A bibliometric profile of *Current Science*

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We carry out a citation-based bibliometric profiling of the journal *Current Science*. A three-dimensional approach breaks down scholarly performance into three primary components – quantity, quality and consistency. The citation data are retrieved from the *Web of Science*. We quantify the evolution of these primary indicators with time, and along with two additional secondary indicators, the *h*-index and the *z*-index, identify the most productive authors, cities and states that have published articles and notes in *Current Science* in the recent past.

Keywords: Bibliometrics, citation, *Current Science*, indicators, three-dimensional evaluation.

GLANZEL[1] pointed out that 'there is no single best indicator that could accommodate all the facets of the new reality of journal metrics'. This emerged from a comprehensive review of the evolution of journal metrics from the impact factor (IF)[2–4] till today. Indeed it would be impossible to capture the entire spectrum of research performance in a single metric, whether of an individual author, or institution, or journal.

A similar situation is found in the management of very large databases. Laney[5] introduced a three-dimensional metaphor based on a volume–velocity–variety approach to controlling and classifying data. We can easily project this 3V metaphor to the information production process as well. The three dimensions that seem to be orthogonal in nature are quantity, quality and consistency (or evenness). The number of papers P, indicates quantity (i.e. size or volume). The impact i measured by the ratio C/P, where C is the total number of citations received by P papers, is a proxy for quality. Finally, one can introduce a third term called consistency η, which appears naturally when second-order indicators are generated. This seems to capture the variability in the quality of the individual papers in the publication set, or in other words, the shape of the distribution curve.

The search strategy

Publication Name=(current science)
Refined by: Document Types=(ARTICLE OR NOTE)
Timespan=All years. Databases=SCI-EXPANDED, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC

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using the *Web of Science* (*WoS*) database (subscription covering 1986 till the present date accessed on 6 November 2013) showed that there were 9981 results when the document types are restricted to articles or notes. Figure 1 shows the time evolution of the record count of all document types and notes published in *Current Science* from 1987 to 2012. Altogether, 17,095 items have appeared in the journal during this period, of which 7114 items are documents which are categorized as letters, editorial material, reviews, etc. Since 2005, there has been a steady decline in the number of articles and notes published in *Current Science*. Indeed, while the number of items under articles and notes has halved from 1987 to 2012, the rest which comprised letters, editorial material and review has increased more than fourfold.

The *WoS* database allows further refinement of these results in terms of countries, cities and states of origin, authors, etc. This can be used to profile the impact and influence of the research content in *Current Science* in terms of the leading authors, leading cities and states from whom/where articles and notes have originated. The quantitative approach uses a three-dimensional methodology recently proposed by Prathap[6]. In this, the quantity dimension (productivity in terms of number of papers published) and the quality dimension (specific impact as defined by citations per paper) are complemented with a third dimension, called consistency η (refs 7 and 8).

The precise computation of η requires the knowledge of the complete citation sequence (i.e. the distribution curve) for each individual scientist (or aggregation like institute, state, city, etc.). This is obtained directly from the *WoS* for each case taken up in the present analysis and the methodology to obtain this is discussed below.

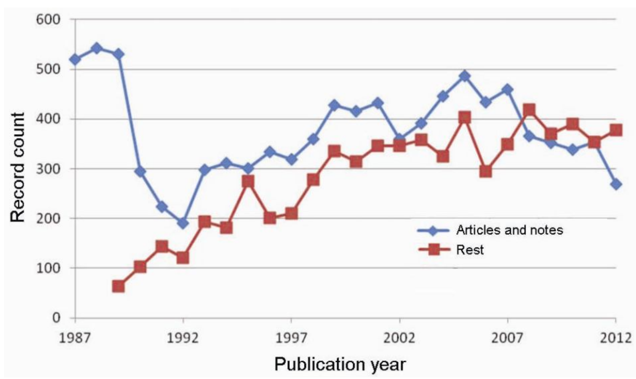

Figure 1. Time evolution of the record count of document types published in *Current Science* from 1987 to 2012.

The quality–quantity–consistency parameter space and evolution of second-order indicators

The debate on what indicators will best serve to judge the performance or influence of a journal still continues[1]. Pendlebury and Adams[9] pointed out that the journal IF[2–4] was not introduced to serve as a direct measure or proxy of quality. However, for quite some time now, it has been accepted as a proxy or indirect measure of the quality or scholarly influence of a journal. Thus, to start with, the size (quantity) and impact (quality) of a journal can be measured using the following parameter space:

Quantity – Number of papers/articles P published during a prescribed window which we will call the publication window (in our case, the window is from 1987 to the date of access of *WoS* database).

Quality – The impact i computed as C/P, where C is the number of citations during a prescribed citation window of all the articles P. Note that the definition of i needs two distinct windows to be identified – the publication window and the citations window. Here we use the same window for both.

Prathap[10] showed that once the quantity P and quality i parameters are defined, it is possible to postulate the following sequence of indicators of performance:

Zeroth-order indicator: $P = i^0P$,

First-order indicator: $C = i^1P$,

Second-order indicator: $X = i^2P = i^1C$.

C is derived from the citation sequence, c_i of the citations of each paper in a publication portfolio of P papers as the total number of citations, $C = \sum c_i$, $I = 1$ to P. Note that both P and C serve as indicators of performance in their respective ways. One can think of $C = iP$ as the first-order integrated indicator for performance. Prathap[8,10] showed that the exergy indicator $X = i^2P$, is an energy-like quantity which can be thought of as a second-order integrated indicator of performance. This paradigm then leads to a trinity of energy-like terms[8,10]:

$X = i^2P$,

$E = \sum c_i^2$,

$S = \sum(c_i - i)^2 = E - X$,

where

$P = \sum 1$

$C = \sum c_i$

$i = C/P$.

The h-index is constructed by ordering the citation sequence in a monotonically decreasing fashion[11]. Highly cited articles are seen to be concentrated in a small core, implying a possible huge variation in the quality of the papers in the publication set. Prathap[8,10] argued that when such high skews are present, the product $X = iC = i^2P$, which is a robust second-order indicator is a better proxy for performance than C itself. Apart from X, an additional indicator E also appears as a second-order indicator as seen above. The coexistence of X and E allows us to introduce a third attribute that is neither quantity nor quality. In the context of 3D data management[5], the attribute ‘variety’ is introduced as a third component. We find that in a bibliometric context, the appellation ‘consistency’ may be more meaningful. The simple ratio of X to E can be viewed as the third component of performance, namely the consistency term $\eta = X/E$. Perfect consistency ($\eta = 1$, i.e. when $X = E$) is a case of absolutely uniform performance; that is, all papers in the set have the same number of citations, $c_i = c$. The greater the skew, the larger is the concentration of the best work in a few papers of extraordinary impact. The inverse of consistency thus becomes a measure of concentration.

Thus, for a complete 3D evaluation of publication activity, we need P, i and η. These are the three components of a quantity–quality–consistency or volume–velocity–variety landscape.

Methodology

We look at all items from the 32,594,816 records in the data limits selected within the *WoS* that match the various queries (see below) during the period 1986 – all years (updated 1 November 2013) for which subscription was available. All articles P and citations C gathered by these P articles are counted. Then the impact i is computed for this period. From the citation sequence for each entity (author, city, state, etc.), consistency η can be computed using simple Excel spread-sheet functions.

Using all three components together, a z-index can be computed from an energy-like term ($Z = \eta X = \eta^2E$) as $z = Z^{1/3}$, which has the same dimensions as the number of publications, and therefore also the h-index[11]. Since X is exergy and E is energy, it is possible to imagine a composite indicator named zynergy for $Z = \eta X = \eta^2E$. This index combines quantity, quality, and consistency (or efficiency) in the true spirit of 3D evaluation. One can think of P, i and η as primary bibliometric indicators, and the h- and z-indices are secondary, composite indicators.

However, the precise computation of η requires knowledge of the complete citation sequence (i.e. the distribution curve) for each individual scientist (or aggregation like institute, journal or country). This is obtained directly from the *WoS* for each country, organization, author and journal taken up in the present analysis and the protocol to obtain this is discussed below.

Data, results and discussion

We shall first investigate how the three-dimensional components and the *h*- and *z*-indices vary with the publication year. For this we refine the analysis using the publication years option adopting the following strategy:

Publication Name=(current science)
Refined by: Document Types=(ARTICLE OR NOTE) AND Publication Years=(xxxx)
Timespan=All years. Databases=SCI-EXPANDED, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC.

Table 1 shows the variation of the three primary bibliometric components and the *h*- and *z*-indices with publication year of the articles and notes published in *Current Science*. We have terminated the list with the year 2008, as articles and notes of more recent origin would not have had enough time to collect a reasonable number of citations. In terms of impact (which is arguably a meaningful proxy for quality), the most successful year was 2000, when the following two papers collected more than 100 citations:

Title: Small-angle neutron scattering diffractometer at Dhruva reactor
Author(s): Aswal, VK; Goyal, PS
Source: CURRENT SCIENCE Volume: 79 Issue: 7 Pages: 947-953 Published: OCT 10 2000
Total citations: 166
Average citations/year: 11.86

Title: An introduction to the proper orthogonal decomposition
Author(s): Chatterjee, A
Source: CURRENT SCIENCE Volume: 78 Issue: 7 Pages: 808-817 Published: APR 10 2000
Total citations: 126
Average citations/year: 9.00

In 13 out of the 22 years listed in Table 1, no article collected more than 100 citations. The most highly cited paper appeared in 1996:

Title: Arsenic in groundwater in seven districts of West Bengal, India - The biggest arsenic calamity in the world.
Author(s): Mandal, BK; Chowdhury, TR; Samanta, G; et al.
Source: CURRENT SCIENCE Volume: 70 Issue: 11 Pages: 976-986 Published: JUN 10 1996
Total citations: 250
Average citations/year: 13.89

During this period, the paper which has most rapidly collected citations is:

Title: High resolution daily gridded rainfall data for the Indian region: Analysis of break and active monsoon spells
Author(s): Rajeevan, M.; Bhate, Jyoti; Kale, J. A. et al.
Source: CURRENT SCIENCE Volume: 91 Issue: 3 Pages: 296-306 Published: AUG 10 2006
Total citations: 192
Average citations/year: 24.00

Figure 2 is a two-dimensional map showing the evolution of the *h*- and *z*-indicators with publication year. The *h*-index is now a popular indicator of bibliometric performance that combines quantity with quality in a heuristic manner[11]. The *z*-index is a composite indicator that by design incorporates the consistency aspect as well into the measure for bibliometric performance. It would appear that the performance of *Current Science* as a journal peaked around 2000 (highest impact) to 2002 (second highest impact and highest consistency). The subsequent slide could be attributed to the fact that the number of articles and notes has declined after 2005 and also that the window after that may not have been sufficient for articles published after 2002 to have collected their fully deserved lot of citations. It was for this reason that the list has been terminated with the year 2008. A five-year citation window is considered to be reasonable from this

Table 1. Variation of the three primary bibliometric components and the *h*- and *z*-indices with publication year of the articles and notes published in *Current Science*

Year	P	i	η	h	z
1987	519	1.97	0.15	12	6.75
1988	543	1.71	0.23	12	7.13
1989	530	1.60	0.19	11	6.33
1990	295	2.28	0.07	11	4.69
1991	223	3.75	0.08	12	6.42
1992	190	5.21	0.19	15	9.94
1993	297	4.55	0.11	17	8.66
1994	311	3.33	0.06	12	5.76
1995	301	4.02	0.23	18	10.36
1996	334	6.39	0.13	20	12.09
1997	319	6.33	0.15	19	12.46
1998	360	4.87	0.31	19	13.80
1999	427	5.30	0.27	21	14.88
2000	415	8.39	0.25	27	19.31
2001	432	7.67	0.32	26	20.17
2002	360	7.71	0.47	22	21.59
2003	391	7.43	0.26	24	17.80
2004	445	6.50	0.43	21	20.06
2005	487	6.45	0.32	22	18.73
2006	434	6.67	0.23	22	16.40
2007	460	4.47	0.37	16	15.01
2008	366	3.14	0.35	14	10.80

Table 2. Values of the three primary bibliometric components and the h- and z-indices for leading authors who have published in *Current Science*

Authors	P	i	η	h	z
KUMAR S – CSIR	31	4.48	0.44	8	6.50
KUMAR A – CSIR	24	7.88	0.36	8	8.15
MISHRA DC – CSIR	20	5.95	0.40	6	6.58
RAVISHANKAR GA – CSIR	20	8.05	0.57	8	9.06
GADGIL S – IISc	20	20.75	0.54	12	16.73
RAVINDRANATH NH – IISc	17	8.29	0.37	6	7.56
SUKUMAR R – IISc	13	16.23	0.35	6	10.65
GADAGKAR R – IISc	12	5.83	0.44	5	5.66
GADGIL M – IISc	12	10.00	0.58	6	8.85
BALASUBRAMANIAM R – IIT	17	2.76	0.47	4	3.93
MOHANTY UC – IIT	16	4.13	0.37	5	4.64
SINGH RP – IIT	16	8.06	0.21	5	6.02
RAI DC – IIT	10	3.30	0.28	3	3.11
MISHRA DC – NGRI	20	5.95	0.40	6	6.58
THAKUR NK – NGRI	19	2.79	0.30	4	3.53
SINGH VS – NGRI	15	5.00	0.57	5	5.96
GAUR AS – NIO	15	3.07	0.42	5	3.91
TRIPATI S – NIO	12	1.58	0.49	3	2.46
MURTHY KSR – NIO	11	3.55	0.63	5	4.44
SINGH AK – IARI	9	3.22	0.30	3	3.05
KUMAR S – IARI	8	7.13	0.57	4	6.13
SINHA SK – IARI	8	6.38	0.48	4	5.37
Mandal BK	9	71.44	0.39	7	26.07
Nandy A	5	73.00	0.47	5	23.23
Rajeevan M	9	43.89	0.38	7	18.81

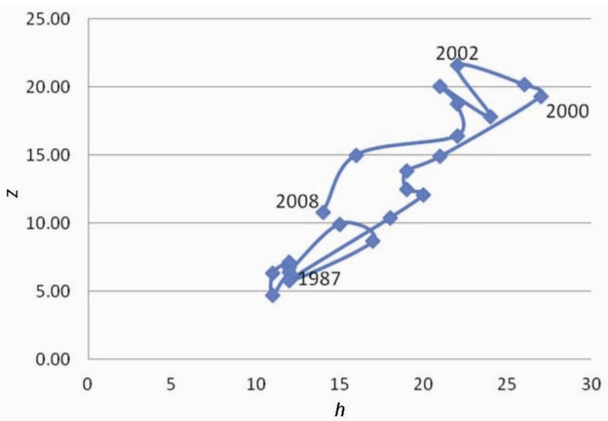

Figure 2. A two-dimensional z–h map showing the evolution of these indicators with publication year.

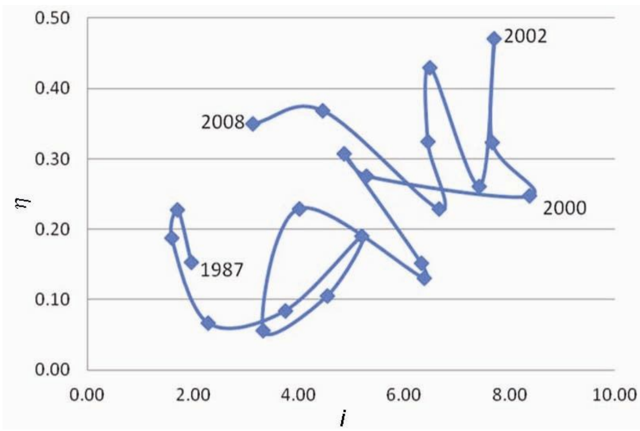

Figure 3. A two-dimensional map showing the evolution of the i and η indicators with publication year.

point of view. Also, the relative decline in the number of items under articles and notes and the corresponding increase in the category comprising letters and editorial material which usually gather fewer citations have also caused this decline in impact. We can best appreciate these results by examining the evolution of the i and η indicators with publication year. This is shown in Figure 3. It is seen that 2000 is the year of highest impact and 2002 the year when the highest consistency was obtained.

We can also refine the analysis according to the authors option adopting the following strategy:

Publication Name=(current science)
Refined by: Authors=(xxx)
Timespan=All years. Databases=SCI-EXPANDED, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC.

Table 2 shows the leading authors who have published in *Current Science*. Because of problems involving disambiguation (for example, Kumar, S. is shown to have 101 publications and is seen to be multiple persons from as many as 83 organizations), we have adopted a staged refinement strategy, first by organization, and then by author. For example, the search strategy:

Publication Name=(current science)
Refined by: Document Types=(ARTICLE OR NOTE) AND Organizations-Enhanced=(COUNCIL OF SCIENTIFIC INDUSTRIAL RESEARCH CSIR INDIA) AND Authors=(KUMAR S)
Timespan=All years. Databases=SCI-EXPANDED, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC.

will pick up the first entry of the first twenty-two authors listed in Table 2. For these authors, there is a good correlation between the h- and z-indices (Figure 4).

Also shown in Table 2 are three 'citation stars', who have the most highly cited articles in *Current Science* during this period. They are picked up using the strategy shown below:

Distinct Author Summary: Rajeevan, M
Refined by: Source Titles=(CURRENT SCIENCE)
Timespan=All years. Databases=IC, SCI-EXPANDED, CCR-EXPANDED, CPCI-SSH, CPCI-S.

We see that for such cases, the h-index is a poor measure of performance and that the z-index is a more meaningful proxy. This is also clear from Figure 4.

The advanced search option of *WoS* can be used to perform a city-wise and state-wise analysis. Typical search options are shown below:

CI=(delhi OR new delhi) AND SO=(current science)
Refined by: Document Types=(ARTICLE OR NOTE)
Timespan=All years. Databases=SCI-EXPANDED, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC

PS=(kerala) AND SO=(current science)
Refined by: Document Types=(ARTICLE OR NOTE)
Timespan=All years. Databases=SCI-EXPANDED, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC

Table 3 shows the values of the three primary bibliometric components and the h- and z-indices for leading cities and states which have published in *Current Science*. Figure 5 shows the two-dimensional z–h map showing the leading cities and states of India which have published in *Current Science*. Bangalore's, and therefore Karnataka's strong showing is not unexpected. Low consistency values are seen for Kolkata, and therefore for Bengal, because of the concentration of citations in a few highly cited papers.

Concluding remarks

To the best of my knowledge, a bibliometric profiling of *Current Science* based on quantitative indicators has not been performed before. The three-dimensional strategy breaks down scholarly performance into three components – quantity, quality and consistency. Citation data from the *WoS* are used. We quantify the evolution of these primary indicators with time, and along with two

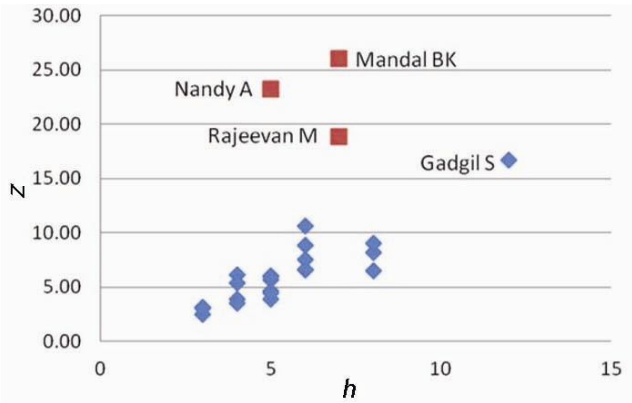

Figure 4. The two-dimensional z–h map showing the leading authors in *Current Science*.

Table 3. Values of the three primary bibliometric components and the h- and z-indices for leading cities and states which have published in *Current Science*

City/States	P	i	η	h	z
bangalore OR bengaluru	1303	4.62	0.21	31	18.03
chennai OR madras	419	4.68	0.25	20	13.13
mumbai OR bombay	457	4.30	0.16	17	10.97
delhi OR new delhi	1009	5.24	0.20	28	17.64
kolkata OR calcutta	347	6.25	0.07	19	9.68
hyderabad	749	4.51	0.29	21	16.48
kanpur	170	3.59	0.22	13	7.82
kharagpur	86	6.00	0.27	11	9.38
chandigarh	117	4.12	0.26	10	8.07
roorkee	88	5.08	0.31	11	8.89
KERALA	216	5.58	0.30	18	12.62
UTTAR PRADESH	1194	4.70	0.32	25	20.34
TAMIL NADU	577	4.19	0.29	20	14.34
MAHARASHTRA	786	5.74	0.14	28	15.39
KARNATAKA	1348	4.71	0.22	31	18.78
ANDHRA PRADESH	879	4.47	0.30	22	17.44
BENGAL	373	7.05	0.09	21	11.69
GUJARAT	364	5.28	0.32	20	14.74

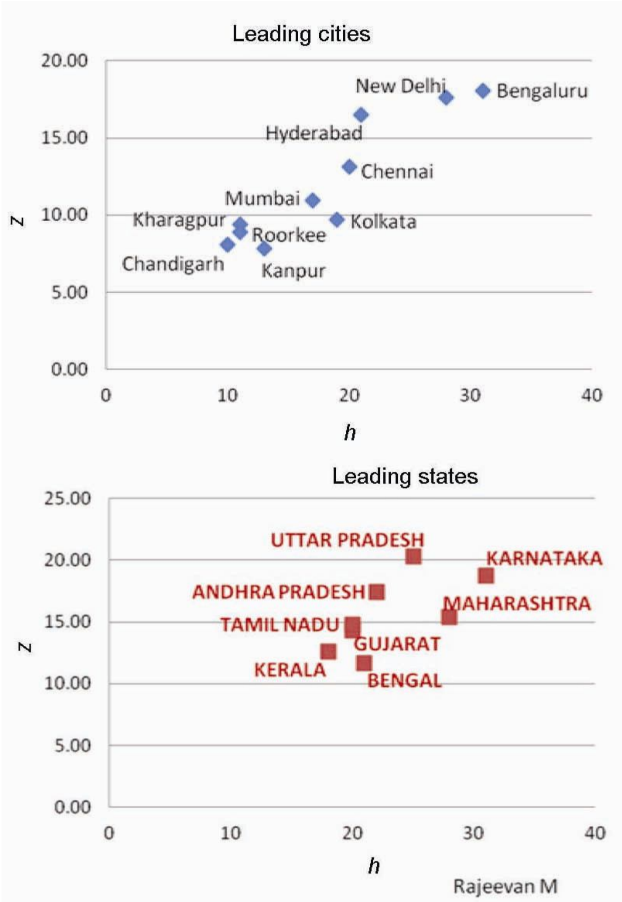

Figure 5. The two-dimensional z–h map showing the leading cities and states of India which have published in *Current Science*.

additional secondary indicators, the h-index and the z-index, identify the most productive authors, cities and states that have published articles and notes in *Current Science* in the recent past. The performance of *Current Science* as a journal peaked around 2000 (highest impact) to 2002 (second highest impact and highest consistency). There has also been a steady decline in the number of articles and notes after 2005 and arguably this is one factor that contributes to the decline in impact.

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