Jointly published by Elsevier Science B. V., Amsterdam and Akadémiai Kiadó, Budapest

Scientometrics, Vol. 35, No. 1 (1996) 93-117

THE SCI JOURNAL CITATION REPORTS: A POTENTIAL TOOL FOR STUDYING JOURNALS?

I. Description of the JCR journal population based on the number of citations received, number of source items, impact factor, immediacy index and cited half-life

MARIE-HÉLÈNE MAGRI,* ALINE SOLARI**

Institut National de la Recherche Agronomique (INRA), Centre de Recherches de Jouy-en-Josas,
** Unité Centrale de Documentation,*
*** Station de Physiologie animale, Unité Statistique 78352 Jouy-en-Josas Cedex (France)*

(Received June 30, 1995)

In this paper, we analysed six indicators of the SCI Journal Citation Reports (JCR) over a 19-year period: number of total citations, number of citations to the two previous years, number of source items, impact factor, immediacy index and cited half-life. The JCR seems to have become more or less an authority for evaluating scientific and technical journals, essentially through its impact factor. However it is difficult to find one's way about in the impressive mass of quantitative data that JCR provides each year. We proposed the box plot method to aggregate the values of each indicator so as to obtain, at a glance, portrayals of the JCR population from 1974 to 1993. These images reflected the distribution of the journals into 4 groups designated low, central, high and extreme. The limits of the groups became a reference system with which, for example, it was rapidly possible to situate visually a given journal within the overall JCR population. Moreover, the box plot method, which gives a zoom effect, made it possible to visualize a large sub-population of the JCR usually overshadowed by the journals at the top of the rankings. These top level journals implicitly play the role of reference in evaluation processes. This often incites categorical judgements when the journals to be evaluated are not part of the top level. Our «rereading» of the JCR, which presented the JCR product differently, made it possible to qualify these judgements and bring a new light on journals.

Introduction

In most fields of science, journals are still the main means of disseminating research findings. In decision-making processes, their expertise is inevitable. This expertise is involved particularly in the management of library journal collections, information retrieval, the choice of where to publish, the evaluation of research systems and scientists. It is based on various methods of evaluation[1] including citation

0138-9130/96/US $ 15.-

analysis.[2-4] In evaluating scientific and technical journals, citation analysis has imposed itself over the last 20 years, under the influence of SCI Journal Citation Reports (JCR) published by the Institute for Scientific Information (ISI). The JCR seems to have become more or less an authority for evaluating scientific and technical journals through its impact factor.[5-7] According to *Garfield*,[8] «The JCR is unique because it is the only source of citation data on journals. This provides a new set of quantitative tools for ranking, evaluating, categorizing and comparing journals». Instructions for using the JCR are not explicitly provided with the tool but a certain number of studies recommend using JCR indicators for selecting or deselecting journals (for example: Refs 9, 10). As stated by *Garfield*,[8] «the JCR permits you to answer many important and fundamental questions about journals. What are the largest journals?... What journals are most frequently used?... What are the 'hottest' journals?... What journals have the highest impact?...» While it is true that we can answer this type of question rapidly by consulting the very beginning of the different JCR sections, what are we to think of the journals between the extremes? It is indeed difficult to find one's way about in the impressive mass of quantitative data that the JCR provides each year. Although many studies use these indicators, they are generally limited to a relatively restricted number of journals and most often deal with specific scientific fields (for example: Refs 11, 12). The lack of overall analysis or summary of JCR quantitative data leads to a fragmented use of this tool and hence a simplistic analysis of the complex reality of the world of journals.

The aim of our study was to aggregate the data from six of the indicators of the SCI Journal Citation Reports in order to obtain a visual portrayal of the JCR journal population. We believed that the description of this population, although it reflects an «in-house selection»[a] of all the scientific journals in the world, would provide us with information essential for understanding journals.

Materials and methods

Our material was made up of part of the annual data from the SCI Journal Citation Reports. Since 1974, the JCR has gathered quantitative data on a corpus of scientific and technical journals. In this corpus, the number of journals has increased each year (from 2630 in 1974 to 4541 in 1993). Two types of indicators characterize

[a] How are the journals in the JCR selected? Appendix 1 gives the indications that the JCR provides on how it constructs the corpus of journals which constitute the journal rankings.

the JCR journals: raw data which are the counts of source items[b] and citations[b] and indexes which are the variables calculated from these counts.

In this study, we analysed the following 6 indicators[b]: total number of citations, number of citations to the two previous years, number of source items, impact factor, immediacy index and cited half-life.

These six indicators are ranked in descending numerical order in sections 2 to 6 of the journal rankings and in ascending order in section 3 of the journal half-life listing of the JCR.

The descriptive statistical analysis of the JCR population was conducted in two stages. First, we studied the frequency distributions of the 6 indicators for each year of the JCR (19 years[c] from 1974 to 1993) using a graphical method of summarization, the box plot method.[13] Second, we checked the results obtained by the box plot method by constructing frequency polygons of the 6 indicators on a sample of recent years of the JCR (6 years from 1987 to 1992).

Box plots of the indicators over 19 years of data (JCR 1974 to 1993)

The box plot schematizes and summarizes the prominent features of a frequency distribution. The relationship between the frequency distribution and the box plot is shown in Fig. 1.

The construction of the box plot is based on the following characteristics: the quartiles Q_{25}, Q_{50}, Q_{75}, the interquartile range, the lower adjacent value and the upper adjacent value.[13,14]

The quartiles Q_{25}, Q_{50}, Q_{75} split the ranked values as follows: 25% of the journals have values lower than Q_{25} (lower quartile), 50% of the journals have values lower than Q_{50} (median) and 75% have values lower than Q_{75} (upper quartile). The interquartile range which measures the spread of the central half of the values is defined by the difference between the upper quartile and the lower quartile ($IQR = Q_{75}-Q_{25}$). The lower adjacent value is defined as being the smallest value that is greater than or equal to ($Q_{25} - 1.5 \times IQR$). The upper adjacent value is defined as the largest value less than or equal to ($Q_{75} + 1.5 \times IQR$) (Fig. 1).

In a box plot, the central part of the frequency distribution is portrayed by a rectangle of any width and of a length equal to the interquartile range. The lower and upper quartiles are represented by the small sides of the rectangle. The median is

b The definition of these terms and indexes constructed by ISI can be found in Appendix 2.

c There is no JCR covering the 1976 journals (*Garfield*, 1977, p. 1A).[15]

illustrated by a vertical line within the rectangle. Two line segments extend from both ends of the box to the lower and upper adjacent values. Any value situated outside the range of the two adjacent values is called an outside value. According to standard notation, each outside value is represented by an asterisk. In our study however, it was not possible to adopt these individual graphic representations because there were always more than 100 outside observed values. We therefore chose to illustrate symbolically the zones of outside values by dashed lines. On our graphs, only the maximum outside value is represented by an asterisk (Fig. 1).

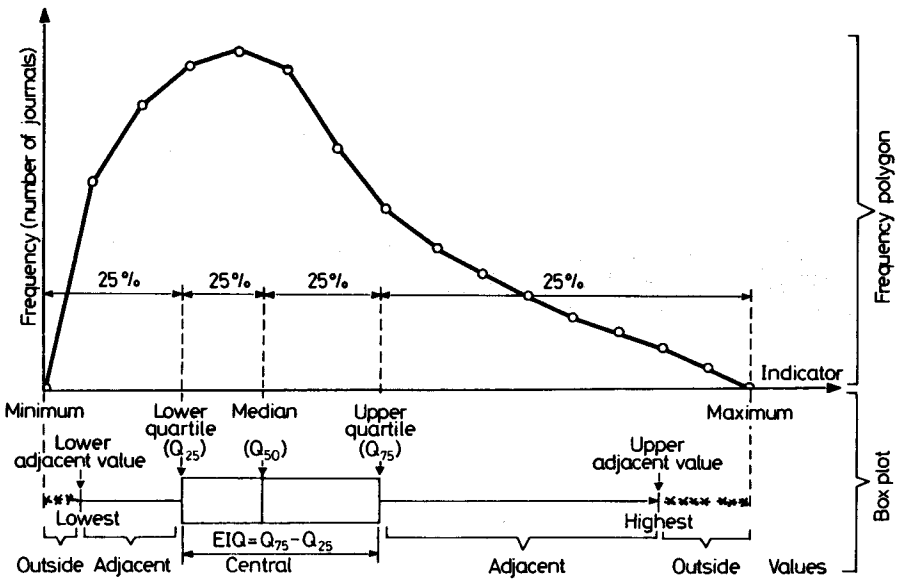

Fig. 1. Two graphic representations of the same distribution: the frequency polygon and the box plot

In the six sections of the JCR which we analysed, the individual values of each indicator studied were ranked in ascending or descending numerical order. Each value is associated with its rank number. This rank represents the position of the value on its variation interval and also a cumulative number of journals. We used the pair of values (cumulative number; value of the indicator X) to calculate the characteristics of the 19 box plots of each of the 6 indicators. The box plots were constructed from the number of titles whose indicator values were greater than or equal to zero. This number was determined by manual counting in the different sections of the JCR. The results of these counts are presented in Appendix 3.

Possible modifications in the frequency distributions of each indicator were detected by studying the changes in the characteristics of the box plots from 1974 to 1993. The correlation coefficient of Kendall's ranks (Kendall's τ) was used to determine evidence of a monotonic trend, i.e. an increasing or decreasing trend. The values of this coefficient are always between +1 and -1; a value close or equal to zero corresponds to the absence of any trend. A two-tailed test was used. Testing was carried out at the 5% and 1% significance level.[14]

Frequency polygons of the indicators over 6 years of data (JCR 1987 to 1992)

Unusual behaviour is not necessarily revealed by the box plot method. This is why we established, on a sample of recent years, the frequency polygons of the 6 indicators analysed.

For 6 consecutive years of the JCR, we constructed the non cumulative frequency distributions of each indicator using the pairs of values (cumulative number of journals, value of the indicator). We divided the variation interval into non-overlapping successive classes. We determine the number of journals per class by calculating the differences between the rank numbers.

The distributions are represented graphically by frequency polygons (as a percentage of the total number of journals) with equal class intervals. The six annual distributions of each indicator are shown on the same graph.

Results

Distribution of the journals along the variation interval of the indicators

From 1974 to 1993, the JCR journal population produced overall the same phenomena in citations and article production but there was considerable heterogeneity between journals. For all the indicators studied except the cited half-life, the heterogeneity between journals was revealed by a very strong asymmetry of the frequency distributions. For these 5 indicators, each year, the different components of the box plot were not symmetric about the median; the upper components were stretched relative to their counterparts below the median, indicating that the distribution was skewed to the right. 1) The median was not in a central position in the rectangle, it was always situated in the lower part of the

interquartile range. 2) The upper and lower segments which extend the rectangle were of very different length. The upper segment was always much longer. 3) There were never any small outside values whereas large outside values were extremely numerous (from 109 to 600 titles according to the indicators and years) and distributed on a very stretched variation interval. The interval occupied by the outside values accounted for more than 90% of the total interval of each of the 5 indicators (Figs 2 to 6).

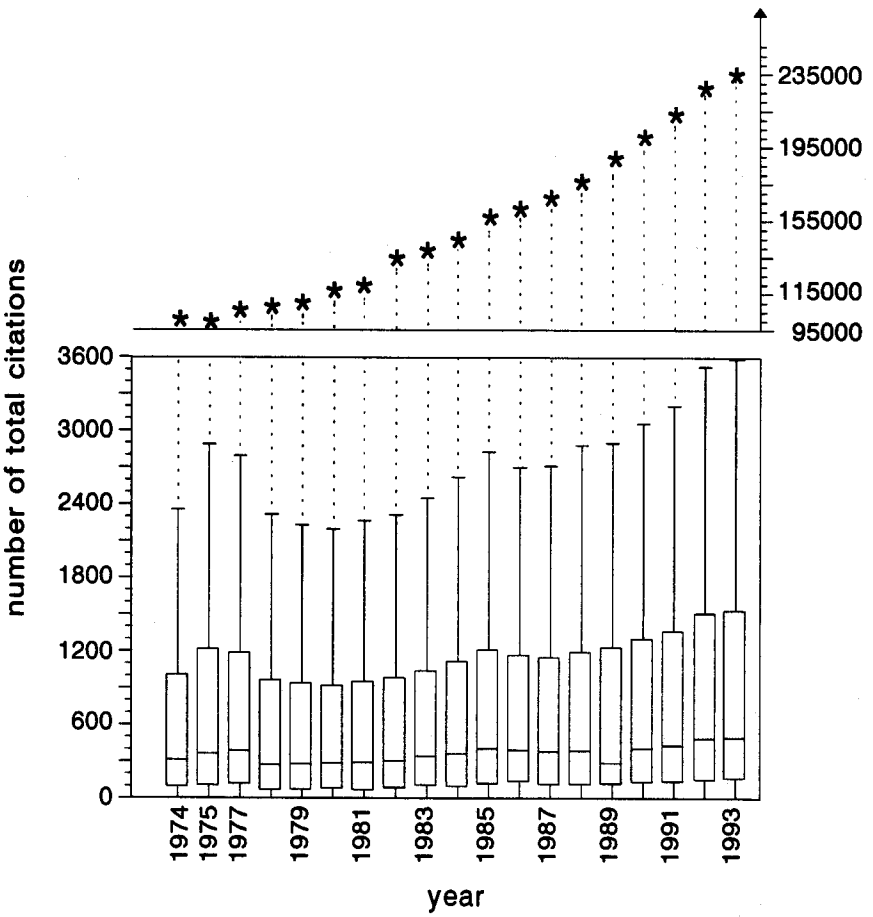

Fig. 2. Box plots of the number of total citations from 1974 to 1993

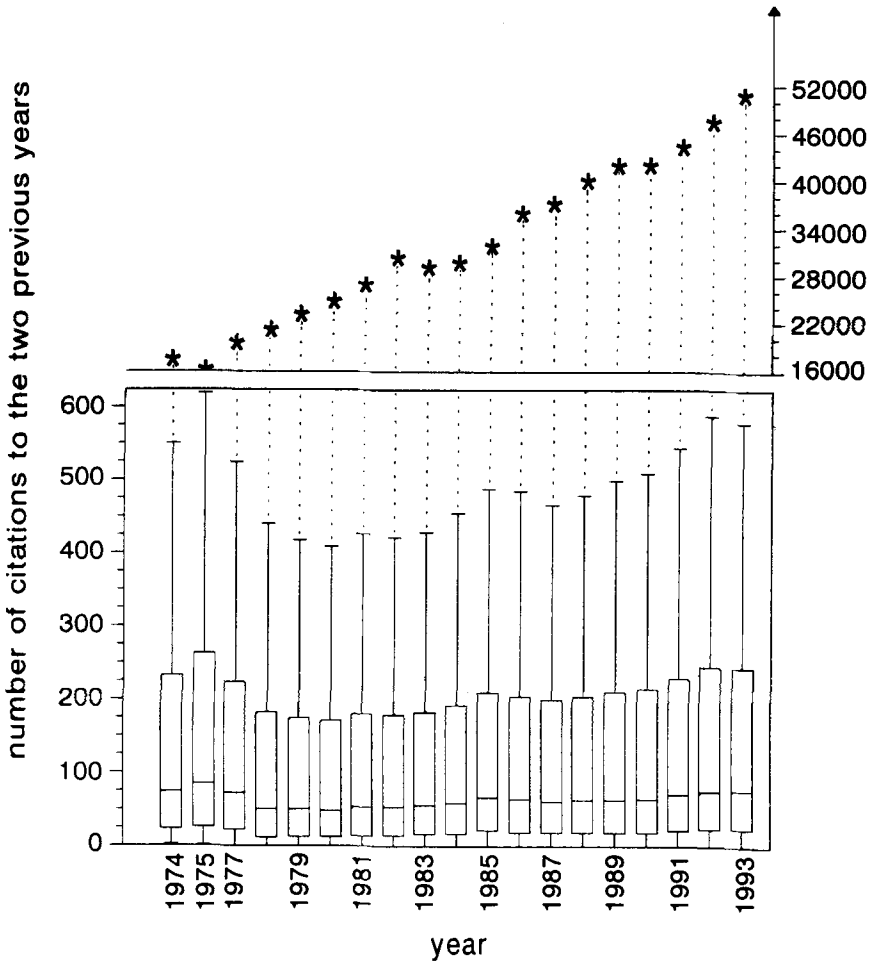

Fig. 3. Box plots of the number of citations to the two previous years from 1974 to 1993

On the other hand, since 1978, the box plot of the cited half-life of the journals receiving at least 100 citations per year[d] showed a certain symmetry for the central 50% of this distribution since the median was always in an almost central position in the rectangle. However, we could not come to any conclusions on a possible symmetry or asymmetry of the tails of the distribution. For this population of journals receiving at least 100 citations, as for those of the other 5 indicators, there

were no small outside values. The conventions of the JCR[d] made it impossible to evaluate the upper adjacent value and therefore the length of the upper segment as well as the number of upper outside values, if there were any. According to our calculations, the upper adjacent value was between 10 and 15.65 years, the latter being the maximum obtained in 1993. Since the frequency distributions were right-censored, we did not know the maximum value of the cited half-life and consequently we did not know the range of the total variation interval for this indicator (Fig. 7).

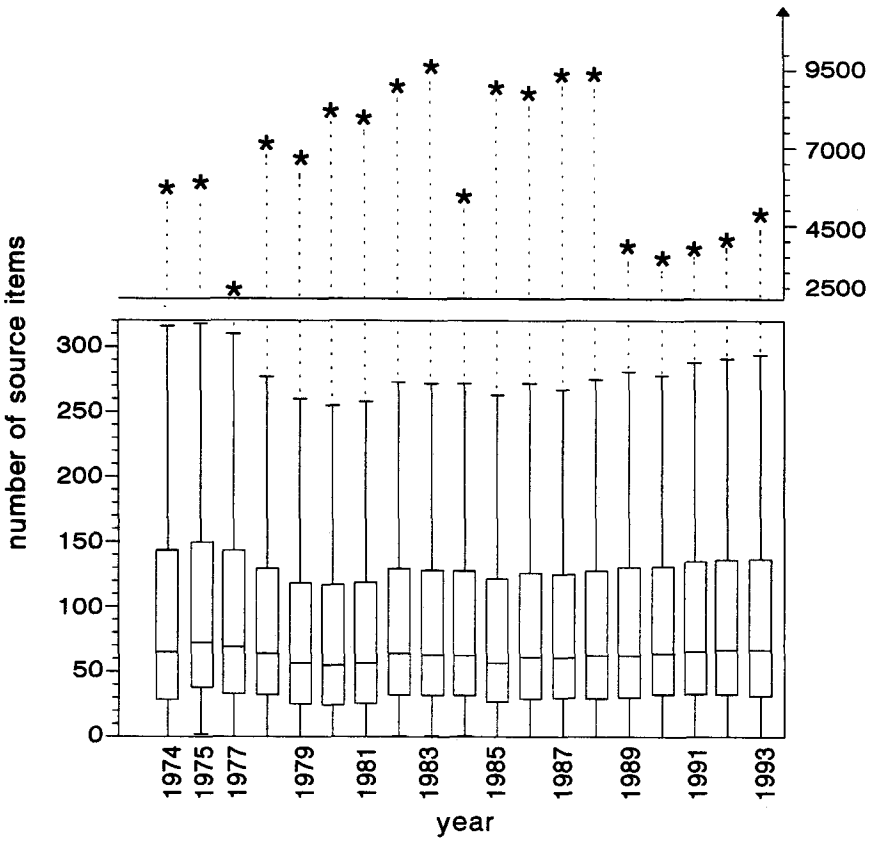

Fig. 4. Box plots of the number of source items from 1974 to 1993

[d] For the cited half-life, the conventions of the JCR are the following: the journals receiving fewer than 100 citations are not given in the journal half-life listing of the JCR and we did not have the exact values for the titles with a cited half-life greater than 10 years. This indicator begins in 1978 (see Appendix 3).

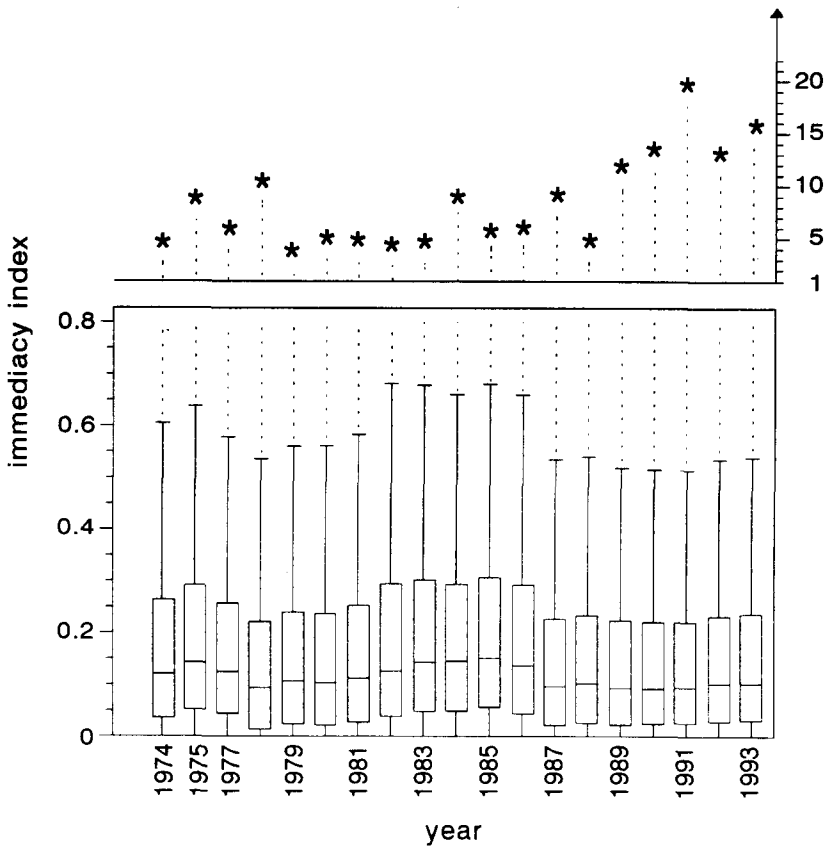

Fig. 5. Box plots of the immediacy index from 1974 to 1993

To describe the JCR population, we assimilated the compounds of the box plots to four groups of journals. These groups were defined by the characteristic values of the box plots. The JCR population was thus divided into the following groups: low, central, high, extreme. Surrounding the central group, we therefore isolated a group at the beginning of the distribution and two at the end.

We called the first of these groups, situated at the beginning of the distribution, the *low group*. It included the journals whose indicators were situated between the lower adjacent value (always equivalent to the minimum value of each indicator) and the lower quartile. This group covered 25% of the journals because there were no small outside values, whatever the year and indicator.

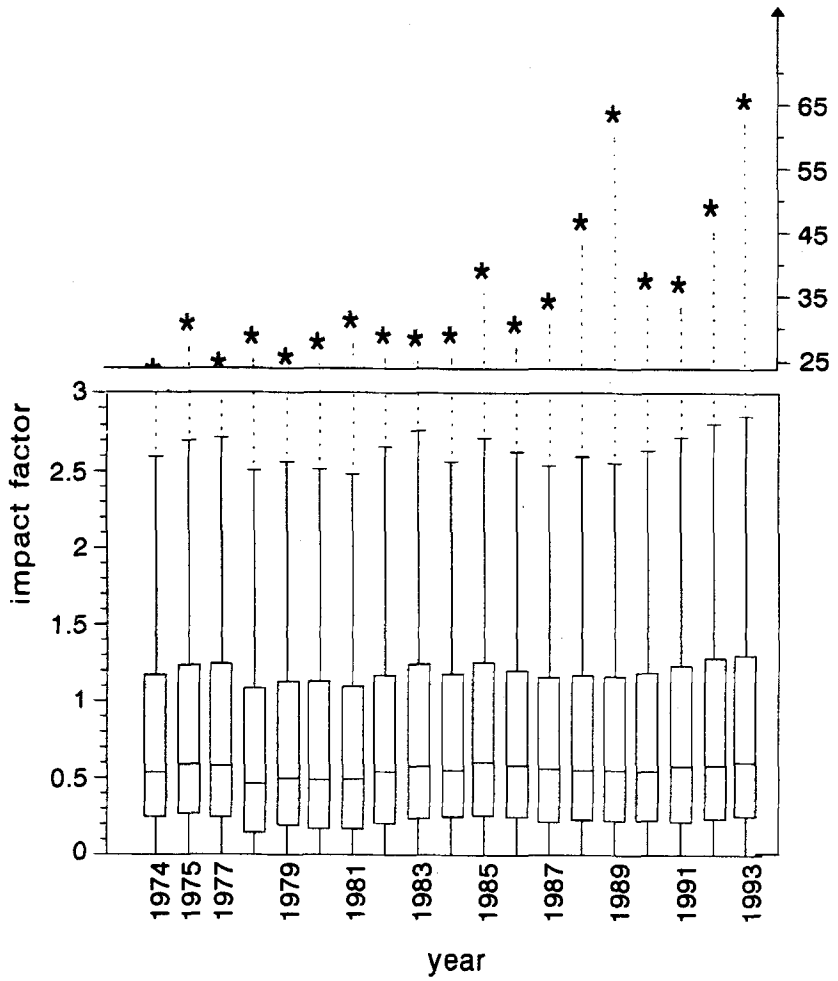

Fig. 6. Box plots of the impact factor from 1974 to 1993

The following group was called the *central group*. It took into account journals whose indicators were between the lower and upper quartile. This group, including the median, contained by definition 50% of the JCR population. It was representative of the bulk of JCR journals.

The group following the central group was the *high group*. The journals from this group had indicators between the upper quartile and the upper adjacent value. The median percentage of titles was 12% for the number of total citations and citations to

the two previous years, 16% for the number of articles, 17% for the impact factor and 19% for the immediacy index.

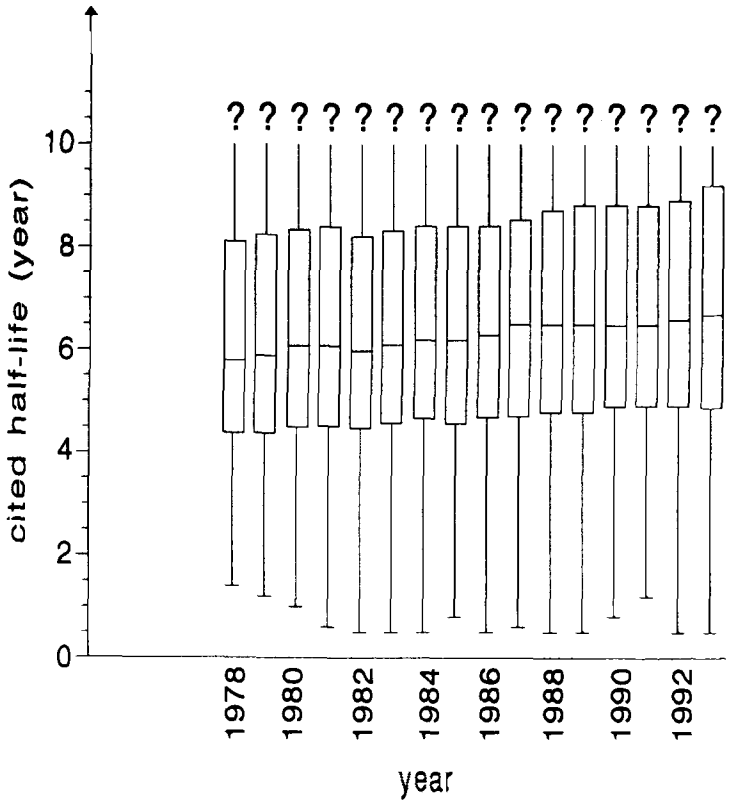

Fig. 7. Box plots of the cited half-life from 1978 to 1993

The fourth and last group was the *extreme group*. It was made up of the journals with the highest indicators (or outside values). These outside values were distributed on a very stretched variation interval towards the large values. The median percentage of titles counted in this group was 13% for the number of total citations (from 290 to 559 titles depending on the years) and for the number of citations to the two previous years (296 to 591 titles), 9% for the number of source items (179 to 380 titles), 8% for the impact factor (171 to 333 titles) and 6% for the immediacy index (109 to 281 titles).

For each indicator, there were no changes in the percentages of journals which made up the high and extreme groups during these 19 years. It should be kept in mind that the small number of journals in the extreme group occupied more than 90% of the total variation interval of each indicator whereas, on the contrary, the low and central groups which include 75% of the JCR population, occupied a reduced interval of variation.

For the cited half-life, because the total variation interval of this indicator was not known and the data were right-censored, we could not limit the high group with an upper adjacent value, as we had done for the other indicators. We were therefore not able to show any possible outside values which would form an extreme group. We could only deduce that the percentage of journals belonging to the high group was at least 11.5% in 1978 and that it gradually decreased until 1993 to reach 5%. This percentage was represented by the journals whose cited half-life was between the upper quartile and 10 years.

Evolution with time of the box plot characteristics

Total citations and cited half-life (Figs 2 and 7). For these two indicators, the limits of the 4 groups of journals showed a significant trend: the 3 quartiles, the upper adjacent value, the maximum value of the total citations as well as the 3 quartiles of the cited half-life all increased with time ($P<0.01$, Table 1). The minimum values of these characteristics were observed during the period 1974/1980 and the maximum values in 1993 (Table 2). For total citations, the limits of each of the 4 groups of journals increased by at least 60% (Table 2). For the cited half-life from 1978 to 1993, the limits of the central group increased by 0.5 year for the lower limit and by 1 year for the upper limit (Table 2).

Source items, impact factor, citations to the two previous years and immediacy index (Figs 3-6). For source items, impact factor and citations to the two previous years, although the values of the quartiles and the upper adjacent value had fluctuations during the 19 years, we did not find any significant increasing or decreasing trend throughout this period ($P>0.05$, Table 1). The same applied to the immediacy index except for its upper adjacent value which decreased slightly over the 19 years ($P<0.05$, Table 1). The maximum value of the upper adjacent value was observed in 1982 with 0.682 and the minimum value in 1991 with a value of 0.515 (Fig. 5).

Table 1
Kendall's rank correlation coefficient of the frequency distribution characteristics for the 6 indicators from 1974 to 1993

Characteristic / Indicator	Q_{25}	Q_{50}	Q_{75}	Upper adjacent value	Maximum value	Maximum value[a]
Total citations	0.637**	0.575**	0.602**	0.614**	0.988**	
Cited half-life	0.918**	0.904**	0.901**			
Source items	0.168	0.066	0.096	0.118	0.006	0.614**
Impact factor	0.211	0.282	0.305	0.287	0.673**	0.579**
Citations to the 2 previous years	0.326	0.330	0.328	0.322	0.953**	
Immediacy index	-0.084	-0.223	-0.293	-0.340*	0.427*	0.047

[a] Correlation coefficient calculated by excluding the "meeting abstract" journals which occupy the first positions.
* $P<0.05$.
** $P<0.01$.

Table 2
Minimum and maximum values of the frequency distribution characteristics for the number of total citations (from 1974 to 1993) and of the cited half-life (from 1978 to 1993)

Indicator	Characteristic	Q_{25}	Q_{50}	Q_{75}	Upper adjacent value	Maximum value
Total citations	Min	65[b]	272[b]	922[c]	2195[c]	98315[a]
	Max	164	495	1530	3577	234319
Cited half-life	Min[b]	4.4[b]	5.8[b]	8.1[b]		
	Max	4.9	6.7	9.2		

Minimal values observed in:
[a] = 1975,
[b] = 1978,
[c] = 1980.
The maximum values were always observed in 1993.

As for the total citations, the maximum annual values of the citations to the two previous years and the impact factor increased significantly from 1974 to 1993 ($P<0.01$, Table 1).

For the maximum value of source items, we observed a large variability throughout the 19 years (Fig. 4). This variability was due to the fact that, up until

1988, for a small number of journals, the numerous meeting abstracts which they published were counted as source items (up to 9663 articles a year).[15] In 1989, the meeting abstracts of these journals were no longer counted as source items.[16] By excluding these «meeting abstract» journals, the maximum value of source items then increased significantly ($P<0.01$, Table 1) from 2429 in 1974 to 4770 in 1993.

The maximum value of the immediacy index increased significantly from 1974 to 1993 ($P<0.05$, Table 1). However, by excluding the «meeting abstract» journal, Clinical Research,[e] which was in the first position from 1989 to 1993, we no longer showed any monotonic trend ($P>0.05$, Table 1).

In summary, unlike cited half-life and total citations, for impact factor, citations to the last two years, source items and immediacy index, the limits of the groups of low, central and high journals have not been modified over the last two decades apart from the limit between the high/extreme groups of the immediacy index which tended to decrease. However, for all the other indicators apart from the immediacy index, the upper boundary of the extreme group increased regularly if we excluded the «meeting abstract» journals which occupied the first position of some of these indicators.

Form of frequency distributions

The frequency polygons from 1987 to 1992 did not show bimodal distributions for any of the six indicators and confirmed the results previously obtained from the box plot: whatever the indicator, the distributions were similar from one year to the next (Figs. 8 to 13). All the highly asymmetric frequency distributions were hyperbolic, except for the cited half-life (Figs 8 to 12). For the latter indicator, the form of the frequency distributions looked like the form of the normal law. As already noted, this distribution is right-censored (Fig. 13).

[e] Clinical Research is the journal with the maximum immediacy index since 1989 and the maximum impact factor since 1991. From 1989 on, the meeting abstracts of this type of journal were no longer counted as source items to calculate these two indicators. They are therefore not involved in calculating the denominator of these indicators whereas the citations that these meeting abstracts receive seem to be counted in the calculation of the numerator (*Garfield*, 1989)[16].

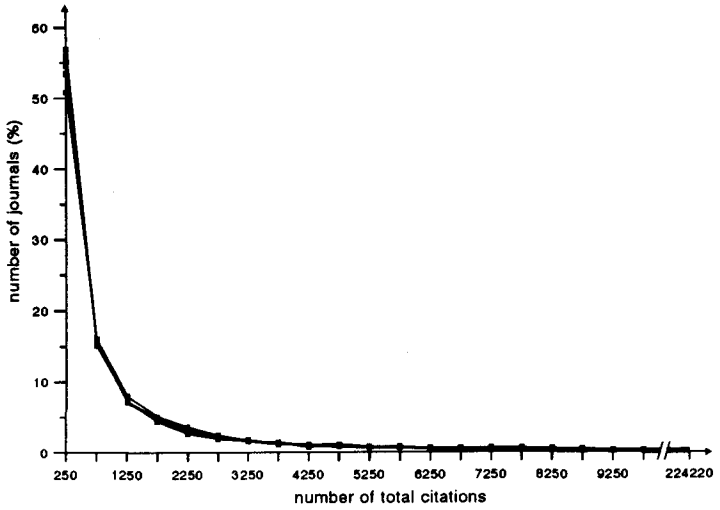

Fig. 8. Annual frequency distributions of the number of total citations from 1987 to 1992 (class interval = 500 citations)

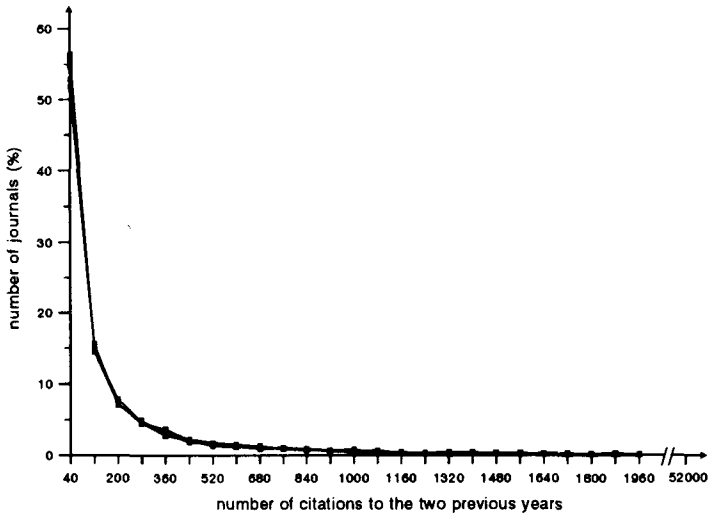

Fig. 9. Annual frequency distributions of the number of citations to the two previous years from 1987 to 1992 (class interval = 80 citations)

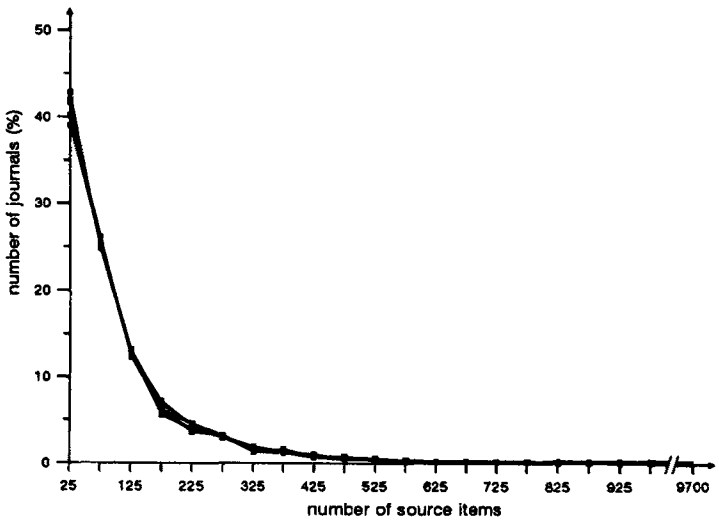

Fig. 10. Annual frequency distributions of the number of source items from 1987 to 1992 (class interval = 50 articles)

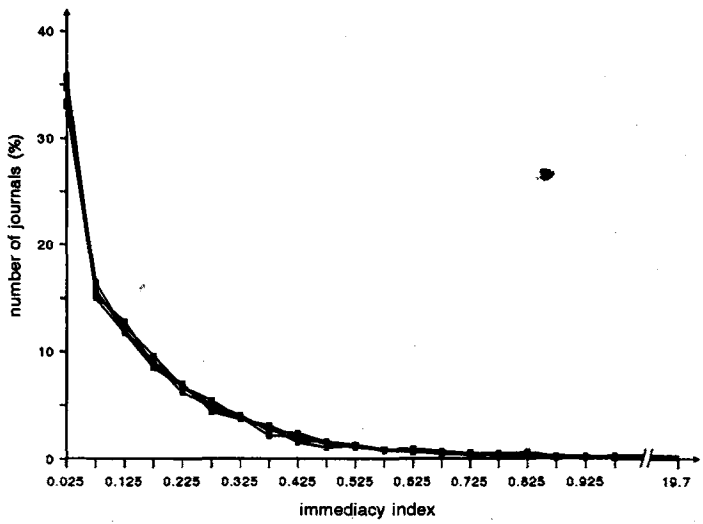

Fig. 11. Annual frequency distributions of the immediacy index from 1987 to 1992 (class interval = 0.05)

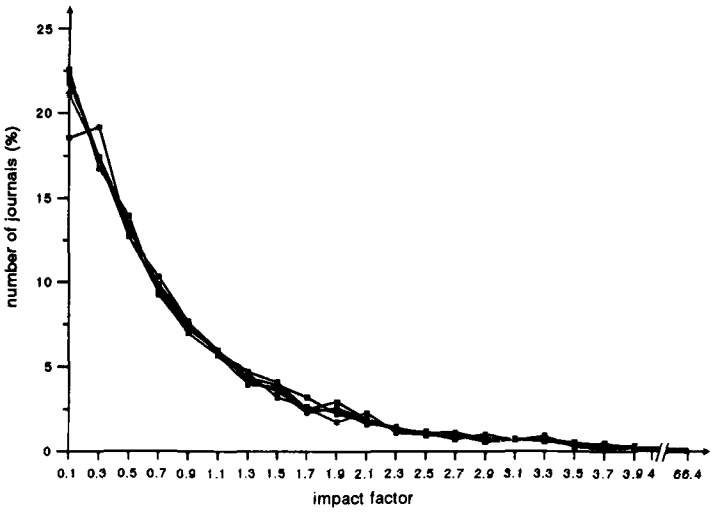

Fig. 12. Annual frequency distributions of the impact factor from 1987 to 1992 (class interval = 0.02)

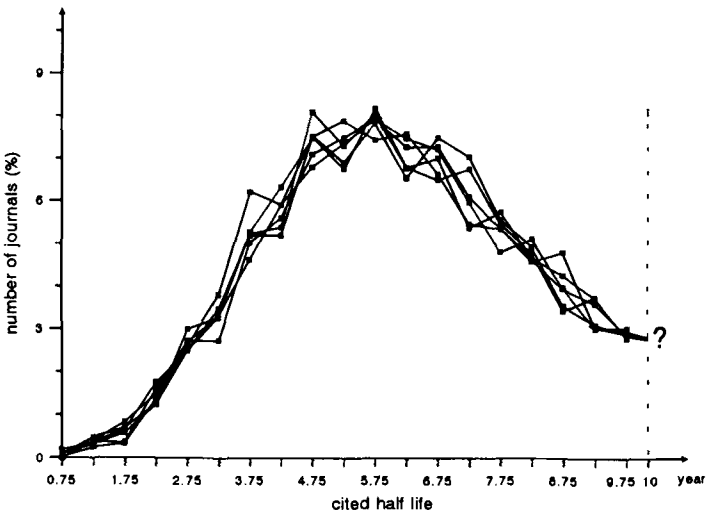

Fig. 13. Annual frequency distributions of the cited half-life from 1987 to 1992 (class interval = 0.5 year)

In conclusion, we summarized all the results of this study by a synoptic table giving the reference values which tag the variation interval of each of these indicators.

These reference values were the medians of the characteristics of the 19 box plots and the minima and maxima of each indicator over 19 years. For the total number of citations and cited half-life, the reference values were better represented by the values of the 1993 box plots due to the significant increasing trend shown during these 19 years (Table 3).

Table 3
Reference values of the journal groups per indicator

Indicator	Group	Min.	LOW	Q25	Q50	Q75	CENTRAL	HIGH	Upper adjacent value	EXTREME	Max
total citations		1		164	495	1530			3577		234319
citations to the 2 previous years		0		19	64	206			485		51535
source items		0		32	63	129			275		9663[a] (4770)[b]
immediacy index		0		0.028	0.107	0.239			0.561		19.667[a] (10.7)[b]
impact factor		0		0.237	0.555	1.193			2.631		66.273[a] (64.0)[b]
cited half-life		0.5		4.9	6.7	9.2			?		?

(a) : 'meeting abstract' journals.
(b) : By excluding 'meeting abstract' journals.

Discussion

The journals at the top of the JCR rankings implicitly play the role of reference for evaluating scientific and technical journals. Most often, the journals tested are cursorily judged good or bad depending on whether or not they are part of this top level. Our graphical method enabled us to make less categorical judgements by presenting the JCR product differently. In the environment of each of the 6 indicators studied, the JCR journal population over 20 years could be visualized, at a glance, by a comprehensive image. This image reflected the distribution of the journals into 4 groups designated low, central, high and extreme.

The top level journals belonged to the extreme group. In this group, the values of the indicators are outside values. They may even be outliers[13] because they are situated beyond the upper adjacent value. In admitting that these outside values are «non standard values», these extreme journals could therefore be considered as distinct from the rest of the JCR population. All the JCR journals can no longer be

described solely through these 10% of conspicuous journals of the extreme group even if these journals are the most cited and/or the most productive.[2] It is in fact the 3 other groups (90% of the journals) and more particularly the central group (50%) which constitute the main part of the population. This reality is usually totally overshadowed by the wide range of the indicator values of the extreme group. Our graphical representation in groups, which gives a zoom effect, made it possible for the first time to visualize this large sub-population by disassociating it from the top level journals. Therefore, with this zoom, we magnified the variation interval of this sub-population.

The limits of the group which marks the variation interval of each indicator constituted a system of references. Using this reference system, it was possible to situate very rapidly (with the synoptic table) and visually (in the annual box plots) a given journal or group of journals in the overall JCR population. We determined which group the journal belonged to and situated it accurately within this group. We were also able to follow the changes with time for each indicator of the journal and also better interpret the amplitude of annual variations of these indicators. This rapid method for situating a journal within the ISI environment has been used for one of the journals of our Institute.[17] It can be easily applied to any journal included in the SCI Journal Citation Reports. Positioning journals within the overall ISI environment must be complemented by the same sort of positioning within their scientific discipline. We have therefore undertaken a similar analysis presented in this paper using the subject category listing of the SCI Journal Citation Reports.[18] The same study should be carried out on the SSCI Journal Citation Reports.

In our analysis of the SCI Journal Citation Reports, the journals were not distinguished by their title because, among other reasons, electronic JCR data are not easily available. The next stage would be to treat the journals by title in order to more fully understand the indicators and groups. If the indicators designed by ISI cover the notions of journal quality, how do each group of journals contribute to initiating and developing research activities and exchanges within each scientific community? Furthermore, are the 4500 JCR journals a representative sample of the population of scientific and technical journals in the world? The SCI Journal Citation Reports is however one of the rare structures where information on a large number of journals is assembled in a systematic, detailed and regular manner. Our «rereading» of the JCR brings a new light on journals and becomes a necessary complement to a less simplistic use of this tool.

*

The article was translated by *C. Young*. This work could not have been carried out without the efficient technical help of *E. Barbé, M. Trofleau* and *P. Dieudonné* and the full support of *K. Rérat*, Director of the Unité Centrale de Documentation at the INRA Centre in Jouy-en-Josas. We would like to thank *D. Marie* for his cooperation.

References

1. J. REED-SCOTT, *Guide de l'inventaire des collections des bibliothèques de recherches en Amérique du Nord*, Association of research libraries, office of management services, 1988, p. 68.
2. E. GARFIELD, Citation analysis as a tool in journal evaluation, *Science (Washington, D.C.)*, 178, No. 4060 (1972) 471-479.
3. E. GARFIELD, *Citation Indexing – Its Theory and Application in Science, Technology, and Humanities*, John Wiley & Sons, New York, 1979, p. 274.
4. R. TODOROV, W. GLÄNZEL, Journal citation measures: a concise review, *Journal of Information Science*, 14 (1988) 47-56.
5. E. GARFIELD, The impact factor, *Current Contents. Life Sciences*, 37, No. 25 (1994) 3-7.
6. E. GARFIELD, Using the impact factor, *Current Contents. Life Sciences*, 37. No. 29 (1994) 3-5.
7. E. GARFIELD, The application of citation indexing to journals management, *Current Contents. Life Sciences*, 37, No. 33 (1994) 3-5.
8. E. GARFIELD, 1993 SCI Journal Citation Reports; a bibliometric analysis of science journals in the ISI database, Institute for Scientific Information, Philadelphia, 1994.
9. T.E. SMITH, The Journal Citation Reports as a deselection tool, *Bulletin of the Medical Library Association*, 73, No. 4 (1985) 387-389.
10. R.N. BROADUS, A proposed method for eliminating titles from periodical subscription lists, *College & Research Libraries*, (January, 1985) 30-35.
11. A.E. CAWKELL, Evaluating scientific journals with Journal Citation Reports – A case study in acoustics, *Journal of the American Society for Information Science*, 29, No. 1 (1978) 41-46.
12. B.A. RICE, Selection and evaluation of chemistry periodicals, *Science and Technology Libraries (New York, N.Y.)*, ., No. 1 (1983) 43-59.
13. J.M. CHAMBERS, W.S. CLEVELAND, B. KLEINER, P.A. TUKEY, *Graphical Methods for Data Analysis*, Wadsworth & Brooks, California, 1983, p. 386.
14. P. SPRENT, *Applied Nonparametric Statistical Methods*, Chapman and Hall, London, 1989, p. 255.
15. E. GARFIELD, SCI Journal Citation Reports; a bibliometric analysis of science journals in the ISI database. *Science Citation Index* 1977 annual, Vol. 13, Institute for Scientific Information, Philadelphia, 1978, p.8.
16. E. GARFIELD, 1989 SCI Journal Citation Reports; a bibliometric analysis of science journals in the ISI database, Institute for Scientific Information, Philadelphia, 1991.
17. M.H. MAGRI, A. SOLARI, K. RERAT, Le SCI Journal Citation Reports ou comment positionner une revue dans l'environnement ISI. Journées d'étude sur les systèmes d'information élaborée, 30 Mai – 2 Juin, Ile Rousse, 1995, session poster.
18. A. SOLARI, M.H. MAGRI, The SCI Journal Citation Reports as a potential tool for studying journals? II Description by subject category of the JCR journal population based on the impact factor. (In preparation, 1995).
19. E. GARFIELD, SCI Journal Citation Reports; a bibliometric analysis of science journals in the ISI database, *Science Citation Index* 1987 annual, vol. 19, Institute for Scientific Information, Philadelphia, 1987.
20. R.W. ALLEE, The relationship between primary and secondary publishers: ISI's journal selection guidelines and use of the Journal Citation Reports (JCR), *Serials Librarian*, 13, No. 2/3 (1987) 47-55.
21. E. GARFIELD, How ISI selects journals for coverage: quantitative and qualitative considerations, *Current Contents. Life Sciences*, 33, No. 22 (1990) 5-13.

Appendix 1: Journal Rankings

In this appendix, is listed the information supplied by the JCR in its annual prefaces about journals included in the journal rankings.

1) «The journal rankings list the science journals that are covered in the SCI and Current Contents in six sections...» (Garfield, 1994, p.9).[8]

2) «The first part of the JCR is the journal rankings. It contains six sections. The first section is an alphabetic list of journals cited in current year's references of science journals processed as source journals for the SCI and Current Contents... In addition to SCI source journals, the journal rankings include some 1,000 clinical, agricultural and engineering journals not indexed by the SCI, but covered in Current Contents» (Garfield, 1994, p.14).[8]

3) «Section 1 is a listing of science journals cited in the references of Science Citation Index, Social Sciences Citation Index and Arts & Humanities Citation Index source journals...» (Garfield, 1987, p.14A).[19]

4) «Source journal: this is a journal that is covered in the SCI, SSCI or A&HCI, so called because it is the source of published items processed for compilation of the four sections of the citation indexes. In the JCR a source journal is a citing journal» (Garfield, 1994, p.11).[8]

In spite of the nuances existing in these definitions, the fundamental question remains that of the selection criteria of these source journals which make up the ISI products, whether it be Current Contents, SCI, SSCI or A&HCI. The information published on this subject (Allee, 1988; Garfield, 1990)[20,21] is still too imprecise.

Appendix 2: Definitions

Below are Garfield's definitions of the main terms and indicators which we have studied (Garfield, 1994, p. 10, 11, 14)[8].

CITATION

When one document (A) mentions or refers to another document (B), the latter has been cited by the former as a source of information, as support for a point of view, as authority for a statement of fact, etc. The term «citation» is used to indicate not only the fact that document B has been cited in a reference of document A, but also the description of document B contained in the reference. In this sense, citation and reference are frequently used interchangeably.

CITED HALF-LIFE

The number of journal publication years going back from the current year which accounts for 50% of the total citations received by the cited journal in the current year.

IMMEDIACY INDEX

... The immediacy index of journal X would be calculated by dividing the number of all current citations of current source items published in journal X by the total number of articles journal X published that year...

IMPACT FACTOR

... The JCR impact factor is basically a ratio between citations and recent citable items published. Thus, the impact factor of Journal X would be calculated by dividing the number of all current citations of source items published in Journal X during the two previous years by the number of articles Journal X published in those two years...

NUMBER OF CITATIONS TO THE TWO PREVIOUS YEARS

For example, for the year 1993, it is «the portion of the total citations that were received by articles that the journal published in 1992» plus «the portion of the total citations that were received by articles that the journal published in 1993».

NUMBER OF TOTAL CITATIONS

For example, for the year 1993, it is «the total number of times the journal was cited by SCI, SSCI and A&HCI source items during 1993».

NUMBER OF SOURCE ITEMS

For example, for the year 1993, it is «the number of 1993 source items the journal published».

SOURCE ITEMS

A source item is an item published in any of the journals covered in the SCI, SSCI or A&HCI. In the JCR, only original research articles, review articles and technical notes are counted as source items.

Appendix 3: Number of titles per indicator and per year

To construct the frequency distributions of each of the 6 indicators, we counted the titles whose indicator was higher than or equal to zero from 1974 to 1993. All these results are shown in figure 14. These titles concern principally current journals as well as journals which have been discontinued or have changed their titles.

Total citations (section 2 of the journal rankings)

Since 1974, the titles in this section have received at least one citation in so-called «source» journals (except in 1985 and 1986 where 4 and 6 titles, respectively, did not receive any citations). We called this group of titles «JCR population». The number of titles of this population increases practically every year. In 19 years, the number has almost doubled (from 2630 titles in 1974 to 4541 in 1993). From 1976 to 1982, the increase in the number of titles (1543 more titles) was higher than that observed between 1982 and 1993 (368 more titles).

Citations to the two previous years (section 6 of the journal rankings)

The titles in this section corresponded to the JCR population defined above (except in 1974 and 1975 where there were 137 and 38 fewer titles, respectively). This variable, numerator of the impact factor, is a subset of total citations.

Number of source items (section 5 of the journal rankings)

The median percentage of titles in this section represented 97% of the JCR population. The JCR did not dispose of the number of articles of 3% of its titles.

Impact factor (section 3 of the journal rankings)

The median percentage of titles with an impact factor higher than or equal to zero represented 96% of the JCR population. 4% of the titles did not have an impact factor because there were no source items.

Immediacy index (section 4 of the journal rankings)

The median percentage of titles with an immediacy index higher than or equal to zero represented 91% of the JCR population. 9% of the titles therefore did not have an immediacy index. For 3% of them, the number of articles published was unknown and for 6%, the number of articles was nil.

Cited half-life (section 3 of the journal half-life listing)

In 1978, the first year that this indicator appeared in the JCR, the percentage of titles in relation to the JCR population was 68% and it reached 83% in 1993. This difference with the JCR population was due to the fact that the JCR does not provide the cited half-life of the titles receiving fewer than 100 total citations (Garfield, 1993, p.16). Among the titles receiving a number of total citations higher than or equal to 100, the JCR does not give exact values for the titles whose half-life is greater than 10 years: only a cited half-life of >10 years is given. The percentage of journals whose cited half-life was greater than 10 years increased throughout the 19 years, since it went from 13.5 in 1978 to more than 19% in 1993.

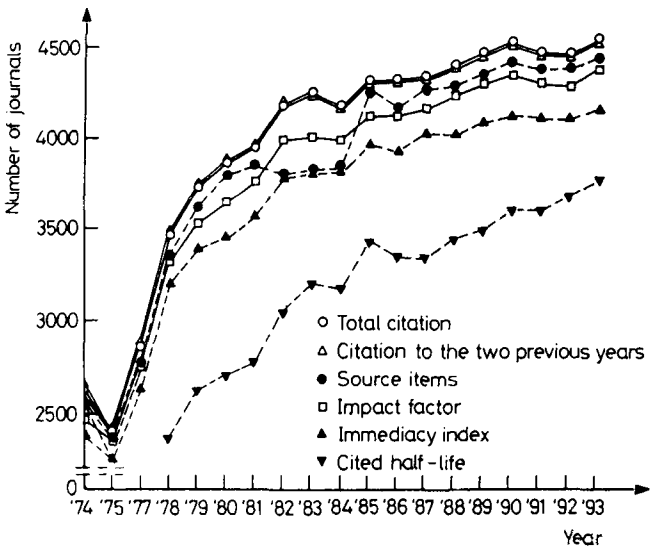

Fig. 14. Number of journals per indicator ≥0 per year (from 1974 to 1993)