Treating bibliometric indicators with caution : their dependance on the source database

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Database comparisons

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Nowadays, with computer-supported analysis of databases, constructing bibliometric or scientometric indicators may be considered easy. The problem is more to verify the accuracy of the global analysis, including the sampling of data. The global coherence of an analysis depends on the adequacy of all the steps. Using on-line databases, an experiment was designed to demonstrate this. Keeping the same protocol for data collection, the same indicators are used over the various samples. The results from three separate databases are profoundly different.

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SCIENTIFIC PRODUCTION and collaborative ability[1–3] are used as indicators of the activity of a laboratory even though they are quantitative not qualitative indicators.[4] We have tested the accuracy of these indicators through various on-line bibliographic databases. Since we were dealing with researchers' work in detail, we looked only at our own laboratory, according to the code of practice for information brokers.[5]

Data collection

Among our laboratory activities are bibliometry, scientometry and informetry. We used these three words, well recognised and defined nowadays,[6] as keywords with the Dialog Dialindex to get the databases with the best coverage in this area. Our purpose was not to build the best data collection in each database, but more to show the individual perception of each database, using keywords recognised by the scientists of the area. gives the main responses.

Cost considerations led us to use as much information as possible from CD-ROM to constitute our internal database. Lisa was collected from CD-ROM for 1994, and Pascal for 1987–94. Because there are so many duplicates between SciSearch, Social SciSearch and Current Contents Search, the latter database was not considered. An internal database was downloaded from Dialog from the other two without duplicates.

There is some variability between the CD-ROM versions and the original databases, so the internal databases do not have exactly the same number of references as shown in Table 1. For example, Pascal

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Table 1. Data collection strategy with Dialog Dialindex

Number	Base collection in 01/1995	Bibliometry	Scientometry	Informetry	1, 2 or 3
61	Lisa(Library&infoSci)	2005	203	59	2071
144	Pascal	1380	457	93	1606
202	Information Science Abs	884	298	52	931
7	Social SciSearch	388	158	53	566
440	Current Contents Search	317	155	63	479
434	SciSearch	270	147	10	410

does not exist in CD-ROM before 1987. The producers of the three internal databases are different (English for Lisa, French for Pascal, and American for SciSearch). Two of these databases are multidisciplinary (SciSearch and Pascal), and one thematic (Lisa). The number of bibliographic notices collected is reported in Table 2.

Analysis

From these databases, we performed several analyses for internal purposes. We now present a few of them. Instead of building a common database without duplicates, we kept the databases separate to demonstrate the particularity of each one. Each has its own indexation practice, sources and point of view. Applying the same treatment over each separate database will outline the specificities.

Fields constitution and indexation practice

Outlining the databases' specificity could seem obvious but is very important. SciSearch is the only database including author's citations, but it has a weak keyword index (240/803 references) which is better in both Pascal and Lisa. SciSearch is also the only database which gives a description of the activity of the journal. Pascal is the only database that provides the country of publication. Our next analysis emphasises one specificity — the data collection practices.

Sources and abstracting practice

To outline this point we determined the groups of co-authors. We have devised software which builds groups (for example authors' groups) using a propagation algorithm.[7] It is not based on a classic clustering technique, but the natural structure of co-authoring,[8] using only the co-presence of items in references. This means that the algorithm determines all the co-authors of an author. Then it determines the co-authors who work with the original co-authors, and continues until there are no new co-authors in the group.

Then, the algorithm builds a new database, linking for each group, the affiliations, keywords and papers used by this group in the whole of the studied database. When one group is finished, other groups are built up until the last author enters a group or is recognised as an individual author.

This algorithm may be applied over any field in the studied database. We chose authors' groups, but we could build keyword groups. The fields linked to the group may also be chosen depending on the purpose of the analysis. The algorithm works very well with authors, because the relations between them are finite. Other researchers have published a similar algorithm, but without the linked fields to each built group.[9,10]

The thresholds used for this analysis are explained in Table 3. The Table 4 represents our laboratory in the SciSearch database with those thresholds.

With these parameters, our laboratory, through SciSearch, is perceived as small (three persons), without collaborations and publishing few (a maximum of three articles) in journals in information science and library science.

With exactly the same parameters, we analysed the Lisa databases. First, it is important to note that it is impossible to extract affiliations from of the Lisa CD-ROM. The author field is also not homogeneous. A bibliometric treatment of this field requires manual control of the database. Table 5 shows the output of the treatment.

The perception of our laboratory begins to change. It appears to have four authors that still publish few (a maximum of eight papers in the last six years). The initial specificity of our laboratory appears (chemistry).

Table 2. Number of bibliographic notices in internal databases

Internal database	Number of bibliographic notices
SciSearch + Social SciSearch 01/95 Dialog	803
Pascal from 1987-1994 CD-ROM	1191
Lisa from 1994 CD-ROM	2229

Table 3. Analysis parameters

Author minimum frequency:	2
Co-authors minimum frequency:	1
Relations with other fields minimum frequency:	2
Other fields in SciSearch: affiliation, publication year, source, journal subject category, author keywords, keywords plus.	
Other fields in Pascal: affiliation, publication year, source, English descriptors.	
Other fields in Lisa: source, publication year, keywords	

Table 4. Our laboratory group in the SciSearch database

Authors
Dou H (3); Quoniam L (2); Hassanaly P (2)

Co-author's relations
Dou H [hassanaly p (2), quoniam l (2)]
Hassanaly P [dou h (2), quoniam l (2)]
Quoniam L [dou h (2), hassanaly p (2)]

Affiliations
Dou H [marseille; france (3)]
Hassanaly P [marseille; france (2)]
Quoniam L [marseille; france (2)]

Journal subject category
Dou H [information science & library science (2)]

Note: Numbers in parenthesis are frequencies

Table 5. Our laboratory group in the Lisa database

Authors
Dou (8); Hassanaly (7); Quoniam (6); La Tela (2)

Co-author's relations
Dou [hassanaly (7), la tela (2), quoniam (6)]
Hassanaly [dou (7)]
Hassanaly [la tela (2)]
Hassanaly [quoniam (5)]
La Tela [dou (2)]
La Tela [hassanaly (2)]
La Tela [quoniam (1)]
Quoniam [dou (6), hassanaly (5), la tela (1)]

Sources
Dou [scientometrics (3)]
Hassanaly [scientometrics (2)]
Quoniam [scientometrics (3)]

Publication year
Dou [1989 (2), 1988 (2)]
Hassanaly [1989 (2), 1988 (2)]
Quoniam [1989 (2)]

Keywords
Dou [chemistry (2), bibliometrics (6), library materials (6), stock (6)]
Hassanaly [chemistry (2), bibliometrics (6), library materials (6), stock (6)]
Quoniam [bibliometrics (5), library materials (5), stock (5)]

Note: Numbers in parenthesis are frequencies

With exactly the same parameters we analysed the Pascal database. Table 6 shows the result.

The initial specificity of our laboratory appears (chemistry), but also a rather good definition of our activity in information science: automated processing, classification, code, data analysis, data processing, decision making, downloading, graphics, information layout, information processing, on line processing, patent document, relational analysis, research indicator, research program, scientific research, scientific technical information, software, statistical analysis, technological awareness, tool, user interface. Our publications in French journals appear too (*Cahiers de la documentation*).

Our working group is now made up of 18 authors which publish normally (a maximum of 20 publications over a seven-year period). Collaborations appear with the IBM CEMAP Center of Paris (Huot and Bedecarrax), with the IRIT in Toulouse (Dousset, Dkaki, Koussoube), with the CEDOCAR (CEntre de DOcumentation des ARmées) (Paoli, Dionne, Hilaire, Longevialle) and the CNRS URA 1409 G.O.A.E. (Kister).

The graph of our team is shown in Figure 1. The thickness of links is a function of the number of co-publications between authors. Keeping in mind just the thick links, the structure of collaboration appears. There are thick links between members with the same affiliation, thin links between members with different affiliations. This graph was generated automatically using an algorithm created in our laboratory.[11]

Using the same parameters the three databases were analysed for one French laboratory: results varied from only showing three authors and no collaborations, through four authors with no collaborations, to 18 authors who publish normally

Discussion

Depending on the indicators, macro- or micro-level bibliometry[12,13] and the application country, the choice of database may be more important than the choice of indicator. An indicator may be considered efficient when it does not change the perception of the reality. What happens if the reality of the database is wrong?

We showed that an American multidisciplinary database and an English specific database may

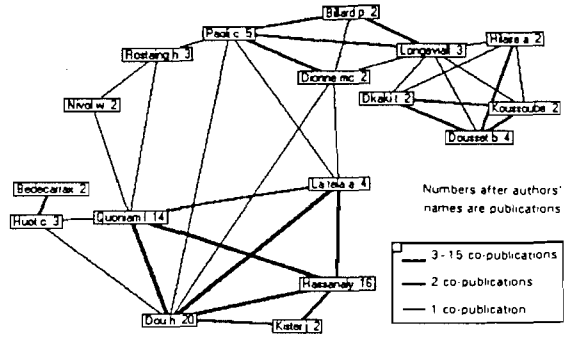

Figure 1. Co-authors relations in the Pascal database

Table 6. Our working group in the Pascal database

Authors

Dou H (20); Hassanaly P (16); Quoniam L (14); Paoli C (5); La Tela A (7); Dousset B (4); Rostaing H (3); Longevialle C (3); Huot C (3); Nivol W (2); Koussoube S (2); Kister J (2); Hilaire A (2); Dkaki T (2); Dionne Mc (2); Billard P (2); Bedecarrax C (2)

Co-authors relations

Bedecarrax C [huot c (2)];

Billard P [dionne mc (1), longevialle c (2), paoli c (2)];

Dionne MC [billard p (1), dou h (1), la tela a (1), longevialle c (1), paoli c (2)];

Dkaki t [dousset b (2), hilaire a (1), koussoube s (2), longevialle c (1)];

Dou H [dionne mc (1), hassanaly p (15), huot c (1), kister j (2), la tela a (7), paoli c (1), quoniam l (10)];

Dousset B [dkaki t (2), hilaire a (2), koussoube s (2), longevialle c (1)];

Hassanaly P [dou h (15), kister j (2), la tela a (6), quoniam l (8)];

Hilaire A [dkaki t (1), dousset b (2), koussoube s (1), longevialle c (1)];

Huot C [bedecarrax c (2), dou h (1), quoniam l (1)];

Kister J [dou h (2), hassanaly p (2)];

Koussoube S [dkaki t (2), dousset b (2), hilaire a (1), longevialle c (1)];

La Tela A [dionne mc (1), dou h (7), hassanaly p (6), paoli c (1), quoniam l (2)];

Longevialle C [billard p (2), dionne mc (1), dkaki t (1), dousset b (1), hilaire a (1), koussoube s (1), paoli c (2)];

Nivol W [quoniam l (1), rostaing h (1)];

Paoli C [billard p (2), dionne mc (2), dou h (1), la tela a (1), longevialle c (2), rostaing h (1)];

Quoniam L [dou h (10), hassanaly p (8), huot c (1), la tela a (2), nivol w (1), rostaing h (1)];

Rostaing H [nivol w (1), paoli c (1), quoniam l (1)]

Affiliations

Bedecarrax C [paris, fra (2)]; Billard P [paris, fra (2)]; Dkaki T [toulouse, fra (2)]; Dou H [marseille, fra (18)]; Dousset B [toulouse, fra (4)]; Hassanaly P [marseille, fra (14)]; Hilaire A [toulouse, fra (2)]; Huot C [paris, fra (3)]; Kister J [marseille, fra (2)]; Koussoube S [toulouse, fra (2)]; La Tela A [marseille, fra (7)]; Longevialle C [paris, fra (2)]; Nivol W [marseille, fra (2)]; Paoli C [marseille, fra (2), paris, fra (3)]; Quoniam L [marseille, fra (11)]; Rostaing H [marseille, fra (3)]

Sources

Dou H [Cahiers de la documentation(2), Scientometrics (3)];

Quoniam L [Cahiers de la documentation (2), Scientometrics (3)]

Publication date

Dkaki T [1991 (2)]; Dou H [1990 (2), 1992 (4), 1991 (4), 1987 (4), 1989 (4)]; Dousset B [1991 (2)]; Hassanaly P [1991 (2), 1990 (2), 1987 (4), 1989 (5)]; Koussoube S [1991 (2)]; La Tela A [1990 (2), 1987 (2)]; Paoli C [1991 (2)]; Quoniam L [1992 (2), 1990 (2), 1991 (4), 1989 (5)]; Rostaing H [1993 (2)]

Keywords

Bedecarrax C [bibliometrics (2), bibliometric analysis (2), database (2), application (2), data processing (2), data analysis (2), patent document (2), relational analysis (2)];

Billard P [bibliometric analysis (2), database (2)];

Dionne MC [bibliometric analysis (2), database (2), bibliographic data (2)];

Dkaki T [bibliometrics (2), graphics (2), information layout (2), data processing (2), information processing (2)];

Dou H [classification (2), decision making (2), tool (2), research program (2), method (2), firm strategy (2), case study (2), research indicator (2), information processing (2), coword analysis (2), frequency (2), information science (2), patent document (2), methodology (2), congress (2), published document (2), evaluation (2), code (3), bibliographic data (3), scientific technical information (3), data analysis (3), on line processing (3), data processing (4), statistical analysis (4), europe (4), france (4), bibliometry (5), bibliometrics (6), downloading (6), scientific research (6), scientometrics (8), chemistry (10), bibliometric analysis (10), database (12)];

Dousset B [bibliometrics (2), information layout (2), data analysis (2), bibliometric analysis (2), software (2), user interface (2), graphics (3), data processing (3), information processing (3)];

Hassanaly P [decision making (2), tool (2), research program (2), scientific technical information (2), research indicator (2), information processing (2), coword analysis (2), frequency (2), code (2), information science (2), patent document (2), methodology (2), congress (2), automated processing (2), data processing (3), data analysis (3), europe (3), france (3), on line processing (3), statistical analysis (4), downloading (4), scientific research (5), bibliometry (5), scientometrics (6), chemistry (8), database (9), bibliometric analysis (10)];

Hilaire A [data processing (2)];

Huot C [bibliometric analysis (2), database (2), application (2), data processing (2), data analysis (2), patent document (2), relational analysis (2), bibliometrics (3)];

Kister J [scientific research (2), tool (2), research program (2)];

Koussoube S [bibliometrics (2), graphics (2), information layout (2), data processing (2), information processing (2)];

La Tela A [chemistry (2), scientometrics (3), data processing (2), statistical analysis (2), bibliometry (2), scientific research (2), bibliometric analysis (3), database (7), downloading (4)];

Longevialle C [data analysis (2), bibliometric analysis (2), database (2)];

(continued)

Table 6 (*continued*)

Nivol W [bibliometrics (2), bibliometric analysis (2), method (2)];

Paoli C [bibliographic data (2), database (3), bibliometric analysis (4)];

Quoniam L [informetrics (2), classification (2), code (2), bibliographic data (2), information processing (2), example (2), scientific literature (2), data analysis (2), patent document (2), methodology (2), congress (2), published document (2), automated processing (2), evaluation (2), bibliometry (3), statistical analysis (3), on line processing (3), downloading (4), data processing (4), europe (4), france (4), scientific research (4), bibliometrics (5), scientometrics (5), database (7), chemistry (8), bibliometric analysis (10)];

Rostaing H [bibliometrics (2), scientific literature (2), bibliometric analysis (2), technological awareness (2), information processing (2)]

Note: Numbers in parenthesis are frequencies

grossly underestimate the activity of a French laboratory. Anyone might imagine that the French multidisciplinary database would overestimate the activity of this laboratory. We are not convinced of this, because the Pascal database seems exhaustive in information science, and other bibliometrics teams (which do not publish in French) are also underestimated in the American and English database in comparison with the French database.

On the other hand, it is feasible that other teams are overestimated in both American and English databases. Yet most teams maintain the same importance from one database to the other. A consideration of both estimations (under and over) is the minimum for an 'objective' evaluation. This is why we keep separate databases from various producers to emphasise the contrast between databases. Then it is possible to try to explain their different points of view.

For location considerations, and to minimise the political problems of evaluating researchers,[5] we just used the sample of our own working group. The bibliometrician, who uses on-line databases, has no influence over the data collection of the producer or the server of the database. Nor can he/she control the accuracy of indexation. The most control is over the misspelling of author names or affiliations. An accurate estimate of the validity of the database must be performed before building bibliometric indicators. An analysis involving several databases is very often the best solution.

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