is to study the science of science, my preferred term over the latest years.

Coming from another discipline, namely management, I (YF) got acquainted with the term bibliometrics once metrics have

been more extensively used in the evaluation of research. More recently, with the use of social media, the term altmetrics has been adopted in marketing.

These personal reflections led us to the following research questions.

Q1. What is the relative use of the different metrics-related terms? Which term is used the most?

Q2. What is the relative contribution of documents related to bibliometrics (in the broad sense) compared to the whole universe of scientific documents? Is this relative contribution increasing?

We will show the evolution of the most-used terms referring to the field of bibliometrics (used here in a broad sense). As similar studies have been done in the past, see e.g.,^[2,3] this paper can be considered a partial update. We point out, see further, that our approach is considerably different from.^[3]

Articles referring to the broad field of bibliometrics have been assigned to different categories and have made use of several keywords over the years: bibliometrics, scientometrics, informetrics, webometrics and webmetrics, altmetrics or social media metrics; in addition, a small number of articles refer to cybermetrics, naukometrics, imetrics, and librametrics. Recently,



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the term “quantitative science studies” has come to the fore, mainly because a new journal of this name has been founded.

We point out that the broadest term, namely “science of science” and the most specific, namely bibliometrics (originally referring to books and libraries), were introduced at about the same time: 1934-35. The term “science of science”, although well-known to Derek de Solla Price, had almost disappeared over the years, but during the latest two decades has gained a new life, be it in a slightly different context. The latter term, bibliometrics, introduced by Otlet,^[4] see also^[5] was practically unknown outside the francophone world and was re-introduced much later by Pritchard.^[6] The term *naukometriya* = scientometrics was introduced by Nalimov in the Russian literature in 1966^[7] and made popular first as a Russian term^[8] and later through its translation as scientometrics and the use of this term as the title of a scientific journal in 1978. For a history of these terms, we refer to.^[1]

Besides showing the evolution in the use of the “metrics” terms in absolute numbers, we also want to find out their relative use, answering, for instance, questions such as “Which term is the most-used metric term”, “Which term(s) show an increasing use compared to other terms” and most importantly “Is the relative number of publications using metric terms increasing or decreasing in the whole database?”. We queried three international databases (WoS, Scopus, and Dimensions) corroborating our main conclusions.

This article is an extended version of a presentation made at the 2022 STI conference, held in Granada (Spain).^[9]

Data collection

Data are collected during July 2022 from three databases: the Web of Science (WoS), Scopus, and Dimensions. We focus on WoS data and use the other two databases to confirm the results obtained via the WoS. Results were always restricted to the period before 2022. Additional data on reviewers’ requests, were collected during July 2023.

In the Web of Science

We collected data in the Web of Science Core Collection (WoS) by performing queries related to the following terms in the Web of Science (WoS):

bibliometr*

scientometr* OR naukometr*

informetr* OR infometr*

webmetr* OR webometr* OR cybermetr*

altmetr* OR “social media metr*”

For historical reasons, we also searched for *librametr** but it turned out that this term is rarely used, and then mostly by Indian colleagues or by colleagues who try to cover all possible metrics-related terms, see e.g., the discipline with many names, as Maltseva and Batagelj^[10] call it. We also mention the terms *patentometrics* and *knowmetrics* (a Chinese term), two other metric terms not used in this investigation. We included the term *naukometr** together with *scientometr** but note that, in the whole WoS, this term has been used only 11 times.

Another term that is sometimes used is *iMetrics*. Yet, a search for “i-metric*” OR “imetric*” in the WoS yielded mostly articles in astronomy or physics dealing with Bianchi (type-) I metrics. Restricting to *imetric** yielded about 15 metric-related items, but even more other ones. For these reasons (small numbers and possible confusion), we do not include this term, promoted by Milojević and Leydesdorff,^[11] in our investigation.

We also searched for the term “science of science” because it precedes the formal introduction (or practically coincides with it, as in the case of bibliometrics) of the other terms, and also for the personal reason mentioned in the introduction.

Moreover, we collected the data for the union of the resulting sets related to these metrics, including the term science of science. We point out that it is not feasible to search for ‘metrics’ as this term is also used in computer science, astronomy, and several other fields. We further note that, on the one hand, we consider the term *infometrics* as an error (the term should not be used), but on the other hand, we consider the terms *webometrics* and *webmetrics* as equally valid, be it that *webometrics* is the original term,^[12] while personally, we prefer the term *webmetrics*.

These searches were restricted to the period [1955-2021] and were performed once for all fields, (ALL=); hence including e.g., the journal *Scientometrics*, once as a topic search (TS=), once as a title search (TI=), and once as a topic search, restricted (by ‘analyzing’) to the WoS category of *Information Science and Library Science*. The difference between an (ALL=)- search and a (TS=)-search is discussed in.^[13]

In Scopus

Similar to the queries in the WoS, we performed searches in Scopus. Here we searched under TITLE-ABS-KEY for the same terms as in the WoS, restricting to the period [1960, 2021]. Advanced search in Scopus makes it possible to find the union of the articles including one of the metric terms, in a similar way as in the WoS.

In Dimensions

We used the free version of Dimensions and searched under title and abstract (but this includes keywords). We note that Dimensions does not support wildcards making queries more

complicated (but e.g., bibliometric and bibliometrics yield the same result).

Overall results and a short preliminary discussion

Data obtained from the WoS

The following Table 1 shows the number of publications found by different queries in the WoS. In this table and further on in this article, metric terms are represented by the most-important notion (so scientometrics stands for the results of e.g., TS = (scientometr* OR naukometr*).

Table 1 shows that among the metrics terms bibliometrics is the most used, say most popular one, followed by scientometrics. Yet, because there exists a journal *Scientometrics*, and not a journal called *Bibliometrics* (at least not in the WoS) the difference between the use of these two terms is much smaller for ALL than for TS. The terms webmetrics (and variants), “science of science” and the Indian term librametrics are the least popular. Because of the extremely low numbers, we exclude the term ‘librametrics’ from further discussion. The fifth column, i.e., the ratio ALL/TS between the second (ALL=) and the third column (TS=), reflects the influence of the journals *Scientometrics* and *Informetrics* and of the biennial conferences of the ISSI (International Society for Informetrics and Scientometrics) on the use of these terms. Finally, the sixth column TS/TI(LIS) provides an indication of the relative importance of these metric terms in the field of Information and Library Science. Here we see that informetrics and webmetrics are the most typical terms (the least dispersed to other fields) for the LIS field. Bibliometrics and certainly “science of science” is, relatively speaking, the best-known or most-used outside our field. The ratio TS/TI, in the last column, is calculated to answer the question “If the term is used, is this then mentioned in the title?” Values (ratios) here are similar, except for the term webmetrics which is not so often used in the title. Finally, we note that the values on the last line are not the sum of the previous ones, because many publications use more than a single metric term.

We also collected the timelines for each (TS=) search. These are discussed further on. Remarkably, informetrics and webmetrics reached their top (in absolute numbers) a few years ago.

Bibliometrics vs. scientometrics

The use of the terms scientometrics (starting in 1976) and bibliometrics (starting in 1969, which is the year in which Pritchard,^[6] introduced the term, both show a huge increase in their absolute use, see Figures 1-2. As the curves for ALL=bibliometr* and TS=bibliometr* almost coincide, we only show one of the two. For the other terms, we will always show the results of the two queries, where the curve for (ALL=) is, by definition, always situated above the curve for (TS=). We recall that the term bibliometrics was introduced by Otlet,^[4] but this was largely forgotten by 1969, explaining why the term makes its first occurrence only in 1969. We note that the vertical axis of most figures refers to the number of publications, those showing a ratio being obvious exceptions.

The next figure (Figure 3), using a 3-year moving average, shows the relation between scientometrics and bibliometrics over time (starting in 1980) for (ALL=) and for (TS=). This yields a remarkable result. Because of the journal *Scientometrics*, the term scientometrics is in the beginning years more used than the term bibliometrics (ALL=)-data, but this is never the case for the results of a TS= query. Through (Proceedings of) the International Society for Scientometrics and Informetrics (ISSI), it is only since 2007 that bibliometrics became the more popular one. Yet, as a term used in documents (title, abstract, keywords) bibliometrics has always been the more popular one. Its relative use with respect to scientometrics has been increasing in the WoS, especially since the year 2000, leading to a decreasing trend line for the variable (use of scientometrics)/(use of bibliometrics). This is shown in a separate graph (Figure 4).

Informetrics

The next figure (Figure 5) shows the use of the term informetrics. Here we see a clear increasing trend. The first occurrence of this

Table 1: WoS results.

	ALL=	TS=	TI=	TS= (LIS)	ALL/TS	TS/TS(LIS)	TS/TI
Bibliometrics	20,879	20,563	8,801	5,399	1.02	3.81	2.34
Scientometrics	13,467	4,991	1,835	2,105	2.70	2.37	2.72
Informetrics	4,689	790	311	602	5.94	1.31	2.54
Web(o)metrics	892	587	149	377	1.52	1.56	3.94
Altmetrics	1,445	1,342	541	640	1.08	2.10	2.48
Librametrics	5	5	3	5	1.00	1.00	1.67
Science of science	569	356	130	72	1.60	4.94	2.74
All metrics	33,316	25,665	11,559	7,741	1.30	3.32	2.22

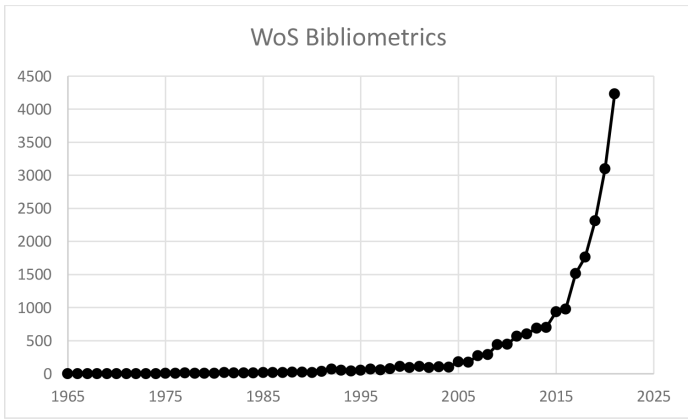


Figure 1: Timeline for TS=bibliometr* in the WoS.

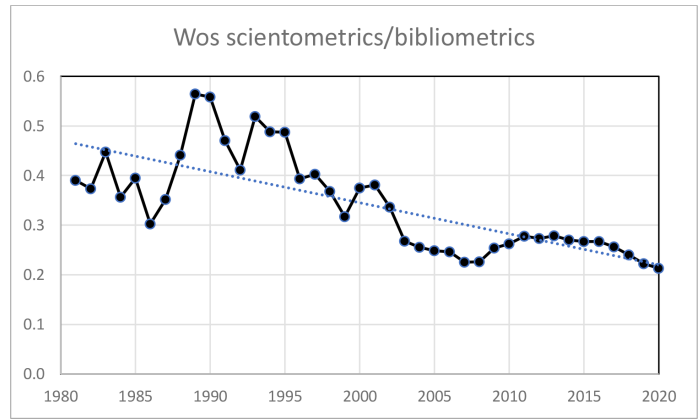


Figure 4: Ratio of the use of the term scientometrics versus the use of the term bibliometrics, only (TS=) results, WoS data.

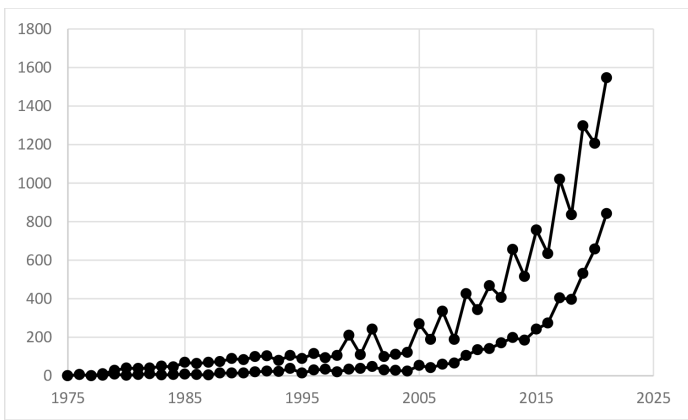


Figure 2: Timelines for ALL= (highest curve) and TS= (scientometr* OR naukometr*) in the WoS.

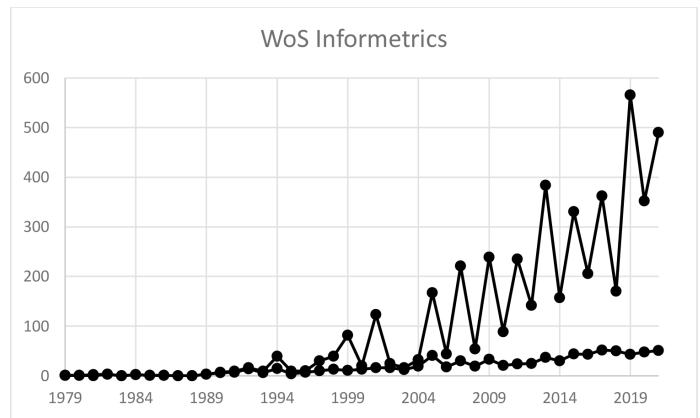


Figure 5: Timeline for All= (highest curve) and TS = (informetr* OR infometr*), WoS data.

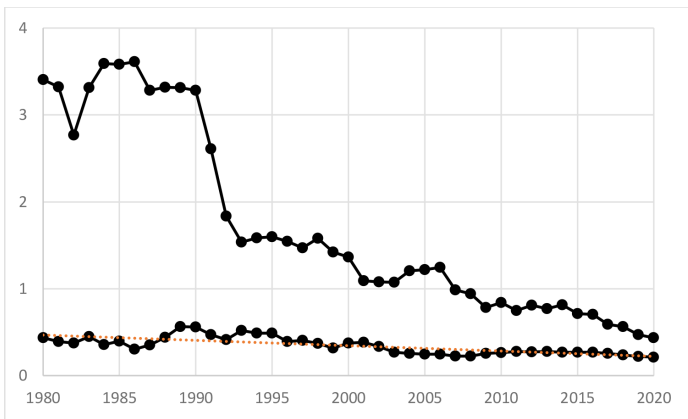


Figure 3: Ratio of the use of the term scientometrics versus the use of the term bibliometrics, ALL= (highest curve) and TS= (lower curve) results, WoS data.

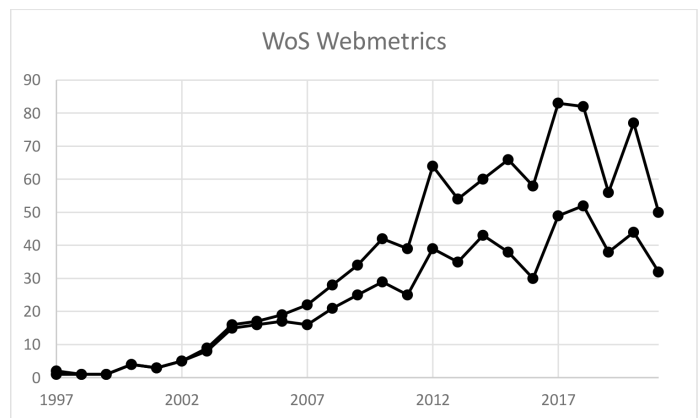


Figure 6: Timeline for ALL= (highest curve) and TS= (webometr* OR webometr* OR cyberometr*), WoS data.

term was in 1979, the year in which the term has been proposed. The difference between the two curves is due to the *Journal of Informetrics*, and, leading to a jagged effect for the All= curve, the biennial conferences of the ISSI.

Webmetrics

The use of the term web(o)metrics begins in 1997, the year in which the term was introduced by Almind and Ingwersen.^[12] It shows an increasing trend until 2017-2018 but seems on the decline since then, see Figure 6.

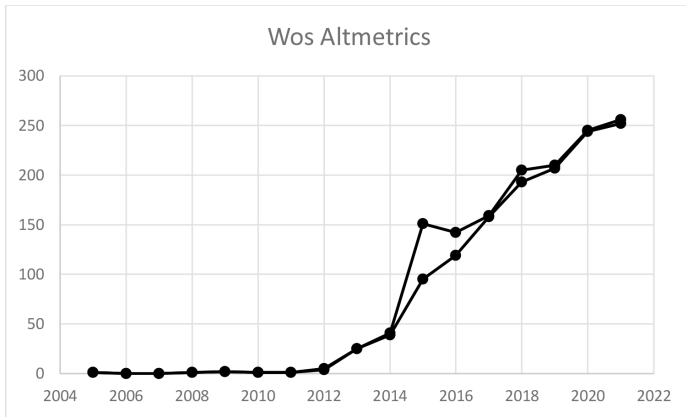


Figure 7: Timeline for ALL= (highest curve) and TS=(altmetr* OR "social media metr*"), WoS data.

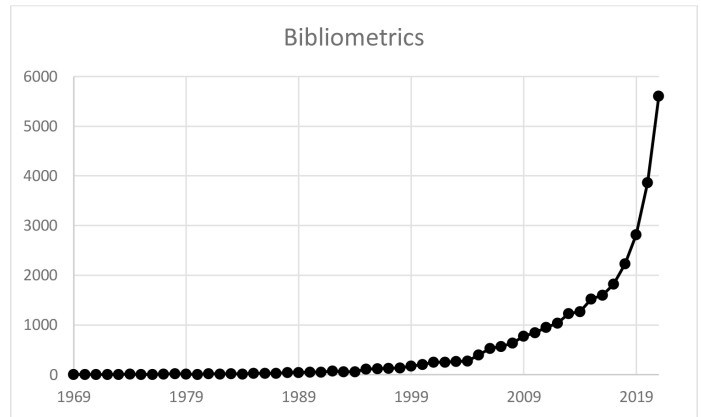


Figure 9: Timeline for the term *bibliometrics* in Scopus.

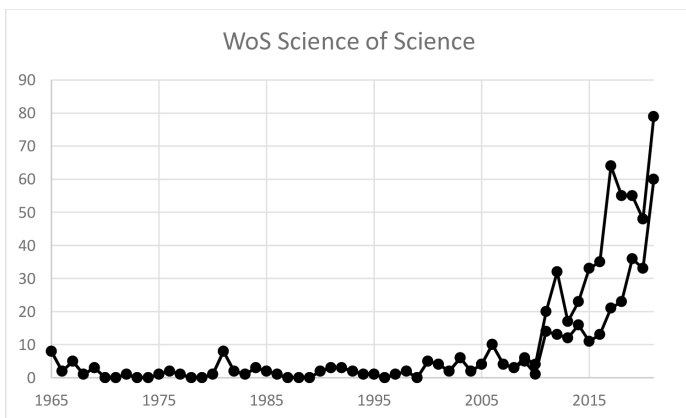


Figure 8: Timeline for the term "science of science", WoS data (ALL= leads to the higher curve).

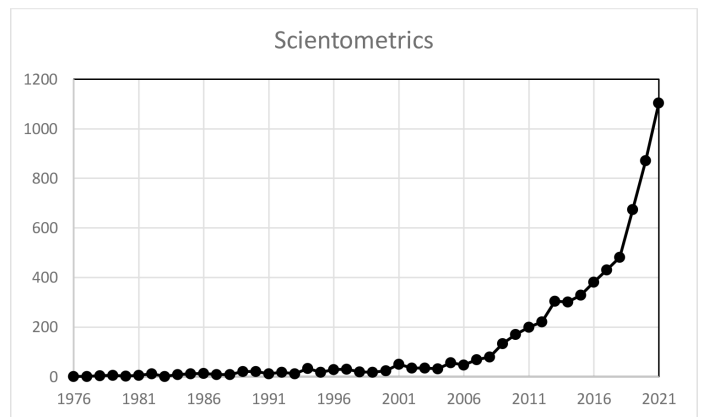


Figure 10: Timeline for the term *scientometrics* in Scopus.

Altmetrics

The first use of the notion of "altmetrics" occurred in 2005 as "social media metrics". The term altmetrics itself was proposed by Priem *et al.*^[14] in 2010, but it is only since 2013 that the use of this term became increasingly popular, see Figure 7.

Science of science

Finally, we see that the term 'science of science' occurred in this database (WoS since 1955) for the first time in 1956 and has a low but increasing trend, especially since about 2010 (Figure 8). Maybe this is related to the Science of Science and Innovation Policy (SciSIP) program launched by the US NSF in 2007. Since then, this program has been followed by the Science of Science: Discovery, Communication, and Impact (SoS: DCI) program. Recall though that the term "science of science" was already introduced in 1935^[15] in the Polish literature.

Results obtained from Scopus

Results for Scopus and Dimensions are very similar to the WoS. We only show the timelines for bibliometrics and scientometrics

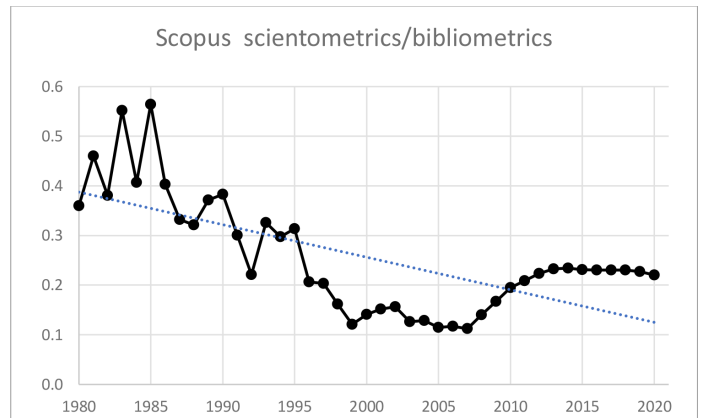


Figure 11: Ratio of the use of the term *scientometrics* versus the use of the term *bibliometrics*, Scopus data.

and their ratio. For Scopus, we used the period [1960-2021]. Absolute and relative numbers are shown in Table 2 and discussed further on. Here, we show the timelines for bibliometrics (since 1969) and scientometrics (since 1976), as Figures 9 and 10.

Next, we compare the use of the terms bibliometrics and scientometrics in Scopus since 1980 (Figure 11). There is a decreasing trend over the whole period since 1980 (three-year

Table 2: Use of metric terms: separately and as percentages; period [1960-2021].

	WoS	% of total	Scopus	% of total	Dimensions	% of total
Bibliometrics	20,563	80.1	30,180	82.6	31,227	81.5
Scientometrics	4,991	19.4	6,337	17.3	6,093	15.9
Informetrics	790	3.1	856	2.3	744	1.9
Web(o)metrics	587	2.3	799	2.2	807	2.1
Altmetrics	1,342	5.2	1,483	4.1	1,703	4.4
Science of science	356	1.4	423	1.2	563	1.5
All metrics	25,665		36,534		38,298	

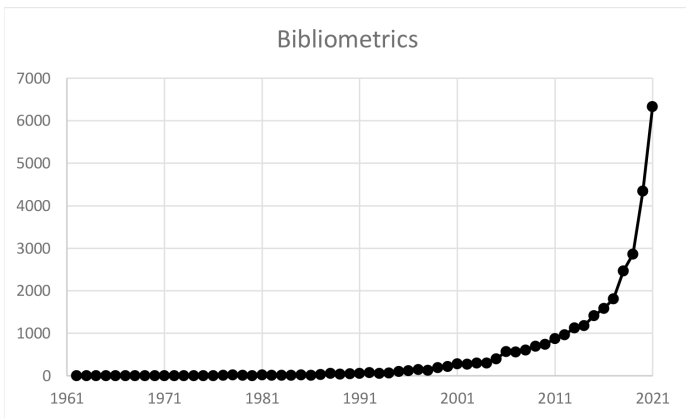


Figure 12: Timeline for the term *bibliometrics* in Dimensions.

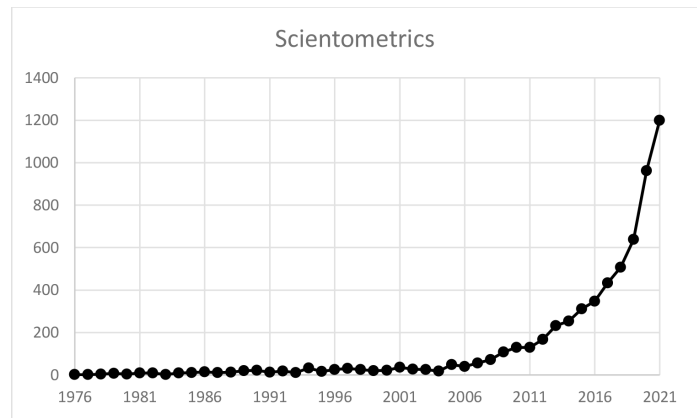


Figure 13: Timeline for the term *scientometrics* in Dimensions.

averages), but contrary to the case of the WoS there is only a slight decline for the ratio (use of scientometrics)/(use of bibliometrics) over the latest years.

Results obtained from Dimensions

As for Scopus, absolute and relative numbers are shown in Table 2 and discussed further on. Again, we show the timelines for the terms bibliometrics (Figure 12) and scientometrics (Figure 13) and their ratio (Figure 14).

In the two other databases, we found a general decrease in the ratio (use of scientometrics)/(use of bibliometrics), but the behavior for the latest years was slightly different. Here, we see a confirmation of the results obtained for Scopus.

Percentages of different terms with respect to the total

In the next table (Table 2) we show the absolute numbers of documents using the metric terms separately and as a percentage of the total, and this for the three international databases.

The percentage distribution of these terms in the three databases shows similar rankings with two dominant terms bibliometrics (around 80%) and scientometrics (between 16 and 19%), while the remaining terms group 10 to 12% of the uses. Dimensions

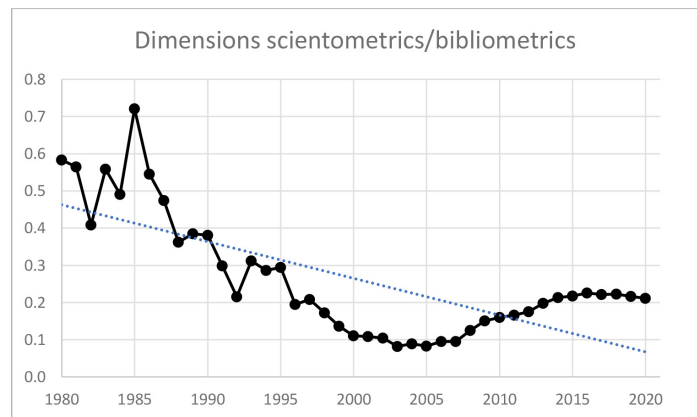


Figure 14: Ratio of the use of the term *scientometrics* versus the use of the term *bibliometrics* in Dimensions.

and Scopus have the highest absolute use of metric terms, as a consequence of being the larger databases. A comparison between the three databases shows differences in the relative use of the ‘metrics’ terms. WoS has the highest percentages for all terms except bibliometrics and “science of science”. Scopus has the highest relative use for bibliometrics and Dimensions for “science of science”.

Relative increase of the metric terms

The next figure (Figure 15) shows our most important result, namely the number of items dealing with metrics divided by all items in the database (Scopus, Dimensions, and Web of Science Core Collection), multiplied by 10^4 . We consider the period since 1973. This graph shows that the relative increase in the use of “metric terms” started in earnest in the period between 2000 and 2005. The relative increase in the latest years, although showing a faster than exponential increase, is not as steep as for the absolute numbers. This proves that the increase shown in the previous figure is partly due to the growth of the databases as a whole. The highest curve refers to Dimensions, the second one to the WoS, and the lowest one to Scopus. Yet, all three show the same tendency.

This is a very important result showing the growth – with respect to all topics - in the relative importance of quantitative methods (metrics) to study researchers, research results, and science itself.

Diffusion in the WoS

As a first indication of the diffusion over time of the metric terms in the WoS, we collected the number of WoS categories and Research Areas in which at least one of the metric terms occurred as the result of a (TS=)-query. This is a way to quantify knowledge

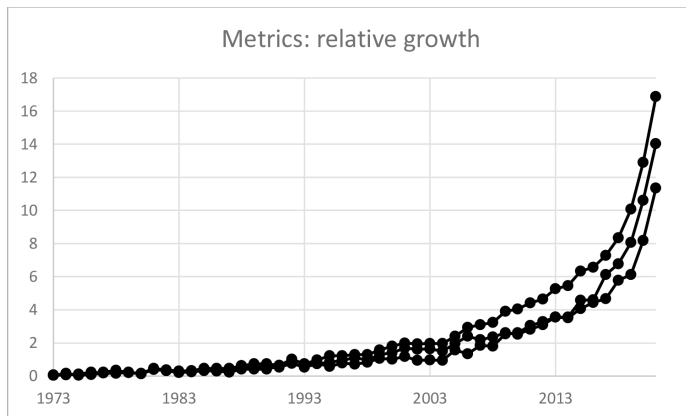


Figure 15: Relative increase of the “metric” terms, period [1973-2021]. The vertical axis denotes the number of items dealing with metrics divided by all items in the database multiplied by 10^4 . The upper curve refers to Scopus, the middle one to Dimensions, and the lower one to the WoS.

Table 3: Diffusion of the metric terms in the WoS.

Period	# WoS Categories	# Research Areas
Before 1982	39	32
[1982-1991]	65	48
[1992-2001]	144	97
[2002-2011]	219	137
[2012-2021]	246	149

export and diffusion from one academic field to another. We note though that the number of WoS categories has increased over time, see Table 3.

For each period, the leading WoS category and Research Area is Information Science Library Science, followed by Computer Science (for research areas). Computer Science Interdisciplinary Applications is most of the time the second WoS Category. Multidisciplinary Sciences slowly moves down the list, while Management and Business went up. In the latest period, Environmental Sciences jumped to third place, due to the journal *Sustainability* (a mega journal covering a wide range of topics).

The journal *Scientometrics* is by far the leading source for metrics-related topics, followed by the Proceedings of the conferences of the ISSI (under various names). More details about the leading journals (hence not including the Proceedings of the ISSI conferences) are shown in Table 4. We added results for *American Documentation*, *Journal of the American Society for Information Science*, *Journal of the American Society for Information Science and Technology*, and *Journal of the Association for Information Science and Technology* by the name of JASIST; similarly, we added results for *Information Processing and Management* and its precursor *Information Storage and Retrieval*. When journals are included in the WoS category *Information Science and Library Science* (and maybe another one) we indicate this by IS&LS in the third column. Otherwise, all categories are mentioned. The last column shows the year in which the journal was founded. Besides the top 15 journals, we also added a few IS&LS journals which might be of interest to the reader.

A large group of articles published in journals completely related to another field present applications of bibliometric analysis in those fields. They mainly use basic bibliometric techniques and have a title such as “Topic: a (bibliometric/scientometric) (analysis/approach)”. For some of these megajournals such as *Sustainability* the number of bibliometric-related publications is high in absolute terms, but very small seen as a percentage of the total number of their publications

DISCUSSION

In earlier publications, colleagues tried to define and delineate the difference between the metric terms, see e.g.,^[6] including their famous Figure 15 in,^[6] but nowadays we consider it futile to try to find out the difference between bibliometrics, scientometrics, and informetrics; and aren’t most metric investigations in some way web-related? For this reason, we do not try to formulate an exact definition for the different metric terms. Obviously, to cover all metric fields and come close to a full recall, one must perform a search for all terms.

In the WoS, we found five articles using the term scientometrics (but not naukometriya or naukometria), all published in 1976, before the launching of the journal *Scientometrics* (in 1978),

Table 4: List of journals publishing articles on bibliometrics in the broad sense, data from WoS (July 2023), ranked by frequency.

Rank	Journal	WoS category	Starting year
1	Scientometrics	IS&LS	1978
2	Sustainability	Green and Sustainable Science and Technology Environmental Sciences	2009
3	Journal of Informetrics	IS&LS	2007
4	JASIST	IS&LS	1950
5	International Journal of Environmental Research and Public Health	Environmental Sciences Public, Environmental and Occupational Health	2004
6	Environmental Science and Pollution Research	Environmental Sciences	1994
7	PLoS One	Multidisciplinary Sciences	2006
8	Journal of Cleaner Production	Engineering, Environmental Environmental Sciences Green and Sustainable Science and Technology	1993
9	Technological Forecasting and Social Change	Regional and Urban Planning Business	1970
10	Medicine	Medicine, General and Internal	1922
11	Research Evaluation	IS&LS	1991
12	Frontiers in Public Health	Public, Environmental and Occupational Health	2013
13	Current Science	Multidisciplinary sciences	1932
14	Journal of Information Science	IS&LS	2010
15	World Neurosurgery	Surgery Clinical Neurology	2012
	other		
18	Journal of Scientometric Research	IS&LS	2012
23	Profesional de la Información	IS&LS	1991
24	Information Processing and Management	IS&LS	1963
25	Journal of Documentation	IS&LS	1945
26	Quantitative Science Studies	IS&LS	2020
54	Journal of Data and Information Science	IS&LS	2016

among which two by Derek de Solla Price, published in the *International Forum on Information and Documentation*.

The following Figure 16 shows the timelines for the number of publications obtained by the search ALL= (scientometr* OR naukometr*) and the number of publications in the journal *Scientometrics* (WoS data). Clearly, in the earlier years, the two almost coincide, while there is a marked difference between them since about the year 2005. In later years the influence of the proceedings of the biennial conference of the International Society for Scientometrics and Informetrics (ISSI), published under different names, becomes very clear.

We performed a similar investigation for informetrics, see Figure 17. The first use of the term informetrics occurred in the year 1979, the exact year in which the term was proposed by Nacke^[17] and Blackert and Siegel.^[18] We notice the influence of the *Journal of Informetrics*, launched in 2007, and of the ISSI conferences.

Comparing our timelines with those shown in^[3] we first notice that Mejia *et al.* only show the part between 2011 and 2020. More importantly, according to their timelines in 2013, the use of the terms bibliometrics and scientometrics is almost equal

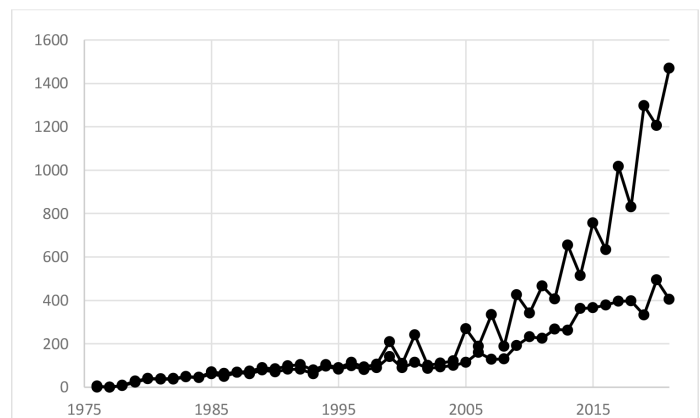


Figure 16: The term *scientometrics* and the influence of the journal with the same name, WoS data, (ALL=) data.

(in the WoS Core Collection), while this does not show at all in our Figure 3. Checking, we found that Mejia *et al.* did not do a (TS=)-search, but an (ALL=)-search. This was not clear from their explanation. Moreover, a (TS=) refers to the use of the corresponding term by scientists in their articles, while an (ALL=) refers to the use of the metric terms over the whole database, including their use in journal titles, conferences, and

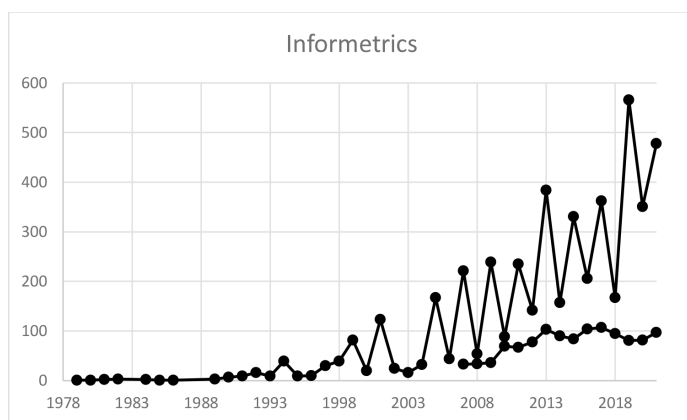


Figure 17: The term informetrics and the influence of the journal with the same name. WoS data, (ALL=) data.

books. Both points of view are valid of course. With a (TS=)-search one misses some implicit uses of the terms, as all articles published in journals such as *Scientometrics* and the *Journal of Informetrics* can be assumed to deal with metric-related topics. Yet, an article published in the *Journal of Informetrics* may deal exclusively with a webmetric or altmetric topic, or may only use the term bibliometrics in the body of the article, without mentioning it in the title, abstract, or keywords.

The curves for bibliometrics and scientometrics, in the WoS as well as Scopus, have a clear “exponential-like” increasing trend (a best-fitting exponential function stays for recent data below the observed points). Yet, we know that such a trend cannot continue and at some point, the increase will slow down, leading to an S-curve see e.g., p. 298 in.^[19] We have, however, not yet reached the onset of an S-curve.

Figures 16 and 17 show how the inclusion of a specific technical term in the title of a prominent journal or leading conference of a field can have a significant impact on the frequency of use of the term as a keyword or topic. In the introduction, we mentioned the term “quantitative science studies” and a new journal with this name. Suggested by the editor we had a closer look at this term. Concretely, we performed the following search in the WoS on July 14, 2023:

TS= “quantitative science stud* “ OR TS= “quantitative studies of science“, resulting in 59 publications. Table 5 gives the corresponding time distribution.

The oldest use dates from 1983 when András Schubert started a regular feature in the journal *Scientometrics*, entitled “Quantitative studies of science – a current bibliography”, which explains the relatively high number of occurrences before 1990. Recent use occurs mainly in the journal “*Quantitative Science Studies*”, especially during its first year (2020).

Table 5: Distribution of the term “quantitative science studies” over time.

Period	Number of publications
Before 1990	15
1990-1999	8
2000-2009	5
2010-2019	10
2020 and later	21

Limitations: What we get and what we miss

When performing a bibliometric survey of a field it is important to assure that no “important” articles are missed. We first note that a search for the most popular term (in the WoS), namely ‘bibliometrics’ yielded 63% (ALL), 81% (TS), and 77% (TI) of all results (see Table 1). An interesting analysis, besides the results of individual searches, is the study of searches with a combination of keywords. Combining bibliometrics and scientometrics via an OR-search yielded, respectively 92%, 93%, and 92% of all results. Would that suffice for some purposes? Checking what we missed, we found for the (TS)-query, 22 articles with more than 100 citations, among which 16 related to altmetrics and social media metrics, 3 related to webmetrics, and 3 related to informetrics. So, we would miss important contributions related to the newer subfields.

Table 6 shows the combination of different keywords (two by two) by an OR-query in the WoS. Table 6 does the same for the results of an AND-query. We note that the combination of all five keywords (OR-query) delivers 25,764 publications.

At the individual level, bibliometrics reaches 81% of the total, scientometrics 19%, whereas altmetrics provides 5% of the total and informetrics and webometrics even lower amounts.

Combining terms via an AND-query turns out to be very selective (Table 7). Altmetrics articles seem more related to bibliometrics (as keywords) with 30% of altmetric articles also included in ‘bibliometrics’. This only holds for 10% when using scientometrics, for 4% when using webometrics, and for 2% when combining with informetrics.

Besides the question of what we obtain using certain queries, an important question is what we miss with the choice of one keyword with respect to another. For this reason, Table 8 presents combinations for the use of the search terms ‘bibliometrics’ with the other search terms.

The second column shows the number of articles for each other term (denoted as number), with their percentage placed in the third column. The fourth column presents the number of articles selected with the OR function, with their percentage in the fifth column. The sixth column presents the number of articles selected with the AND search function, with their percentage added in the seventh column. Finally, the eighth column shows

Table 6: Results of two-by-two OR-queries* (WoS data).

OR query	Single term	Biblio- metrics	Sciento- metrics	Infor- metrics	Web- metrics	Alt- metrics	% of the union of all queries
Bibliometrics	20,975	20,975					0.81
Scientometrics	5,016	24,076	5,016				0.19
Informetrics	760	21,505	5,559	760			0.03
Webmetrics	572	21,421	5,505	1,279	572		0.02
Altmetrics	1,360	21,923	6,243	2,093	1,881	1,360	0.05
All	25,764	25,764					1.00

° These data slightly differ from the other data, as this search was done somewhat later.

Table 7: Results of two-by-two AND-queries* (WoS data).

AND query	Bibliometrics	Scientometrics	Informetrics	Web(o)metrics	Altmetrics
Bibliometrics	20,975	1,915	230	126	412
Scientometrics		5,016	217	83	133
Informetrics			760	53	27
Web(o)metrics				572	51
Altmetrics					1,360

° These data slightly differ from the other data, as this search was done somewhat later.

Table 8: Results for bibliometrics in combination with other terms.

Bibliometrics	Number	%	OR	%	AND	%	Excl	%
Scientometrics	5,016	19%	24,076	93%	1,915	7%	3,101	62%
Informetrics	760	3%	21,505	83%	230	1%	530	70%
Web(o)metrics	572	2%	21,421	83%	126	≈ 0%	446	78%
Altmetrics	1,360	5%	21,923	85%	412	2%	948	70%
All metrics	25,764	100%	25,764	100%	25,764	100%	0	

the number of articles excluded (denoted as Excl) by the AND function; the ninth column gives the ratio of the excluded items for each search.

While 1,915 of the 5,016 'scientometrics' articles are also retrieved by bibliometrics as a keyword, 3101 articles (or 62%) will be missed. This percentage, namely 62%, increases to 70% for informetrics and altmetrics, and to 78% for web(o)metrics.

The editor pointed out to us that our study is somewhat related in spirit to the early work of Derek Price^[20] on quantitative ways to understand and describe scientific activities and the growth of science.

CONCLUSION

In this paper, we took another look at the use of the metrics terms within the information sciences. An important caveat is the fact that the used databases only partially cover the Russian, Latin-American, Indian, or Chinese literature, biasing this study

in favor of use in the West. The most important observation is the fact that the growth in the metric terms is higher than the growth of the databases themselves, indicating an increasing interest in bibliometrics (in the broad sense). We recall^[21] that e.g., the whole WoS database increases exponentially over time (but relatively close to linear growth).

We compared the use of metrics-related terms as registered in the WoS, in Scopus, and in Dimensions. Bibliometrics is by far the most used term to refer to quantitative studies of science. Generally speaking, the use of all metric terms shows a huge increase, and this in absolute as well as relative (with respect to the database) terms. The term bibliometrics has a slightly higher dominance in Scopus, occurring in more than 82% of all metrics-articles, than in WoS, where it occurs in about 80% of the (TS=)-searches, with Dimensions coming in between. If one is interested in the general scientific use of metrics terms, including in titles of journals or conference proceedings, then one must perform an (ALL=) query (using WoS terminology), leading to

a considerable difference in the use of the terms scientometrics and informetrics. There is no overarching category that englobes all metric-related articles. While bibliometrics englobes some articles on informetrics, altmetrics, and webmetrics, this is less the case for the term scientometrics.

Of course, sometimes a term is used in another context. We found, for instance, the sentence “Philosophy is the science of sciences” in an old book review included in Dimensions. Similarly in Dimensions, if the original article has no keywords, then MeSH terms are added if they exist. Sometimes these MeSH terms were added some years later (after the publication of the article) explaining why a query for bibliometrics finds an article by Raisig,^[22] dealing with “statistical bibliography” before Pritchard (re-)introduced the term bibliometrics. This illustrates that the approach of adding MeSH terms makes perfectly good sense from an information retrieval point of view, but is, historically speaking, less accurate.

Our analysis shows the need for a better categorization system. This could require a post-publication review of the assignment of keywords to each article, possibly with first and second-order keywords. This same observation is valid for other scientific fields and subfields, with a variety of themes. Because science progresses in new subdomains and new themes such a categorization cannot be statically designed ad hoc but needs regular adaptations over time. Seen the imperfection of the categorization with imperfect keywords, a comprehensive bibliometric study should make use of a combination of related keywords to cover the whole field of study. This remark, of course, also holds for all studies related to a given field, not only to bibliometrics/scientometrics.

The term ‘bibliometrics’ has been adopted in all fields of science as the generic term for studies/applications of metrics through ‘bibliometric’ methods, whereas scientometrics, informetrics, and other related terms are more used by the specialists in the field, and have not followed the same dissemination towards other scientific fields. We note that all data referring to the introduction of metric terms can be found in.^[19]

A limitation of the present study is that we only studied the publication aspect, not the citation one. Hence, a more in-depth analysis should focus on the citation analysis of the metric fields. Is there a similar increase in the number of citations of metrics-related publications? Further, one could study if colleagues from certain countries, or in certain fields, have preferences for one of the terms.

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CONTRIBUTION

Both authors contributed equally to the design, the data analysis, and the writing of the article.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- Rousseau R. Naukometriya, Nalimov and Mul'chenko. Collnet Journal of Scientometrics and Information Management. 2021;15(1):213-24.
- Hood WW, Wilson CS. The literature of bibliometrics, scientometrics, and informetrics. *Scientometrics*. 2001;52(2):291-314.
- Mejia C, Wu M, Zhang Y, Kajikawa Y. Exploring topics in bibliometric research through citation networks and semantic analysis. *Frontiers in Research Metrics and Analytics*, 2021;6. art. 742311.
- Otlet P. *Traité de Documentation, le Livre sur le Livre*. Brussels: D. Van Keerberghen and Sons. 1934.
- Rousseau R. Forgotten founder of bibliometrics. *Nature*. 2014;510(7504):218
- Pritchard A. Statistical bibliography or bibliometrics? *Journal of Documentation*. 1969;25(4):348-9.
- Nalimov VV. Kolichestvennyye metody issledovaniya protsesa razvitiya nauki (Quantitative methods of research of scientific evolution). *Voprosy Filisofii*. 1966;12:38-47.
- Nalimov VV, Mul'chenko ZM. Наукометрия, Изучение развития Науки как информационного процесса [Naukometriya, the Study of the Development of Science as an Information Process] (in Russian). Moscow: Nauka. 1969.
- Rousseau R, Fassin Y. The number of articles dealing with metrics grows faster than the Web of Science itself. In: N. Robinson-Garcia, D. Torres-Salinas, and W. Arroyo-Machado (Eds.), 26th International Conference on Science and Technology Indicators, STI, 2022. <https://doi.org/10.5281/zenodo.6959277>
- Maltseva D, Batagelj V. iMetrics: the development of the disciplines with many names. *Scientometrics*, 2020;125(1):313-59.
- Milojević S, Leydesdorff L. Information Metrics (iMetrics): A research specialty with a socio-cognitive identity? *Scientometrics*. 2013;95(1):141-57.
- Almind TC, Ingwersen P. Informetric analyses on the world wide web: Methodological approaches to 'webometrics'. *Journal of Documentation*. 1997;53(4):404-26.
- Fassin Y, Rousseau R. On the difference between an (ALL=)- and a (TS=)-query in the Web of Science: the case of bibliometrics versus scientometrics. *ISSI Newsletter*, #70, 2022;18(2):30-3.
- Priem J, Taraborelli D, Groth P, Neylon C. Altmetrics: A manifesto. 2010. Available from <http://altmetrics.org/manifesto/>
- Ossowska M, Ossowski S. Nauka o nauce. *Nauka Polska*. 1935;20:1-12.
- Ingwersen P, Björneborn L. Methodological issues of webometric studies. In: *Handbook of quantitative science and technology research* (Moed, Glänzel and Schmoch, Eds.) 2004:339-69. Dordrecht: Kluwer Academic Publishers.
- Nacke O. Informetrie. Ein neuer Name für eine neue Disziplin. *Nachrichten für Dokumentation*. 1979;30(6):219-26.
- Blackert L, Siegel S. Ist in der wissenschaftlich-technischen Information Platz für die Informetrie? *Wissenschaftliches Zeitschrift TH Ilmenau*. 1979;25(6):187-99.
- Rousseau R, Egghe L, Guns R. *Becoming metric-wise: A Bibliometric Guide for Researchers*. Chandos Publishing; 2018.
- Yagi E, Badash L, Beaver DD, Derek J. de S. Price (1922-83). *Historian of science and herald of scientometrics*. *Interdisciplinary Science Reviews*. 1996;21(1):64-84.
- Hu XJ, Leydesdorff L, Rousseau R. Exponential growth in the number of items in the WoS. *ISSI Newsletter*, # 62; 2020;16(2):32-8.
- Raisig LM. Statistical bibliography in the health sciences. *Journal of the Medical Library Association*. 1962;50(3):450-61.

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