Science & Technology Research Impact and the Associated Factors:

Analysis of Cross National Data

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Sponsored by

CHORD, DST
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About NSTMIS:

The National Science and Technology Management Information System(NSTMIS),a division of Department of Science and Technology (DST) has been entrusted with the task of building the information base on a continuous basis on resources devoted to scientific and technological activities for policy planning in the country.

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Disclaimer:

Every care has been taken to provide the authenticated information. However, the onus of authenticity of data rests with the PI of the project.

Contents

List of Abbreviations

CitableDocs	Citable Documents
CitesPerDoc	Citations per Document
DORA	Declaration on Research Assessment
GDP	Gross Domestic Product
Inter.Collab.	International Collaboration
JCR	Journal Citation Ratio
NIRF	National Institute Ranking Framework
R&D	Research & Development
RefPerDoc	References per Document
S&T	Science & Technology
SJR	Scimago Journal Ranking
TotalCites	Total Citations
TotalRefs	Total References

List of Graphs

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Summary

Academic establishments and funding agencies around the world are increasingly interested in assessing the quality of academic output. Most judgments about research are based on perceived quality of the publications. This study examined the factors associated with scholarly impact from a select macro and micro perspectives. The analyses was intended to provide evidence base and policy lead.

Objectives

The objectives of the study were to -

1. Examine the S&T publication patterns and their subject-wise distribution for major S&T publishing countries.
2. Analyze the overall citation patterns and their subject-wise trends.
3. Capture and analyze the comparative data on bibliometric and non-bibliometric variables for the identified countries.
4. Identify cases of publication impact and the factors associated with them from different countries.
5. Develop evidence based macro understanding for impact and what can be the learning from the international experience for Indian science.

Data and Methods

The data for the analysis were sourced from Scopus citation database and ScimagoJr.com.

The entire set of journal output and the associated citation related data were analysed to learn the functional relationship between citation variables and a set of other bibliographic variables.

Country-wise citation related analyses were narrowed down to 32 countries making up the top 90% of the scholarly literature output. This was done to make the analyses viable without leaving out any major contributor to research output. India is part of these countries.

Two micro analyses were carried out – (a) to understand the citations in the context of international collaborations using 2018 data pertaining to Immunology for select set of countries, including India; (b) to evaluate the validity of tail-end citations. This analysis used 2014-2015 data relating to Economics pertaining to India and the UK. The study also enquired into publisher interest in citations.

Extent of scholarly literature

Scholarly literature as indexed by Scopus for the period 1996-2018 includes output from 239 countries. Despite the vast representation, publications of 32 countries make up the top 90% of the output in Scopus. China and the US figure as the top two countries on CitableDocs. The contributions of Australia, Belgium, Canada, Denmark, Finland, Israel, Netherlands, Norway, Singapore, Sweden, and Switzerland have higher than average citedness per document.

Analysis of citations

The variables identified for this analyses were the extent of Citable Docs; TotalCites; TotalRefs; RefPerDoc; International Collaboration; Scimago Journal Ranking (SJR); CitesPerDoc - both Journal-wise and Country-wise. Both CitableDocs and CitesPerDocs were restricted to three-year period 2016-2018.

Total Citations

CitableDocs uniquely explained 78.1% of the observed variance in the Regression model (as derived from the part correlation), followed by SJR, which accounted for 20.1%. Articles with international

collaboration on its own accounted for 0.8% of the total, and RefPerDoc -0.7% of the accounted variance.

The same set of four predictor variables were regressed against TotalCites for articles in each of the 27 subject categories identified by Scopus. The results indicate that the four chosen independent variables explain a high degree of variance ranging from 97.7% (R^2 .977) for Agricultural and Biological Sciences to 27.8% (R^2 =.278) for Economics. SJR makes a substantial and statistically significant difference in all the subjects in accruing total citations. The results on the whole reveal that citations accrued to articles in journals in different subjects depend mostly on the number of CitableDocs published by the journals indexed in Scopus. Higher the number, greater the citations accrued.

Actual and estimated citations to Indian journals

Total citations accrued to 499 Indian journals during 2016-2018 period was 93,380. As per the estimates based on regression equation derived in the multivariate model this should have been 154,803 citations. There was a shortfall of 61,423 going by the larger trends in Scopus indexed journals.

CitesPerDoc

It is not the total citations, but the higher citation impact of what is published, considering countries and their respective scholarly academic base comes in varying size.

The results of this analysis indicate that high impact for CitableDocs is a function of the Publication appearing in journals with high SJR more than the other variables. The Regression analyses for CitesPerDoc for 27 subjects show statistically significant results. Total Variance accounted for vary from a low of 7.6% (for Biochemistry, Genetics & Molecular biology) to a high of 96.8% (Energy).

Actual and estimated CitesPerDoc for Indian journals

Regression equation derived in the multivariate model indicate that the mean CitesPerDoc for Indian journals was 0.650 against the estimated value of 0.720. Scholarly contributions in our journals are less frequently cited that the estimated figures based on the world trends.

Analysis of citations at country level

Multivariate linear regression with the predicator variables - Researchers in R&D per capita; Total expenditure in R&D per capita ($); University Education Index, GDP (PPP) per capita, Citable Documents with Total Citations as criterion variable returned R^2 of .991. Beta values significant in the context were University Education Index (ß .231**), GDP (PPP) (per capita) (ß .052*), and CitableDocs (ß .820**)

The results indicate that

- If we want higher citation figures against the country we can rely on publishing more citable documents, focus on university education standards, and economic development as reflected in GDP(PPP).
- However, this does not result in higher CitesPerDoc. It is the higher R&D Expenditure that matters more along with better economic development as reflected in GDP (PPP).
- Higher number of CitableDocs does not result in higher CitesPerDoc.

Estimated and actual citations to Indian contributions

Indian scholarly contributions have appeared both in Indian and foreign journals. During 2016-2018 our contributions had accrued 1,939,535 total citations against the estimate of 2,471,399 based on the Regression equation. We accrued 531,864 citations less. Our Cites PerDoc was only 4.33 for the period as against the estimate of 4.68 based on Regression equation for CitesPerDoc, a shortfall of 0.35 per citable documents.

Are journals of some countries better than the others in citation yield?

This analysis explored possible mean difference in Total Cites among the journals of the countries making up the top 90% of the total citable documents in Scopus, using Anova statistic.

Total Citations

The main Anova inclusive of all the journals showed significant F Ratios indicating that there exists a statistically significant difference in Total Cites yield among country-wise grouping of journals. The analysis also indicate that in 13 of the 27 country-wise subject grouping of the journals a significant statistical difference is noticeable.

Indian journals accrue significantly lesser mean citations compared to those of Netherlands, Switzerland, the US, the UK as a whole, and so also in specific subjects, namely Engineering, Environmental Science, Medicine, Pharmacology, Toxicology, and Pharmaceutical, Social Sciences, and Veterinary Sciences.

Citesperdoc

Similar analysis carried out on variable CitesPerDoc for country-wise journal groupings and also their subject-wise groupings show a more complex pattern. Pecking order of journals for higher CitesPerDoc is those published in Netherlands, the US, the UK, Switzerland, Germany, and the others

Analyses of data for countries with high citation impact

This analysis explored the international collaboration, collaboration advantage, and desirability of publication in journals of higher SJR with publication and citation data pertaining to immunology. Four countries – Denmark, Netherlands, Sweden, and Switzerland – which have shown high citedness were considered for the analysis. Incidentally, these countries are also high on international collaboration in Citable Docs. Data pertaining to India was used for comparison.

Total Indian publications on immunology is more than twice that of Netherlands and Switzerland, and thrice as much as Sweden and almost four folds that of Denmark. However, the citation intensity for Denmark, Switzerland, Sweden, and Netherlands is twice or more than that of Indian publications. Despite the variation in number of total publications, extent of total authorial involvement remains more or less the same for India and Netherlands because of international collaboration. The number is not far behind for Switzerland. Mean number of authors for Indian contributions was 4.73 as against 10.72 for those of Denmark, and 9 and a fraction above for the other three.

Approximately 20% of Indian contributions had international collaboration compared to 77% for Denmark; 77% for Switzerland; 71% for Sweden and 75% for Netherlands.

In our international collaborative research projects we have been in lead in more than half the cases. The tabulated citation data shows that when Indian researchers were in the lead, almost for 25% of those collaborative publications the citation yield was 0 and so it goes. The other four countries had substantially greater proportion of CitableDocs with 10 or more citations. The distribution points to factors other than publication quality in play in citation yield.

The analysis was taken one step further to understand whether the publications of the five countries yield overlapping citations when they are published in journals of similar SJR category. Indian publications get significantly less citation yield compared to the other four countries individually. Indian research publications, despite being in the 'same company' seem to get significantly different citation impact. It is not where you publish, who you are seem to matter for citation yield.

Journal clustering on Publishers and citation distribution in Scopus

Top three publishers - Elsevier, Taylor & Francis, and Springer - own 4,769 (19.37%) of the total journals in Scopus. Each of these business houses published over 1,000 plus indexed journals. The next three publishers, in descending order of titles indexed – Sage, Wiley, and Blackwell - owned Journal titles ranging from 500 to 999 making up 9.14% of those indexed in Scopus. These six top publishers cumulatively publish **36.04% of** the total citable docs, and these have accounted for 42.29% of the citations accrued during 2016-2018 period. Elsevier alone made up 8.59% of the total journals, 17.86% of citable publications, and 24.92% of the citations.

At the other end of the journal distribution were those publishing one journal. There are 5877 of those making up 23.88% of the total, contributing 15.12% of the articles to Scopus, and got a citation yield of 5.20% of the total.

The distribution is explicit in being skewed towards a few top publishers both in terms of journal ownership, total CitableDocs, and TotalCites.

CitesPerDoc depends most on SJR. SJR is prestige of the journals. This prestige is a construct of the scholars themselves. The chances of an average journal (included in Scopus) from a developing country being in the top of this 'prestige' heap is not feasible and so higher CitesPerDoc from the CitableDocs in the journals from developing country like India is very less probable. Among the 4,533 Scopus indexed journals which have SJR one or higher, Brazil has 4, China 25, India 3, Mexico 1, and Turkey 0. These are the countries which are in the middle and lower income bracket. To contrast this are the journals from the US in this category are (1773) 28.55%; the UK (1502) 27.39%; Switzerland (120) 23.30%; Netherlands (719) 34.72%; Germany (256) 15.88%; Denmark (4) 11.11%. We have to understand that these journals are the product of the local research culture, and this culture sets the standards for science.

The analysis of data on immunology in the study also holds this out clearly. The chances of contributions with international collaboration getting cited is less for Indian publications falling in this category. The analysis also shows that even when Indian contributions appear in the journals of broadly overlapping SJR categories the citation accrual is significantly less. This trend supports the social constructivist argument of citations, as against the normative theory.

If Indian scientific contributions need such a recognition we need to work hard in multiple fronts of economy, as CitesPerDoc is a function of higher GDP(PPP) per capita, as also greater expenditure on R&D. It is only then we can enter the elite club. Without that even publications in higher SJR would run short on this.

The relevant question in the context is whether we can make a good scholarly contribution in the context of low investment or from the less developed countries? Though it is immensely possible, chances of them getting cited is low as the analysis from the Scopus data suggest.

Given the lukewarm acceptance of Indian scholarly publications as demonstrated in the analyses, the appropriate question could be how does it serve our science and what the society looks from such pursuits. The analysis shows that there is a pecking order among the journals and author affiliations. The source and also the contributions of some countries are preferred in citation terms than the others. This suggests the play out of social constructivist view of knowledge growth and citation practice. In that scheme of things both Indian citable documents and Indian journals do not figure prominently. It is so across the subjects. In such a context perhaps promotion of wider local science base and generating locally relevant knowledge needs emphasis, apart from engaging with contemporary science and technology in general. Nonetheless, this has to be approached strategically with a longer term perspective. As we are so engaged we have to acquire the best practices in scholarly journal management, among others.

We may take a careful look at the evaluation practices like Sistema Nacional de Investigadores (National System of Researchers) adopted by Mexico as the country's main instrument for stimulating competitive research in science and technology. SNI is a cornerstone of the higher education system in Mexico, and is authorized to rank both research and researchers.

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Chapter 1
Introduction

Science and technology impact is part of the larger body of research on scientific productivity. In academic institutions, research productivity refers to publications, as most research works are reported as publications. Major outputs from research are publications, patents, and product developments. Scholarly journal articles, books, chapters in books, conference papers, monographs, along with some others, are included in publication counts. Among the publications, peer reviewed journal articles are most frequently used as a productivity measure. Impact refers to productivity of scientists in their research performance and their direct or indirect endorsement by the peer group.

In the recent years the extent of scientific research has proliferated due to massification of higher education. Consequently science has become expensive to produce. Funding agencies around the world are increasingly interested in assessing the quality of academic research. Several governments with centralized academic funding mechanisms have implemented research evaluation systems and distribute at least a portion of research funding on the basis of quality assessments. To add to this increasing competition among institutions has necessitated a control.

Producing a lot of research is not the same as producing good research. Most judgments about the published research are based on perceived quality of publication, or by ascribing to the research perceptions the journal or the publisher that prints the research. This kind of judgment about article or journal quality is inherently subjective. Evaluation criteria represent different views of scientific activity and choice made in resource distribution in recognizing merit among researchers and institution. To that extent all forms of evaluations are arbitrary.

Qualitative approach to evaluation is grounded in peer review. The approach is said to suffer from subjectivity, conservatism, corporatism, and conflict of interest. The quantitative approach comes with bibliometrics in productivity evaluation.

Replacement of evaluation through peer review with reliance on metrics in matters such as recruitment, funding, and institutional evaluation has reached our door steps. For instance, NIRF and UGC giving weightage to Web of Science or Scopus indexed articles (not necessarily citations to them), citation impact of publication in the context of Bhatnagar Award, suggests confirmation with dominant trend of viewing citations and sources which give a perceived credible measure as valid criterion.

It is well established that there are large differences in productivity among scientists. Relatively small proportion of scientists contributes a majority of the publications. Lotka (1926), almost a hundred years ago, formulated his famous inverse square law of productivity, which states that the number of authors producing n papers is approximately 1/n2 of those producing one. Highly skewed pattern of productivity in scientific publishing is established by later studies as well (Kyvik, 1991).

Citation analysis is expected to provide some degree of objectivity for assessments of research impact. The argument is that an article (and also the journal in which it is published) that is cited by many researchers has, in some way, made a significant contribution to science. There are many criticisms of this approach.

The emphasis on quantification of scientific activity has its own consequences. While it simplifies and brings in an element of objectivity, accomplishing the yardsticks may become an end in itself. This has led to 'accelerated academy' or 'productivity culture' and this opens the ways to specious self-citation, strategic citations, salami publication, and growing incidence of plagiarism and scientific retraction (Ding, et al. (2020); Smolčić (2013); https://retractionwatch.com/). As Werner (2015) would put it: 'When we believe that we will be judged by silly criteria we will adapt and behave in silly ways.'

This study intends to understand the impact as it is understood in the citation context, explore the dynamics of accruing more citations for publications, and built in bottlenecks in the process. This becomes important in the context of a developing country like ours where more research, both in terms of output and their impact, is due. If the output is dubbed as less important, it may result in dependence on external sources for both ideas and technologies, which could result in the long term falling behind or followership in S&T.

The outcome of the study is presented in the following chapters:

1. Introduction
2. Research methodology
3. Literature survey
4. Scholarly output in science and technology
5. Analysis of Total citations
6. Analysis of Citations per document
7. Citation and economic variables
8. Citation impact and country-wise journal groupings
9. High impact countries – A case analysis of immunology
10. Tail-end citations – A case analysis of economics
11. Publisher-wise citation distribution
12. Summary and conclusions

Chapter 2

Research Methodology

The study intended to understand the factors affecting S&T impact. Impact as a concept in bibliometrics falls in the confines of publications and citations associated to them. Based on citations article quality is ascertained and citation impact is correlated with other associated variables.

The immediate variables that make the publication universe in the context are the following:

Author: Main and joint authors; collaborator/ international collaborator; discipline/institution/country affiliation
Title / contents: Title per se; subject area that could be derived from title
Journal: subject; discipline/ country affiliation; impact factor (JCR)
Imprint: Publisher / Year/ country affiliation
Citations: citations to Journals / author(s) (self or external) discipline/ institution / country affiliation/

The associated external variables include, GDP of the country, R&D personnel base, R&D investment, and such others.

Citation impact is a dynamic variable and it changes continuously. Updates depend on the database and indexing capability of citation database publisher. However, the public domain databases like https://www.scimagojr.com/ provide such data for a given period. This study examined as to what are the factors associated with S&T Impact with macro and micro perspectives to facilitate policy leads for science administration.

More specifically the objectives of the study are:

1. Examine the S&T publication patterns and their subject-wise distribution for select S&T publishing countries.
2. Analyze the overall citation patterns and their subject-wise trends.
3. Capture and analyze the comparative data on bibliometric and non-bibliometric variables for the identified countries.
4. Identify cases of high impact publications and the factors associated with them from different countries.
5. Develop evidence-based macro understanding for high impact and what can be the learning from the international experience for Indian science.

The data for the analysis was sourced from Scopus citation database. Apart from the database, the Scopus data is also made available in ScimagoJr.com public domain source for different time periods. Both the sources were used for the study. Scopus is the largest - in terms of journal (and other sources) - coverage among the commercial citation indices. Scopus has been widely accepted among the Indian academics and educational administrators to benchmark scholarly impact, and also to an extent for productivity measures. The study considered the following variables for various analyses.

Author	For analysis on collaboration and its association with the citation impact
Title	For analysis on subject-wise distribution of citable documents and its relations to total citations, and citations per document
Journal	Journal country affiliation and its relations
	Subject-wise journal ownership across the countries and its relation to citation
Imprint	Country-wise distribution of citations and its associations
	Publisher clustering in Scopus and the citation distribution among them
Other variables	Select economic and infrastructure related variables and their relations with total citations and citations per document

Time period considered for most of the analysis was the three-year period (2016-2018) as obtained from https://www.scimagojr.com/ database. The entire set of data was analysed initially to ascertain the international distribution of productivity and citation intensity. To make the analysis viable and meaningful, the data considered were narrowed to the top 90% of the S&T literature output. This limited the countries included in the analysis to 32. These were the following:
Australia, Austria, Belgium, Brazil, Canada, China, Czech Rep., Denmark, Finland, France, ermany, Greece, India, Iran, Israel, Italy, Japan, Mexico, Netherlands, Norway, Poland, Portugal, Russia, Singapore, South Korea, Spain, Sweden, Switzerland, Taiwan, Turkey, the UK, the US,

The analysis attempted the following:

1. Extent of publication – Total publications for all the subject areas included in Scopus and in different subject areas as categorized by the database;
2. Extent of cited and uncited documents – Total publications for all the subject areas and also separately for all the subject areas as cateorised by the database;
3. Bivariate relations between total citations and Citations per documents published in different journals and a set of independent variables such as references per document, Total citable documents;

4. Multivariate analysis of Total Citations and Citations per Document published in different journals as per their country affiliations and a set of independent variables such as Citable documents, SJR, International Collaboration, References per Document, and economy, Infrastructure related variables;
5. Multivariate analysis Total Citations and Citations per Document in different journals as per their subject categorization and a set of independent variables such as Citable Documents, SJR, International Collaboration, References per Document, and economy, Infrastructure related variables;
6. Mean difference in Citations and Citations per Document in journals published by countries making up top 90% of the S&T literature;
7. Analysis of International Collaboration related data for a narrower subject for the year 2018 for high impact countries, namely Switzerland, Netherlands, Denmark, Sweden, and India to understand how collaboration makes a difference in citation yield;
8. Analysis of publications under economics of the UK and India for the years 2014 and 2015 to understand the features of tail end citation distribution;
9. Analysis of journal clustering on publishers along with distribution of citable documents and citations among them.

Data analysis

The study used the following statistical methods to analyze the data:

- Linear regressions for both bivariate and multivariate analyses to understand the functional relations of journal ownership and citations as also Citations per Document and other independent variables.
- Anova to understand the mean difference in Total Citations and Citations per Document for journals published by countries as a whole, and the subject wise distribution of the same
- Chi Square analysis to explore the association between tail end citations for Economics related data relating to India and the UK
- Frequency distribution and proportions were used to represent the journal clustering

SPSS software was used for data analyses.

Scope and Limitations

The study was exploratory in nature and intended to arrive at policy leads based on the analyses. These analyses answered questions such as: how we may get better citation impact; how far the received wisdom on citation impact can work for us; and also the reliability of citation index for policy leads.

The analyses considered journals from all the countries represented in the database for initial analysis. The analyses were later confined to 32 countries making up 90% of the total Citation impact based. To understand the international collaboration effect of very high impact countries the study was confined to four European countries (based on the initial understanding of citation intensity) and India. The analysis considered 2018 immunology literature indexed in Scopus. Tail-end citation pattern was explored for citable documents in economics indexed in Scopus. This analysis explored the output from the UK and India for two years – 2014 and 2015.

The study also explored as to publishing in journals of which countries matter for citation impact, and also publishers' role in citation measure.

Chapter 3

Literature survey

The prevailing trend of managerialism in research and academics is characterized by a growing emphasis on performance, measurement, competition, and accountability. The goal of measuring scientific productivity has given rise to quantitative performance metrics, including publication count, citations, journal impact factor, h-index, and the like. These quantitative metrics now dominate decision making in academic institutions, as also in policy formulation at different levels. In fact, in the recent times citations to publications are at the core of these measures. The practice of citations itself, as opined by historians of science, is a 20th century phenomenon (Nicolaisen 2003).

The underlying assumption of these measures - bibliometrics (or scientometrics) – is, that through citations in their published research output, scientists are engaging in an ongoing poll to elect the best quality academic contributions.

The original purpose of citation was to be ‘a bibliographic system for science literature that can eliminate the uncritical citation of fraudulent, incomplete, or obsolete data by making it possible for the conscientious scholar to be aware of criticism of earlier paper’ (Garfield, 1955). In a later publication, Garfield (1962) listed the following reasons for citing: “Paying homage to pioneers; Giving credit to related works; Identifying methodology, equipment etc; Providing background reading; Correcting one’s own work; Correcting the works of others; Criticizing previous work; Substantiating claim; Alerting to forthcoming work; Providing leads to poorly disseminated, uncited works; Authenticating data and classes of fact; Identifying original publication describing an eponymic concept or disclaiming work or ideas of others (negative claim) ; Disputing priority claims of others (negative homage)”.

Studies in citation analysis were exploratory in nature even in the late 1990s. Garfield (1998) in his assessment and ‘prediction’ of Nobel winners and members of the US National Academy of Sciences through citation analysis, quotes a former Academy president: ‘for every scientist elected to the Academy there is another equally qualified who is not elected’ (Garfield, 1998) (http://www.garfield.library.upenn.edu/papers/scientometricsv43%281%29p69y1998.pdf). The application of bibliometrics data for evaluating science, scientists, and framing policy was a later discovery, and has not been without contestations.

There are two competing theories of citing behavior - the normative theory of citation behavior and the social constructivist view. Both are situated within the broader social theories of science.

Normative theory (Merton, 1979) basically states that scientists give credit to colleagues whose work they use by citing that work. "The reference serves both instrumental and symbolic functions in the transmission and enlargement of knowledge. Instrumentally, it tells of work we may not have known before, some of which may hold further interest for us; symbolically, it registers in the enduring archives the intellectual property of the acknowledged source by providing a pallet of peer recognition of the knowledge claim accepted or expressedly rejected, that was made in that source" (Merton 1979). Thus, citations are expected to represent cognitive influence on scientific work.

Social constructivist view of citing behavior is grounded in constructivist sociology of science (Young & Collins 2004; Latour & Woolgar, 1979). This view casts doubt on the assumptions of normative theory and questions the validity of evaluative citation analysis. Constructivists argue that cognitive content of articles has little influence on how they are received. Scientific knowledge, Knorr-cetina (1981) holds, is socially constructed through the manipulation of political and financial resources, and the use of rhetorical devices for this reason, citations cannot be satisfactorily described unidimensionally through the intellectual content of the article itself. Participatory observation studies have shown that scientists have complex citing motives that, depending on the intellectual and practical environment, are variously socially constructed (Latour and Woolgar, 1979). British sociologist, Gilbert (1977), associated with this view, argues that citing is an aid to persuasion. Garfield (1998), and Leydesdorff (1998) have reflected on citation theory giving different sides of the argument.

For Cozzens (1989, p 440) "Citations stand at the intersection between two systems: one rhetorical system (conceptual, cognitive), through which scientists try to persuade each other of their knowledge claims; and the other reward system (recognition, reputation), through which credit for achievements is associated".

Citing Kaplan (1965), Gilbert (1977), and Latour & Woolgar (1979), Walling (2005) sums up the two sides of the arguments in citation theory, as follows: The constructivist theory rests on the social and economic conditioning of scientific production from an external perspective, based up on the 'impact of journals, the prestige of authors, self-interest, or target audience'. In other words, the influence of one paper within science depends on 'what one says' in the normative view, and on 'who one is' in the constructivist view (Stewart, 1983). Between these two major theories is an eclectic position or multi-dimensional approach, which confront for explanations in the details (Nicolaisen, 2007).

Motives to cite

In fact, the diverse motives to cite, which modify the Mertonian view, have been explored through a host of writings critiquing the concept as viewed by Garfield (1962). Early among them were

MacRoberts & MacRoberts (1996) and Seglan (1998). This has continued over the years through assessments like that of Teixeira (2016), Todd & Ladle (2008), just to name a few.

There are several studies in sociology of knowledge that categorize citations like Chubin & Moitra (1975), and Spiegel-Rosing (1977). Cole's (1975) analysis of papers relating scientific knowledge shows that about half of the articles had cited Merton's works (proponent of normative theory) in a 'ceremonial' fashion.

Moravcsik & Murugesan (1975) classified citations through an in depth analysis of 30 articles dealing with theoretical high energy physics in to the following five pairs of opposite characteristics:

- Conceptual | Operational – Conceptual citation made a connection with a concept / theory, operational with a tool / physical technique;
- Organic | Perfunctory – organic citation is truly needed for the understanding of the citing article; perfunctory one making an acknowledgement that some other work in the same general area of performance;
- Evolutionary | Juxtapositional – Evolutionary citing articles built on the foundations provided by the citing articles; Juxtapositional ones an alternative to it;
- Confirmative | Negational – Confirmative is claims by the citing article that the content of the citing is correct; negational ones correction is disputed;
- Valuable | redundant – Valuable citation is one which is essential; redundant where citation made to several articles, each of which makes the same point.

Camacho-minano et al. (2009) categorise citations under two heads: Conceptual (useful for showing concepts, definitions or interpretations, or for substantiating a statement or an assumption), and operational (contributes additional information, data, a point of comparison, or methodology).

Erikson & Erlandson (2014) suggested a taxonomy consisting of four main categories of motives to cite:

- Argumentation – delimitation, active support (gives support for arguments; cited author's claims are treated as correct; passive support; further reading);
- Social alignment – scientific tradition; scientific self-image; effort compensation;
- Mercantile alignment – credits; own credentials; bartering material (authors are cited in the expectation that they will respond in kind); self-promotion (self-citation) pledging (to make the right impression on the journal editor or (presumed) reviewers;
- Data – Review (present an overview); make analysis (comparing and combining the results of previously published studies); text study (cited text is regarded as data).

There are less honorable reasons to cite too - to boost a friend's citation statistics; to satisfy a potential big-shot referee; and to give the impression that there is a community interested in the topic by stuffing the introduction with irrelevant citation to everybody, often recycled from earlier papers (Werner, 2015).

Several decades of studies on citation analysis has certainly generated a huge amount of interesting statistical material offering remarkable insight into scientific trends and sociological difference between disciplines, specialties, departments, and countries (Smith et al 1986).

Perhaps the notion of discreteness and equality of value of citations need to be revised for adequate models of citing behavior to evolve (Cano, 1989). As it found that 'frequent occurrence of citations are perfunctory (up to 50%), followed by persuasive (40%), and the negational types (up to 15%) (Bornman & Daniel, 2008). Such revelations have led a number of scientists to doubt whether the citations can reflect intellectual and cognitive impact of research as is assumed by the normative theory of citation. Willet (2013) shows that it is very difficult to draw any certain conclusions about citing authors' motives when reading a finished paper.

Garfield has led the defence of normative theory through his extensive analysis, essays and editorials in Current Contents (http://garfield.library.upenn.edu/).

Given this, citation impact is a mine field. This and associated concepts have generated much literature as egos are involved. Increasing hard work of academics in bibliometrics result in either incremental, notional improvement, or confirmation. Every inch of the territory is fought, as there are even more articles on the topic written.

With a long tradition of studies there is a tacit consensus that citation counts are a function of many variables. The probability of being cited depends on many factors that do not have to do with the accepted conventions of scholarly publishing. This varies across time, field, journal, article, author/reader, availability of publication, and technical problems addressed.

Utility of citation index

Amidst divergent views on the utility of the citation analysis, numerous studies have analysed the contributions in various subjects using this method to identify popular journals, authors (Moosa, 2016). Some of these give a glimpse of the growth of science as reflected in citations (Zhao & Li (2015). There have also been many studies which point to lacunae of the technique at the operational level (Adam, 2002). Some others give a panoramic view of these measures and methods as in Bornmann & Daniel

(2008); Some have questioned the veracity of the data used for citation studies (Adam, 2002); Wright's (2008) article 'Fawlty Towers of Knowledge' highlights the secondary and tertiary citation habits where he points to various errors in citations leading to the conclusion that a large proportion of all citations are erratic, including 36 variations of the same reference found in SCI, in the topic that was examined.

Availability of the citation data has facilitated studies correlating economic growth with citation impact (King, 2004, Smith et al., 2014; Allik, 2013) and also their social impact (Bornmann & Haunschild, 2017). There are also studies on what the citation is worth in terms of salary hikes and promotions based on citation impact (Diamond, 1986). Emphasis on citation based evaluation has also led scholars like Jaffe (2014) to wonder whether science is evolving in the right direction.

Citation Index as a product is a labour intensive and expensive enterprise. It was particularly so for Science Citation Index in its earlier phase. The index itself was confined to a small proportion of scholarly journals during the time of Garfield, and it continues to be so even now. Journal being included in the citation index has in itself become coveted thing.

It was Garfield's effort to rank order the journals, depending on the citations received by the articles published in them, called Impact Factor and later promoting this concept as a proxy for predicting the worth of the science they carry – calling it impact – which caused enormous backlash in the scholarly community (Garfield, 2003). Considering this, why and how the concept still lingers is for one to wonder.

"The impact factor of an academic journal is an index that reflects the yearly average number of citations that articles published in the last two years in a given journal received" (Garfield, 2006). 'Impact' is a misnomer in the context. Taken innocently at its face value, the concept makes one think science of some countries is more important than the others. This is not so because of their research content but because they are published in journals indexed in citation indices (consequently higher impact) or cited more often.

Today the value of a scientific publication is increasingly judged by the impact factor of the journal in which it is published. This, even before the publication has time enough to accrue citation on its own. In fact, evaluating the contributions from Impact Factor of the journals is one remove further than the citation itself, and has received resistance.

Impact factor has been critiqued for its misuse by Seglen (1998); Khan & Hegde (2009) Shubert (2012); Fleck (2013) Salimi (2017) and reflected as to how it has influenced publishing (Brown 2007). Some referred to this phenomenon as impact factor mania (casadevall 2014) with its seductive power

(Nkomo, 2009). Some have pointed to the (mis) use of impact factor for marketing of the journals (Fleck, 2013).

Considering Impact factor is what it is, it is somewhat mysterious as to why scientists as a group embrace this. The Declaration on Research Assessment, (DORA) https://sfdora.org/ is the first concerted move to counter its influence in assessment of individual performance.

Along with impact factor came other hybrid measures such as eigenfactor, H-index etc. H Index proposed by Hirsch (2005, 2007) has come under adverse criticism by Barnes(2014), Waltman(2011), Yong (2014), Bornmann (2008). Some contributions have focused on spotting the H-index manipulation by scholars (Bartneck & Kokkelmans, 2011). And in an age where there are more than one citation index, Bar-Ilan (2007) wonders which h index one can use, as the individual measure. It was left to Joint Committee on Quantitative Assessment of Research (A Report by International Mathematical Union, in collaboration with International Council of Industrial & Applied Mathematics, and Institute of Mathematical Statistics (2008) to illustrate and mention 'Even a casual inspection of h-index and its variants show that these are naïve attempts to understand citation records'. While they capture a small amount of information about distribution of a scientist's citations, they lose crucial information that is essential for the assessment of research. The same Report also observes that using impact factor alone to judge a journal (or the article published in them) is like using weight alone to judge a person's health. Counter to journal impact factor as a measure for evaluation has been forcefully culminated in San Francisco Declaration of Research Assessment, which argues for eliminating the journal based metrics in evaluation (https://sfdora.org/). Leiden Manifesto is another move towards correcting excessive dependence of journal impact factor for evaluation http://www.leidenmanifesto.org/

However, considering the resilience of the method and the hardened followership it has accumulated, the later studies have focused on how to make citation happen. Discussion on methodologies for increasing journal impact factors and citation count for individual paper abound in the literature of science – Reciprocal altruism - bloating the reference list in a paper, to boost the number of citations (Corbyn, 2010) being one of them. A study covering articles published in 21 management journals (Judge, et al, 2007), for instance, conclude that researchers can increase the number of times their work is used by others by conducting either qualitative or meta-analytic literature reviews, conducting empirical studies that clearly extend the theoretical base of existing literature, employing longitudinal designs in empirical research, and ensuring that their presentation are clear and readable.

Spanish Law rewards the researchers for publishing in journals that are considered prestigious by Web of Science and Scopus. In Sweden, a Ph.D. student must publish two papers in impact factor 4 journals. Brazil has established a Qualis scale based on the average impact factor of their publications, which is used to grade students and faculty (Cross, 2012). China, Turkey and South Korea offer cash bonuses to scientisits who publish in journals of high impact factor (Chandra, 2017). In Finland Journal Impact Factor is canonized in law (https://bio-diglib.biomedcentral.com/articles/10.1186/1742-5581-2-7). This list seems to be ever growing.

Scimago Journal Ranking - SJR - which Scopus is promoting in place of JIF, ranks journals on the source journal of the reference cited by the articles, and the outward flow of destination journals of the reference from the article published in the journals. The journal ranking is conceptualized as prestige factor. Such computations, however, are based on the citation data, which excludes the citations to the journals not chosen by Scopus. This makes citations a closed and exclusivist universe (https://www.scimagojr.com/SCImagoJournalRank.pdf)

From the days of selfless scientist in the cause of society, we have now reached the paid impact promoters like https://info.growkudos.com/ , apart from a host of writings like, 'Tips to Increase Citation Count & Impact Factor of Research Papers' https://www.proof-reading-service.com/en/blog/how-to-improve-citation-counts-for-academic-and-scientific-papers/

All the same, nobody knows how accurate the raw data are. It is well known to those involved in citation analysis studies that they are certainly not clean, accurate data in the way that some people think. As far back as in 2002, in an article in Nature Adams(2002) mentions that there have been problems in the past of under counting. Even broad subject categorization of documents is in several cases suspect and could be seen in the journal based or source level method adopted for the purpose.

Indian bibliometric contributions

India has contributed much to bibliometric writings - thanks to library movement, elite following of the subject and early appreciation of bibliometrics. An excellent compilation of Indian contributions totaling more than 1000 published articles has been published by Garg & Tripathi (2017, 2018), Sen (2018, 1986). Garg & Tripathi(2018) categorises Indian studies under 10 heads: Scientometrics analysis of Indian academics; Individual journals; different disciplines; assessment of institutional output; studies on collaboration; applicability of bibliometric laws; and theoretical studies. These studies have largely interested library and information professionals. Scientists and academics have not taken these critically though the scientometric analysis, particularly focusing on citation analysis and impact factor affects them directly.

Topics covered for bibliometric analysis range from CO^2 reduction trends to conjunctivitis; microRNA to plastic literature; and monsoons to mobile technology. The studies have covered broad subjects such as agricultural sciences, biological sciences, chemical sciences, engineering and technology, environment sciences, medicines, physics, social sciences, and more. Most of these studies make an estimate of the literature availability, Indian contributions *vis-à-vis* that of the world; popular authors; preferred journals, and the like.

Under bibliometric assessment of Indian S&T using one or the other citation indices, like WoS, Scopus, GoogleScholar, or various abstracting services, they essentially map the Indian scholarly publication trends.

Studies in institutional comparisons deals with productivity, popularity of the output on citations, and sources used by these researchers. Some of these draw comparisons with other countries hinting at the productivity or citation impact gap.

The analysis of journals present the topics covered, source documents used by the contributors, citations received by the journal, and in some of them the impact factor and aspects such as authorship pattern, etc. Nearly a hundred Indian journals are analysed thus.

Several famous scientists representing different specialisations like HJ Bhabha (Swarna et al., 2008), CV Raman (Kademani et al., 1994), MN Srinivas (Devarai et al., 1998) have been analysed to present what they cited, who cited them, topics they wrote on, where they published etc. Others fall in the focus of who cites what, gender differences in productivity (Goel, 1996, 2002), obsolescence studies (Biradar & Kumar, 2003; Gupta, 1998; Mulla, et al 2012; Sudhier, 2007; Vimala et al 1998) and more recently webometric studies (Gopalakrishnan, et al 2002; Jalal, et al 2010; Shukla & Tripathi 2009).

Theoretical studies examine the applicability of Bradford's Law (Rao, 1998; Sudhier, 2010; Devi, 2007), Lotka's Law (Savanur, 2014; Sen, et al 1996, 2010; Sudhier, 2013), Zipf's Law (Janhari, et al 2007; Saxena et al 2007; Sen et al 1998) in various subjects and other contexts.

Among the early enthusiasts of citation studies was S. Arunachalam. In doing so he relied mostly on Science Citation Index. Arunachalam (1998) saw no need for a theory of citation. He published papers on collaboration (Arunachalam, 2000), citation analysis of various topics such as fish science research (Arunachalam, 2001), diabetics research (Arunachalam, 2002), tuberculosis research (Arunachalam, 2002), agricultural research (Arunachalam, 2001) fuel cell research (Arunachalam, 2008) leading up to challenging the relevance of medical science research in India based on Mediline records (Arunachalam, 1997). Most of his studies showed the bleaker side of Indian S&T. These studies were published mostly in library science journals and did not seem to have got much attention from the scientists. The studies have taken suggested bibliometric methods uncritically.

Some of the studies point to relative lack of Indian S&T impact in terms of citations. Given the inferences possible through such analysis it is left to the scientists to pick up the clue as to why it is so. Some studies indicate where to go for collecting more citations or point to the dilemma of Indian scientists while calling for action. Nishy, et al. (2012), for instance, have shown that publishing in foreign journals yield better citations than the Indian ones. Muthamilarasan & Prasad (2014) observe that Impact Factor based evaluation discourages Indian researchers publishing in Indian journals and call for amending the evaluation criteria by Indian institutions to eradicate 'Impact Factor slavery' and stop distinguishing publications as Indian and international.

Garg et al., (2013) analysed data pertaining to about 90,000 papers published by Indian scientists and indexed by Science Citation Index-Expanded (SCI-E) during 2010-2011. The analysis revealed that academic institutions produced about 43% of the output. The highest number of papers was published in the discipline of chemical sciences and the same subject registered the highest impact. About 83% papers were published in journals originating from outside India. The US journals were the most preferred choice for publishing papers. About half of the papers were published in medium impact factor journals and 66% were cited one or more times. IISc, Bangalore, published the highest number of papers and the JNCASR (Bangalore) made the highest impact.

P. Balaram's editorials in Current Science (1998, 2010, 2013) have addressed this issue from scientists' perspective. The editorials on the topic – several of them hard hitting – mention how citation counts and Journal Impact Factors appear to be gaining importance in committee room discussion across the country "… despite many warnings that have appeared in the literature, citation counting is becoming a critical factor in evaluating science". Referring to Science Citation Index (SCI)'s influence as disturbing to less developed countries as the source covers only a few journals from the poorer countries, he opined that the trend may lead to works published in non-SCI journals as 'lost science'. He also mentions that Indian works of similar quality attract lesser attention than the ones from the west. Science, he says, 'is a harshly competitive international game, where the rules are written elsewhere." Describing the then Institute for Scientific Information (ISI) statistics, he says, '… in evaluation of colleagues, journals and institutions in our country, personal knowledge (and prejudices) may still turnout to be better indicators than the raw statistics of the ISI.

Balaram (2013) revisited the concept in his 2013 editorials of Current Science in the context of DORA – San Francisco Declaration of Research Assessment - whose stated intention is to begin 'putting science into the assessment of research', and suggested how even policy makers would also benefit if they set out to understand the tools of research assessment before they begin to use them.

Balaram's (2010) editorial comment in Current Science – stated that the ever increasing emphasis on quantitative parameters in assessing individuals and institutions as a 'bad idea whose time has come' - would still ring a bell in our context. Such sentiments has been voiced also by Philip Atlbach (2013) when he observes 'for India or other developing countries to obsess about rankings is a mistake. There may be lessons, but not rules.

However, these sources and measures persist in the current academic evaluations, as suggested by FAQ in NIRF website: 'Most of the data pertaining to the research, which has a large weightage, is taken from third party and authentic sources like Scopus or Web of Science. This data is certainly valid and correct.' https://www.nirfindia.org/FAQ.html

This is a limited survey intended to capture the main strains of arguments on citation based evaluation. There have been suggestions from the scientometricians to make the citation data more functional by embedding the purpose the citation is intended to serve in the context. There have also been attempts to restructure the presentation of scientific papers (Aalbersberg, et al, 2012)). Till such moves are accepted by the wider scholarly community, we have to deal with the citation data as given in these databases and derive meanings within the accepted framework.

Chapter 4
Growth of S&T Scholarly Literature

S&T literature as indexed by Scopus for the period 1996-2018 includes output from 239 countries. This output covers four different source types, namely articles from journals, book series, conference and proceedings, and trade journals. In 2018 there were as many as 94,283,776 documents in the database. In the same year the database indexed 773 book series; 6,123 conference & proceedings; 24,702 journals; and 373 trade journals. The coverage has grown over the years. As depicted in Graph 4.1 journals have shown a steady increase, so also conference & proceedings.

The database is a cumulation of citable and non-citable documents from these sources. In 2018 the database included as many as 34 million (34,822,182) journal articles from sources published from 119 countries. In the same year the publications of 239 countries were represented in the database, including Herald Island (2 citable articles), Pitconsy (1 citable article).

Graph 4.2 presents the distribution of journal articles for the top countries. Despite the vast representation, publications of 32 countries make up 90% of the output in Scopus. Ranked in descending order the US makes up 22.26% of the total, followed by China (10.88%), the UK (6.36%), Germany (5.57%), Japan (5.07%), France (3.91%), Canada (3.22%), Italy (3.22%), India (3.08%), and others (Table 4.1). Ten percent of the total literature at the bottom is made up by 207 other countries featured in the database. Various analyses presented in this study examine the entire set of data, and also the subsets of the same to understand how S&T impact works.

Graphs 4.3 and 4.4 present the data and the trends in growth of citable and cited articles for the select top countries. India figures in both the representations. However, significantly noticeable trend is dominance of the US and China. There is a relative decline in the US contributions to the database in proportion to the total, which is mainly due to increase in that of China, particularly from the year 2000 onwards. Rest of the top countries' contribution to Scopus, more or less, remains the same during the period.

Table 4.1 Country-wise Citable Documents (2018)

Country	Citable docu ments
United States	570104
China	569227
United Kingdom	172148
Germany	158437
India	152110
Japan	118409
France	106278
Italy	102581
Canada	95047
Australia	89153
Russian Federation	95359
Spain	84147
South Korea	79646
Brazil	74195
Netherlands`	53784
Iran	54915
Poland	45365
Switzerland	41973
Turkey	39847
Sweden	38073
Taiwan	33455
Belgium	30295
Malaysia	31102
Indonesia`	31708
Denmark	25662
Austria	23107
Portugal	23023
Mexico	22515
South Africa	21843
Czech Republic	22539
Norway	21017
Saudi Arabia	21598
Israel	19380
Singapore	19903
Egypt	20074
Hong Kong	19571
Finland	18750
Pakistan	18885
Greece	16835
Thailand	16485
New Zealand	14252
Ireland	13111
Romania	13982
Argentina	13185
Chile	13295
Ukraine	12914
Colombia	11498
Hungary	10582
Nigeria	8346
Viet Nam	7908
Tunisia	7790
Iraq	8174
Slovakia	7757
Serbia	7069
Algeria	6960
United Arab Emirates	6521
Croatia	6529
Morocco	6385
Slovenia	5729
Bangladesh	5024
Bulgaria	4944
Jordan	4122
Ecuador	4131
Qatar	3550
Kazakhstan	3606
Lithuania	3523
Philippines	3398
Lebanon	3081
Ethiopia	3223
Peru	2953
Estonia	2975
Kenya	2840
Ghana	2624
Cyprus	2598
Belarus	2210
Sri Lanka	2094
Luxembourg	1968
Latvia	2111
Georgia	1837
Oman	1723
Kuwait	1714
Iceland	1568
Uganda	1601
Cuba	1624
Cameroon	1601
Uruguay	1560
Tanzania	1526
Macao	1553
Nepal	1365
Venezuela	1286
Bosnia and Herzegovina	1203
Azerbaijan	1235
Armenia	1208
Costa Rica	1054
Sudan	921
Macedonia	875
Zimbabwe	788
Malta	773
Senegal	776
Palestine	779
Malawi	709
Puerto Rico	702
Botswana	613
Bahrain	611
Panama	582
Burkina Faso	566
Zambia	550
Uzbekistan	581
Myanmar	512
Ivory Coast	507
Benin	495
Yemen	497
Montenegro	445
Albania	450
Mongolia	462
Rwanda	433
Moldova	419
Mozambique	425
Cambodia	428
Congo	437
Libya	443
Brunei Darussalam	420
North Korea	438
Namibia	386
Syrian Arab Republic	417
Trinidad and Tobago	362
Fiji	333
Jamaica	301
Bolivia	328
Madagascar	331
Mauritius	283
Kyrgyzstan	278
Mali	269
Guatemala	265
Laos	266
Afghanistan	226
Paraguay	233
Papua New Guinea	228
Grenada	208
Togo	178
Gabon	182
New Caledonia	174
Dominican Republic	169
Honduras	157
Monaco	158
Niger	155
Democratic Republic Congo	155
French Polynesia	145
Tajikistan	142
Sierra Leone	136
Gambia	142
Swaziland	133
Nicaragua	125
Liechtenstein	123
El Salvador	130

Greenland	121
Bhutan	100
Angola	102
Barbados	99
French Guiana	97
Haiti	91
Saint Kitts and Nevis	87
Faroe Islands	90
Liberia	83
Guinea	87
Burundi	78
Bahamas	64
Central African Republic	64
Mauritania	61
Suriname	55
Guadeloupe	49
Guyana	56
Guam	52
Chad	53
Guinea-Bissau	49
Reunion	49
Solomon Islands	50

Lesotho	47
Martinique	40
Seychelles	43
Eritrea	46
Belize	30
Samoa	34
Timor-Leste	39
Bermuda	38
San Marino	35
Maldives	30
Cape Verde	36
Dominica	34
Somalia	28
Andorra	29
Vanuatu	27
Cayman Islands	25
Falkland Islands (Malvinas)	25
American Samoa	28
Federated States of Micronesia	23
Djibouti	21
Antigua and	22

Barbuda	
Equatorial Guinea	19
Palau	20
Tonga	19
Comoros	18
Virgin Islands (U.S.)	16
Saint Lucia	12
Anguilla	9
Vatican City State	8
Turkmenistan	9
Marshall Islands	9
Netherlands Antilles	8
Aruba	6
Saint Helena	8
Gibraltar	5
Cook Islands	6
Turks and Caicos Islands	5
Northern Mariana Islands	7
Virgin Islands (British)	6
Saint Vincent	5

and the Grenadines	
Svalbard and Jan Mayen	6
Tuvalu	4
Sao Tome and Principe	5
Nauru	3
Kiribati	3
Mayotte	4
Montserrat	4
British Indian Ocean Territory	3
South Georgia and the South Sandwich Islands	3
French Southern Territories	2
United States Minor Outlying Islands	2
Niue	1
Norfolk Island	0
Christmas Island	1
Bouvet Island	1
Tokelau	1

Subject-wise growth of publications

Scopus classifies its contents under 27 broad subject headings. Some of the documents fall in more than one category, as the journals and other source materials span more than one subject. Graphs 4.5 to 4.23 presents the growth of journal articles under different subjects in Scopus for the select top countries, invariably including India. We can notice that China has surpassed the US total publications in Chemical Engineering, Chemistry, Earth Sciences, Engineering, Environment Sciences, Energy, Material Sciences, Mathematics, Physics & Astronomy, and Decision Sciences in the recent years. In other subjects, such as Economics, Health Sciences, Immunology & Microbiology, Psychology, Medicine, Neuroscience, Social Sciences, and veterinary sciences, the US is the top contributor to the database. Indian contributions, and that of others, are invariably below 10% of the annual total over the period.

Uncited articles

Being cited is the key to S&T impact. Graph 4.24 presents the uncited journal articles. The US and China, again, figure as the top two countries on this variable. In that, those of the US have been increasingly getting cited and those of China remaining uncited despite being included in the database.

Proportion of uncited records for the other countries is relatively low, but so are their research contributions in the database.

Analysis of uncited records was taken further to understand how the other countries fare with 32 country average as the benchmark. Top 32 countries, as was noted, make up 90% of the contributions. Data show (Graph 4.27) that the contributions of China, Czech. Republic, India, Japan, Mexico, Poland, Russia, and Turkey have more than the group average uncitedness.

Publications of countries, including Austria, Brazil, France, Greece, Iran, Italy, Portugal, South Korea, Spain, Taiwan, the UK, and the US border around the 32 country average for the period (Graph 4.26). Interestingly, the contributions of Australia, Belgium, Canada, Denmark, Finland, Israel, Netherlands, Norway, Singapore, Sweden, and Switzerland have higher than average citedness per document (Graph 4.27). As we look for scholarly impact details pertaining to some of these countries would be of interest, as the publications of these countries in the top 90% group, though not dominant in absolute numbers, seem to fare better in being cited more often and creating better citation impact.

Self and external citations

It is also of interest, in the context, to understand the relative external and self-citations to the country contributions. Self-citation in Scopus is defined as a reference to an article from the same journal. A country self-citation occurs whenever author of a citing publication and the cited one have at least one country in common.

The US external citations have declined from 33.72% of the total to 17.00% in 2018. All the other top ranking countries have less than 10% of the total external citations. What is glaring otherwise is the self-citation of China which has consistently increased over the years and registers a total of 26.30% in 2018. The figures are more or less the same for the US in 2018. The other countries register a below 10% of the total on this criterion. Chinese literature growth has risen with disproportionate self-citations to their own contributions.

Self-citations are looked down somewhat in the recent years. The overall data for 1996-2018 show that the US has greater proportion of self-citations of the total, followed by China, among the countries. Indian contributions cite external sources more than the internal ones (Graph 4.33-4.34). This data, however, is not sufficient for any conclusion. Self-citations could be due to the gap in the research among the countries, research priorities set by the countries, and the like. It could also be due to incentivization of citations, as it is reported in the context of China (Davis. 2011; Prest, 2017, Abritis & McCook, 2017, Quan, Wei et al, 2017).

Country-wise journal ownership

Graph 4.28 show country-wise distribution of journals indexed in Scopus both in terms of absolute figures and as a proportion of the total. The US (6,217) and the UK (5,493) together had 47.43% of the total indexed journals in 2018. This is followed by 2,084 of Netherlands, 1,705 of Germany. As proportion of the total the US (25.18%) and UK (22.25%) made up nearly 50% of the total, followed by Netherlands (8.44%), Germany (6.91%). There were 499 journals from India in the database making up a mere 2.02% of the total.

It is interesting to see that in 2018 there were 328 journals with 0 H index score, and 1,741 of them had over 100 (Graph 4.29). H score of the US and the UK journals also fall in different brackets (Graphs 4.30-4.32). The database, on the whole, had 328 journals with 0 H index score in 2018.

Journal ownership gives control of supply, that is populating records in the index. As the data indicate, Germany, Netherlands, the UK, and the US control the journal's indexed and consequently publication records indexed in Scopus. Countries like Australia, Canada, China, India, Japan, and others have to depend on the external journals for their publications. This skewed distribution of journals gives some countries greater choice to pick and choose from as to where they want to publish. It is natural that research culture of host countries would have better reception.

Citable documents and citations

Scopus database includes both cited and citable documents. Citable documents are those which fall in to one of the following categories: Article, Book, Book Chapter, Conference Paper, Editorial, Erratum, Letter, Note, Review, Short Survey. Citable documents and citations accrued to them are shown in Graph 4.35. The overall picture shows a correspondence between the citable documents included in the database and the citations accrued to them over the years. This aspect would be explored further later for a narrower and more recent period of 3 years.

International Collaboration

International collaboration in publications is a phenomenon that has attracted attention of bibliometricians. International collaborative publications are those whose affiliation includes more than one country address. In general it is noted that publications with international collaboration tend to attract higher citations. Graphs 4.36 and 4.37 show distribution of citable articles and international collaboration. It can be seen that some countries like Austria, Belgium, Denmark, Finland, Netherlands, Norway Singapore, and Switzerland have international collaboration reaching to nearly 70% of their contributions. Several other countries, including India have lesser proportion of the total in this category. How do these variables impact citable output, citations, and citations per document is to be understood to make an informed decision on how bibliometrics affect larger scholarly strength of a country – both in terms of S&T contributions for growth, and for equipping quality of S&T manpower to contribute to knowledge growth in the comity of nations.

Correlation of bibliometric variables

Table 4.2 presents the correlation matrix for the four important variables in the context namely, total citations (TotalCites), citable documents (CitableDocs), citations per document (CitesPerDoc), and country-wise journal ownership in 2018. This analysis included the data pertaining to 239 countries from the Scopus database (as made available through http://www.scimagojr.com). The results show the following:

Correlation –Total set of countries

CitableDocs correlate significantly(r=.9 and above) with TotalCites accrued, and journal ownership by countries indicating importance of journals' country affiliation in Scopus database. This, despite the practice among journals of publishing research output from different countries. (Table 4.2)

TotalCites accrued by countries correlate significantly with their CitableDocs ($r(237) = .945$ $p<.000$), so also CitesPerDoc ($r(237)=.161$ $p<.000$), and journal ownership of countries represented in Scopus ($r(237)=.872$ $p<.000$) . The trend indicates the importance of country journal ownership in Scopus to derive corresponding citation benefit. However, CitesPerDoc correlates weakly with total citations as observed. Higher citations could mean cumulative (citation) score less than the other countries, and yet greater number of highly cited publications.

CitesPerDoc, indicative of publication quality, correlates weakly with TotalCites accrued to countries ($r(237)=.161$ $p<.05$) and also journal ownership by countries ($r(237)= .153$ df = $p<. 05$). Mere inclusion of articles in Scopus does not imply higher quality of the publications, relatively speaking.

Countries with journal ownership

Though Scopus represents publications by 239 countries, journals included in Scopus originate from 116 countries only. When the correlation was confined to only these countries, the results were slightly better than what was observed earlier, though the overall pattern remained the same.

Table 4.2

Correlation Matrix for all the listed countries in Scopus

	Citable documents	Total Citations	Citations per document	Country-wise Journals in 2018
Citable documents	1	.945**	.113	.806**
Citations	.945**	1	.161*	.872**
Citations per document	.113	.161*	1	.153*
Country-wise Journals in 2018	.806**	.872**	.153*	1

N=239

Correlation Matrix for countries with journals appearing in Scopus

	Citable documents	Total Citations	Citations per document	Country_jls_2018
Citable documents	1	.944**	.243**	.798**
Citations	.944**	1	.319**	.867**
Citations per document	.243**	.319**	1	.302**
Country-wise Journals in 2018	.798**	.867**	.302**	1

N= 116 (Countries which has at least 1 journal included in Scopus)

Correlation Matrix for top 32 countries which make up 90% of the citable documents in Scopus

	Citable documents	Total Citations	Citations per document	Journals 2018
Total Documents	.999**	.951**	.131	.784**
Citable documents	1	.936**	.109	.762**
Citations	.936**	1	.296	.845**
Citations per document	.109	.296	1	.303
Country-wise Journals in 2018	.762**	.845**	.303	1

N=32

**. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).

CitableDocs correlated significantly at 1% level with TotalCites (r(114)= .944 p<.000); CitesPerDoc (.243 df p<.00); and country-wise journal ownership (r(114)=.798 p<.000)

TotalCites correlates significantly with CitesPerDoc (r(114)=.319 p<.00) and country-wise journal ownership (r(114) =.867 p<.00)

With this limited dataset **CitesPerDoc** correlated significantly at 1% level with CitableDoc (r(114) =.245 p<.00); TotalCites (r(114) =.319 p<.00); and journal ownership (r(114) =.302 p<.00) indicating these three variables go together when the correlation criteria is limited to countries with journals that form Scopus database.

Countries making up 90% of the citable documents

Correlations analysis was also carried out limiting to the 32 countries making up top 90% of the citations. The results differ for the variable **CitesPerDoc** when correlation was calculated with scores of Total CitableDocs (r(30)=.109 N.S); and TotalCites (r(30)=296 N.S); journal ownership (r(30)= .303 N.S).

TotalCites when correlated with CitableDocs yielded the result r(30) .936 p<.00).

CitesPerDoc behaved differently when the sample was restricted to the countries making up 90% of the CitableDocs and TotalCites. Both these correlations were not significant

The results indicate that higher quality research as reflected in CitesPerDoc does not reflect in TotalCites, or number of CitableDocs; or for that matter journal ownership by the countries. It is independent of these three variables. These variables are probed further in the later analyses.

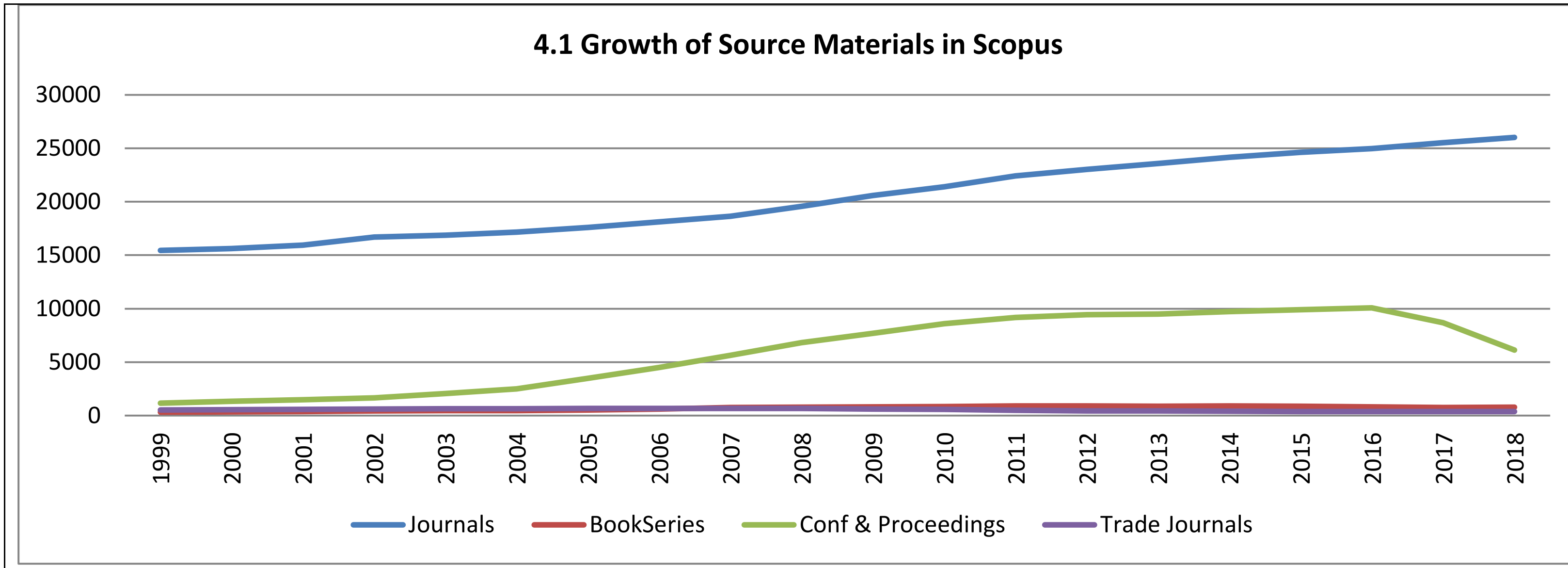
Countries with no journals of their own in Scopus during 1996-2018

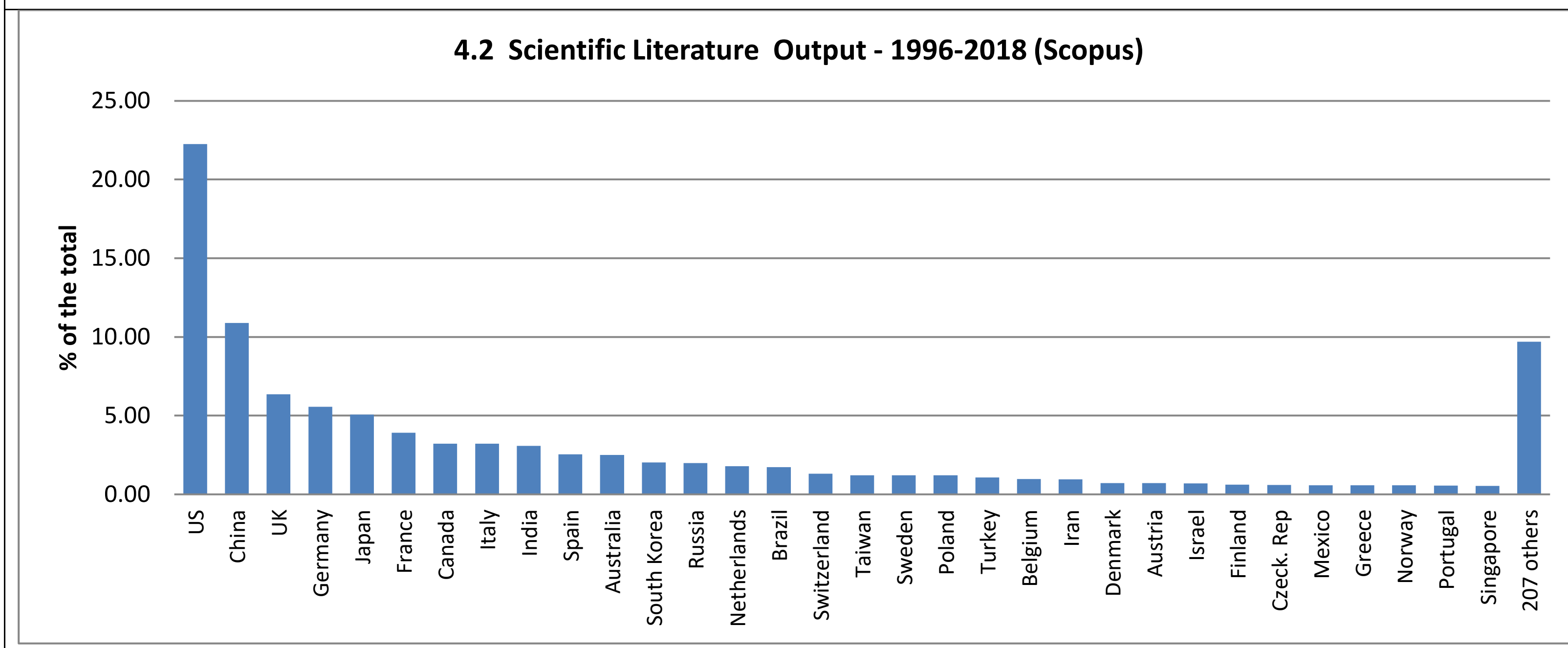
The countries listed below had no journal of their own included in Scopus, though a handful of CitableDocs pertaining to these countries are published in journals forming part of Scopus. These countries have accrued a minor share of citations. These countries may not have a sizeable research / academic establishments.

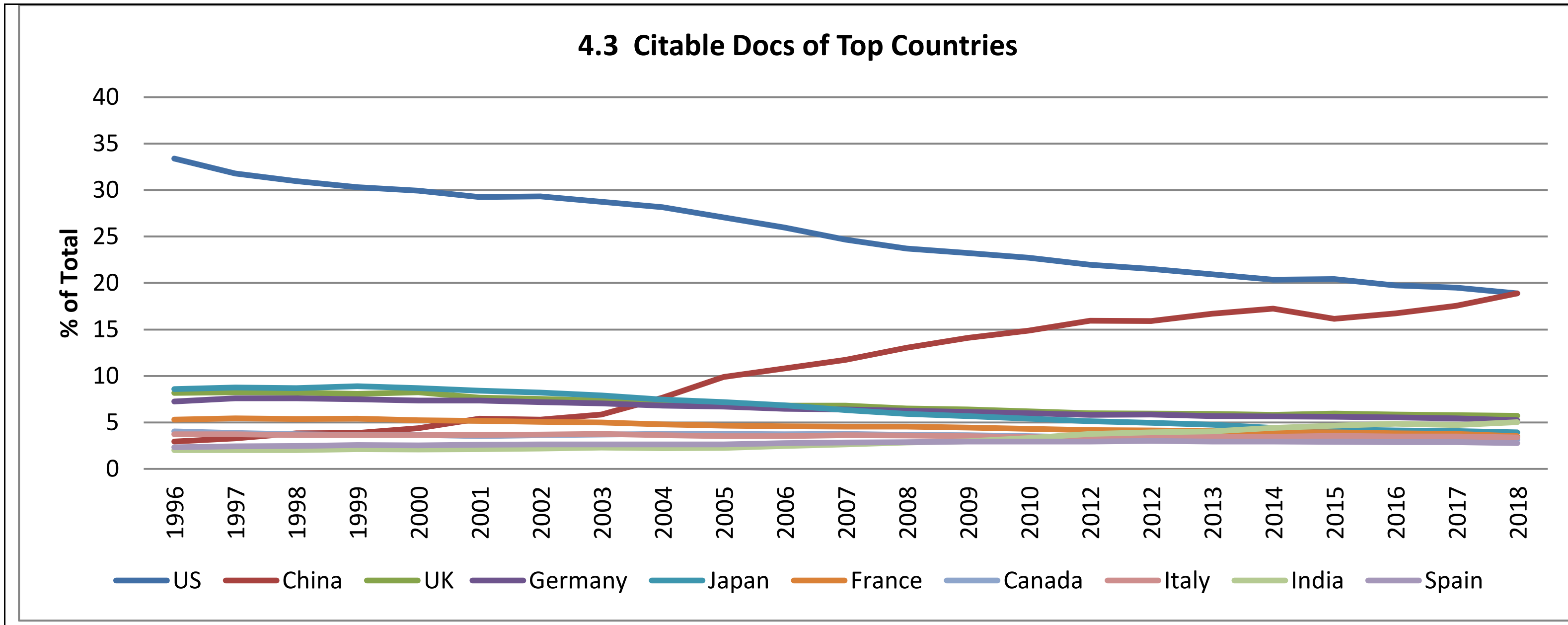
Afghanistan, Albania, American Samoa, Andorra, Angola, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Benin, Bermuda, Bhutan, Bolivia, Botswana, Bouvet Island, British Indian Ocean Territory, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Cayman Islands, Central African Republic, Chad, Christmas Island, Cocos (Keeling)

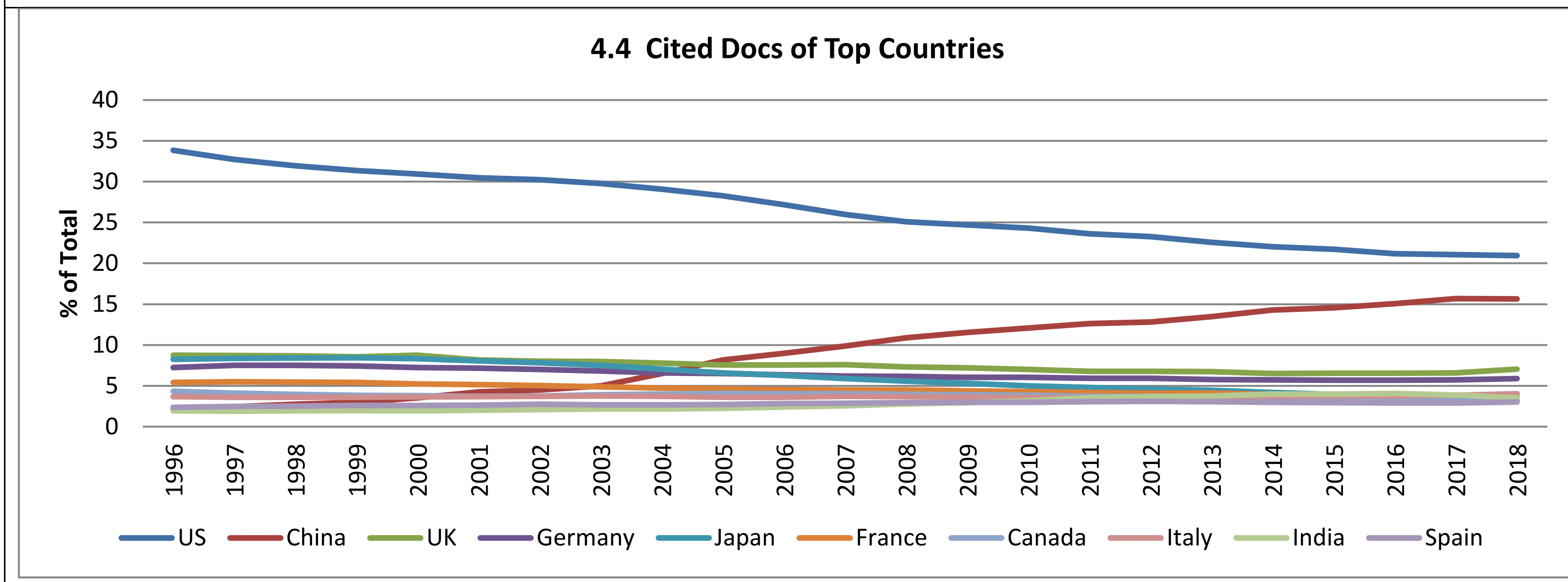
Islands, Comoros, Congo, Cook Islands, Côte d'Ivoire, Democratic Republic Congo, Djibouti, Dominica, El Salvador, Equatorial Guinea, Eritrea, Falkland Islands (Malvinas), Faroe Islands, Federated States of Micronesia, French Guiana, French Polynesia, French Southern Territories, Gabon, Gambia, Ghana, Gibraltar, Greenland, Grenada, Guadeloupe, Guam, Guatemala, Guinea, Guinea-Bissau, Guyana, Haïti, Heard Island and McDonald Islands, Honduras, Iraq, Kiribati, Kyrgyzstan, Laos, Lesotho, Liberia, Liechtenstein, Macao, Maldives, Marshall Islands, Martinique, Mauritania, Mayotte, Mongolia, Montserrat, Mozambique, Myanmar, Nauru, Netherlands Antilles, Nicaragua, Niger, Niue, Norfolk Island, North Korea, Northern Mariana Islands, Palau, Panama, Paraguay, Pitcairn, Reunion, Saint Helena, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Samoa, San Marino, Sao Tome and Principe, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Georgia and the South Sandwich Islands, Suriname, Svalbard and Jan Mayen, Swaziland, Syrian Arab Republic, Tajikistan, Timor-Leste, Togo, Tokelau Tonga, Turkmenistan, Turks and Caicos Islands, Tuvalu, United States Minor Outlying Islands, Vanuatu, Vatican City State, Virgin Islands (British), Virgin Islands (U.S.), Wallis and Futuna, Western Sahara, Yemen, Zambia

Collectively from 1996-2018 these countries have 0.42% of total documents, 0.42% of citable documents, 0.31% of total citations, 0.01 % of self-citation.

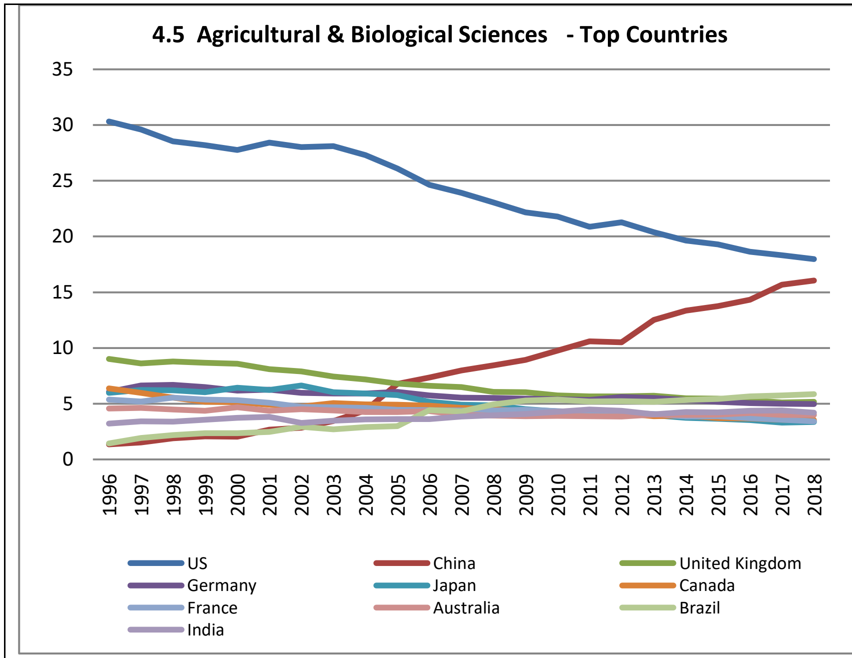

4.1 Growth of Source Materials in Scopus
30000
25000
20000
15000
10000
5000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Journals
BookSeries
Conf & Proceedings
Trade Journals

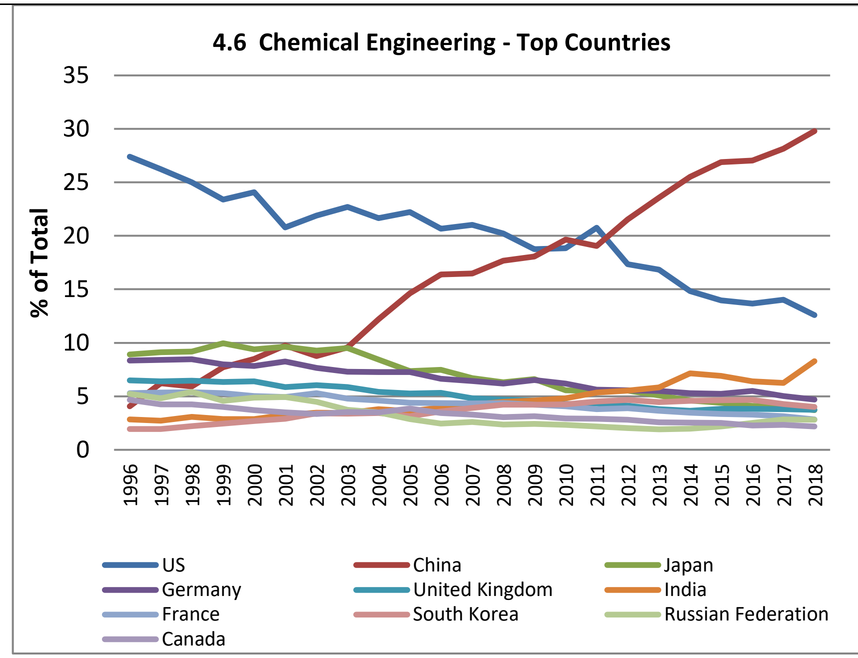

4.2 Scientific Literature Output - 1996-2018 (Scopus)
% of the total
25.00
20.00
15.00
10.00
5.00
0.00
US
China
UK
Germany
Japan
France
Canada
Italy
India
Spain
Australia
South Korea
Russia
Netherlands
Brazil
Switzerland
Taiwan
Sweden
Poland
Turkey
Belgium
Iran
Denmark
Austria
Israel
Finland
Czeck. Rep
Mexico
Greece
Norway
Portugal
Singapore
207 others

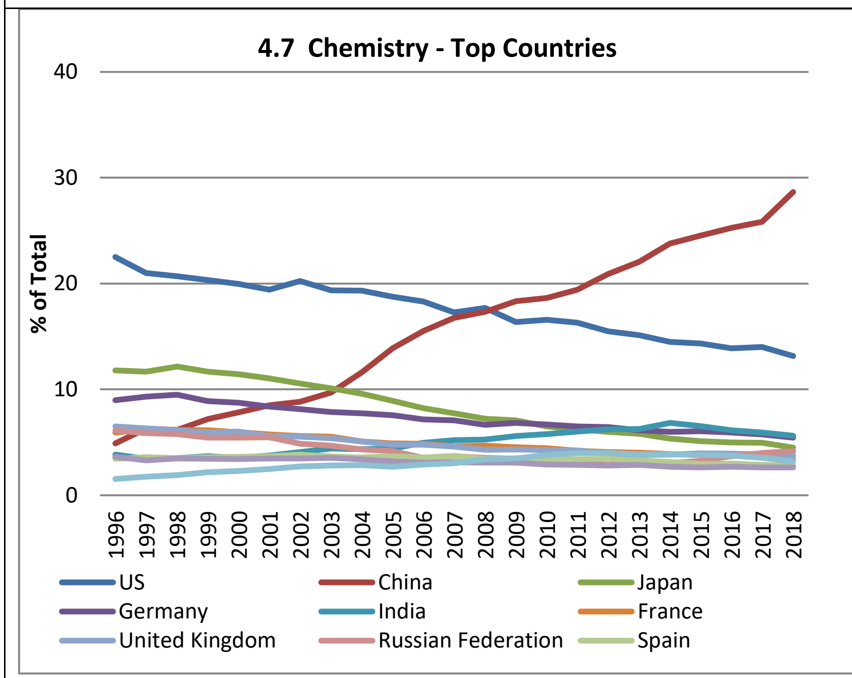

4.3 Citable Docs of Top Countries
% of Total
40
35
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2012 2012 2013 2014 2015 2016 2017 2018
US China UK Germany Japan France Canada Italy India Spain

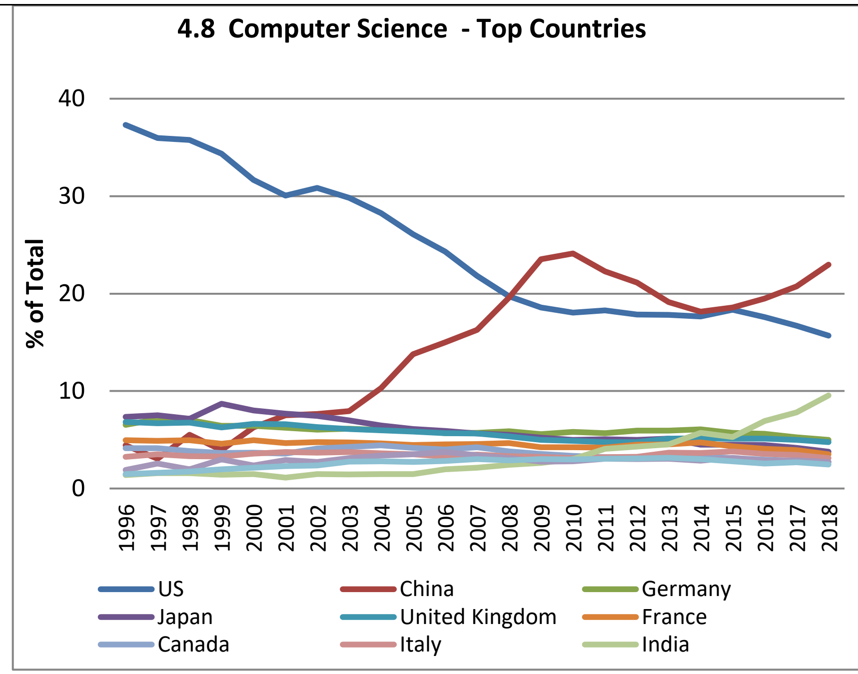

4.4 Cited Docs of Top Countries
% of Total
40
35
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US China UK Germany Japan France Canada Italy India Spain

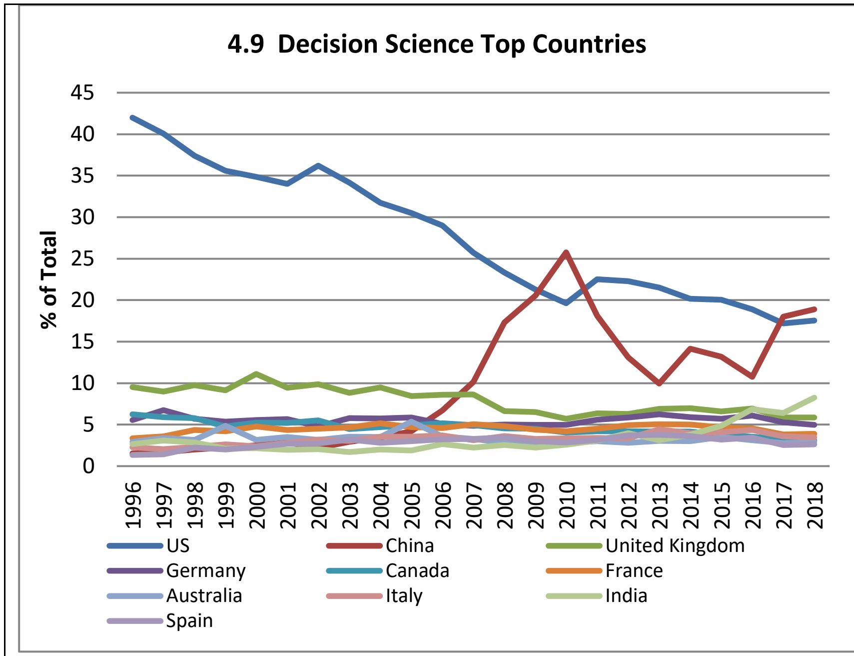
CitableDocs in Various Subjects

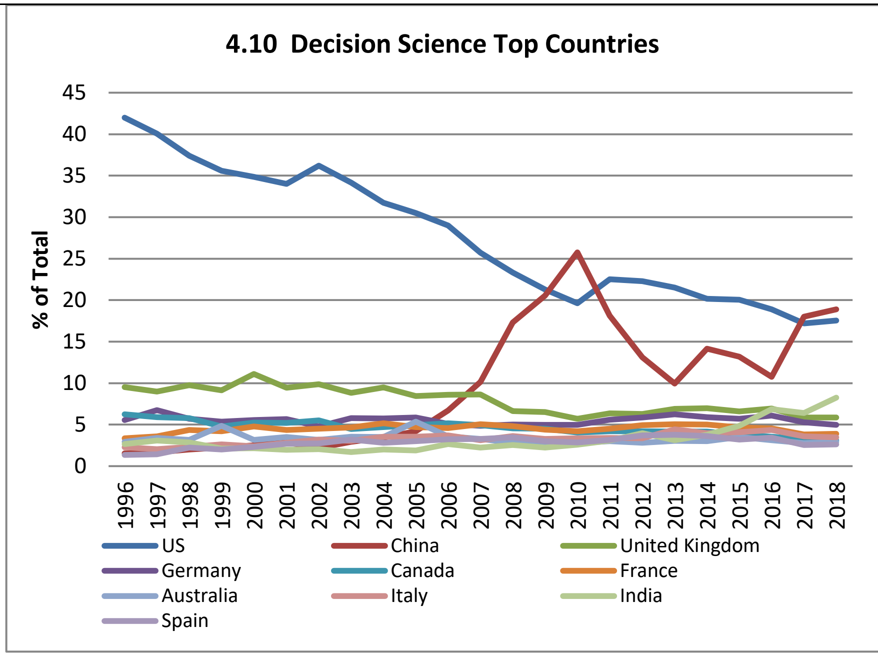

4.5 Agricultural & Biological Sciences - Top Countries
35
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
United Kingdom
Germany
Japan
Canada
France
Australia
Brazil
India

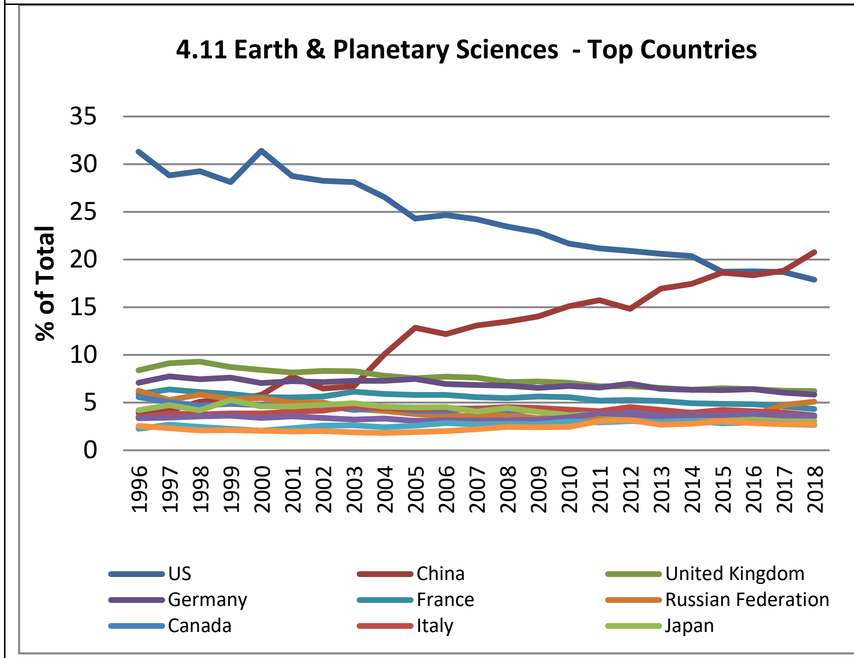

4.6 Chemical Engineering - Top Countries
% of Total
35
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
Japan
Germany
United Kingdom
India
France
South Korea
Russian Federation
Canada

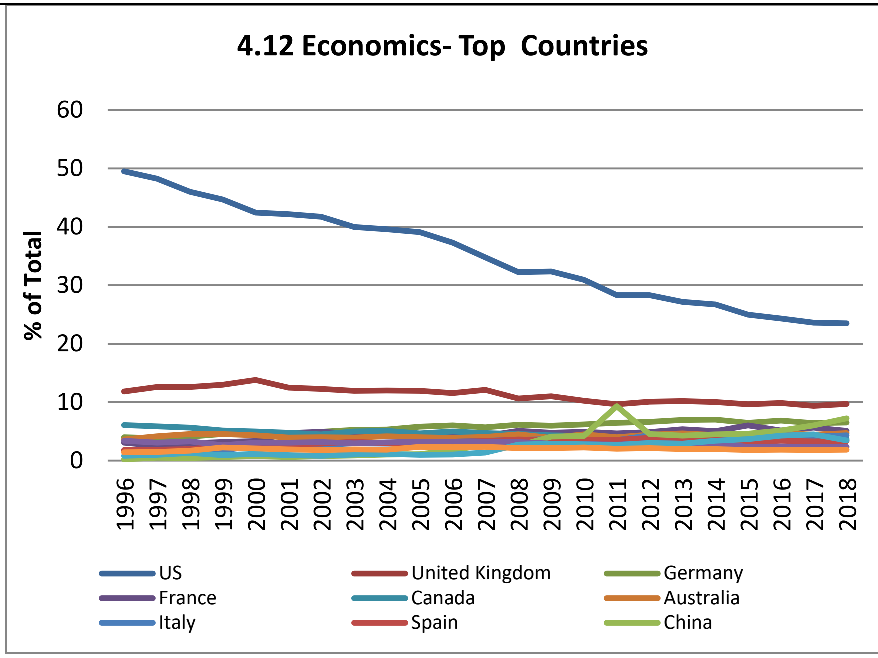

4.7 Chemistry - Top Countries
% of Total
40
30
20
10
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
Japan
Germany
India
France
United Kingdom
Russian Federation
Spain

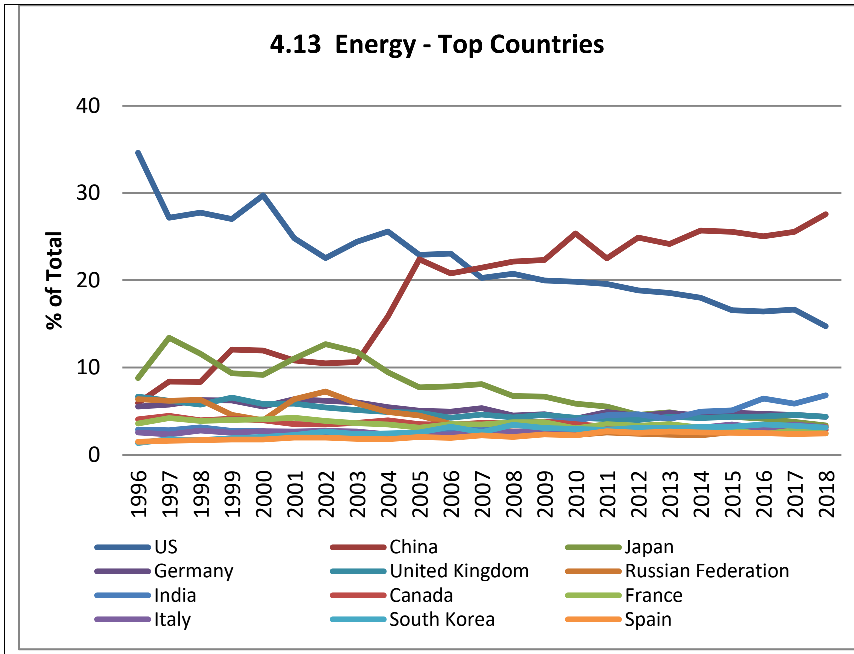

4.8 Computer Science - Top Countries
% of Total
40
30
20
10
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
Germany
Japan
United Kingdom
France
Canada
Italy
India

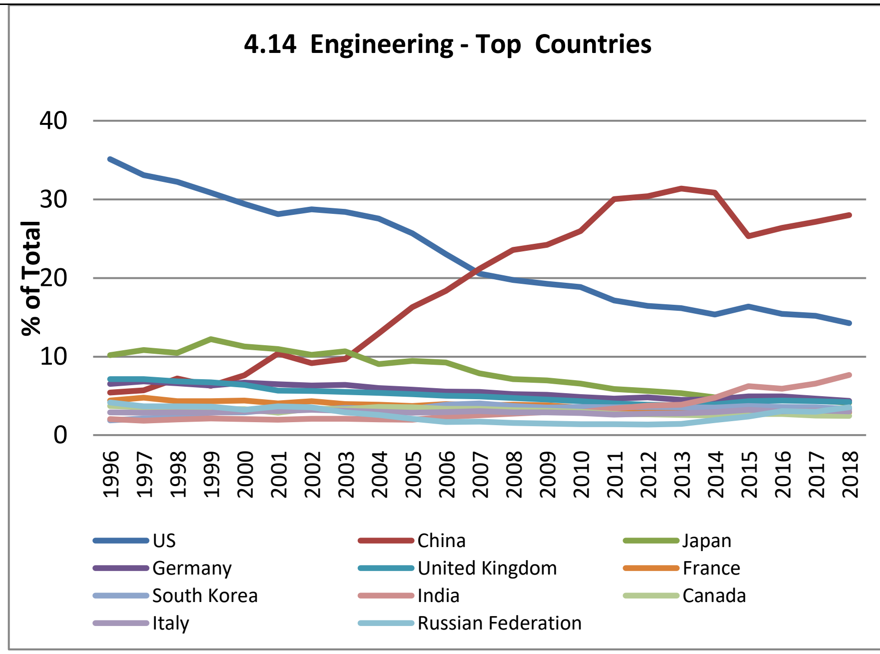

4.9 Decision Science Top Countries
% of Total
US
China
United Kingdom
Germany
Canada
France
Australia
Italy
India
Spain

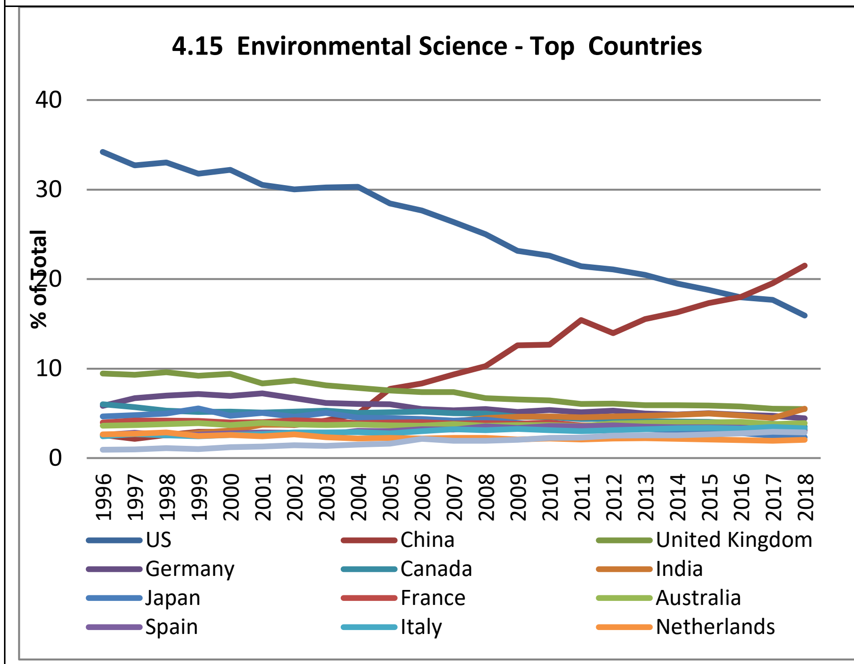

4.10 Decision Science Top Countries
% of Total
US
China
United Kingdom
Germany
Canada
France
Australia
Italy
India
Spain

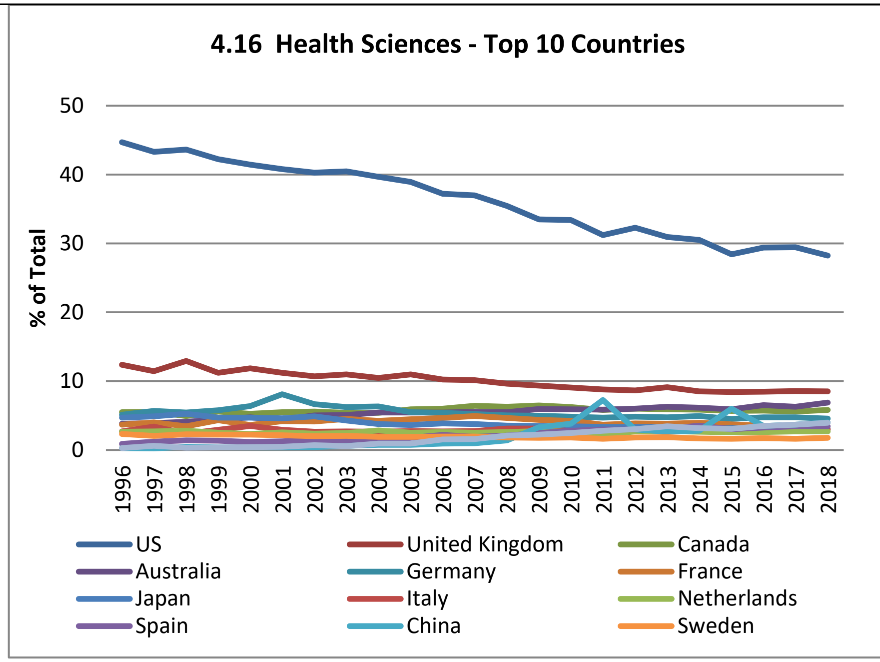

4.11 Earth & Planetary Sciences - Top Countries
% of Total
US
China
United Kingdom
Germany
France
Russian Federation
Canada
Italy
Japan

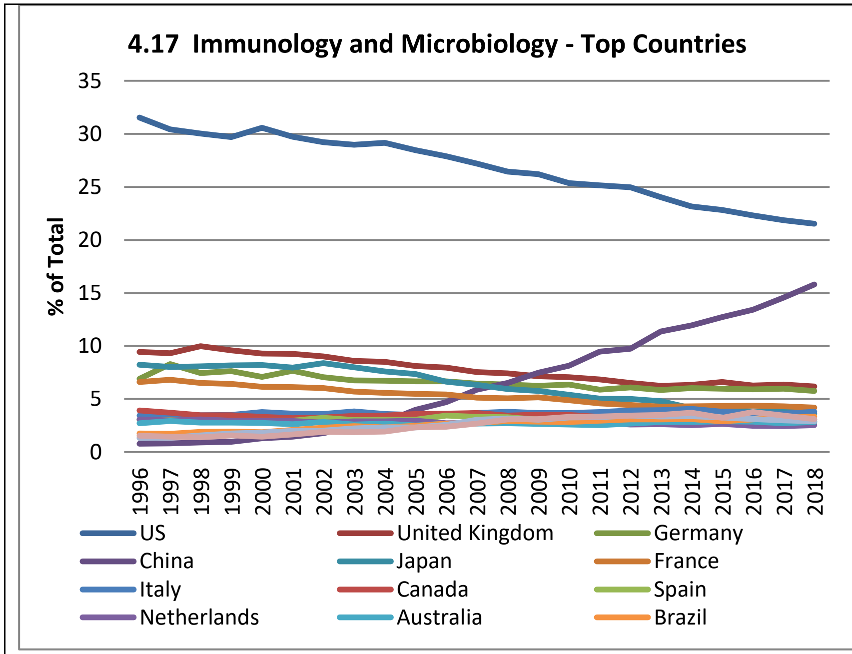

4.12 Economics- Top Countries
% of Total
US
United Kingdom
Germany
France
Canada
Australia
Italy
Spain
China

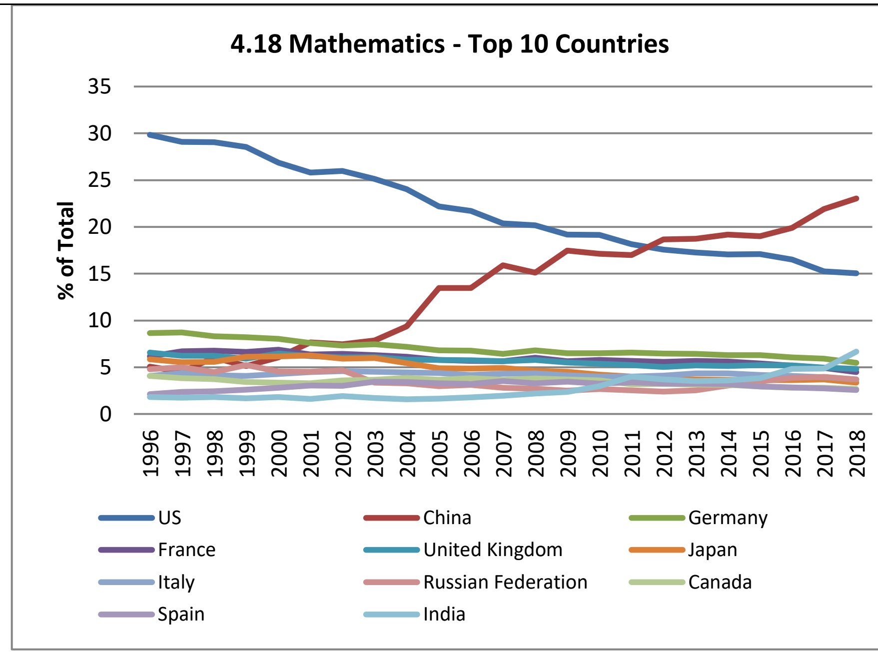

4.13 Energy - Top Countries
40
30
20
10
0
% of Total
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
Japan
Germany
United Kingdom
Russian Federation
India
Canada
France
Italy
South Korea
Spain

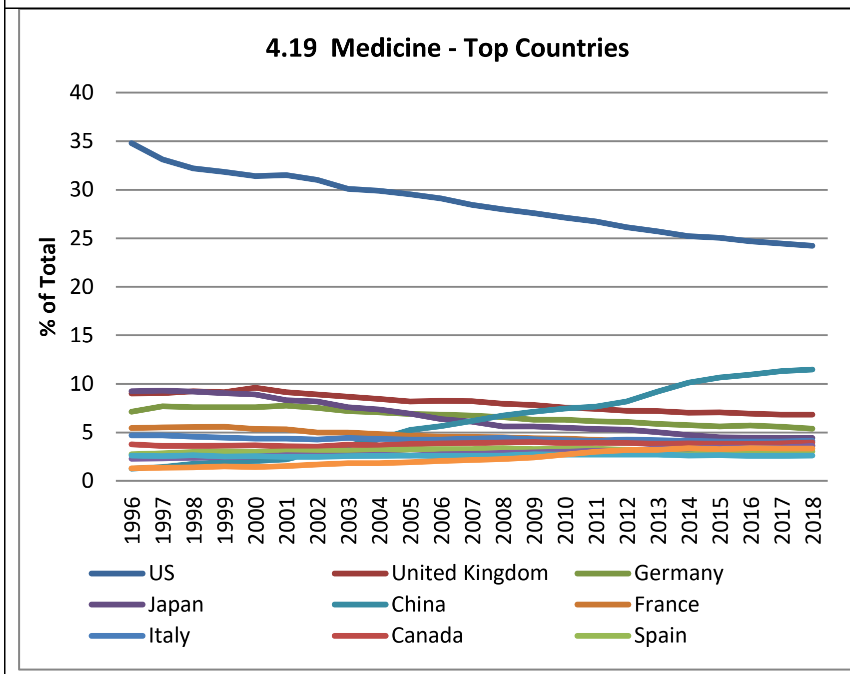

4.14 Engineering - Top Countries
40
30
20
10
0
% of Total
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
Japan
Germany
United Kingdom
France
South Korea
India
Canada
Italy
Russian Federation

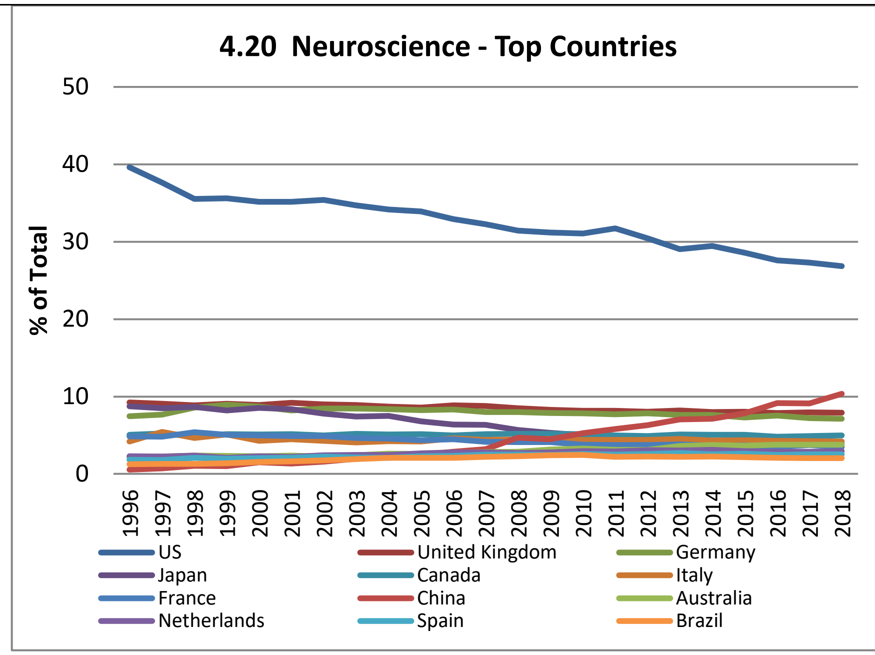

4.15 Environmental Science - Top Countries
40
30
20
10
0
% of Total
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
United Kingdom
Germany
Canada
India
Japan
France
Australia
Spain
Italy
Netherlands

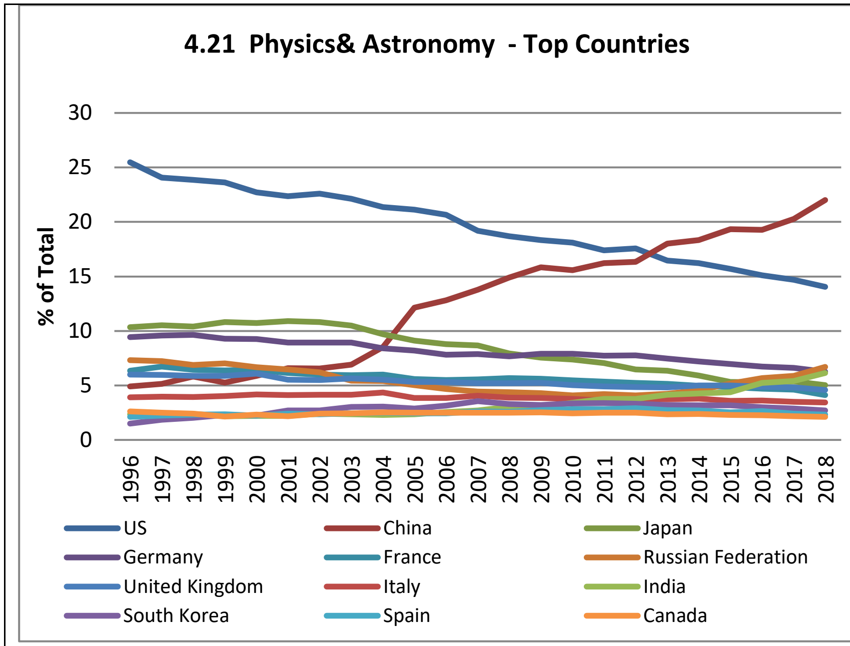

4.16 Health Sciences - Top 10 Countries
50
40
30
20
10
0
% of Total
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
United Kingdom
Canada
Australia
Germany
France
Japan
Italy
Netherlands
Spain
China
Sweden

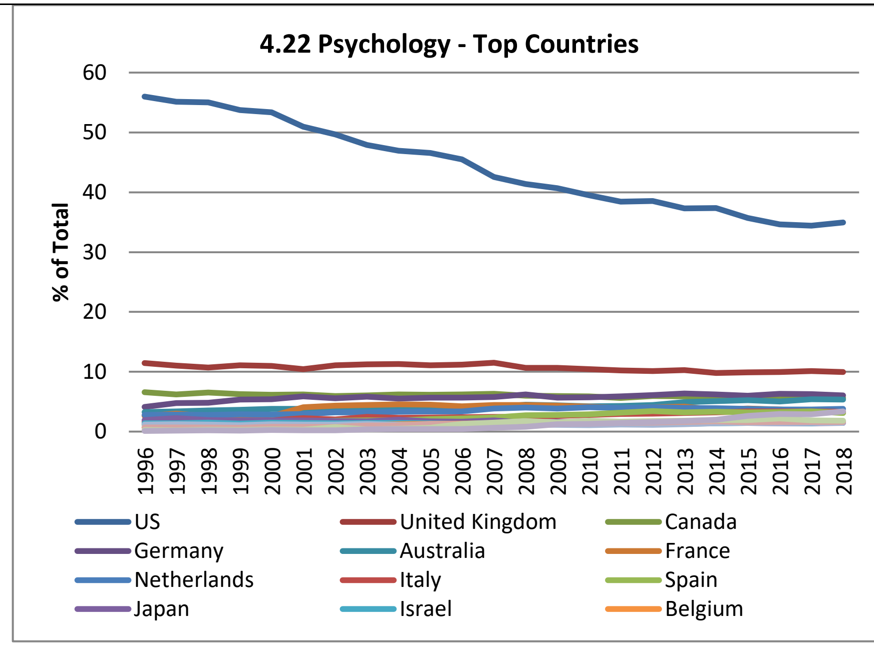

4.17 Immunology and Microbiology - Top Countries
% of Total
35
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
United Kingdom
Germany
China
Japan
France
Italy
Canada
Spain
Netherlands
Australia
Brazil

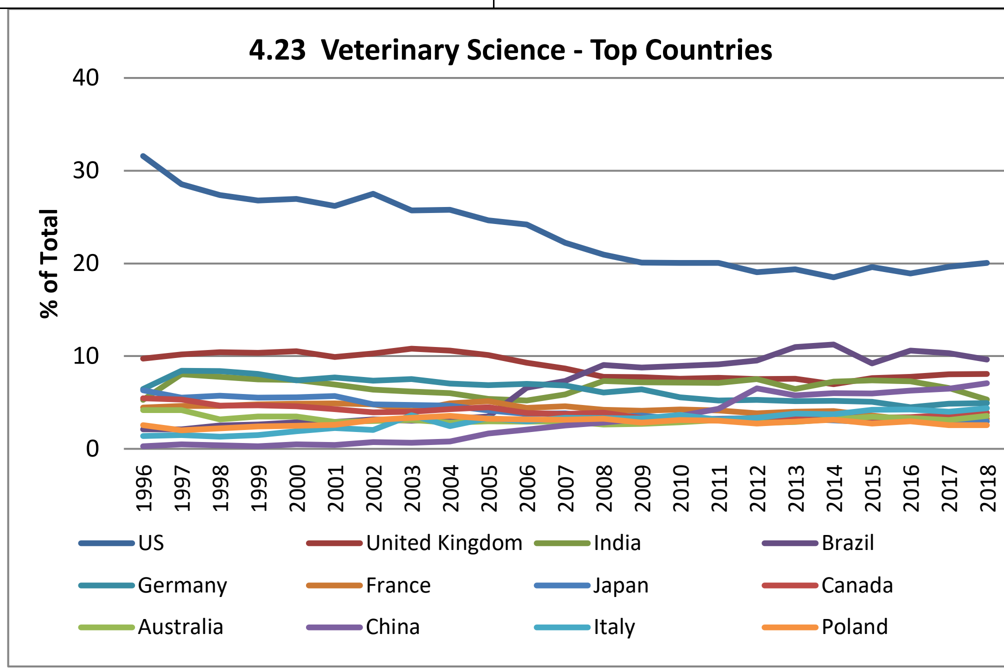

4.18 Mathematics - Top 10 Countries
% of Total
35
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
Germany
France
United Kingdom
Japan
Italy
Russian Federation
Canada
Spain
India

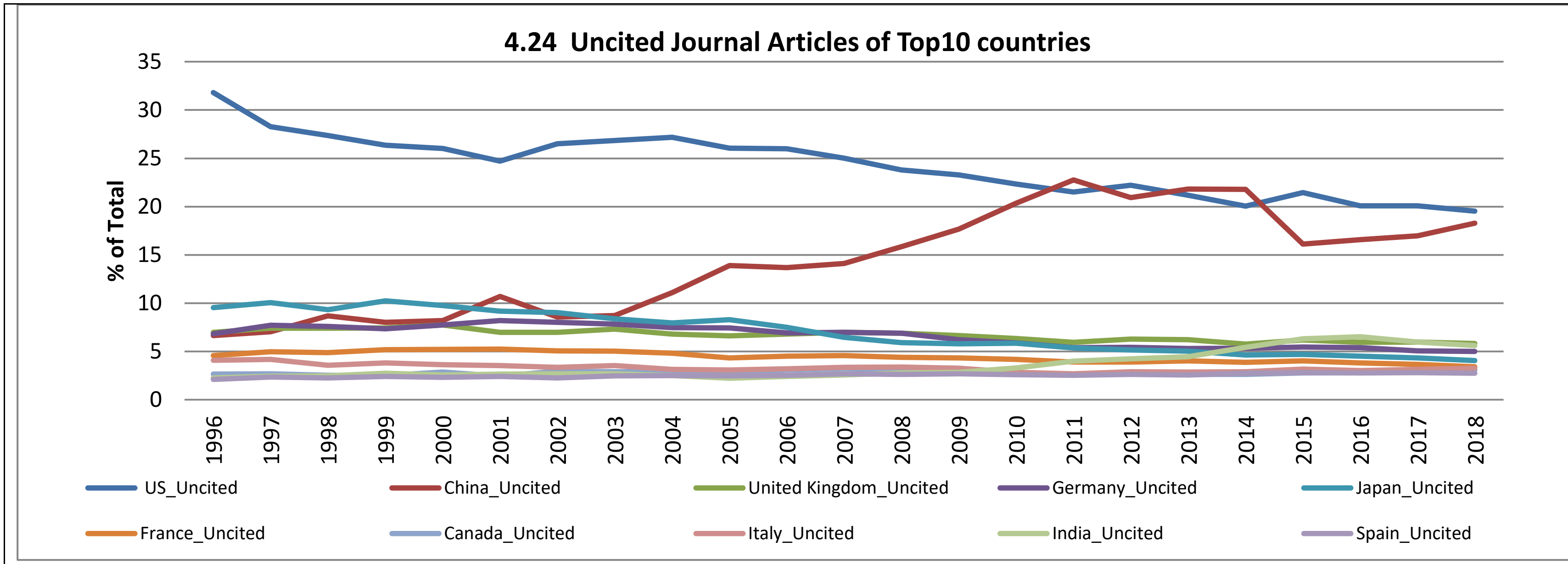

4.19 Medicine - Top Countries
% of Total
40
35
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
United Kingdom
Germany
Japan
China
France
Italy
Canada
Spain

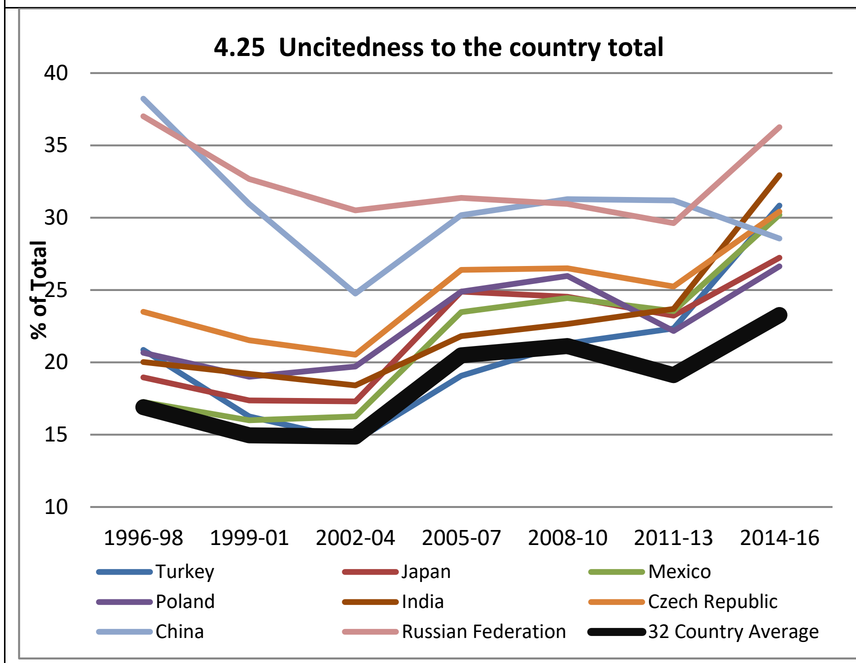

4.20 Neuroscience - Top Countries
% of Total
50
40
30
20
10
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
United Kingdom
Germany
Japan
Canada
Italy
France
China
Australia
Netherlands
Spain
Brazil

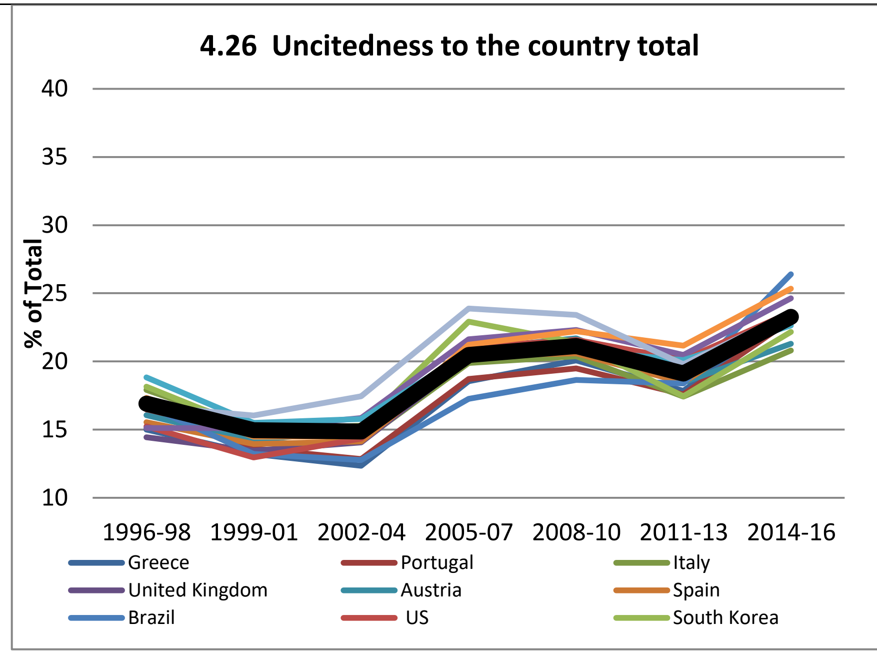

4.21 Physics& Astronomy - Top Countries
% of Total
30
25
20
15
10
5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
China
Japan
Germany
France
Russian Federation
United Kingdom
Italy
India
South Korea
Spain
Canada

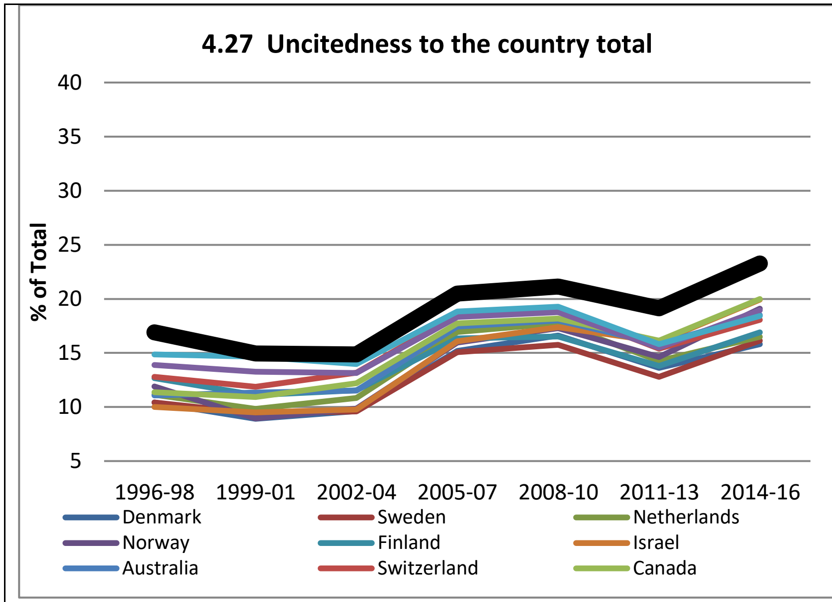

4.22 Psychology - Top Countries
% of Total
60
50
40
30
20
10
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
United Kingdom
Canada
Germany
Australia
France
Netherlands
Italy
Spain
Japan
Israel
Belgium

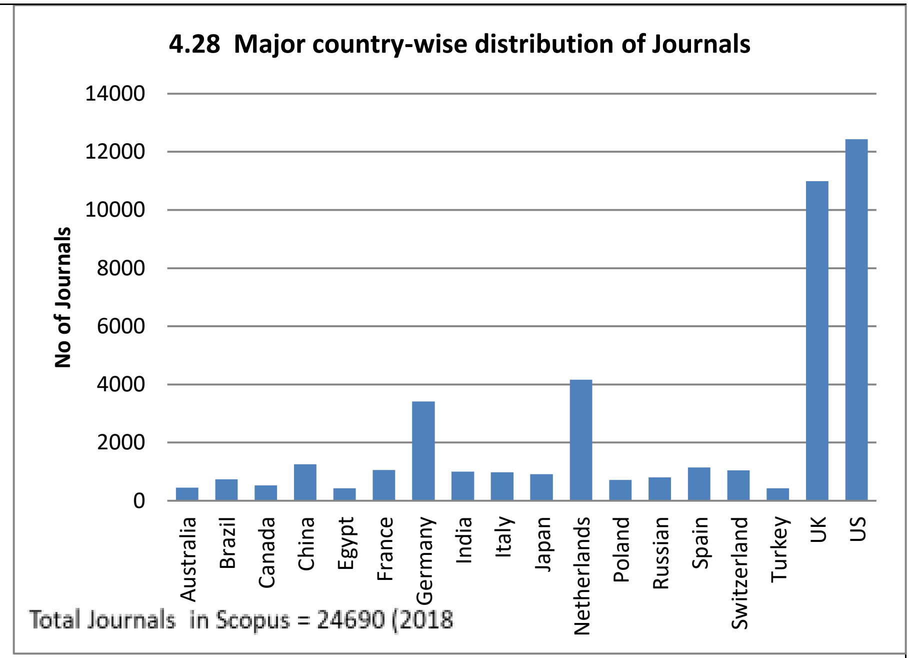

4.23 Veterinary Science - Top Countries
% of Total
40
30
20
10
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
US
United Kingdom
India
Brazil
Germany
France
Japan
Canada
Australia
China
Italy
Poland

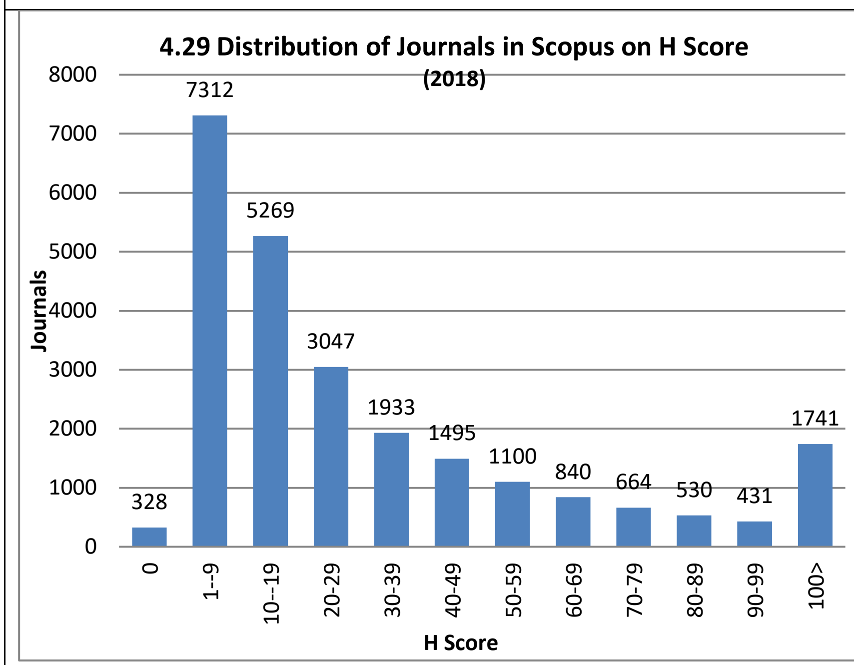

4.24 Uncited Journal Articles of Top10 countries
% of Total
35
30
25
20
15
10
5
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
US_Uncited
China_Uncited
United Kingdom_Uncited
Germany_Uncited
Japan_Uncited
France_Uncited
Canada_Uncited
Italy_Uncited
India_Uncited
Spain_Uncited

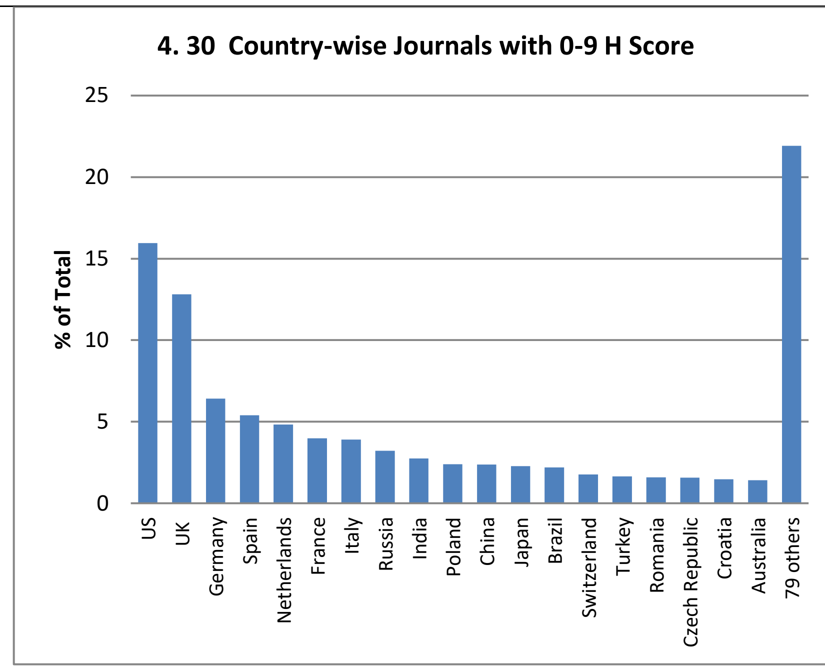

4.25 Uncitedness to the country total
% of Total
40
35
30
25
20
15
10
1996-98
1999-01
2002-04
2005-07
2008-10
2011-13
2014-16
Turkey
Japan
Mexico
Poland
India
Czech Republic
China
Russian Federation
32 Country Average

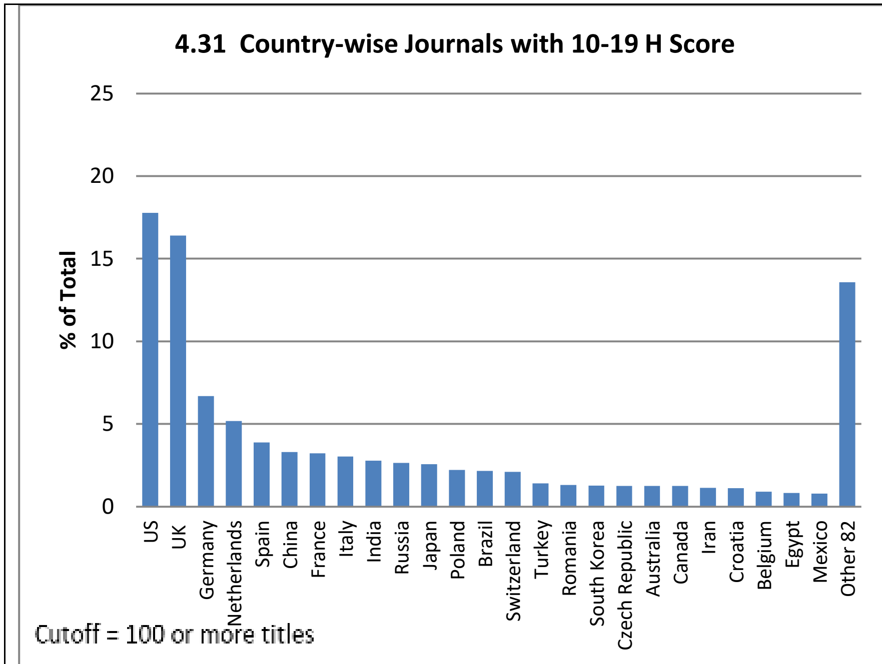

4.26 Uncitedness to the country total
% of Total
40
35
30
25
20
15
10
1996-98
1999-01
2002-04
2005-07
2008-10
2011-13
2014-16
Greece
Portugal
Italy
United Kingdom
Austria
Spain
Brazil
US
South Korea

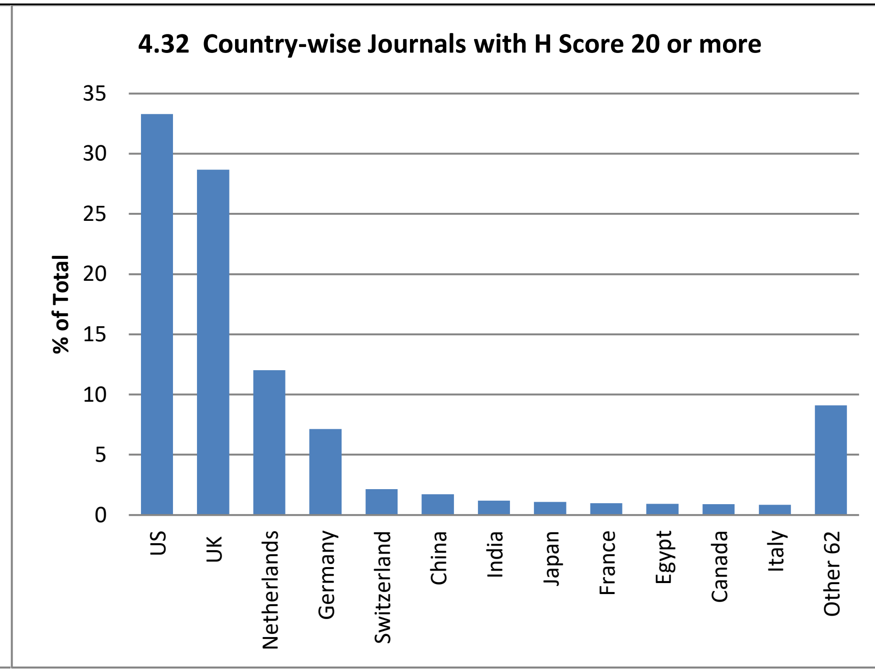

4.27 Uncitedness to the country total
% of Total
40
35
30
25
20
15
10
5
1996-98
1999-01
2002-04
2005-07
2008-10
2011-13
2014-16
Denmark
Sweden
Netherlands
Norway
Finland
Israel
Australia
Switzerland
Canada

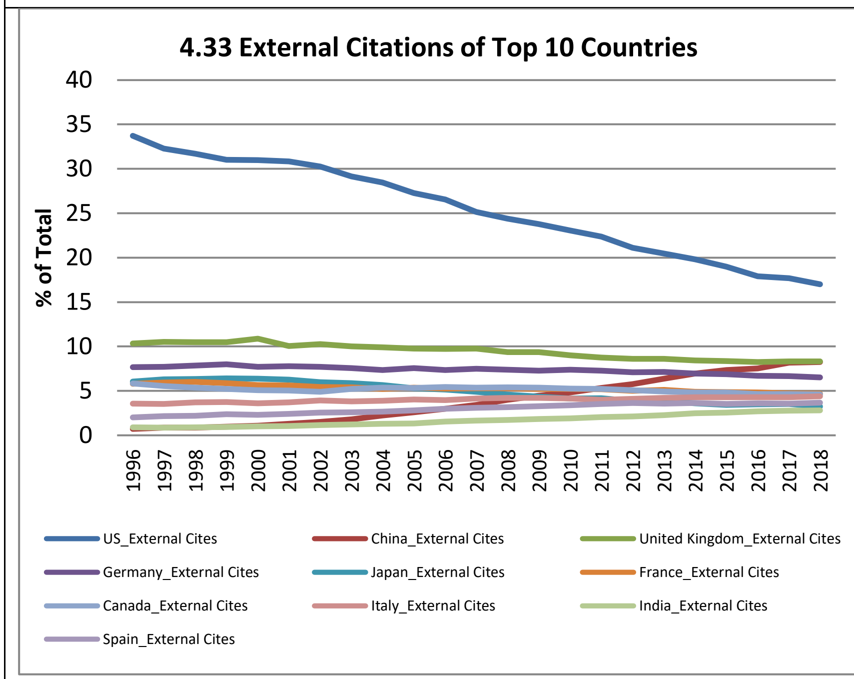

4.28 Major country-wise distribution of Journals
No of Journals
14000
12000
10000
8000
6000
4000
2000
0
Australia
Brazil
Canada
China
Egypt
France
Germany
India
Italy
Japan
Netherlands
Poland
Russian
Spain
Switzerland
Turkey
UK
US
Total Journals in Scopus = 24690 (2018

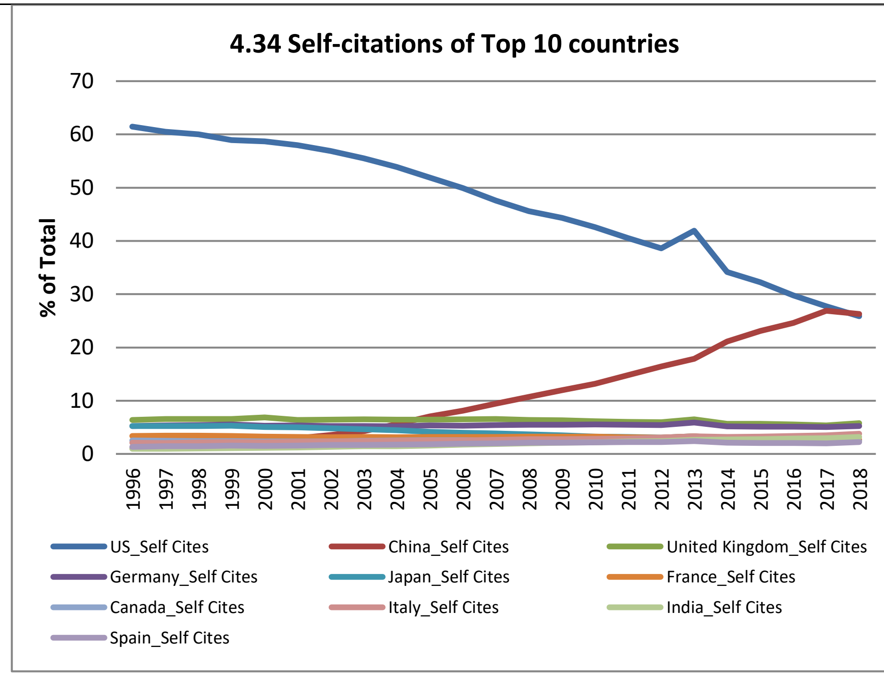

4.29 Distribution of Journals in Scopus on H Score
(2018)
Journals
8000
7000
6000
5000
4000
3000
2000
1000
0
328
7312
5269
3047
1933
1495
1100
840
664
530
431
1741
0
1--9
10--19
20-29
30-39
40-49
50-59
60-69
70-79
80-89
90-99
100>
H Score

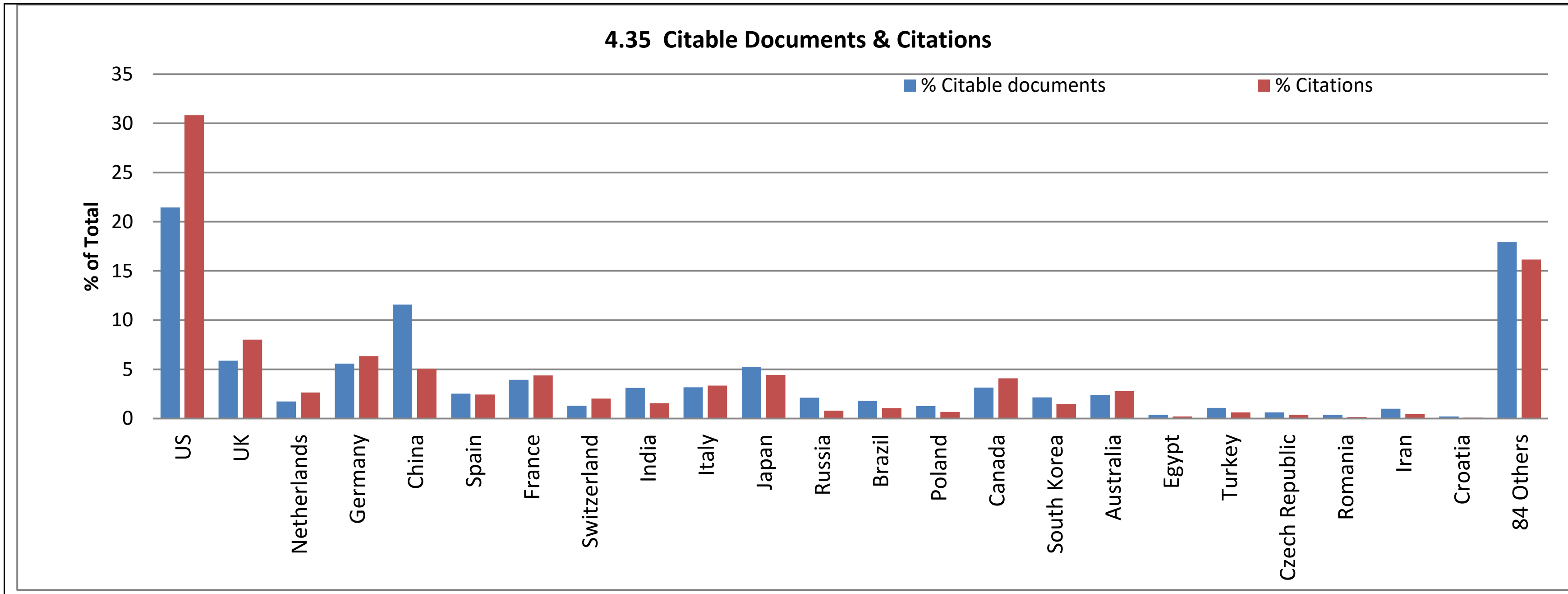

4. 30 Country-wise Journals with 0-9 H Score
% of Total
25
20
15
10
5
0
US
UK
Germany
Spain
Netherlands
France
Italy
Russia
India
Poland
China
Japan
Brazil
Switzerland
Turkey
Romania
Czech Republic
Croatia
Australia
79 others

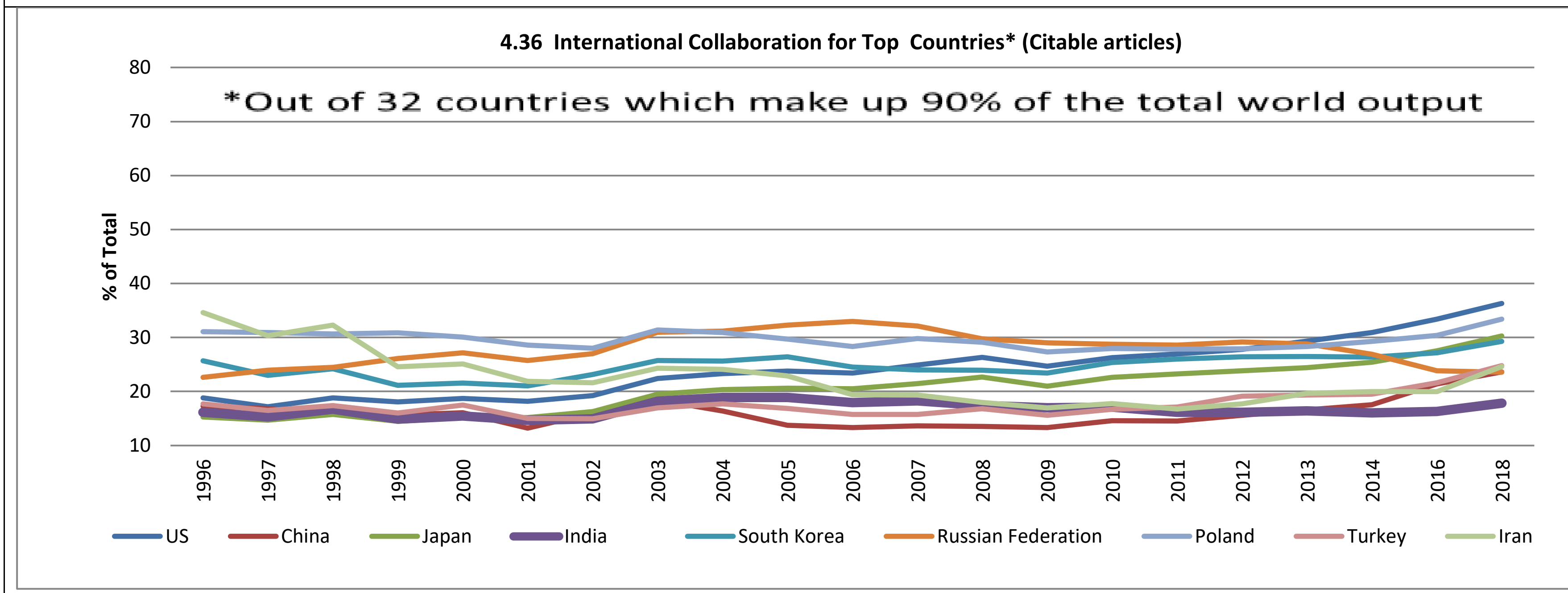

4.31 Country-wise Journals with 10-19 H Score
25
20
15
10
5
0
% of Total
US
UK
Germany
Netherlands
Spain
China
France
Italy
India
Russia
Japan
Poland
Brazil
Switzerland
Turkey
Romania
South Korea
Czech Republic
Australia
Canada
Iran
Croatia
Belgium
Egypt
Mexico
Other 82
Cutoff = 100 or more titles

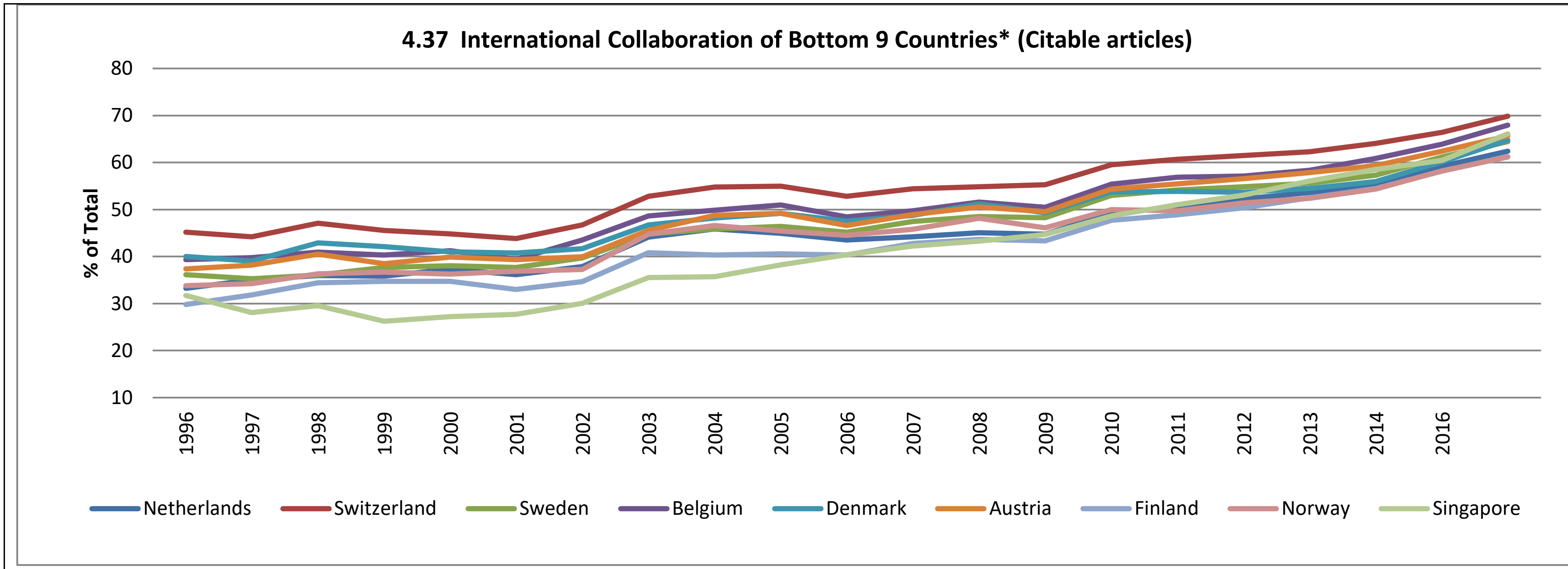

4.32 Country-wise Journals with H Score 20 or more
35
30
25
20
15
10
5
0
% of Total
US
UK
Netherlands
Germany
Switzerland
China
India
Japan
France
Egypt
Canada
Italy
Other 62

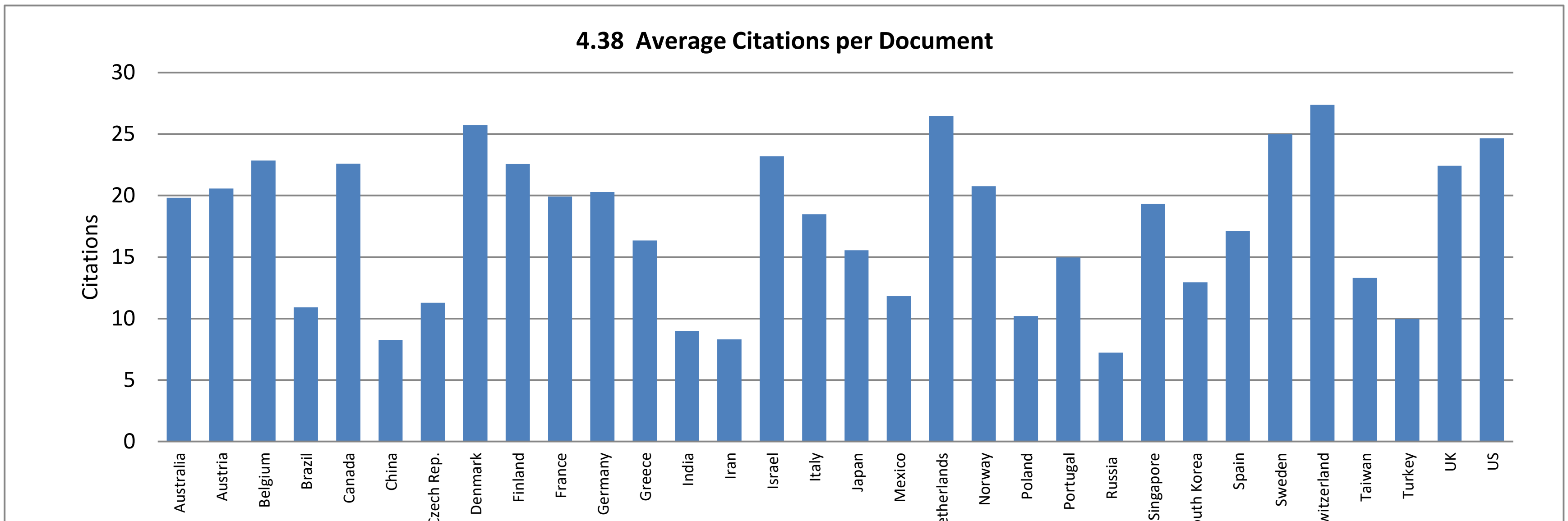

4.33 External Citations of Top 10 Countries
40
35
30
25
20
15
10
5
0
% of Total
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
US_External Cites
China_External Cites
United Kingdom_External Cites
Germany_External Cites
Japan_External Cites
France_External Cites
Canada_External Cites
Italy_External Cites
India_External Cites
Spain_External Cites


4.34 Self-citations of Top 10 countries
70
60
50
40
30
20
10
0
% of Total
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
US_Self Cites
China_Self Cites
United Kingdom_Self Cites
Germany_Self Cites
Japan_Self Cites
France_Self Cites
Canada_Self Cites
Italy_Self Cites
India_Self Cites
Spain_Self Cites


4.35 Citable Documents & Citations
% Citable documents
% Citations
% of Total
35
30
25
20
15
10
5
0
US
UK
Netherlands
Germany
China
Spain
France
Switzerland
India
Italy
Japan
Russia
Brazil
Poland
Canada
South Korea
Australia
Egypt
Turkey
Czech Republic
Romania
Iran
Croatia
84 Others


4.36 International Collaboration for Top Countries* (Citable articles)
*Out of 32 countries which make up 90% of the total world output
% of Total
80
70
60
50
40
30
20
10
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2016
2018
US
China
Japan
India
South Korea
Russian Federation
Poland
Turkey
Iran





Source: https://www.scimagojr.com/

Chapter 5
Analysis of Total Citations

The current analysis intends to explore macro level relations among several citation related variables. The source used for the purpose was database made available in https://www.scimagojr.com/ - an organ of Scopus Citation Database.

The variables identified for the study include the following:
Extent of Citable Docs; Total Citations (TotalCites); Total References (TotalRefs); References Per Doc in journals (RefPerDoc); International Collaboration; Scimago Journal Ranking (SJR); Citation per document (CitesPerDoc)- both Journal-wise and Country-wise.

Data were collected both at journals level and also at the country level. Data were analysed for tracing the publication growth trends and journal level behavior in accruing citations. Country level analysis included both citation related data and other economic data of relevance in the context.

Several bivariate and multivariate regression models were tested to predict TotalCites accrued to journals. The predictor variables included extent of TotalRefs used in these journals, references used per CitableDoc, articles with international collaboration, and SJR as made available by Scopus.

Both CitableDocs and CitesPerDoc were restricted to the three-year period 2016-2018. This was done to bring in currency to the analysis carried out. International collaboration data referred to the year 2018, and the most recent available SJR was considered. The analysis included 24,690 journals and the corresponding data.

Initially the analysis explored the variance accounted for citations received by the journals in Scopus over the previous three years.

Linear regression analysis tested the following propositions:
TotalCites accrued to journals is a function of CitableDocs published by them; TotalRefs in the journals; mean RefPerDoc, International Collaboration, and the SJR.

Bivariate regression analyses show the following:
Number of CitableDocs in journals predict the citations to a high degree of 66.0% (R^2 .660). The results indicate that with every one unit change in CitableDocs in journals, citations increase by .812

units (ß .812 p<.000). The results point to the need for maintaining high productivity in Scopus indexed journals to get cited. This calls for getting country journals into the Scopus database (Table 5.1).

Total references the journals carry as appended to their citable publications is significantly related to citations it accrues R^2 .668 and ß 0.817 p < .000 indicate every unit increase in references would account for 0.817 increase in citation it received (Table 5.2).

So also, bivariate regressions model with RefPerDoc as independent variable shows a significant F value. However, the total variance explained (R^2 .008) is low. Every unit increase in RefPerDoc results in .09 unit (ß .092 p< .000) of citations the articles in the journals accrued on an average (Table 5.3).

Articles with International Collaboration in journals (proportion of the total articles published by the journal in 2018) were also explored as a lone independent variable in the context. Though the model with F value of 1174.126 (p < .000) was statistically significant, the variance articles with International Collaboration accounted for was minimal in predicting TotaCites (R^2 of .027. ß 0.165 p < .000). International Collaborative articles within the journals made a difference of 0.165 units for every unit increase in the citations (Table 5.4).

So also, bivariate regression of SJR as predictor variable against TotaCites results in a significant F value (F=2444.7 p <. 000) indicating the validity of the model. However, as in the case of International Collaboration, SJR alone would account for relatively limited variance (R^2 = .091) though ß of 0.302 (p <.000) is statistically significant (Table 5.5).

Multivariate Analysis

These bivariate exploratory regressions were followed by a multivariate model where all the independent variables considered earlier were pooled together to regress against dependent variable TotalCites.

The predictor variables initially included were the ones considered in bivariate model, namely CitableDocs, TotalRefs, RefPerDoc, International Collaboration, and SJR. It was noticed that variables CitableDocs, and TotalRefs correlated highly (r=0.857) to cause collinearity issue in the model. Consequently TotalRefs was removed from the equation. All the other independent variables correlated positively.

The model with four independent variables, namely CitableDocs, International Collaboration, RefPerDoc, and SJR were regressed against total citations. The Model was found valid with F value of

14775.4 ($p<.000$) reflecting statistical significance (Table 5.6). The selected four predictor variables collectively explained 70.7% of the variance with an R^2 value of .707. All the four independent variables were contributing significantly to the variation. CitableDocs explained the major variance, followed by SJR, International Collaboration, and RefPerDoc, in that order. RefPerDoc, however, showed negative relations with the criterion variable, though relatively to a small degree.

CitableDocs uniquely explained 78.1% of the observed variance in the model, as derived from the part correlations, followed by SJR, which accounted for 20.1%. International collaboration on its own accounted for .8% of the total and RefPerDoc - .7%. ß values in the model suggest that every unit increase in CitableDocs results in .789 ($p < .000$) unit increase in Citations. The corresponding figures for SJR is ß 0.218 ($p< .000$). International Collaboration and RefPerDoc have minor effect, though both are statistically significant (Table 5.6).

Cutting across the subjects, citations is, for the most part, a function of publishing in Scopus indexed journals. The journals in which the CitableDocs are published account for the remaining part of the citation. It pays for Scopus indexed journals to carry more CitableDocs, and for the scholars to publish in journals that carry more number of CitableDocs. Number of references cited in the CitableDocs does not make a substantial difference in total citation yield. In other words, reciprocal altruism – cite more to get cited more – do not seem to work in the context of TotalCites.

The following is the Regression Equation obtained from the analysis, where $\hat{y}$ (**Y hat**) is the predicted value of **y** (TotalCites):

$$\hat{Y} = -674.505 + 3.722\,(CitableDocs) - 1.214\,(RefPerDoc) + 2.243\,(Inter.Collab) + 624.564\,(SJR)$$

Actual and estimated citations to Indian journals:

Total citations accrued to 499 Indian journals during 2016-2018 period was 93,380. As per the estimates based on Regression Equation in the multivariate model using four predictor variables this should have been 154,803 citations. There was a shortfall of 61,423 going by the larger trends in Scopus indexed journals. This is so despite indexed Indian journals passing the publisher's quality benchmark. Contributions in Indian journals are less preferred for citations, as indicated by the data.

Table 5.1 Regression Tables for CitableDocs Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.812[a]	.660	.660	2291.9514

a. Predictors: (Constant), CitableDocs

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	251038901027.210	1	251038901027.210	47789.250	.000[b]
	Residual	129256333023.777	24606	5253041.251		
	Total	380295234050.987	24607			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), CitableDocs

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-272.310	15.315		-17.781	.000	
	CitableDocs	3.833	.018	.812	218.608	0.000	.812

a. Dependent Variable: TotalCites

N= 24608

Table 5.2 Regression Tables for TotalRefs Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.817[a]	.668	.668	2266.1150

a. Predictors: (Constant), TotalRefs

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	253936601402.072	1	253936601402.072	49449.443	.000[b]
	Residual	126358632648.915	24606	5135277.276		
	Total	380295234050.987	24607			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), TotalRefs

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlation
		B	Std. Error	Beta			Part
1	(Constant)	-202.307	15.043		-13.448	.000	
	TotalRefs	.243	.001	.817	222.372	0.000	.817

N= 24608

Table 5.3 Regression Tables for International Collaboration Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.165[a]	.027	.027	3877.5340

a. Predictors: (Constant), Inter.Collab.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10337380892.319	1	10337380892.319	687.542	.000[b]
	Residual	369957853158.668	24606	15035269.981		
	Total	380295234050.987	24607			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), Inter.Collab.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	56.233	35.684		1.576	.115	
	Inter.Collab.	40.472	1.544	.165	26.221	.000	.165

a Dependent Variable: TotalCites
N= 24608

Table 5.4 Regression Tables for SJR Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.302[a]	.091	.091	3760.3266

a. Predictors: (Constant), SJR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34568548881.186	1	34568548881.186	2444.725	.000[b]
	Residual	345639534667.010	24444	14140056.237		
	Total	380208083548.197	24445			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	137.548	26.923		5.109	.000	
	SJR	862.499	17.444	.302	49.444	0.000	.302

a. Dependent Variable: TotalCites
N= 24608

Table 5.5 Regression Tables for RefPerDoc Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.092[a]	.008	.008	3914.7550

a. Predictors: (Constant), RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3200744311.646	1	3200744311.646	208.854	.000[b]
	Residual	377094489739.341	24606	15325306.419		
	Total	380295234050.987	24607			

a. Dependent Variable: TotalCites

b. Predictors: (Constant), RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	254.938	41.331		6.168	.000
	RefPerDoc	14.075	.974	.092	14.452	.000

a. Dependent Variable: TotalCites

Table 5.6 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.841[a]	.707	.707	2133.3226

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	268975498652.827	4	67243874663.207	14775.414	.000[b]
	Residual	111232584895.369	24441	4551065.214		
	Total	380208083548.197	24445			

a. Dependent Variable: TotalCites

b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-674.505	23.907		-28.214	.000	
	CitableDocs	3.722	.016	.789	225.797	0.000	.781
	RefPerDoc	-1.214	.602	-.008	-2.018	.044	-.007
	Inter.Collab.	2.243	.968	.009	2.318	.020	.008
	SJR	624.564	10.733	.218	58.189	0.000	.201

a. Dependent Variable: TotalCites

Subject-wise Regression

In 2018 Scopus included 24,690 journals. They were categorized into 27 different subjects as given below. As watertight compartmentalization of journals into subject categories is not possible several fall into more than one subject categories. This is how Scopus deals with the issue. The categorization was accepted as given for the analysis.

The same set of four predictor variables were regressed against TotalCites for CitableDocs in Journals for each of the 27 subject categories identified by Scopus. Summary of the results are presented in Table 5.7 and the details of regression in Tables 5.8 – 5.34 –

Subject-wise distribution of journals in Scopus

	Frequency	Percent
Agricultural and Biological Sciences	2085	5.2
Arts and Humanities	3656	9.1
Biochemistry, Genetics and Molecular Biology	2014	5.0
Business, Management and Accounting	1271	3.2
Chemical Engineering	591	1.5
Chemistry	801	2.0
Computer Science	1513	3.8
Decision Sciences	362	.9
Dentistry	201	.5
Earth and Planetary Sciences	1135	2.8
Economics, Econometrics and Finance	977	2.4
Energy	419	1.0
Engineering	2731	6.8
Environmental Science	1367	3.4
Health Professions	516	1.3
Immunology and Microbiology	550	1.4
Materials Science	1150	2.9
Mathematics	1402	3.5
Medicine	7185	17.9
Multidisciplinary	116	.3
Neuroscience	559	1.4
Nursing	609	1.5
Pharmaceutics	737	1.8
Physics and Astronomy	1047	2.6
Psychology	1159	2.9
Social Sciences	5858	14.6
Veterinary Sciences	235	.6
Total	40246	100.0

The four chosen independent variables explain a high degree of variance ranging from 97.7% (R^2 .977) for Agricultural and Biological Sciences to 27.8% (R^2 =.278) for Economics. The explained R^2 for two subject groupings were .9 and above. It was .8 and above for eight subjects; range from .6 to .7 in eleven subject categories; .4 to .5 for CitableDocs in three subject groupings of journals. Both Business Management (R^2 .308) and Economics (R^2 .288) have less variance explained by predictor variables in consideration. F statistics for all the 27 subjects were significant.

Presence of CitableDocs in the journals explain substantial portion of the variance in all the subject groups. β values for this variables is .5 and above in all the subject categories, except Economics. It is as high as .977 for Agriculture, indicating every one unit of increase in publications in Scopus indexed journal results in .976 increase in citation.

RefPerDoc, examined here to understand whether more references used in CitableDocs lead to higher citation, has mostly contrasting relations with the dependent variable – TotalCites. For 15 out of 27 of subjects ß values are statistically significant, and among them for 11 it is negative. Their individual unique negative contribution, however, is relatively small, and in only one case – Physics –it was slightly more (ß -0.137 $p < .000$). Exceptions to this trend are Decision Sciences, Economics, Mathematics, Social Sciences. In these subjects the concept of reciprocal altruism – if you cite more than the average, you tend to get cited more often - seems to work. In all these subjects higher RefPerDoc has yielded positive and significant total citation accretion. Most of these subjects fall under Social Sciences where more references cited with the publication seem to suggest better scholarship.

Interestingly the number of International Collaborative articles in journals as a variable does not bear high impact on the Total Citation in all the subjects. In 17 out of 27 cases it indicate a significant ß value. In fact, they have significant negative relations in Arts (ß -0.115 $p < .000$). For the other subjects, namely Agriculture, Chemical Engineering, Decision Sciences, Dentistry, Engineering, Multidisciplinary, Neuroscience, Nursing, Psychology and Veterinary science, journals with articles of international collaboration do not seem to make significant difference in accruing citations. ß values observed were invariably 0.1 or less.

SJR is based on transfer of prestige from a journal to another one. Such prestige is transferred through the references (in CitableDocs) that a journal makes to the rest of the journals and to itself. This variable is inclusive of Citation from one journal to another, number of references in journal, number of total journals, number of articles in the journal. Calculation of SJR involves multiple stages and is based on a complex formula devised by Scopus.

SJR as a predictor variable makes a substantial and statistically significant difference in all the subjects in accruing total citations. They particularly standout in multidisciplinary journal (ß.464 $p< .000$), Dentistry (ß .471 $p<.000$), Nursing (ß .412 $p<.000$), Engineering (ß .413 $p<.000$). Immunology (ß .381 $p<.000$), Neuroscience (ß .379 $p<.000$), and Chemistry (ß .362 $p<.000$). At the lower end are Veterinary science (ß 0.198 $p<.000$) and Agriculture (ß .098 $p<.000$) indicating the variance accounted for by SJR is relatively low for the criterion variable TotalCites under these subjects.

The results on the whole indicate that citations accrued to CitableDocs in journals of different subjects depend mostly on the number of citable articles published by the journals indexed in Scopus. Higher the number, greater the citations accrued. Extent of articles with International Collaboration is not an important factor at the Journal level when we consider the universe of CitableDocs included in the database. So also SJR, in some subjects, in itself does not seem to help in accruing more citations. SJR matters substantially in some subject – higher the ranking, greater the citations accrued by the journals.

The following section explains the results separately for the subjects considered in the analysis. A summary of the R^2, F value, ß values and part correlations for the subjects are presented in Table 5.8-5.34.

Agriculture: The Regression model for Agriculture & Biological Sciences reveal that the four identified variables explain 97.7% of variance. CitableDocs account for substantial proportion of that with a ß value of 0.976. SJR of the journals uniquely explain a small portion (ß .098 Part r=.472). RefPerDoc as a variable shows a significant negative correlation to citations the journals accrue in the subject.

Arts and Humanities has 3,656 journals indexed in Scopus. The regression model shows that overall variance accounted for by the four independent variable is only 50.2% (R^2 .502). CitableDocs account for a larger share with ß value of .572 p<.000 followed by SJR ß .278 p<.000. The other two independent variables indicate a statistical significance. RefPerDoc and International Collaboration have negative influence indicating higher the RefPerDoc or the extent of International Collaborative paper the citation accrued is low.

Biochemistry: This subject has 2014 journals in Scopus. ß values of four predictor variables in the model are significant and collectively could explain 77.5% of the variance (R2 .775). Citable articles (ß .835 p<.000), SJR (ß .22 p<.000) contribute most to the variance. Every unit increase in citable articles would result in .835 unit increase in citations. Part correlation in the context suggest that .869 of the variance is accounted for by this variable. RefPerDoc bears a negative influence (ß -.042 p<.000), indicating higher Ref PerDoc would result in fewer citations.

Business management: Scopus indexed 1271 journals under this heading in 2018. Four predictor variables could account for 30.8% (R^2 .308) of the total variance in predicting TotalCites accrued to them in this subject. CitableDocs (ß .508 p<.000), followed by SJR (ß 0.134 p<.000) could account for most of the variance in the model. Extent of International collaboration makes a significant contribution, yet less than 1.5% of the total variance is explained by the variable.

Chemical engineering: With 591 journals pertaining to chemical engineering, the multivariate model could explain 73.4% of the variance (R2 .734). CitableDocs (ß .774 p<.000) and SJR (ß.265 p<.000) make most of the contribution in explaining the variance. RefPerDoc had a minor, yet statistically significant ß value of -0.059 $p < .000$.

Chemistry: There are 801 journals relating to chemistry indexed in Scopus. All the four independent variables contribute significantly in explaining the variance for citation accrued in the model (R^2 .754). Citable Doc (ß .733 p<.000) followed by SJR (ß .362 p<.000) register most of the influence, followed by a relatively low ß of .047 p <.05 by extent of International collaboration. The variable RefPerDoc shows a significant negative influence (ß -.057 p< 000) on the dependent variable.

Computer science: For articles in Journals relating to computer science citation accrual is influenced mostly by citable documents (ß .736 p < .000) and SJR (ß .243 p<.000). International collaboration makes a significant but limited contribution (ß .093 p<.000). As in the case of Chemistry, RefPerDoc has a negative, albeit non-significant influence on citations accrued.

Decision science: Decision science in Scopus has 362 journals under the category. With an R^2 of .578 variance accounted for is in the midrange among the subject categories. As with the other subjects citable documents (ß .663 p<.000) and SJR (ß .262 p<.000) contribute the most, followed by RefPerDoc, which is positive and significant (ß .074 p<.000) though exerting minor influence.

Dentistry: With just 201 journals under this subject category, the regression model accounts for over 80% of the variance (R^2 .822) in the TotalCites accrued. Interesting phenomenon in this groups of journals is relatively higher variance (ß .471 p<.000) accounted for by SJR. Implying that articles in the journals with higher SJR attract more number of citaitons. All the same CitableDocs (ß .58 p<.000) contribute to the variance in a major way.

Earth science: Earth science, with 1135 journals in Scopus, falls in the conventional pattern when explaining the influence of predictor variables to TotalCites. Presence of CitableDocs make the most (ß .897 p<.000) in explaining the variance, followed by SJR (ß .124 p<.000) and international collaboration (ß .053 p<.000) in that order. RefPerDoc has a negative influence (ß -.49 p <.05). Part correlations indicate that 35.2% of the variance is from SJR alone in the context.

Economics: There were 977 journals relating to economics in 2018. Presence of Citable documents in this subject indicates altogether a different trend compared to the other subjects in accounting for citations. In that the model accounts only for 27.8% of the variance (R^2 .278). SJR leads the predictor variables (ß .33 p<.000) followed by CitableDocs (ß .261 p<.000). Extent of International collaboration too explains the variance significantly (ß .193 p<.000) and to a higher degree compared to the other subjects, and is followed by RefPerDoc. In fact, citations for economics behaved differently even when compared with larger in scope more inclusive category social sciences in the analysis. Part correlations show that SJR on its own account for 31.2% (r=.312) of the observed variance, followed by CItableDocs (r=.259).

Energy: There were 419 journals categorized under the subject. The citation accrual behavior is on the predictable lines with CitableDocs accounting for the most (β .807 p<.000) in explaining the observed variance, followed by SJR (β .173 p<.000) and International collaboration (β .113 p<.000). The analysis indicates a more even distribution of citations across the journals

Engineering: With R^2 of .607 the four predictor variables in the model could account for a large amount of variance. Though CitableDocs make the most of the influence (β .594 p<.000), SJR follows closely behind with β .413 p <.000). part correlation in the analysis shows that CitableDocs alone explain 58.0% of the variance. RefPerDoc as has been noticed in other contexts remain a minor negative influence (-.048) on citation accrued. Engineering had 2731 journals indexed in Scopus in 2018.

Environmental science: With an R^2 .679 four identified variables explain a large share of variance in citations. CitableDocs with β .79 p <.00 and SJR (β .134 p< .000) are major contributors to the variance. Documents in Scopus indexed journals make most of the difference in accruing citations. Every unit increase in CitableDocs would result in .79 unit increase in Total Citations. Scopus had 1367 journals dealing with Environmental Science.

Health professionals: There were 516 journals under this category. The predictor variable behavior is the same as the most other subjects – CitableDocs (β .762 p<.000), followed by SJR (β .174 p<.000), and International collaboration (β .116 p<.000) account for the variance.

Immunology: This subject has 550 journals indexed in Scopus. The TotalCites is noted to behave as per the larger observed trends for other subjects. R^2 of .815 is on the higher end with CitableDocs (β .770 p<.000) and SJR (β .381 p<.000) making the most of the variance in explaining TotalCites. Publishing in higher ranked journal can predict the citations accrued in this subject relatively to a larger extent. RefPerDoc (β -0.58 p<.000) has a negative and significant influence in the context.

Material science: with 1150 journals in the category four predictor variable in the model account for 76.5 (R^2 .765) of the variance. SJR (β .247 p<.000) and Citable Doc (β .765 p<.000) makes the most of the variance followed by International collaboration and a negative RefPerDoc. CitableDocs uniquely explain 75.0 % of the variance accounted for in the subject.

Mathematics: The trend of TotalCites accrued being influenced mostly by two of the four variables considered in the analysis remains largely the same for Mathematics with R^2 .598. CitableDocs makes the most of it (β .725 p<.000) followed by SJR (β 0.17 p<.000)

Medicine: With 7185 distinct journals medicine had largest number of journals in Scopus in 2018. CitableDocs account for most of the variance, in medicine (β .849 p< .000) and is next only to Agriculture in its influence on Citations. Even SJR as a predictor variable contributes substantially (β .236 p<.000) to the total accounted variance of 81.2% (R^2 .812). International collaboration has minor (β .042 p<.000), but accounts for statistically significant variation in the positive direction.

Multidisciplinary: Scopus categorizes 116 journals under multidisciplinary category. The articles under this head of journals are most highly cited in which CitableDocs published (β .805 p<.000) and SJR are the good predictors (β .464 p<.000). The other two variables in the model are not significant. On the whole, these two variables account for 97.8% of the variance accounted for in the model (R^2 .979)

Neuroscience: Being part of medicine, and with some journals overlapping in both categories, Neuroscience follows a similar trend with SJR (β .379 p<.000) and CitableDocs in journals (β 0.751 p<.000) making the most of the contribution to the total variance accounted (R^2 .853). The other two variables in the equation are not significant. There are 559 journals under this heading in 2018.

Nursing: with 609 journals the behavior of variables is the same as that of medicine and neuroscience. SJR (β .412) and CitableDocs (β .64) contributing the most of the variance accounted. for this is .806. Part correlation in the output indicate that SJR alone accounts for 32.5% of the total observed variance.

Pharmacology: CitableDocs (β .714 p<.000), SJR (β .311 p<.000) and International collaboration (β .119 p<.000) contribute significantly to the total accounted variance of 71.4%. There were 737 journals under this head in 2018.

Physics: This is one of the classical sciences with a well-established scholarly communication pattern. The analysis of 1047 journals show an .595, leaving nearly 40%of variance unaccounted by the select variables. CitableDocs (β .685 p<.000) and SJR (β .294 p<.000) are the important variable in the context RefPerDoc has a negative but significant beta of .137 p<.000, followed by International collaboration (β .085 p<.000).

Psychology: 1159 journals are categorized under this subject. Total citations are predicted (R^2 .861 to a large extent by Total CitableDocs (β .844 p<.000) and SJR (β .246 p<.000) . Part correlation in the analysis show that CitableDocs uniquely explain 81.5% and SJR 20.3% of the accounted variance. The other two variables are not significant.

Social Sciences: This is the second most numerous category in terms of journals. The model accounted for 60.2% of the variance. All four predictor variables were significant and positive in their contributions in the familiar order of Citable Docs, (β .681 p<.000), SJR (β . 22 p<.000), International Collaboration (β .11 p<.000) and RefPerDoc (β .037 p<.000)

Veterinary Science: With 235 journals in this category is second least number of sources. CitableDocs (β .769 p<.000) and SJR (β .198 p<.000) are the two variables that contribute to the variance.

What do the results of the analysis imply?

When we consider the TotalCites accrued in a subject-wise manner the dominant contributor that holds out is the presence of CitableDocs. To accrue more citations there is a need to publish more CitableDocs in the Scopus journals. Though this is a dominant variable, this is not sufficient. In subjects like Economics (Econometrics and Finance), and Arts (and Humanities) this trend does not hold good.

Journals with higher rank (SJR), is also important and contribute to the TotalCites. Extent of international collaboration in published articles is not a major factor and explains relatively lesser accounted variance, though it is statistically significant in most of the cases. Presence of international collaboration in itself does not accrue more citations. Neither authors, nor for that matter journals, need to look for contributions with international collaboration to have their publications cited by the peer group. Reciprocal altruism does not seem to work in accruing citation in most of the instances. They have negative and significant impact, though they seem to affect in a minor way.

Table 5.7											
Subject	No of Journals & Other Sources	R^2	F	Citable Doc ß	t	RefPerDoc ß	t	IN Collab ß	t	SJR ß	t
Agricultural and Biological Sciences	2085	0.977	21663.03	0.976	289.75	-0.01	-2.49	0.001	0.233	0.098	24.382
Arts and Humanities	3656	0.502	912.761	0.575	44.366	-0.031	-2.462	-0.115	-8.793	0.278	20.004
Biochemistry, Genetics and Molecular Biology	2014	0.775	1728.471	0.835	78.531	-0.042	-3.48	0.05	4.168	0.22	19.179
Business, Management and Accounting	1271	0.308	140.516	0.508	21.506	0.052	1.842	0.087	3.007	0.134	5.195
Chemical Engineering	591	0.734	405.08	0.774	35.829	-0.057	-2.134	0.05	1.859	0.265	11.203
Chemistry	801	0.754	612.892	0.733	40.764	-0.072	-3.401	0.047	2.378	0.362	17.463
Computer Science	1513	0.686	822.473	0.736	50.145	-0.008	-0.482	0.093	5.61	0.243	15.138
Decision Sciences	362	0.578	123.825	0.663	18.793	0.074	2.063	0.01	0.248	0.262	6.895
Dentistry	201	0.822	230.371	0.58	16.583	-0.04	-1.084	0.023	0.631	0.471	10.926
Earth and Planetary Sciences	1135	0.893	2348.831	0.897	87.32	-0.049	-3.671	0.053	4.283	0.124	9.902
Economics, Econometrics and Finance	977	0.278	94.273	0.261	9.485	0.061	2.008	0.193	6.17	0.33	11.407
Energy	419	0.768	345.078	0.807	33.4	-0.002	-0.079	0.113	3.877	0.173	6.799
Engineering	2731	0.607	1048.493	0.594	48.224	-0.06	-3.955	0.013	0.885	0.413	28.987
Environmental Science	1367	0.679	717.227	0.79	50.687	-0.013	-0.687	0.062	3.402	0.134	7.965
Health Professions	516	0.678	269.579	0.762	29.512	-0.02	-0.685	0.116	4.196	0.174	6.278
Immunology and Microbiology	550	0.815	602.741	0.77	40.741	-0.058	-2.726	0.052	2.474	0.381	19.096
Materials Science	1150	0.714	715.151	0.765	47.45	-0.037	-1.941	0.065	3.429	0.247	13.94
Mathematics	1402	0.598	517.75	0.725	42.553	0.073	4.046	0.037	1.971	0.17	9.122
Medicine	7185	0.812	7737.015	0.849	164.481	-0.034	-5.645	0.042	7.07	0.236	43.003
Multidisciplinary	116	0.978	1277.538	0.805	56.398	0.008	0.494	-0.025	-1.4	0.464	30.986
Neuroscience	559	0.853	807.99	0.751	44.17	-0.033	-1.764	0.019	1.003	0.379	20.882
Nursing	609	0.806	625.498	0.64	32.255	-0.037	-1.731	0.03	1.311	0.412	18.121
Pharmacology, Toxicology and Pharmaceutics	737	0.739	520.16	0.714	37.148	-0.025	-1.029	0.119	5.067	0.311	13.309
Physics and Astronomy	1047	0.595	384.913	0.685	34.211	-0.137	-5.518	0.085	3.748	0.294	11.813
Psychology	1159	0.861	1781.999	0.844	74.104	0.02	1.489	-0.006	-0.459	0.246	18.447
Social Sciences	5858	0.602	2190.88	0.681	80.841	0.037	4.16	0.11	12.297	0.22	25.192
Veterinary	235	0.801	235.439	0.769	23.267	0.009	0.25	0.059	1.628	0.198	4.914

1

Table 5.8: Regression Tables for Variables Predicting TotalCites in Agricultural and Biological Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.988[a]	.977	.977	789.299

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	53983656588.409	4	13495914147.102	21663.032	.000[b]
	Residual	1289595201.921	2070	622992.851		
	Total	55273251790.330	2074			

a. Dependent Variable: TotalCites

b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlation
		B	Std. Error	Beta			Part
1	(Constant)	-523.315	35.240		-14.850	.000	
	CitableDocs	3.148	.011	.976	289.750	0.000	.973
	RefPerDoc	-2.280	.916	-.010	-2.490	.013	-.008
	Int.Collab	.266	1.141	.001	.233	.816	.001
	SJR	625.482	25.653	.098	24.382	.000	.082

a. Dependent Variable: TotalCites

2

Table 5.9: Regression Tables for Variables Predicting TotalCites in Arts and Humanities

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.709[a]	.502	.502	1223.486

a. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5465313148.147	4	1366328287.037	912.761	.000[b]
	Residual	5411356397.615	3615	1496917.399		
	Total	10876669545.762	3619			

a. Dependent Variable: TotalCites

b. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlation
		B	Std. Error	Beta			Part
1	(Constant)	-583.036	36.153		-16.127	.000	
	CitableDocs	7.532	.170	.575	44.366	0.000	.520
	RefPerDoc	-2.103	.854	-.031	-2.462	.014	-.029
	Int.Collab	-17.741	2.018	-.115	-8.793	.000	-.103
	SJR	887.027	44.343	.278	20.004	.000	.235

a. Dependent Variable: TotalCites

3

Table 5.10: Regression Tables for Variables Predicting TotalCites in Biochemistry, Genetics and Molecular Biology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.881[a]	.776	.775	3372.021

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	78614477784.247	4	19653619446.062	1728.471	.000[b]
	Residual	22718306460.506	1998	11370523.754		
	Total	101332784244.753	2002			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-867.759	144.028		-6.025	.000	
	CitableDocs	3.448	.044	.835	78.531	0.000	.832
	RefPerDoc	-9.751	2.802	-.042	-3.480	.001	-.037
	Int.Collab	22.801	5.470	.050	4.168	.000	.044
	SJR	739.207	38.542	.220	19.179	.000	.203

a. Dependent Variable: TotalCites
4

Table 5.11: Regression Tables for Variables Predicting TotalCites in Business, Management and Accounting

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.557[a]	.310	.308	1123.508

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	709475639.642	4	177368909.911	140.516	.000[b]
	Residual	1580361329.243	1252	1262269.432		
	Total	2289836968.885	1256			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-352.287	72.965		-4.828	.000	
	CitableDocs	1.886	.088	.508	21.506	.000	.505
	RefPerDoc	2.866	1.556	.052	1.842	.066	.043
	Int.Collab	7.320	2.434	.087	3.007	.003	.071
	SJR	124.365	23.938	.134	5.195	.000	.122

a. Dependent Variable: TotalCites

5

Table 5.12 Regression Tables for Variables Predicting TotalCites in Chemical Engineering

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.858[a]	.735	.734	4798.001

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37301090393.802	4	9325272598.451	405.080	.000[b]
	Residual	13421132275.278	583	23020810.078		
	Total	50722222669.080	587			

a. Dependent Variable: TotalCites

b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-1252.428	355.132		-3.527	.000	
	CitableDocs	4.254	.119	.774	35.829	.000	.763
	RefPerDoc	-19.160	8.979	-.057	-2.134	.033	-.045
	Int.Collab	33.364	17.947	.050	1.859	.064	.040
	SJR	1648.616	147.153	.265	11.203	.000	.239

a. Dependent Variable: TotalCites

6

Table 5.13 Regression Tables for Variables Predicting TotalCites in Chemistry

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.869[a]	.755	.754	5339.354

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69890995776.370	4	17472748944.093	612.892	.000[b]
	Residual	22635908367.039	794	28508700.714		
	Total	92526904143.409	798			

a. Dependent Variable: TotalCites

b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-2163.756	374.896		-5.772	.000	
	CitableDocs	4.552	.112	.733	40.764	.000	.716
	RefPerDoc	-25.093	7.378	-.072	-3.401	.001	-.060
	Int.Collab	38.387	16.144	.047	2.378	.018	.042
	SJR	2519.555	144.280	.362	17.463	.000	.307

a. Dependent Variable: TotalCites

7

Table 5.14 Regression Tables for Variables Predicting TotalCites in Computer Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.829[a]	.687	.686	1141.359

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4285739553.548	4	1071434888.387	822.473	.000[b]
	Residual	1951444247.386	1498	1302699.765		
	Total	6237183800.934	1502			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-715.638	63.630		-11.247	.000	
	CitableDocs	3.446	.069	.736	50.145	0.000	.725
	RefPerDoc	-.756	1.568	-.008	-.482	.630	-.007
	Int.Collab	11.701	2.086	.093	5.610	.000	.081
	SJR	588.901	38.902	.243	15.138	.000	.219

a. Dependent Variable: TotalCites
8

Table 5.15 Regression Tables for Variables Predicting TotalCites in Decision Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.764[a]	.583	.578	888.880

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	391339563.893	4	97834890.973	123.825	.000[b]
	Residual	279698295.907	354	790108.181		
	Total	671037859.799	358			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-495.531	120.347		-4.118	.000	
	CitableDocs	3.088	.164	.663	18.793	.000	.645
	RefPerDoc	5.049	2.447	.074	2.063	.040	.071
	Int.Collab	.883	3.564	.010	.248	.804	.009
	SJR	245.851	35.655	.262	6.895	.000	.237

a. Dependent Variable: TotalCites
9

Table 5.16 Regression Tables for Variables Predicting TotalCites in Dentistry

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.908[a]	.825	.822	260.730

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	62642518.197	4	15660629.549	230.371	.000[b]
	Residual	13256122.998	195	67980.118		
	Total	75898641.195	199			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Correlations
Model		B	Std. Error	Beta	t	Sig.	Part
1	(Constant)	-283.186	41.375		-6.844	.000	
	CitableDocs	1.772	.107	.580	16.583	.000	.496
	RefPerDoc	-1.771	1.634	-.040	-1.084	.280	-.032
	Int.Collab	1.001	1.585	.023	.631	.528	.019
	SJR	541.146	49.526	.471	10.926	.000	.327

a. Dependent Variable: TotalCites

Table 5.17 Regression Tables for Variables Predicting TotalCites in Earth & Planetary Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.945[a]	.893	.893	836.435

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6573182795.448	4	1643295698.862	2348.831	.000[b]
	Residual	786376041.266	1124	699622.813		
	Total	7359558836.714	1128			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Correlations
Model		B	Std. Error	Beta	t	Sig.	Part
1	(Constant)	-569.029	42.387		-13.425	.000	
	CitableDocs	4.029	.046	.897	87.320	0.000	.851
	RefPerDoc	-3.794	1.034	-.049	-3.671	.000	-.036
	Int.Collab	6.414	1.498	.053	4.283	.000	.042
	SJR	329.787	33.307	.124	9.902	.000	.097

a. Dependent Variable: TotalCites

Table 5.18 Regression Tables for Variables Predicting TotalCites in Economics, Econometrics & Finance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.530[a]	.281	.278	420.072

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	66541866.173	4	16635466.543	94.273	.000[b]
	Residual	169931465.360	963	176460.504		
	Total	236473331.533	967			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-86.080	30.209		-2.850	.004	
	CitableDocs	.357	.038	.261	9.485	.000	.259
	RefPerDoc	1.359	.677	.061	2.008	.045	.055
	Int.Collab	5.505	.892	.193	6.170	.000	.169
	SJR	74.325	6.516	.330	11.407	.000	.312

a. Dependent Variable: TotalCites

Table 5.19 Regression Tables for Variables Predicting TotalCites in Energy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.878[a]	.771	.768	3604.628

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17934855334.199	4	4483713833.550	345.078	.000[b]
	Residual	5340265299.433	411	12993346.227		
	Total	23275120633.632	415			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-2132.316	311.423		-6.847	.000	
	CitableDocs	5.501	.165	.807	33.400	.000	.789
	RefPerDoc	-.757	9.568	-.002	-.079	.937	-.002
	Int.Collab	55.697	14.365	.113	3.877	.000	.092
	SJR	604.309	88.887	.173	6.799	.000	.161

a. Dependent Variable: TotalCites

Table 5.20 Regression Tables for Variables Predicting TotalCites in Engineering

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.780[a]	.608	.607	2407.496

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24308428057.822	4	6077107014.456	1048.493	.000[b]
	Residual	15695670145.521	2708	5796037.720		
	Total	40004098203.344	2712			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-867.911	80.810		-10.740	.000	
	CitableDocs	3.067	.064	.594	48.224	0.000	.580
	RefPerDoc	-11.391	2.881	-.060	-3.955	.000	-.048
	Int.Collab	3.549	4.010	.013	.885	.376	.011
	SJR	1812.437	62.525	.413	28.987	.000	.349

a. Dependent Variable: TotalCites

Table 5.21 Regression Tables for Variables Predicting TotalCites in Environmental Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.825[a]	.680	.679	2097.344

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12619894172.312	4	3154973543.078	717.227	.000[b]
	Residual	5938447235.120	1350	4398849.804		
	Total	18558341407.432	1354			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-725.192	112.602		-6.440	.000	
	CitableDocs	4.293	.085	.790	50.687	0.000	.780
	RefPerDoc	-1.986	2.890	-.013	-.687	.492	-.011
	Int.Collab	12.955	3.808	.062	3.402	.001	.052
	SJR	300.380	37.711	.134	7.965	.000	.123

a. Dependent Variable: TotalCites

Table 5.22 Regression Tables for Variables Predicting TotalCites in Health Professions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.825[a]	.680	.678	603.956

a. Predictors: (Constant), SJR, Int.Collab, CitableDocs, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	393330110.106	4	98332527.527	269.579	.000[b]
	Residual	184934907.595	507	364763.131		
	Total	578265017.701	511			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, Int.Collab, CitableDocs, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-311.996	56.866		-5.487	.000	
	CitableDocs	3.016	.102	.762	29.512	.000	.741
	RefPerDoc	-1.110	1.620	-.020	-.685	.494	-.017
	Int.Collab	8.153	1.943	.116	4.196	.000	.105
	SJR	76.814	12.236	.174	6.278	.000	.158

a. Dependent Variable: TotalCites

Table 5.23 Regression Tables for Variables Predicting TotalCites in Immunology & Microbiology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.904[a]	.817	.815	1242.466

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3721859874.233	4	930464968.558	602.741	.000[b]
	Residual	835153321.034	541	1543721.481		
	Total	4557013195.267	545			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-671.527	104.671		-6.416	.000	
	CitableDocs	3.648	.090	.770	40.741	.000	.750
	RefPerDoc	-5.707	2.094	-.058	-2.726	.007	-.050
	Int.Collab	8.769	3.544	.052	2.474	.014	.046
	SJR	508.568	26.632	.381	19.096	.000	.351

a. Dependent Variable: TotalCites

Table 5.24 Regression Tables for Variables Predicting TotalCites in Materials Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.845[a]	.715	.714	3827.725

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41912066049.004	4	10478016512.251	715.151	.000[b]
	Residual	16717337418.438	1141	14651478.894		
	Total	58629403467.442	1145			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-1906.230	200.914		-9.488	.000	
	CitableDocs	4.882	.103	.765	47.450	.000	.750
	RefPerDoc	-8.777	4.522	-.037	-1.941	.052	-.031
	Int.Collab	32.926	9.603	.065	3.429	.001	.054
	SJR	1030.520	73.925	.247	13.940	.000	.220

a. Dependent Variable: TotalCites

Table 5.25 Regression Tables for Variables Predicting TotalCites in Mathematics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.774[a]	.599	.598	851.549

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1501758154.083	4	375439538.521	517.750	.000[b]
	Residual	1006489002.590	1388	725136.169		
	Total	2508247156.673	1392			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-511.252	52.518		-9.735	.000	
	CitableDocs	2.239	.053	.725	42.553	.000	.724
	RefPerDoc	5.796	1.433	.073	4.046	.000	.069
	Int.Collab	3.077	1.562	.037	1.971	.049	.034
	SJR	219.247	24.035	.170	9.122	.000	.155

a. Dependent Variable: TotalCites

Table 5.26 Regression Tables for Variables Predicting TotalCites in Medicine

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.901[a]	.813	.812	1666.657

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85965869958.822	4	21491467489.705	7737.015	.000[b]
	Residual	19833112325.964	7140	2777746.824		
	Total	105798982284.786	7144			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-598.895	33.178		-18.051	.000	
	CitableDocs	3.293	.020	.849	164.481	0.000	.843
	RefPerDoc	-5.740	1.017	-.034	-5.645	.000	-.029
	Int.Collab	10.754	1.521	.042	7.070	.000	.036
	SJR	542.820	12.623	.236	43.003	0.000	.220

a. Dependent Variable: TotalCites

Table 5.27 Regression Tables for Variables Predicting TotalCites in Multidisciplinary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.989[a]	.979	.978	4209.734

a. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90561363418.990	4	22640340854.747	1277.538	.000[b]
	Residual	1967126072.562	111	17721856.510		
	Total	92528489491.552	115			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Int.Collab

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-2733.128	687.011		-3.978	.000	
	CitableDocs	4.357	.077	.805	56.398	.000	.781
	RefPerDoc	12.795	25.927	.008	.494	.623	.007
	Int.Collab	-52.538	37.519	-.025	-1.400	.164	-.019
	SJR	6395.384	206.399	.464	30.986	.000	.429

a. Dependent Variable: TotalCites

Table 5.28 Regression Tables for Variables Predicting TotalCites in Neuroscience

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.924[a]	.854	.853	977.953

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3091024349.397	4	772756087.349	807.990	.000[b]
	Residual	528885343.322	553	956393.026		
	Total	3619909692.719	557			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Correlations
Model		B	Std. Error	Beta	t	Sig.	Part
1	(Constant)	-722.178	89.184		-8.098	.000	
	CitableDocs	3.903	.088	.751	44.170	.000	.718
	RefPerDoc	-3.047	1.727	-.033	-1.764	.078	-.029
	Int.Collab	3.090	3.081	.019	1.003	.316	.016
	SJR	595.103	28.499	.379	20.882	.000	.339

a. Dependent Variable: TotalCites

Table 5.29 Regression Tables for Variables Predicting TotalCites in Nursing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.898[a]	.807	.806	486.636

a. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	592507395.642	4	148126848.911	625.498	.000[b]
	Residual	141851788.934	599	236814.339		
	Total	734359184.576	603			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Int.Collab

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Correlations
Model		B	Std. Error	Beta	t	Sig.	Part
1	(Constant)	-519.502	39.600		-13.119	.000	
	CitableDocs	2.947	.091	.640	32.255	.000	.579
	RefPerDoc	-2.499	1.444	-.037	-1.731	.084	-.031
	Int.Collab	2.539	1.937	.030	1.311	.190	.024
	SJR	701.630	38.720	.412	18.121	.000	.325

a. Dependent Variable: TotalCites

Table 5.30 Regression Tables for Variables Predicting TotalCites in Pharmacology, Toxicology & Pharmaceutics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.861[a]	.741	.739	979.305

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1995410788.983	4	498852697.246	520.160	.000[b]
	Residual	699138406.763	729	959037.595		
	Total	2694549195.745	733			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-713.705	64.038		-11.145	.000	
	CitableDocs	2.648	.071	.714	37.148	.000	.701
	RefPerDoc	-1.600	1.554	-.025	-1.029	.304	-.019
	Int.Collab	16.046	3.167	.119	5.067	.000	.096
	SJR	721.091	54.181	.311	13.309	.000	.251

a. Dependent Variable: TotalCites

Table 5.31 Regression Tables for Variables Predicting TotalCites in Physics & Astronomy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.772[a]	.597	.595	4452.755

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30526738549.534	4	7631684637.383	384.913	.000[b]
	Residual	20639939730.638	1041	19827031.442		
	Total	51166678280.172	1045			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-1394.357	240.862		-5.789	.000	
	CitableDocs	3.391	.099	.685	34.211	.000	.673
	RefPerDoc	-22.000	3.987	-.137	-5.518	.000	-.109
	Int.Collab	35.024	9.345	.085	3.748	.000	.074
	SJR	1306.020	110.555	.294	11.813	.000	.233

a. Dependent Variable: TotalCites

Table 5.32 Regression Tables for Variables Predicting TotalCites in Psychology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.928[a]	.861	.861	341.497

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	831269590.089	4	207817397.522	1781.999	.000[b]
	Residual	133646979.489	1146	116620.401		
	Total	964916569.578	1150			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-317.291	24.313		-13.050	.000	
	CitableDocs	3.249	.044	.844	74.104	0.000	.815
	RefPerDoc	.897	.602	.020	1.489	.137	.016
	Int.Collab	-.383	.834	-.006	-.459	.647	-.005
	SJR	212.668	11.528	.246	18.447	.000	.203

a. Dependent Variable: TotalCites

Table 5.33 Regression Tables for Variables Predicting TotalCites in Social Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.776[a]	.602	.602	316.338

a. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	876965198.775	4	219241299.694	2190.880	.000[b]
	Residual	580105664.766	5797	100069.978		
	Total	1457070863.540	5801			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, Int.Collab, RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-195.268	8.628		-22.632	.000	
	CitableDocs	2.105	.026	.681	80.841	0.000	.670
	RefPerDoc	.826	.199	.037	4.160	.000	.034
	Int.Collab	4.030	.328	.110	12.297	.000	.102
	SJR	106.945	4.245	.220	25.192	.000	.209

a. Dependent Variable: TotalCites

Table 5.34 Regression Tables for Variables Predicting TotalCites in Veterinary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.897[a]	.804	.801	369.983

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	128914320.162	4	32228580.040	235.439	.000[b]
	Residual	31347201.992	229	136887.345		
	Total	160261522.154	233			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Int.Collab

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Correlations
Model		B	Std. Error	Beta	t	Sig.	Part
1	(Constant)	-461.776	62.024		-7.445	.000	
	CitableDocs	2.093	.090	.769	23.267	.000	.680
	RefPerDoc	.523	2.088	.009	.250	.802	.007
	Int.Collab	3.671	2.255	.059	1.628	.105	.048
	SJR	456.899	92.979	.198	4.914	.000	.144

a. Dependent Variable: TotalCites

Chapter 6
Analysis of Citations per Document

Total citation is only one part of the story in scholarly pursuit of citations. The more important variable, one would say, is the CitesPerDoc. It is not the total citations, but the higher impact in terms of what is published, considering countries and their respective academic bases come in varying sizes. To understand this aspect bivariate and multivariate regressions were worked out as in the case of total citations.

At first looks SJR used in the place of JIF looks to be the same as CitesPerDoc, but they are not. As Scopus defines, SJR is “the average number of weighted citations received in the selected year by the documents published in the selected journal in the three previous years, --i.e. weighted citations received in year X to documents published in the journal in years X-1, X-2 and X-3” (https://www.scimagojr.com/SCImagoJournalRank.pdf). To make sure that they are not the same, correlation coefficient of these two variables were calculated, and it resulted in r(24446) = .539. Total observation for the analysis varied from the total number of journals (24,690) as one of the values in correlation was absent.

As was done in the case of TotalCites, the variables used for this analysis are - Total CitableDocs, RefPerDoc, extent of International Collaboration, SJR along with TotalCites which was used as the dependent variable in the analysis. CitesPerDoc was calculated for the years 2016-2018 by dividing the TotalCites for the journals with their corresponding total CitableDocs.

The five variables, namely TotalCites, CitableDocs, International Collaboration, RefPerDoc, and SJR were regressed individually against CitesPerDoc show significant F values. The R^2 values though was relatively low for many of them. CitableDocs account for a mere 6% of the variance on its own in a bivariate model (R^2= .06); TotalCites account for variance of 3.91% (R^2 .0391); International collaboration 4.6% (R^2 =.046) of the variance, SJR account for 29.1% (R^2 = .291) of the total, and RefPerDoc 5.4% (R^2= .054) (Table 6.1 – 6. 5). As we could see individually these variables do not explain much variance, though they all have statistically significant F values.

These five predictor variables were regressed in a multivariate model. The analysis intended to understand how these variables taken together explain the variance for CitesPerDoc.

The five predictor variables was regressed together for the entire set of journals. Regression coefficient (R^2 =.297) indicate that the five variables account for 29.7% of the total variance in CitesPerDoc (Table 6.6). Statistically significant F Value also indicates the validity of the model. All the five predictor variables show statistically significant ß values, though CitableDocs holds out a negative influence, indicating more CitableDocs on its own has a negative influence to the tune of 2.0%, on CitesPerDoc as shown by the part correlation. Observed ß -.36 ($p<.000$) of CitableDocs indicate that every unit increase in CitableDocs result in .36 units less CitesPerDoc. That is, though the number of citations may increase with higher citableDocs, it does not behave the same way with CitesPerDoc.

Though all the other four predictor variables are positively and significantly influence the variance accounted for in the context, the impact of International Collaboration (ß .02 $p<.000$) and TotalCites (ß .069 $p<.000$) are relatively small. Part correlation shows that TotalCites account for 3.7% of the total variance accounted for on its own, and the corresponding figure is 1.9% for International Collaboration, SJR on the other hand accounts for the lion's share with a ß of .496 $p<.000$ indicating every unit increase in SJR, CitesPerDoc would enhance by .496 units. On its own SJR contributes 42.9% of the variance account for.

The results indicate that 'high impact' (in terms of more citations for individual articles) is a function of the article appearing in journals with higher SJR, more than the other factors. Considering SJR is the 'prestige' attributed to the journals, it points to possible Mathew effect in operation. As we can see much of the variance is not accounted for by the independent variables in the model. We may need to expand the model with more relevant independent variables.

The following is the Regression Equation obtained from the analysis, where $\hat{y}$ (**Y hat**) is the predicted value of **y** (CitesPerDoc):

Ŷ = -.027 + .00008273(TotalCites) +.000 (CitableDocs) + .011(RefPerDoc) + .006 (Inter.Collab) + 1.705 (SJR)

Actual and estimated CitesPerDoc for Indian journals:

It was noted earlier that there is a huge difference in estimated and actual citations accrued for Indian journals indexed in Scopus. Similar calculation in the context of CitesPerDoc was carried out based on the obtained Regression Equation. The results indicate that the mean CitesPerDoc for Indian journals was 0.650 against the estimated value of 0.720. Scholarly contributions in our journals are less frequently cited that the estimated figures based on the world trends. Inclusion of Indian journals in Scopus after careful editorial selection does not seem to have helped the journals in accruing greater CitesPerDoc. Despite making 'Scopus indexed' grade, CitableDocs in these journals do not get the estimated average world attention.

Table 6.1 Regression Tables for TotalCites **Predicting CitesPerDoc**

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.198[a]	.039	.039	4.64349

a. Predictors: (Constant), TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21591.236	1	21591.236	1001.358	.000[b]
	Residual	527060.389	24444	21.562		
	Total	548651.625	24445			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	1.468	.030		48.586	0.000	
	TotalCites	.000	.000	.198	31.644	.000	.198

a. Dependent Variable: CitesPerDoc

N = 24446

Table 6.2 Regression Tables for CitableDocs **Predicting CitesPerDoc**

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.077[a]	.006	.006	4.72376

a. Predictors: (Constant), CitableDocs

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3211.173	1	3211.173	143.909	.000[b]
	Residual	545440.452	24444	22.314		
	Total	548651.625	24445			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), CitableDocs

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	1.529	.032		48.265	0.000	
	CitableDocs	.000	.000	.077	11.996	.000	.077

a. Dependent Variable: CitesPerDoc

Table 6.3 Regression Tables for Inter.Collab.**Predicting CitesPerDoc**

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.214[a]	.046	.046	4.62812

a. Predictors: (Constant), Inter.Collab.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25072.421	1	25072.421	1170.540	.000[b]
	Residual	523579.204	24444	21.420		
	Total	548651.625	24445			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), Inter.Collab.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.587	.043		13.739	.000	
	Inter.Collab.	.063	.002	.214	34.213	.000	.214

a. Dependent Variable: CitesPerDoc

Table 6.4 Regression Tables for SJR **Predicting CitesPerDoc**

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.539[a]	.291	.291	3.98928

a. Predictors: (Constant), SJR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	159640.551	1	159640.551	10031.215	.000[b]
	Residual	389011.074	24444	15.914		
	Total	548651.625	24445			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.357	.029		12.511	.000	
	SJR	1.853	.019	.539	100.156	0.000	.539

a. Dependent Variable: CitesPerDoc

Table 6.5 Regression Tables for RefPerDoc **Predicting CitesPerDoc**

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.233[a]	.054	.054	4.60683

a. Predictors: (Constant), RefPerDoc

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29880.543	1	29880.543	1407.943	.000[b]
	Residual	518771.082	24444	21.223		
	Total	548651.625	24445			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), RefPerDoc

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.185	.049		3.800	.000	
	RefPerDoc	.043	.001	.233	37.523	.000	.233

a. Dependent Variable: CitesPerDoc

Table 6.6 Regression Tables for Variables Predicting CitesPerDoc

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.545[a]	.297	.297	3.97203	.297	2067.059	5	24440	0.000

a. Predictors: (Constant), SJR, Citable_Docs, RefPerDoc, Inter Collab, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	163060.458	5	32612.092	2067.059	.000[b]
	Residual	385591.167	24440	15.777		
	Total	548651.625	24445			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter. collab, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.027	.045		-.604	.546	
	TotalCites	8.273E-05	.000	.069	6.947	.000	.037
	CitableDocs	.000	.000	-.036	-3.773	.000	-.020
	RefPerDoc	.011	.001	.060	9.899	.000	.053
	Intern Collab	.006	.002	.021	3.473	.001	.019
	SJR	1.705	.021	.496	79.979	0.000	.429

a. Dependent Variable: CitesPerDoc

Subject-wise Analysis

The analysis was taken forward to see how the model behaves in the context of subject-wise grouping of the journals. To understand these 27 separate multivariate regressions were run – one each for the subject category. Predictor variables used were the same as in the case of main model with values confining to the subject-wise journals in the context.

Summary of these Regressions with data such R^2, ß values, part correlation for the variables are presented in Table 6.7 Details of the Regression statistics are presented in Tables 6.8 - 6.34

As could be seen from the output, Regression models for subjects show statistically significant results. Total Variance accounted for vary from a low of 7.8% (for Biochemistry, Genetics & Molecular biology) to 96.8% (Energy). Most of the models examined indicate R^2 of .8 or .9 . Exceptions to this trend are Biochemistry, Genetics & Molecular biology and, Earth and Planetary Science (R^2 .446), Mathematics (R^2 .594), and Neuroscience (R^2 .273). SJR accounts for major variance for all subjects. Exceptions to this trend are - a. Biochemistry, Genetics & Molecular biology, b. Economics, Econometrics and Finance, and c. Neuroscience.

Other major trend noticeable is the negative impact for the CitableDocs on the criterion variable. It is also to be noted that this negative relation of the variable is significant for 14 of the 27 subjects.

The results indicate that CitesPerDoc is in a major way related to SJR. SJR's influence on CitesPerDoc is the most in all cases, and ß value ranges from .27 to 19.896 in explaining the variance across subjects. So also the SJR's influence on its own in explaining the variance as indicated by part correlation which in the context range from .23 (biochemistry) to a high of .775 .

In most of the subjects the major variation was accounted for by CitableDocs published in journals with higher SJR. The variance accounted for by this variable range from ß value .8 or higher in 14 of the 27 subject groupings to ß 0.270 in the case of Biochemistry, Genetics and Molecular Biology journals. However, the exclusive variation accounted for by SJR is not more than ß .600 in most of the cases as shown by part correlation figures. The 'prestige' factor associated with the journal seems to holdout across subjects confirming the possible Mathew effect.

Interestingly, the extent of articles with international collaboration contribute significantly for 13 of the 27 subjects, though in none of the instance it account for a substantial variance, highest ß value being .208 $p<.000$ for Business Management.

In fact, higher RefPerDoc value as a variable does not seem to influence significantly on CitesPerDoc for 23 of the 27 subjects. Also, TotalCites accrued for publication in the subject do not seems to result in high CitesPerDoc in all subjects. It has, in fact, a significant negative influence in the context of multidisciplinary journals.

Total CitableDocs seems to have more or less consistent negative relations with CitesPerDoc. More CitableDocs does not go with higher CitesPerDoc across the subjects.

It has to be noted that there is a slight variation in the total number of journals considered for these set of regression analysis and those in the context of Total Citations as the analysis entailed presence of values for all the variables and they were absent for a few in the database.

The following section describes the results obtained subject-wise. Complete Regression statistics is presented in Tables 6.8 – 6.34.

Agricultural and Biological Sciences

The variance explained by the five independent variables in the context of CitesPerDoc was to the tune of 86.3%. All of them present a significant β value. SJR (β 0.81 p<.000) contributes most to the variance and this variable alone account for 59.9% of the total variance accounted for by the regression as indicated by part correlation in the analysis. Interestingly higher number of Citable Documents in the journals bears a significant negative influence (β -.374 p<.000), that is every unit increase in CitableDocs will result in .374 units of lesser CitesPerDoc. In other words, higher CitesPerDoc corresponds with journals with lesser no of articles in them.

Arts and Humanities

This equation considered 3,620 journals under Arts and could explain 86.3% of the variance. Variables such as SJR (β.752 p<.000) contributes in a major way, followed by CitableDocs with international collaboration (β .149 p<.000). Part correlation in the analysis show that SJR alone accounts for 60.25 of the variance accounted for in the context. The higher journal prestige as represented by SJR determines the higher CitesPerDoc in the subject.

Biochemistry, Genetics and Molecular Biology

Five independent variables in the context of Biochemistry, Genetics, & Molecular Biology journals account for the least variance, among the subjects (R^2 .078) with respect to CitesPerDoc. Only SJR has significant beta value (β .27 p<.000) and this variable explained on its own only 23% of the variance accounted in the context. This subject exhibit a different tendency compared to the others.

Business, Management and Accounting

Variance explained in the context of business, management by these five independent variables was 68.4% of the total. Four of these variables which influence significantly toward CitesPerDoc are SJR (β .552 p<.000), RefPerDoc (β .206 p<.000), International collaboration (β .208 p<.000) and TotalCites (β .167 p<.000) in that order. SJR on its own, independent of other predictor variables, account for 49.6% of the explained variance.

Chemical Engineering

In case of chemical engineering CitesPerDoc is explained by the selected five independent variables to the extent of 90.9%. SJR (β .768 p<.000) and RefPerDoc (β.261 p<.000) account for most of the variance. SJR alone explains 62.8% of the variance accounted by the equation as indicated by the part correlation in the analysis.

Chemistry

SJR's dominant role as a predictor variable in explaining major share of CitesPerDoc holds good in the case of chemistry journals with beta .853 p<000. Other two variables - CitableDocs with International Collaboration (β .186 p<.000) and RefPerDoc (β .186 p<.000) - are statistically significant, though contribute marginally in the context. On the whole these independent variables explan 95.7% of the variance (R^2 .957)

Computer Science

In the context of journals in computer science all the five predictor variables exhibit significant relations. SJR (β .585) and Total Cites accrued for the journals (β .402 p<.000) are the dominant ones. Interestingly total Citable Doc shows a negative influence (β -.219 p< .000) on the dependent variable and the variance accounted for by this variable on its own is to the extent of -13.1% of what is accounted for here.

Decision Sciences

For Decision Sciences variance explained by the selected five predictor variables is to the tune of 66.2% (R^2 .662). Articles with International collaboration tend to be non-significant. As in other cases SJR explain a major portion of the variance (β .545 p<.000) followed by TotalCites (β .47 p<.000)

Dentistry

Dentistry is another subject where international collaboration or for that matter TotalCites accrued to journals does not come out as significant variables explaining CitesPerDoc. CitableDocs (β -.3 p< .000) also show a negative significant influence on criterion variable. SJR (β.679 p<.000) account for major variance and also on its own explain 37.1% of the variance accounted for as shown by the part correlation in the context.

Earth & Planetary Sciences

Earth science: For this subject CitableDocs in journals behave differently than others. It is only SJR as a predictor variable that is significant with ß 19.896 p<.000 indicating that every unit increase in SJR of the journals where the CitableDocs is published would result in increase of 19.896 times of citesPerDoc. Citations per Document is very sensitive to journals reputation. R2 of .446 show that there are other factors than the five variables considered in the context of this model that may explain the variance.

Economics, Econometrics & Finance

In the context of Economics all the five predictor variables are significant and fall in to the pattern that holds good for most of the subjects. SJR (ß .474 p<.000) followed by TotalCites (ß .34 p<.000), RefPerDoc (ß .175 p<.000) and International collaboration (ß .151 p<.000) contribute positively in that order. The extent of CitableDocs, however, move the other way, and also statistically significant in the context. However, such negative influence, as shown by the variance accounted for, is not much.

Energy

CitesPerDoc of energy related contributions are explained almost completely (R^2 .968) by the identified variables in the context. Among these SJR (ß .89 p<.000) account for most of it, with analysis indicating part correlation of .781 explains on its own most of the variance (78.1%). CitableDocs indicate a negative influence on the dependent variable (ß -056 p<.000). So also RefPerDoc (ß -.003 p<.000).

Engineering

CitesperDoc in Engineering are predicted by the SJR to a large extent followed by the others such as RefperDoc, international collaboration and TotalCites accrued to journals. As in most of the other cases, CitableDocs influence significantly but in a negative direction. SJR (ß .687 p<.000) explain on its own 50.7% of the accounted variance with part correlation of .507. The observed total variance in the context is 78.0 (R^2 .780).

Environmental Science

Environment Science is another subject where most of the variance in CitesPerDoc (R^2 .912) is explained by four of the five independent variables considered for the analysis in positive direction, and the other one – CitableDocs - hold out in the negative way. SJR with ß .864 p<.000 holds the sway and on its own account for 77.5% of the total (part correlation .775)

Health Professions

More or less the same trend as above holds good for journals in Health Professions (R^2 .941). In this case international collaboration does not seem to matter much and the corresponding ß value is not significant. SJR (ß .931 p<.000) account for the most of the variance.

Immunology & Microbiology

Immunology exhibit an interesting phenomena where predictor variables RefPerDoc (ß .13 p< .000) and SJR (ß .904 p<.000) explain the observed variance (R^2 .931) significantly, and to the most part. Again, articles with international collaboration do not seem to matter and holds out a non-significant value.

Materials Science

In the case Material Science also the variance explained by the selected variables is high (R^2 .932). As in most of the other cases SJR account for a dominant share (ß .847 p<.000), indicating better CitePerDoc is possible if the researchers publish in highly ranked journals in Scopus.

Mathematics

In the case of Mathematics CitesPerDoc explained by the selected variables is 59.4% (R^2 .594). Influence of SJR is limited (ß .435 p<.000) compared to the variable TotalCites accrued (ß .586 p<.000). These two variables explain on their own individually 38.5% and 37.1% of the accounted variance in the equation respectively. CitableDocs, as a variable, exhibit a negative influence with the CitesPerDoc yield.

Medicine

Medicine is another instance where behavior of predictor variables fall into the hitherto known familiar pattern, and the variance explained is 90.9% (R^2 .909). With SJR (ß .927 p<.000) explaining most of the variance in the model, and on its own 77.3% when other variables are controlled. With every one unit increase in SJR, CitesPerDoc is expected to increase by .927 units. The influence of the CitableDoc is highly sensitive to where it is published.

Multidisciplinary

For multidisciplinary journals the generally observed trend holds out with almost all the variance explained by the equation (R^2 .974). With every unit increase in SJR it accounted for 1.181 unit increase in CitesPerDoc (1.181 p<.000). Interestingly even CitableDocs with a ß .437 (p<.000), also account for substantial variance in the context.

Neuroscience

Completely contrasting scenario from the one observed above holds out for Neuroscience with R^2 .28. Only SJR (ß .358 p <.000) and RefperDoc (ß -.013 p<.000) are significant. And as we can see the latter variable bears a negative significance.

Nursing

CitesPerDoc for articles in nursing related journals are skewed towards SJR (ß .913 p<.000) with total variance accounting for is 90.0% (R^2. 900). SJR on its own account for 58.0% of the variance in the context, as indicated by part correlation.

Pharmacology, Toxicology & Pharmaceutics

Variance in equation relating to Pharmacology explains CitesPerDoc accounts for 85.0% of the total. Articles with international Collaboration do not matter much as it returns a non significant ß value of .013. Variable CitableDocs indicates a significant negative effect (ß -.069 p<.000), albeit in a limited way. SJR holds the key with a ß of .806 p<.000 and on its own account for 58.4% of the observed variance as indicated by part correlation.

Physics & Astronomy

Physics with an R^2 .895 is skewed towards SJR (ß .86 p<.000) and RefPerDoc (ß .135 p<.000). Other factors do not seem to matter in the context as held out by the analysis. SJR also seem to influence in a major way in the context (63.9%) as shown by part correlation.

Psychology

Psychology has a considerable contingent of journals in Scopus and they fall into the hitherto observed tendency – TotalCites (ß .158 p<.000) , RefPerDoc, (ß .06 p<.000) are significant and positive in their effect on CitesPerDoc along with SJR (ß .852 p<.000) which is major contributor to the total variance

Social Sciences

Social Sciences is the second largest journal base in Scopus with 5802 considered in the analysis. The trend as noticed in the context of majority of the subjects holds good here as well – negative effect of CitableDocs (ß -.067 p<.000) positive impact of the other four variables and SJR making up the most of the deal with ß .839 p<.000 and part correlation of .756, explaining 75.6% of the noted total variance of 87.0% (R^2. 87)

Veterinary Science

Veterinary Science shows a positive effect of articles with International Collaboration (ß .066 p<.000) and RefPerDoc (ß .1 p<.000) and SJR (ß .851 p<.000). Overall variance explained by the equation is 92.3%, and SJR on its own account for 58.7% of this as borne out by part correlation.

On the whole it could be noted that SJR could account for the major portion of the variance explained in most of the subject groupings of the journals. The total variance accounted in explaining dependent variable CitesPerDoc itself varies considerably across the subjects. Extent of articles with international collaboration, on its own, does not seem to have major effect in all the subject groups. CitesPerDoc that could be expected depends on the journal ranking, but it is not so with International Collaborations. In many subjects they do not seem to matter at all. Today's norm for quality of publications is reflected also in higher number of RefPerDoc, and also those journals which have accrued more Total Citations. If the journals have many CitableDocs they do not seem to necessarily result in higher CitesPerDoc in most of the subject areas.

Influence on CitesPerDoc work differently from TotalCites in the context. Indian researchers could attempt for both with a strategic approach to publishing in journals of higher ranking. However, if CitesPerDoc is what we aim for, publishing in Indian journals may not work, as we do not publish many journals with higher SJR.

As SJR figure prominently in influencing CitesPerDoc it is relevant in the context to understand the distribution of journals on these ranking. The data from 2018 shows that nearly 80% of the journals have SJR less than 1. Only 20% of Scopus indexed journals have relatively better 'prestige' (https://www.scimagojr.com/journalrank.php?year=2018). Among these journals with SJR 10 or more include: CA - A Cancer Journal for Clinicians(72), Nature Reviews Materials(34), Quarterly Journal of Economics(30), Cell(25), Chemical Reviews(22), Nature Genetics(21), Nature Reviews Neuroscience(21), Nature Methods(21), New England Journal of Medicine(19), The Lancet Oncology(18), Journal of Finance(17), Nature Reviews Microbiology(17), Econometrica(17), The Lancet(15), Review of Economic Studies(14), Journal of Financial Economics(13), Administrative Science Quarterly(13), Science(13), Energy and Environmental Sciences(13), Annual Review of Psychology(12), Academy of Management Annals(12), and others.

The following Table presents country-wise SJR data for journals indexed in Scopus:

Distribution of SJR among journals

	<1	1	2	3	4	5	6	7	8	9	10 or more	Total journals with SJR
	17503	3116	748	259	111	69	65	47	18	17	83	22028
	79.46	14.15	3.40	1.18	0.50	0.31	0.30	0.21	0.08	0.08	0.38	100.00

SJR Distribution of Journals among countries

	SJR	<1	1 or more	<1 (%)	1 and more (%)
Australia	3	208	11	94.98	5.02
Austria	4	50	2	96.15	3.85
Belgium	9	124	1	99.20	0.80
Brazil	11	359	4	98.90	1.10
Canada	14	245	19	92.80	7.20
China	16	597	25	95.98	4.02
Czech Rep.	22	188	1	99.47	0.53
Denmark	23	32	4	88.89	11.11
Finland	29	42	2	95.45	4.55
France	30	504	20	96.18	3.82
Germany	32	1356	256	84.12	15.88
Greece	34	57	2	96.61	3.39
India	38	491	3	99.39	0.61
Israel	43	12	0	100.00	0.00
Italy	44	478	9	98.15	1.85
Japan	46	443	13	97.15	2.85
Mexico	62	109	1	99.09	0.91
Netherlands	67	1352	719	65.28	34.72
Norway	70	30	0	100.00	0.00
Poland	75	351	2	99.43	0.57
Portugal	76	53	0	100.00	0.00
Russian Federation	80	391	2	99.49	0.51
Singapore	85	112	6	94.92	5.08
South Korea	89	221	21	91.32	8.68
Spain	90	554	6	98.93	1.07
Sweden	92	37	6	86.05	13.95
Switzerland	93	395	120	76.70	23.30
Taiwan	94	85	3	96.59	3.41
Turkey	99	208	0	100.00	0.00
United Kingdom	103	3981	1502	72.61	27.39
United States	104	4438	1773	71.45	28.55
Total		17503	4533	79.43	20.57

Careful view of the data shows that Denmark, Germany, Netherlands, Sweden, Switzerland, the UK and the US have slightly higher proportion of their journals in SJR 1 or more categories. How this ‘prestige’ is acquired is an interesting question and is relevant in the context of debate on possible ‘Mathew Effect’.

Table 6.7 Summary of Regression values for subject groups													
Subject	**n**	**R2**	**F**	**Citable_ Docs ß**	**t**	**Total_ Cites ß**	**t**	**INCO LLAB ß**	**t**	**RefPerDo c ß**	**t**	**SJR ß**	**t**
Agricultural and Biological Sciences	1793	0.863	2610.418	-0.374	-7.106**	0.402	7.547**	0.038	3.767**	0.112	11.019**	0.81	73.639**
Arts and Humanities	3620	0.863	3331.202	0.058	6.045**	0.073	7.329**	0.149	18.944**	0.076	10.131**	0.752	85.725**
Biochemistry, Genetics and Molecular Biology	2003	0.078	33.913	0	0.004	-0.004	-0.078	-0.021	-0.851	0.045	1.854	0.27	10.689**
Business, Management and Accounting	1257	0.684	540.447	-0.016	-0.868	0.167	8.737**	0.208	10.597**	0.206	10.722**	0.552	31.217**
Chemical Engineering	588	0.909	1165.234	-0.023	-1.029	0.08	3.314**	0.054	3.416**	0.261	16.658**	0.768	50.255**
Chemistry	799	0.957	3492.306	0.014	1.048	0.02	1.367	0.017	2.014**	0.186	20.643**	0.853	82.883**
Computer Science	1503	0.733	820.657	-0.219	-9.833**	0.402	16.827**	0.104	6.727**	0.148	9.837**	0.585	36.735**
Decision Sciences	359	0.662	138.451	-0.215	-4.79**	0.47	9.812**	0.011	0.298	0.154	4.7**	0.545	14.951**
Dentistry	200	0.764	125.322	-0.3	-4.733**	0.387	4.636**	0.000	0.000	0.065	1.479	0.679	10.636**
Earth and Planetary Sciences	1129	0.446	180.878	-1.406	0.16	1.444	0.149	1.839	0.066	1.865	0.062	19.896	.000**
Economics, Econometrics and Finance	968	0.681	411.372	-0.045	-2.341**	0.34	15.853**	0.151	7.097**	0.179	8.827**	0.474	23.04**
Energy	416	0.968	2496.593	-0.056	-3.207**	0.114	6.183**	-0.004	-0.336	0.151	13.559**	0.89	88.67**
Engineering	2713	0.78	1924.386	-0.037	-2.93**	0.13	9.012**	0.063	5.494**	0.182	15.939**	0.687	56.271**
Environmental Science	1355	0.912	2808.384	-0.069	-4.963**	0.18	12.662**	0.036	3.735**	0.087	8.571**	0.864	96.111**
Health Professions	512	0.941	1614.995	-0.059	-3.246**	0.104	5.46**	0.023	1.882	0.036	2.819**	0.931	75.18**
Immunology and Microbiology	546	0.931	1458.948	-0.015	-0.631	0.006	0.218	0.021	1.593	0.13	9.813**	0.904	57.092**
Materials Science	1146	0.932	3115.191	-0.016	-1.192	0.061	4.19**	0.019	2.054**	0.183	19.733**	0.849	90.473**
Mathematics	1393	0.594	406.01	-0.322	-12.351**	0.586	21.698**	-0.025	-1.345	0.22	11.985**	0.435	22.481**
Medicine	7145	0.909	14315.17	-0.03	-3.769**	0.038	4.617**	0.006	1.556	0.045	10.868**	0.927	216.907**
Multidisciplinary	116	0.974	830.317	0.437	5.076**	-0.513	-4.88**	0.082	4.05**	0.012	0.659	1.181	22.952**
Neuroscience	558	0.28	42.92	-0.149	-1.849	0.14	1.484	-0.015	-0.363	0.206	5.01**	0.388	7.184**
Nursing	604	0.9	1075.15	-0.014	-0.597	-0.027	-0.901	0.021	1.254	0.107	6.879**	0.913	44.826**
Pharmacology, Toxicology and Pharmaceutics	734	0.85	826.715	-0.069	-2.757**	0.104	3.697**	0.013	0.712	0.118	6.307**	0.806	40.702**
Physics and Astronomy	1046	0.895	1777.88	-0.003	-0.218	0.029	1.84	-0.013	-1.161	0.135	10.569**	0.86	63.68**
Psychology	1151	0.868	1499.808	-0.115	-4.302**	0.158	5.475**	-0.003	-0.216	0.06	4.488**	0.852	57.357**
Social Sciences	5802	0.87	7763.292	-0.067	-9.586**	0.169	22.492**	0.085	16.375**	0.043	8.366**	0.839	159.651**
Veterinary	234	0.923	544.137	-0.037	-0.956	0.059	1.423	0.066	2.877**	0.1	4.498**	0.851	31.867**

1 n=1793

Table 6.8 Regression Tables for Variables Predicting CitesPerDoc in Agricultural and Biological Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.929[a]	.863	.863	.64532

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5435.460	5	1087.092	2610.418	.000[b]
	Residual	861.622	2069	.416		
	Total	6297.082	2074			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, Citable_Docs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.034	.030		1.125	.261	
	CitableDocs	.000	.000	-.374	-7.106	.000	-.058
	TotalCites	.000	.000	.402	7.547	.000	.061
	Inter.Collab.	.004	.001	.038	3.767	.000	.031
	RefPerDoc	.008	.001	.112	11.019	.000	.090
	SJR	1.752	.024	.810	73.639	0.000	.599

a. Dependent Variable: CitesPerDoc

2

N=3620

Table 6.9 Regression Tables for Variables Predicting CitesPerDoc in Arts and Humanities

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.906[a]	.822	.821	.39855

a. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2645.740	5	529.148	3331.202	.000[b]
	Residual	574.069	3614	.159		
	Total	3219.809	3619			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.104	.012		-8.520	.000	
	CitableDocs	.000	.000	.058	6.045	.000	.042
	TotalCites	3.971E-05	.000	.073	7.329	.000	.051
	Inter Collab	.013	.001	.149	18.944	.000	.133
	RefPerDoc	.003	.000	.076	10.131	.000	.071
	SJR	1.305	.015	.752	85.725	0.000	.602

a. Dependent Variable: CitesPerDoc

3 N= 2003

Table 6.10 Regression Tables for Variables Predicting CitesPerDoc in Biochemistry, Genetics and Molecular Biology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.280[a]	.078	.076	12.98230

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28578.308	5	5715.662	33.913	.000[b]
	Residual	336574.651	1997	168.540		
	Total	365152.959	2002			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.559	.560		.999	.318	
	CitableDocs	1.263E-06	.000	.000	.004	.997	.000
	TotalCites	-6.686E-06	.000	-.004	-.078	.938	-.002
	Inter.Collab.	-.018	.021	-.021	-.851	.395	-.018
	RefPerDoc	.020	.011	.045	1.854	.064	.040
	SJR	1.726	.161	.270	10.689	.000	.230

a. Dependent Variable: CitesPerDoc

4 N=1257

Table 6.11 Regression Tables for Variables Predicting CitesPerDoc in Business, Management and Accounting

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.827[a]	.684	.682	1.08305

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, TotalCites, Inter.Collab.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3169.739	5	633.948	540.447	.000[b]
	Residual	1467.430	1251	1.173		
	Total	4637.169	1256			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, TotalCites, Inter.Collab.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.184	.071		-2.593	.010	
	Citable_Docs	-8.588E-05	.000	-.016	-.868	.385	-.014
	TotalCites	.000	.000	.167	8.737	.000	.139
	Inter.Collab.	.025	.002	.208	10.597	.000	.169
	RefPerDoc	.016	.002	.206	10.722	.000	.171
	SJR	.728	.023	.552	31.217	.000	.496

a. Dependent Variable: CitesPerDoc

5 N=588

Table 6.12 Regression Tables for Variables Predicting CitesPerDoc in Chemical Engineering

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.954[a]	.909	.908	1.02112

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6074.890	5	1214.978	1165.234	.000[b]
	Residual	606.846	582	1.043		
	Total	6681.736	587			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.339	.076		-4.433	.000	
	CitableDocs	-4.651E-05	.000	-.023	-1.029	.304	-.013
	TotalCites	2.921E-05	.000	.080	3.314	.001	.041
	Inter.Collab.	.013	.004	.054	3.416	.001	.043
	RefPerDoc	.032	.002	.261	16.658	.000	.208
	SJR	1.735	.035	.768	50.255	.000	.628

a. Dependent Variable: CitesPerDoc

6 N=799

Table 6.13 Regression Tables for Variables Predicting CitesPerDoc in Chemistry

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.978[a]	.957	.956	.80266

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11249.948	5	2249.990	3492.306	.000[b]
	Residual	510.906	793	.644		
	Total	11760.855	798			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.259	.058		-4.507	.000	
	CitableDocs	3.093E-05	.000	.014	1.048	.295	.008
	TotalCites	7.290E-06	.000	.020	1.367	.172	.010
	Inter.Collab.	.005	.002	.017	2.014	.044	.015
	RefPerDoc	.023	.001	.186	20.643	.000	.153
	SJR	2.115	.026	.853	82.883	0.000	.613

a. Dependent Variable: CitesPerDoc

7 N=1503

Table 6.14 Regression Tables for Variables Predicting CitesPerDoc in Computer Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.856[a]	.733	.732	1.23771

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6285.897	5	1257.179	820.657	.000[b]
	Residual	2293.283	1497	1.532		
	Total	8579.180	1502			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations
		B	Std. Error	Beta	t	Sig.	Part
1	(Constant)	.228	.072		3.176	.002	
	CitableDocs	-.001	.000	-.219	-9.833	.000	-.131
	TotalCites	.000	.000	.402	16.827	.000	.225
	Inter.Collab.	.015	.002	.104	6.727	.000	.090
	RefPerDoc	.017	.002	.148	9.837	.000	.131
	SJR	1.664	.045	.585	36.735	.000	.491

a. Dependent Variable: CitesPerDoc

8 N=359

Table 6.15 Regression Tables for Variables Predicting CitesPerDoc in Decision Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.814[a]	.662	.658	1.39808

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1353.102	5	270.620	138.451	.000[b]
	Residual	689.983	353	1.955		
	Total	2043.085	358			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations
		B	Std. Error	Beta	t	Sig.	Part
1	(Constant)	.328	.194		1.693	.091	
	CitableDocs	-.002	.000	-.215	-4.790	.000	-.148
	TotalCites	.001	.000	.470	9.812	.000	.304
	Inter.Collab.	.002	.006	.011	.298	.766	.009
	RefPerDoc	.018	.004	.154	4.700	.000	.145
	SJR	.893	.060	.545	14.951	.000	.462

a. Dependent Variable: CitesPerDoc

9 N=200

Table 6.16 Regression Tables for Variables Predicting CitesPerDoc in Dentistry

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.874[a]	.764	.757	.59891

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	224.763	5	44.953	125.322	.000[b]
	Residual	69.587	194	.359		
	Total	294.350	199			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.428	.106		4.041	.000	
	CitableDocs	-.002	.000	-.300	-4.733	.000	-.165
	TotalCites	.001	.000	.387	4.636	.000	.162
	Inter.Collab.	1.533E-06	.004	.000	.000	1.000	.000
	RefPerDoc	.006	.004	.065	1.479	.141	.052
	SJR	1.536	.144	.679	10.636	.000	.371

a. Dependent Variable: CitesPerDoc

10 N=1129

Table 6.17 Regression Tables for Variables Predicting CitesPerDoc in Earth & Planetary Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.668[a]	.446	.444	2.06303

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3849.174	5	769.835	180.878	.000[b]
	Residual	4779.605	1123	4.256		
	Total	8628.779	1128			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.189	.113		1.682	.093	
	CitableDocs	.000	.000	-.092	-1.406	.160	-.031
	TotalCites	.000	.000	.098	1.444	.149	.032
	Inter.Collab.	.007	.004	.052	1.839	.066	.041
	RefPerDoc	.005	.003	.057	1.865	.062	.041
	SJR	1.704	.086	.593	19.896	.000	.442

a. Dependent Variable: CitesPerDoc

11 N=968

Table 6.18 Regression Tables for Variables Predicting CitesPerDoc in Economics, Econometrics & Finance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.825[a]	.681	.680	.92348

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1754.132	5	350.826	411.372	.000[b]
	Residual	820.413	962	.853		
	Total	2574.545	967			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.014	.067		-.214	.831	
	CitableDocs	.000	.000	-.045	-2.341	.019	-.043
	TotalCites	.001	.000	.340	15.853	.000	.289
	Inter.Collab.	.014	.002	.151	7.097	.000	.129
	RefPerDoc	.013	.001	.179	8.827	.000	.161
	SJR	.352	.015	.474	23.040	.000	.419

a. Dependent Variable: CitesPerDoc

12 N=416

Table 6.19 Regression Tables for Variables Predicting CitesPerDoc in Energy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.984[a]	.968	.968	.89661

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10035.202	5	2007.040	2496.593	.000[b]
	Residual	329.604	410	.804		
	Total	10364.806	415			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.302	.082		-3.699	.000	
	CitableDocs	.000	.000	-.056	-3.207	.001	-.028
	TotalCites	7.587E-05	.000	.114	6.183	.000	.054
	Inter.Collab.	-.001	.004	-.004	-.336	.737	-.003
	RefPerDoc	.032	.002	.151	13.559	.000	.119
	SJR	2.068	.023	.890	88.670	.000	.781

a. Dependent Variable: CitesPerDoc

13 N=2713

Table 6.20 Regression Tables for Variables Predicting CitesPerDoc in Engineering

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.883[a]	.780	.780	1.17095

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13192.864	5	2638.573	1924.386	.000[b]
	Residual	3711.634	2707	1.371		
	Total	16904.497	2712			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.172	.040		-4.284	.000	
	CitableDocs	.000	.000	-.037	-2.930	.003	-.026
	TotalCites	8.423E-05	.000	.130	9.012	.000	.081
	Inter.Collab.	.011	.002	.063	5.494	.000	.049
	RefPerDoc	.022	.001	.182	15.939	.000	.144
	SJR	1.959	.035	.687	56.271	0.000	.507

a. Dependent Variable: CitesPerDoc

14 N=1355

Table 6.21 Regression Tables for Variables Predicting CitesPerDoc in Environmental Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.955[a]	.912	.912	.98826

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13714.227	5	2742.845	2808.384	.000[b]
	Residual	1317.519	1349	.977		
	Total	15031.746	1354			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.004	.054		.065	.948	
	CitableDocs	.000	.000	-.069	-4.963	.000	-.040
	TotalCites	.000	.000	.180	12.662	.000	.102
	Inter.Collab.	.007	.002	.036	3.735	.000	.030
	RefPerDoc	.012	.001	.087	8.571	.000	.069
	SJR	1.748	.018	.864	96.111	0.000	.775

a. Dependent Variable: CitesPerDoc

15 N=512

Table 6.22 Regression Tables for Variables Predicting CitesPerDoc in Health Professions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970[a]	.941	.940	1.02702

a. Predictors: (Constant), SJR, Inter.Collab., CitableDocs, RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8517.186	5	1703.437	1614.995	.000[b]
	Residual	533.710	506	1.055		
	Total	9050.896	511			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, Inter.Collab., CitableDocs, RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.171	.100		1.719	.086	
	CitableDocs	-.001	.000	-.059	-3.246	.001	-.035
	TotalCites	.000	.000	.104	5.460	.000	.059
	Inter.Collab.	.006	.003	.023	1.882	.060	.020
	RefPerDoc	.008	.003	.036	2.819	.005	.030
	SJR	1.624	.022	.931	75.180	.000	.812

a. Dependent Variable: CitesPerDoc

16 N=546

Table 6.23 Regression Tables for Variables Predicting CitesPerDoc in Immunology & Microbiology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.965[a]	.931	.930	.95431

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6643.398	5	1328.680	1458.948	.000[b]
	Residual	491.784	540	.911		
	Total	7135.182	545			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.225	.083		2.693	.007	
	CitableDocs	-8.750E-05	.000	-.015	-.631	.528	-.007
	TotalCites	7.199E-06	.000	.006	.218	.827	.002
	Inter.Collab.	.004	.003	.021	1.593	.112	.018
	RefPerDoc	.016	.002	.130	9.813	.000	.111
	SJR	1.511	.026	.904	57.092	.000	.645

a. Dependent Variable: CitesPerDoc

17 N=1146

Table 6.24 Regression Tables for Variables Predicting CitesPerDoc in Materials Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.965[a]	.932	.932	1.08494

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18334.489	5	3666.898	3115.191	.000[b]
	Residual	1341.896	1140	1.177		
	Total	19676.385	1145			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.225	.059		-3.810	.000	
	CitableDocs	-5.992E-05	.000	-.016	-1.192	.234	-.009
	TotalCites	3.516E-05	.000	.061	4.190	.000	.032
	Inter.Collab.	.006	.003	.019	2.054	.040	.016
	RefPerDoc	.025	.001	.183	19.733	.000	.153
	SJR	2.051	.023	.849	90.473	0.000	.700

a. Dependent Variable: CitesPerDoc

18 N=1393

Table 6.25 Regression Tables for Variables Predicting CitesPerDoc in Mathematics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.771[a]	.594	.593	1.06519

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2303.336	5	460.667	406.010	.000[b]
	Residual	1573.717	1387	1.135		
	Total	3877.052	1392			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.327	.068		4.818	.000	
	CitableDocs	-.001	.000	-.322	-12.351	.000	-.211
	TotalCites	.001	.000	.586	21.698	.000	.371
	Inter.Collab.	-.003	.002	-.025	-1.345	.179	-.023
	RefPerDoc	.022	.002	.220	11.985	.000	.205
	SJR	.696	.031	.435	22.481	.000	.385

a. Dependent Variable: CitesPerDoc

19 N=7145

Table 6.26 Regression Tables for Variables Predicting CitesPerDoc in Medicine

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.954[a]	.909	.909	1.08936

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	84939.731	5	16987.946	14315.168	.000[b]
	Residual	8471.920	7139	1.187		
	Total	93411.651	7144			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.061	.022		2.766	.006	
	CitableDocs	.000	.000	-.030	-3.769	.000	-.013
	TotalCites	3.571E-05	.000	.038	4.617	.000	.016
	Inter.Collab.	.002	.001	.006	1.556	.120	.006
	RefPerDoc	.007	.001	.045	10.868	.000	.039
	SJR	2.008	.009	.927	216.907	0.000	.773

a. Dependent Variable: CitesPerDoc

20 N=116

Table 6.27 Regression Tables for Variables Predicting CitesPerDoc in Multidisciplinary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.987[a]	.974	.973	.58743

a. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1432.627	5	286.525	830.317	.000[b]
	Residual	37.959	110	.345		
	Total	1470.586	115			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.097	.102		-.947	.346	
	CitableDocs	.000	.000	.437	5.076	.000	.078
	TotalCites	-6.463E-05	.000	-.513	-4.880	.000	-.075
	Inter.Collab.	.021	.005	.082	4.050	.000	.062
	RefPerDoc	.002	.004	.012	.659	.511	.010
	SJR	2.053	.089	1.181	22.952	.000	.352

a. Dependent Variable: CitesPerDoc

21 N=558

Table 6.28 Regression Tables for Variables Predicting CitesPerDoc in Neuroscience

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.529[a]	.280	.273	4.29441

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3957.669	5	791.534	42.920	.000[b]
	Residual	10179.974	552	18.442		
	Total	14137.644	557			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.153	.414		.370	.712	
	CitableDocs	-.002	.001	-.149	-1.849	.065	-.067
	TotalCites	.000	.000	.140	1.484	.138	.054
	Inter.Collab.	-.005	.014	-.015	-.363	.717	-.013
	RefPerDoc	.038	.008	.206	5.010	.000	.181
	SJR	1.202	.167	.388	7.184	.000	.259

a. Dependent Variable: CitesPerDoc

22 N=604

Table 6.29 Regression Tables for Variables Predicting CitesPerDoc in Nursing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.949[a]	.900	.899	.51774

a. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1440.982	5	288.196	1075.150	.000[b]
	Residual	160.295	598	.268		
	Total	1601.278	603			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, RefPerDoc, CitableDocs, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.140	.048		-2.934	.003	
	CitableDocs	-9.601E-05	.000	-.014	-.597	.551	-.008
	TotalCites	-3.917E-05	.000	-.027	-.901	.368	-.012
	Inter.Collab.	.003	.002	.021	1.254	.210	.016
	RefPerDoc	.011	.002	.107	6.879	.000	.089
	SJR	2.298	.051	.913	44.826	.000	.580

a. Dependent Variable: CitesPerDoc

23 N=734

Table 6.30 Regression Tables for Variables Predicting CitesPerDoc in Pharmacology, Toxicology & Pharmaceutics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.922[a]	.850	.849	.91112	

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3431.474	5	686.295	826.715	.000[b]
	Residual	604.347	728	.830		
	Total	4035.821	733			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.159	.064		2.465	.014	
	CitableDocs	.000	.000	-.069	-2.757	.006	-.040
	TotalCites	.000	.000	.104	3.697	.000	.053
	Inter.Collab.	.002	.003	.013	.712	.477	.010
	RefPerDoc	.009	.001	.118	6.307	.000	.090
	SJR	2.287	.056	.806	40.702	.000	.584

a. Dependent Variable: CitesPerDoc

24 N=1046

Table 6.31 Regression Tables for Variables Predicting CitesPerDoc in Physics & Astronomy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.946[a]	.895	.895	1.22403	

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13318.580	5	2663.716	1777.880	.000[b]
	Residual	1558.184	1040	1.498		
	Total	14876.764	1045			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.186	.067		2.769	.006	
	CitableDocs	-8.643E-06	.000	-.003	-.218	.828	-.002
	TotalCites	1.568E-05	.000	.029	1.840	.066	.018
	Inter.Collab.	-.003	.003	-.013	-1.161	.246	-.012
	RefPerDoc	.012	.001	.135	10.569	.000	.106
	SJR	2.061	.032	.860	63.680	0.000	.639

a. Dependent Variable: CitesPerDoc

25 N=1151

Table 6.32 Regression Tables for Variables Predicting CitesPerDoc in Psychology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.931[a]	.868	.867	.78395

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4608.708	5	921.742	1499.808	.000[b]
	Residual	703.686	1145	.615		
	Total	5312.394	1150			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.152	.060		2.543	.011	
	CitableDocs	-.001	.000	-.115	-4.302	.000	-.046
	TotalCites	.000	.000	.158	5.475	.000	.059
	Inter.Collab.	.000	.002	-.003	-.216	.829	-.002
	RefPerDoc	.006	.001	.060	4.488	.000	.048
	SJR	1.729	.030	.852	57.357	0.000	.617

a. Dependent Variable: CitesPerDoc

26 N=5802

Table 6.33 Regression Tables for Variables Predicting CitesPerDoc in Social Sciences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.933[a]	.870	.870	.64665

a. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16231.188	5	3246.238	7763.292	.000[b]
	Residual	2423.610	5796	.418		
	Total	18654.799	5801			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), SJR, CitableDocs, Inter.Collab., RefPerDoc, TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	.018	.018		.979	.328	
	CitableDocs	-.001	.000	-.067	-9.586	.000	-.045
	TotalCites	.001	.000	.169	22.492	.000	.106
	Inter.Collab.	.011	.001	.085	16.375	.000	.078
	RefPerDoc	.003	.000	.043	8.366	.000	.040
	SJR	1.459	.009	.839	159.651	0.000	.756

a. Dependent Variable: CitesPerDoc

27 N=234

Table 6.34 Regression Tables for Variables Predicting CitesPerDoc in Veterinary Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.961[a]	.923	.921	.24265

a. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	160.197	5	32.039	544.137	.000[b]
	Residual	13.425	228	.059		
	Total	173.622	233			

a. Dependent Variable: CitesPerDoc

b. Predictors: (Constant), SJR, CitableDocs, RefPerDoc, Inter.Collab., TotalCites

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-.170	.045		-3.755	.000	
	CitableDocs	.000	.000	-.037	-.956	.340	-.018
	TotalCites	6.167E-05	.000	.059	1.423	.156	.026
	Inter.Collab.	.004	.001	.066	2.877	.004	.053
	RefPerDoc	.006	.001	.100	4.498	.000	.083
	SJR	2.043	.064	.851	31.867	.000	.587

a. Dependent Variable: CitesPerDoc

Chapter 7

Citation and Economic Variables

The regression analyses presented so far used data at the journal level. The present analysis uses data at the country level. There are a host of perception and economic variables that could be considered in conjunction with citations. These include brain drain, opinion on S&T orientation of the people, education related expenditure, R&D related expenditure, GDP, etc. Some of these variables fall in the domain of opinions or psychographics, and some are economic variables. As the data for the analysis pertain to a set of countries they have to come from a widely accepted and preferably, for the sake of consistency, a single source. The number of countries considered for the analysis was only 32 (making up 90% of the total CitableDocs in Scopus) because of this there was a limitation in terms of number of predictor variables that could be used. Consequently the opinion / psychographic variables were kept out of the analysis and only data of immediate relevance in economic terms were used. The data were sourced from IMD World Competitiveness Report

Influence of economic factors on scientific performance of countries has engaged the bibliometricians and economists alike. May (1997) using the citation data argued that large economies and large R&D spend correlates with scientific impact. India and China were, however, aberrations to this pattern, in terms of number of papers. Cole & Phelan (1999) in their analysis concluded: "Among more developed countries we find that difference in scientific productivity cannot be completely explained by differences in national wealth." Rousseau & Rousseau (1998) in their study of European countries taking patents and publications as output and GDP, active population, along with R&D expenditure, concluded that in order to obtain a maximum efficiency score countries are forced to perform on every output goal.

There have been some studies on this issue in 2000s. King (2004) using top 1% citation data from Thomson ISI index argued that wealth intensity (GDP Per capita) and citation intensity go together. This study did not consider the extent of publications indexed in SCI. Vinker (2008) found no significant correlation between the GDP and number of publications for EUJ (European Union, US, and Japan) countries. This study analyzed data referring to consecutive time periods and found that there is no direct relations between GDP and information production of countries. The author also suggested that the grants for R&D (which result in publications) do not actually depend on real needs, but rich countries can afford to spend more whist poor countries only less money on scientific research.
Both the citations and scientific articles under 307 sub-domains for 238 countries as obtained from Scimagojr.com (Scopus) database were analyzed by Cimini et al (2014). Technologically leading nations, they observed, employ scientific diversification, and the less developed countries mainly

operate in the domains where other leading nations are present. The analysis also suggests that only nations that spend close to 3% of their GDP in R&D compete most successfully.

Study by Gantman's (2012) also explored linguistic and political factors in the context as possible reasons for low citations for certain countries and indicated that only size of the economy exerts a positive and significant effect across all disciplines.

Muller (2016) used 16 macro level predictor variables, including economic system, political conditions, and structural and cultural attributes of countries to predict the scientific output.

Increasingly more variables have been brought into the analysis, and yet a conclusive argument has not been put forth to explain the scientific performance. India, China, and sometimes Russia'scontributions create the problem as their scholarly output indexed in citation sources is high, R&D spend and citation impact relatively low.

Allik et al (2020) in their critical examination of Essential Science Indicators (ESI) of Clarivate Analytics for 97 countries reveal that relationship between economies and scientific wealth only exists within a group of sufficiently wealthy countries - GNI median value of US$ 22,162. There is no guarantee that national wealth and investments into R&D automatically lead to an increase in scientific excellence. Pointing to several loopholes in the ranking (Panama, Iceland stand 1 and 2 in HQSI rank) they argue that scientific excellence needs good governance.

The studies have used selective top 1% citation data, ESI of Clarivate Analytics, or just the scientific output in terms of papers. Having found India, China, and increasingly Russia as aberrations, they have moved to considering other variable for explanation.

Most of these studies do not touch of the possible Mathew Effect for countries as suggested by Bonitz (2005), though the aberrations seem to crop up in the citation analysis possibly due to perception about low-income country research (Harris, et al, 2017).

The variables considered for the present analysis included the following: Business Expenditure on R&D, Business Expenditure on R&D as % of GDP, Total Expenditure on R&D, Total Expenditure on R&D per capita, Researchers in R&D (total), Researchers in R&D (per capita), Popular Perception of Scientific Research, Total R&D Personnel, University Education Index, and GDP (PPP) Per capita for 32 countries which made up 90% of the total S&T output. Data pertaining to Iran was not included in IMD World Competitiveness Yearbook and the country had to be excluded from the analysis.

Data pertaining to these variables were collected from IMD World Competitiveness Yearbook 2019 online database. The IMD World Competitiveness Yearbook (WCY), first published in 1989, is a comprehensive annual report and worldwide reference point on the competitiveness of countries. It provides benchmarking and trends, as well as statistics and survey data based on extensive research. The Yearbook provides extensive coverage of 63 economies, chosen based on the availability of comparable international statistics and their collaboration with local Partner Institutions, which contribute to the collection of survey data and ensure that all data are reliable, accurate and as up-to-date as possible. Indian collaborating institution for the Yearbook is National Productivity Council, New Delhi.

The variables considered for the analysis and their scope are the following:

- Business expenditure on R&D ($) (US$ millions)
- Business expenditure on R&D (%) (Percentage of GDP)
- GDP (PPP) Percapita ($) (US$ per capita)
- Researchers in R&D per capita (Full-time work equivalent (FTE) per 1000 people)
- Total expenditure on R&D ($) (US$ millions)
- Total expenditure on R&D (%) (Percentage of GDP)
- Total expenditure on R&D per capita ($) (US$ per capita)
- Total R&D personnel in business enterprise (Full-time work equivalent (FTE thousands))
- Total R&D personnel (Full-time work equivalent (FTE thousands)
- University education index (Country score calculated from Times Higher Education university ranking)
  Source: https://www.imd.org/wcc/products/eshop-factor-and-criteria/

Correlation among these variables were initially calculated to know the statistical relations among these economic and citations related variables such as Total CitableDocs, TotalCites, CitesperDoc. The data for these three citation related variables pertained to the years 2016-2018. The results indicate the following:

Total expenditure on R&D, Business expenditure on R&D, Total R&D personnel, and University education index correlate very strongly (in some cases $r(30) = .9$ $p<.000$) and above) with CitableDocs and TotalCites. R&D expenses per capita, Total R&D personnel per capita, along with GDP (PPP) percapita correlate significantly with CitesPerDoc. The results indicate that Total citations and CitesPerDoc do not necessarily go together with the identified economic variables.

Correlation matrix of bibliometric and economic variables									
		Researchers in R&D per capita	Total exp. on R&D $	Total exp. on R&D per capita_ $	Bus exp on R&D	Total R&D personnel	Total R&D personnel per capita	University education index	GDP (PPP) Percapita 2018
CitableDocs		.253	**.915****	-.037	**.915****	**.956****	-.305	**.712****	-.102
	N	31	31	31	31	29	30	31	31
Citations		.230	**.938****	.076	**.934****	**.882****	-.185	**.829****	.034
	N	31	31	31	31	29	30	31	31
CitationaPerDoc		-.020	-.063	**.707****	-.068	-.289	**.654****	.281	**.727****
	N	31	31	31	31	29	30	31	31
**. Correlation is significant at the 0.01 level (2-tailed) *. Correlation is significant at the 0.05 level (2-tailed)									

The analyses were taken further, initially with bivariate regressions between TotalCites as dependent variable and each of the above mentioned variables as predictors.

Analysis validated the model with a significant F value for variables Total expenditure on R&D (R^2 .881 Beta .938 p <.000); Business expenditure on R&D (R^2 .872 Beta .934 p <.000); Total R&D personnel (R2 .778 Beta .882 p<.000), University Education Index (R^2 .687 Beta .829 p <.000), when regressed with TotalCites accrued by the selected countries (Table 7.1-7.16)

When the same variables were regressed against CitesPerDoc as dependent variable, the results indicate the following: variables Total Expenditure on R&D per capita (R^2 .499 ß.707 p<.000), Total R&D personnel in business per capita (R^2.252 ß .502 p<.004), and GDP(PPP) per capita (R^2 .529 ß.727 p<.000). The regression statistic for bivariate analysis is presented in Table 7.1-7.16. It has to be noted here that variables, namely Total R&D Personnel and R&D Personnel per capita had only 29 observations as the corresponding data for the US and India were not available in the WCY compilation, and that could be a factor in non-significance noted in the bivariate regression.

As we can notice, there is no commonality among the variables that show promise catering to two different criterion variables in the context for multivariate application. Total R&D investment across the countries varies with the size of the economy. It is so with Business expenditure on R&D, and Total R&D personnel. To obviate this disparity it was found appropriate to use these variables normalized to per capita and researchers per capita, along with the GDP (PPP) per capita and University education index as the index based on an international survey of universities by Times Higher Education using a set of common criteria (https://www.timeshighereducation.com/).

Multivariate linear regression with the predicator variables - Researchers in R&D per capita; Total expenditure in R&D per capita; University education index, GDP (PPP) per capita, CitableDocs with TotalCites as dependent variables returned (adjusted) R^2 of .991. ß values that are significant in the context are University education index (ß .231 p <.000), GDP (PPP) (per capita) 2018, (ß .058 p<.052), and TotalCitableDocs (ß .820 p<.000). Citable documents on its own contributed 47.6% of the variance explained by the model.

The ß value indicates that every unit increase in Citable Documents result in citations increasing by .820 units. Next in the order is University education index, which explained 13.3% of the explained variance on its own. These two are followed by GDP (PPP) per capita as the predictor (Table 7.17).

When the same predictor variables were regressed against CitesPerDoc, the model could explain 57.4% (Adjusted R^2 .574) of the variance with Total expenses on R&D per capita (ß .342 p<.000) and GDP (PPP) per capita (ß .407 p<.000) comes out significant (Table 7.18)
The results indicate the following:

If we want higher citations against the country we can rely on publication of more CitableDocs, focus on improving the university standards, and general economic development as reflected in GDP (PPP).

However, the same variables do not explain higher CitesPerDoc. It is the total R&D expenditure per capita that matter more, along with better economic development as reflected in GDP (PPP). There is a tendency of implicit bias against third world research (Harris, et al, 2017). We can see this reflected in higher GDP (PPP) per capita explaining higher CitesPerDoc.

Higher number of CitableDocs does not result in higher CitesPerDoc. This could be explained by understanding that relative depth of R&D and resultant publications could attract researcher attention as they set the agenda and would be at the cutting edge of science.

The following are the Regression Equations obtained from the analysis, where ŷ (**Y hat**) is the predicted value of **y** – TotalCites in the first equation and Y = CitesPerDoc in the second equation.

Ŷ *(TotalCites) = -643332.092 -4021.265 (Researchers in R&D Per capita) - 22.012 (Total R&D per capita) + (16701.278(University Education Index)) + (9.486 (GDP (PPP) per capita)) + 6.151 (Total Citable Documents)*

Ŷ *(CitesPerDoc) = 5.054 -.015 (Researchers in R&D Per capita)) + .001 (Total R&D per capita) + .013(University Education Index) + 4.979E-05(GDP (PPP) per capita) -1.424E-06 (Total Citable Documents)*

Estimated and actual citations to Indian contributions

Indian scholarly contributions have appeared both in Indian and foreign journals. During 2016-2018 our contributions had accrued 1,939,535 total citations against the estimate of 2,471,399 based on the Regression equation for TotalCites. We accrued 531,864 citations less. This amounts to 21.52% less than expected TotalCitations.

Our Cites PerDoc was only 4.33 for the period as against the estimate of 4.68 based on Regression equation for CitesPerDoc, a shortfall of 0.35 per citable documents.

Being 'certified by Scopus' (i.e, published in Scopus indexed journals both from within and outside) does not seem to help reach the expected citation levels. This trend points to the play out of varying user perception of similar research output in Scopus journals, possible Mathew effect, in short.

Table 7.1 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.230[a]	.053	.020	2936370.68584

a. Predictors: (Constant), Researchers in R&D per capita

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13997700021723.100	1	13997700021723.100	1.623	.213[b]
	Residual	250045911334536.000	29	8622272804639.170		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), Researchers in R&D per capita

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-788700.949	2351756.169		-.335	.740
	Researchers in R&D per capita	80588.182	63249.034	.230	1.274	.213

a. Dependent Variable: TotalCites

Table 7.2 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.020[a]	.000	-.034	2.26587

a. Predictors: (Constant), Researchers in R&D per capita

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.059	1	.059	.011	.916[b]
	Residual	148.891	29	5.134		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), Researchers in R&D per capita

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.053	1.815		4.437	.000
	Researchers in R&D per capita	-.005	.049	-.020	-.107	.916

a. Dependent Variable: CitesPerDoc

Table 7.3 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.938[a]	.881	.877	1042045.55638

a. Predictors: (Constant), Total expenditure on R&D $

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	232553702050563.000	1	232553702050563.000	214.166	.000[b]
	Residual	31489909305696.400	29	1085858941575.740		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), Total expenditure on R&D $

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	807443.685	207877.214		3.884	.001
	Total expenditure on R&D $	26.282	1.796	.938	14.634	.000

a. Dependent Variable: TotalCites

Table 7.4 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.063[a]	.004	-.030	2.26178

a. Predictors: (Constant), Total expenditure on R&D $

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.597	1	.597	.117	.735[b]
	Residual	148.353	29	5.116		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), Total expenditure on R&D $

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.931	.451		17.577	.000
	Total expenditure on R&D $	-1.331E-06	.000	-.063	-.342	.735

a. Dependent Variable: CitesPerDoc

Table 7.5 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.076[a]	.006	-.028	3008654.51499

a. Predictors: (Constant), Total expenditure on R&D per capita_$

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1535553630370.370	1	1535553630370.370	.170	.683[b]
	Residual	262508057725889.000	29	9052001990547.880		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), Total expenditure on R&D per capita_$

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1839749.342	890841.908		2.065	.048
	Total expenditure on R&D per capita_$	326.457	792.620	.076	.412	.683

a. Dependent Variable: TotalCites

Table 7.6 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.707[a]	.499	.482	1.60365

a. Predictors: (Constant), Total expenditure on R&D per capita_$

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	74.371	1	74.371	28.919	.000[b]
	Residual	74.580	29	2.572		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), Total expenditure on R&D per capita_$

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.833	.475		12.285	.000
	Total expenditure on R&D per capita_$	.002	.000	.707	5.378	.000

a. Dependent Variable: CitesPerDoc

Table 7.7 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.934[a]	.872	.867	1081410.63519

a. Predictors: (Constant), Bus exp on R&D

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	230129591461021.000	1	230129591461021.000	196.785	.000[b]
	Residual	33914019895237.900	29	1169448961904.750		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), Bus exp on R&D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	868295.526	214084.842		4.056	.000
	Bus exp on R&D	35.093	2.502	.934	14.028	.000

a. Dependent Variable: TotalCites

Table 7.8 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.068[a]	.005	-.030	2.26114

a. Predictors: (Constant), Bus exp on R&D

Regression Tables for Variables Predicting CitesPerDoc

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.680	1	.680	.133	.718[b]
	Residual	148.270	29	5.113		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), Bus exp on R&D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.932	.448		17.720	.000
	Bus exp on R&D	-1.908E-06	.000	-.068	-.365	.718

a. Dependent Variable: CitesPerDoc

Table 7.9 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.882[a]	.778	.769	929029.53415

a. Predictors: (Constant), Total R&D personnel

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	81454182847007.600	1	81454182847007.600	94.374	.000[b]
	Residual	23303588633637.200	27	863095875319.897		
	Total	104757771480645.000	28			

a. Dependent Variable: TotalCItes
b. Predictors: (Constant), Total R&D personnel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	831467.985	193879.693		4.289	.000
	Total R&D personnel	2295.437	236.286	.882	9.715	.000

a. Dependent Variable: TotalCItes

Table 7.10 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.289[a]	.083	.050	2.22787

a. Predictors: (Constant), Total R&D personnel

Regression Tables for Variables Predicting CitesPerDoc

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.208	1	12.208	2.460	.128[b]
	Residual	134.012	27	4.963		
	Total	146.220	28			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), Total R&D personnel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.128	.465		17.483	.000
	Total R&D personnel	-.001	.001	-.289	-1.568	.128

a. Dependent Variable: CitesPerDoc

Table 7.11 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.057[a]	.003	-.031	3012457.78106

a. Predictors: (Constant), Total R&D personnel in business per capita

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	871456758542.638	1	871456758542.638	.096	.759[b]
	Residual	263172154597716.000	29	9074901882679.870		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCItes
b. Predictors: (Constant), Total R&D personnel in business per capita

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2419503.101	1075541.059		2.250	.032
	Total R&D personnel in business per capita	-73485.066	237135.807	-.057	-.310	.759

a. Dependent Variable: TotalCItes

Table 7.12 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.502[a]	.252	.226	1.96068

a. Predictors: (Constant), Total R&D personnel in business per capita

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.467	1	37.467	9.746	.004[b]
	Residual	111.484	29	3.844		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), Total R&D personnel in business per capita

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.975	.700		8.535	.000
	Total R&D personnel in business per capita	.482	.154	.502	3.122	.004

a. Dependent Variable: CitesPerDoc

Table 7.13 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.829[a]	.687	.676	1688206.68780

a. Predictors: (Constant), University education index

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	181392398555429.000	1	181392398555429.000	63.646	.000[b]
	Residual	82651212800830.100	29	2850041820718.280		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCItes
b. Predictors: (Constant), University education index

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-587610.005	456180.242		-1.288	.208
	University education index	59885.945	7506.560	.829	7.978	.000

a. Dependent Variable: TotalCItes

Table 7.14 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.281[a]	.079	.047	2.17506

a. Predictors: (Constant), University education index

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.755	1	11.755	2.485	.126[b]
	Residual	137.195	29	4.731		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), University education index

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.171	.588		12.202	.000
	University education index	.015	.010	.281	1.576	.126

a. Dependent Variable: CitesPerDoc

Table 7.15 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.034[a]	.001	-.033	3015661.60249

a. Predictors: (Constant), GDPPPPpercapita2018

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	311379235258.242	1	311379235258.242	.034	.854[b]
	Residual	263732232121001.000	29	9094214900724.160		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCites
b. Predictors: (Constant), GDPPPPpercapita2018

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1886006.021	1432772.527		1.316	.198
	GDPPPPpercapita2018	5.592	30.220	.034	.185	.854

a. Dependent Variable: TotalCites

Table 7.16 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.727a	.529	.512	1.55604

a. Predictors: (Constant), GDPPPPpercapita2018

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	78.733	1	78.733	32.517	.000[b]
	Residual	70.217	29	2.421		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), GDPPPPpercapita2018

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.961	.739		5.357	.000
	GDPPPPpercapita2018	8.892E-05	.000	.727	5.702	.000

a. Dependent Variable: CitesPerDoc

Table 7.17 Regression Tables for Variables Predicting TotalCites

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.996[a]	.991	.989	304478.85099	.991	564.628	5	25	.000

a. Predictors: (Constant), CitableDocsPrev3Yrs, Total expenditure on R&D per capita_$, Researchers in R&D per capita, GDPPPPpercapita2018, University education index

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	261725927088726.000	5	52345185417745.300	564.628	.000[b]
	Residual	2317684267532.560	25	92707370701.303		
	Total	264043611356259.000	30			

a. Dependent Variable: TotalCItes
b. Predictors: (Constant), CitableDocsPrev3Yrs, Total expenditure on R&D per capita_$, Researchers in R&D per capita, GDPPPPpercapita2018, University education index

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	-643332.092	262583.876		-2.450	.022	
	Researchers in R&D per capita	-4021.265	7239.449	-.011	-.555	.584	-.010
	Total expenditure on R&D per capita_$	-22.012	113.782	-.005	-.193	.848	-.004
	University education index	16701.278	2357.727	.231	7.084	.000	.133
	GDPPPPpercapita2018	9.486	4.650	.058	2.040	.052	.038
	CitableDocsPrev3Yrs	6.151	.242	.820	25.400	.000	.476

a. Dependent Variable: TotalCItes

Table 7.18 Regression Tables for Variables Predicting CitesPerDoc

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.803[a]	.645	.574	1.45405	.645	9.090	5	25	.000

a. Predictors: (Constant), CitesPerDoc, Total expenditure on R&D per capita_$, Researchers in R&D per capita, GDPPPPpercapita2018, University education index

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	96.094	5	19.219	9.090	.000[b]
	Residual	52.856	25	2.114		
	Total	148.950	30			

a. Dependent Variable: CitesPerDoc
b. Predictors: (Constant), CitableDocsPrev3Yrs, Total expenditure on R&D per capita_$, Researchers in R&D per capita, GDPPPPpercapita2018, University education index

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations
		B	Std. Error	Beta			Part
1	(Constant)	5.054	1.254		4.030	.000	
	Researchers in R&D per capita	-.015	.035	-.058	-.442	.662	-.053
	Total expenditure on R&D per capita_$	.001	.001	.342	2.026	.054	.241
	University education index	.013	.011	.245	1.180	.249	.141
	GDPPPPpercapita2018	4.979E-05	.000	.407	2.243	.034	.267
	CitableDocsPrev3Yrs	-1.424E-06	.000	-.253	-1.231	.230	-.147

a. Dependent Variable: CitesPerDoc

Chapter 8

Citation impact analysis of country-wise Journal groupings

We could understand from the analyses presented so far that SJR makes substantial contributions in CitesPerDoc, cutting across the subjects. The present analysis takes this forward and examines whether journals as a set, originating from the countries have statistically significant difference in deciding the citations accrued to the CitableDocs. This could be a reflection on publications and research culture of the country.

To ascertain this the present analysis explores possible mean difference in Citations among the journals of the countries* making up 90% of the total citable documents in Scopus, using Analysis of Variance (ANOVA). The analysis intended to understand whether the country origin of journals (when considered collectively) published form these top countries differ significantly in their TotalCites and also CitesPerDoc yields.

The number of journals included in Scopus from these countries varies, so also their subject focus. The analysis initially examines the possible difference for the total set of journals cutting across the subjects. At the second stage journals for each of the 27 subject categories as identified by Scopus is treated separately to understand the TotalCites and CitesPerDoc behavior corresponding to country of journal origin. The analysis helps us to understand the variations in citation yields. Could this be due to differing user / researcher perception of the publishers or the editorial advantage enjoyed by them or simply the 'prestige' or brand image of the journals.

To obviate any bias due to citation advantage historically accrued to some of these journals and countries, analysis confined to total citations accrued to the journals of the select counries during the recent three year period – 2016-2018.

Anova summary for the complete country-wise grouping of journals is presented in Table 8.2 . The results for the subset of subject journals are presented in Tables 8.6- 8.32 along with details of post-hoc analysis. The Post-hoc analysis of the country-wise scores to understand granular details were carried out using Fisher's LSD, wherever the Anova indicated presence of significant mean difference for the countries. LSD analysis compares each country with all the others in the context and indicates the possible statistical difference.

The data included 22,166 journals grouped under 31 countries for analysis on TotalCites, and 22,028 for CitesPerDoc. This variation in number is because several of these journals in Scopus belonging to one or the other of these countries did not have the relevant citation data, being new in the list.

We understand the number of journals indexed in Scopus pertaining to the countries varies as also the citations accrued to them. The analysis explored whether there is a statistically significant variation in the mean citations accrued to articles in journals published by them.

Table 8.1 shows the country-wise distribution of journals (2018) in Scopus.

	Journals considered	
	TotalCites	Cites per Doc
Australia	225	219
Austria	52	52
Belgium	126	125
Brazil	366	363
Canada	266	264
China	627	622
Czech Rep.	189	189
Denmark	37	36
Finland	44	44
France	527	524
Germany	1624	1612
Greece	61	59
India	499	494
Israel	12	12
Italy	491	487
Japan	460	456
Mexico	112	110
Netherlands	2080	2071
Norway	30	30
Poland	356	353
Portugal	53	53
Russia	402	393
Singapore	119	118
South Korea	250	242
Spain	568	560
Sweden	43	43
Switzerland	517	515
Taiwan	88	88
Turkey	212	208
UK	5501	5479
US	6229	6207
Total	22166	22028
Total journals, including those not in this analysis (2018)	24690	24690

The main Anova, inclusive of all the journals, shows F Ratios ($F (30, 22135)$ 8.617, MSE=16917317.778, $p < 000$) for the variable TotalCites (Table 8.2). The results indicate that there exists a statistically significant difference in Total Citation yield among country-wise grouping of journals. In other words, the citations accrued to the CitableDocs in journals making up top 90% of the output vary significantly across their country-wise groupings. Articles in journals of some country origin tend to accrue significantly more citations than the others. There seems to be a country of origin unique characteristic that is facilitating greater citations.

Post-hoc analysis carried out using Fishers LSD show that the significant difference is noticeable mainly among the journals of Netherlands, the US, the UK and to some extent those of Switzerland (Table 8.2). Journals from these countries show a tendency to accrue more citations.

A few other statistically significant inter-country differences could also be noticed as follows:

- Journals published from Germany register a significant difference compared with that of Italy and Spain (TotalCites).

- Countries such as Denmark, Finland, Norway, Sweden, and Taiwan have fewer journals and in statistical terms second only to those from Netherlands. And, 12 journals from Israel are as good as others in terms of citation yield.

This suggests that counties generally need not publish journals and get them included in Scopus in large numbers to get better citation yield for their publications.

Implication of the results for Indian contributions is, that when the articles are published in the journals with imprint of Netherlands, the US, the UK, and Switzerland they have a greater chance of accruing more citations.

Otherwise, irrespective of where they are published, journals of Indian origin or those of other countries, the probability of Indian scholarly contributions getting cited remains more or less the same. As a group 12, 871 journals originating from the identified four countries, in general, score over the others in most of the cases. It is particularly so compared to the Indian journals. The results also imply that even if Indian journals get listed in Scopus, in general, they do not attract significantly higher citations.

Table 8.2 Journal distribution, Anova Summary, Post hoc LSD analysis* results

	Journals considered for TotalCites
Australia	225
Austria	52
Belgium	126
Brazil	366
Canada	266
China	627
Czech Rep.	189
Denmark	37
Finland	44
France	527
Germany	1624
Greece	61
India	499
Israel	12
Italy	491
Japan	460
Mexico	112
Netherlands	2080
Norway	30
Poland	356
Portugal	53
Russia	402
Singapore	119
South Korea	250
Spain	568
Sweden	43
Switzerland	517
Taiwan	88
Turkey	212
UK	5501
US	6229
Total	22166

One way Anova TotalCites vs Country of journal origin

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4373227543.910	30	145774251.464	8.617	.000
Within Groups	374464829005.324	22135	16917317.778		
Total	378838056549.235	22165			

Country	TotalCites *(- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)*
• LSD analysis compares mean citations of every country in the context with all the others. The results could be both **'-'** indicating the mean citaitons are significantly less, or **'+'** indicating that the mean citaitons are high compared to the country in the context. The results presented in the Table capture the essential information where such a statistically significant difference exists.	
Australia	-Netherlands; -Switzerland; -UK; -US *(Australian journals yield significantly less Citaions than those of Netherlands, Switzerland, the UK and the US)*
Austria	-Netherlands
Belgium	-Netherlands; -Switzerland; -UK; US
Brazil	-Netherlands; -Switzerland; -UK; US
Canada	-Netherlands; -Switzerland; -UK; US
China	-Netherlands; -Switzerland; -UK; US
Czech Rep.	-Netherlands; -Switzerland; -UK; US
Denmark	-Netherlands
Finland	-Netherlands
France	-Netherlands; -Switzerland; -UK; -US
Germany	-Netherlands; -Switzerland; -UK; -US
Greece	+Italy; +Spain; -Netherlands; -Switzerland; -UK; US
India	-Netherlands; -Switzerland; -UK; US
Israel	
Italy	-GERMANY; -Netherlands; -Switzerland; -UK; US
Japan	-Netherlands; -Switzerland; -UK; US
Mexico	-Netherlands; -Switzerland; -UK; US
Netherlands	+Australia, +Belgium, +Brazil, +Canada, +China, +Czech Republic, +Denmark, +Finland, +France, +Germany, +India, +Italy, +Japan, +Mexico, +Norway, +Poland, +Portugal, +Russia, +Singapore, +South Korea, +Spain, +Sweden, +Switzerland, +Taiwan, +Turkey, + UK, +US
Norway	-Netherlands
Poland	-Netherlands; -Switzerland; -UK; -US
Portugal	-Netherlands
Russia	-Netherlands; -Switzerland; -UK; -US
Singapore	-Netherlands; -UK; -US
South Korea	-Netherlands; -Switzerland; -UK; -US
Spain	-Germany; -Netherlands; -Switzerland; -UK; -US
Sweden	-Netherlands
Switzerland	Australia, Belgium, Brazil, Canada, China, Czech Republic, France, Germany, India, Italy, Japan, Mexico, Netherlands, Poland, Russia, South Korea, Spain, Turkey
Taiwan	-Netherlands
Turkey	-Netherlands; -Switzerland; -UK; -US
UK	+Australia, +Belgium, +Brazil, +Canada, +China, +Czech Republic, +France, +Germany, +India, +Italy, +Japan, +Mexico, +Netherlands, +Poland, +Russia, +Singapore, +South Korea, +Spain, +Turkey
US	+Australia, +Belgium, +Brazil, +Canada, +China, +Czech Republic, +France, +Germany, +India, +Italy, +Japan, +Mexico, +Netherlands, +Poland, +Russia, +Singapore, +South Korea, +Spain, +Turkey

Table 8.3 Subject-wise ANOVA Results of Country-wise Journals Vs Total_Citations					
Country-wise Journals X TotalCites	**Between Groups (Countries**	**Within Groups (Journals)**	**Total**	**F Ratio**	**Significance P <**
Country-wise Journals X Total_Cites(Total Journals)	**30**	**22135**	**22165**	**8.617**	**.000**
Country-wise Journals X Total_Cites (**Agricultural and Biological Sciences)**	30	1762	1792	.600	NS
Country-wise Journals X Total_Cites (**Arts and Humanities)**	29	3292	3321	.231	NS
Country-wise Journals X Total_Cites (**Biochemistry, Genetics and Molecular Biology)**	24	1783	1807	1.141	NS
Country-wise Journals X Total_Cites (**Business, Management and Accounting)**	23	1163	1186	2.662	.000
Country-wise Journals X Total_Cites (**Chemical Engineering)**	20	506	526	1.048	NS
Country-wise Journals X Total_Cites (**Chemistry)**	20	692	712	1.924	.009
Country-wise Journals X Total_Cites (**Computer Science)**	25	1370	1395	1.732	.014
Country-wise Journals X Total_Cites (**Decision Sciences)**	15	314	329	2.488	.002
Country-wise Journals X Total_Cites (**Dentistry)**	14	162	176	1.884	.032
Country-wise Journals X Total_Cites (**Earth and Planetary Sciences)**	25	996	1021	1.461	NS
Country-wise Journals X Total_Cites(Economics, **Econometrics and Finance)**	21	868	889	4.116	.000
Country-wise Journals X Total_Cites (**Energy)**	17	358	375	1.440	NS
Country-wise Journals X Total_Cites (**Engineering)**	28	2438	2466	3.827	.000
Country-wise Journals X Total_Cites (**Environmental Science)**	28	1229	1257	2.213	.000
Country-wise Journals X Total_Cites (**Health Professions)**	20	459	479	1.008	NS
Country-wise Journals X Total_Cites (**Immunology and Microbiology)**	19	470	489	1.770	.024
Country-wise Journals X Total_Cites (**Materials Science)**	17	1033	1050	2.265	.002
Country-wise Journals X Total_Cites (**Mathematics)**	25	1223	1248	2.071	.002
Country-wise Journals X Total_Cites **Medicine)**	30	6407	6437	3.359	.000
Country-wise Journals X Total_Cites (**Multidisciplinary)**	11	69	80	.735	NS
Country-wise Journals X Total_Cites (**Neuroscience)**	18	498	516	1.091	NS
Country-wise Journals X	20	551	571	1.340	NS

Total_Cites(**Nursing)**					
Country-wise Journals X Total_Cites(**Pharmaceutic)**	20	586	606	2.945	.000
Country-wise Journals X Total_**CitesPhysics and Astronomy)**	20	943	963	1.350	NS
Country-wise Journals X Total_Cites(**Psychology)**	21	1071	1092	3.308	.000
Country-wise Journals X Total_Cites(**Social Sciences)**	30	5345	5375	6.465	.000
Country-wise Journals X Total_Cites(**Veterinary Sciences)**	17	170	187	2.526	.001

The analysis was taken forward to explore the possible mean difference in Total Citations in subject-wise categorization of the journals from these countries. The results summarized in Table 8.3 indicate that 13 of the 27 country-wise subject grouping of the journals show a significant statistical difference. These are -

(1) Business, Management & Accounting (2) Chemistry (3) Decision Science (4) Economics, Econometrics & Finance (5) Engineering (6) Environment Science (7)Material science (8) Mathematics (9) Medicine (10) Pharmacology, Toxicology and Pharmaceuticals (11) Psychology (12) Social Sciences (13) Veterinary Science with respect to citation yield.

For journals in other subject groupings, country-wise journal origin does not make a difference in Total Citation yield.

Post hoc analysis carried out for the subjects, where the difference was significant, to understand which countries have the relative advantage, indicate the following:

Business, Management and Accounting	Journals of Netherlands accrue citations significantly more than France, Switzerland, UK, US and Germany
Chemistry	Journals of UK tend to get significantly greater number of citations than those of Germany
Decision Sciences	Journals published in Netherlands get significantly more citations than those of Germany, Switzerland, US, UK
Economics, Econometrics and Finance	Journals of Netherlands score over those of FR, Germany, Italy, Russia, Spain, Switzerland, US and UK
Engineering	Journals of Netherlands score higher than those of China, France, Germany, India, Italy, Japan, Poland, Russia, South Korea, Switzerland, US and UK
Environmental Science	Journals of Netherlands score significantly higher than those of India, Germany, US and UK
Materials Science	Journals of Netherlands tent to get higher citations than those of China
Mathematics	Journals of Netherlands score significantly higher than Germany
Medicine	Netherlands journals score higher than those of Japan. Journals of US score higher than Japan, and India
Pharmaceutics	Journals of Netherlands, Switzerland, and UK tend to accrue higher citations than

	those of India
Psychology	Journals of Netherlands score higher than those of Brazil, France, Germany, Italy, Spain and the US
Social Sciences	• Journals of Netherlands score higher than Australia, Belgium, Brazil, Czech. Rep., France, Germany, Italy, Poland, Spain, Switzerland, and the US • UK journals score higher than France, Germany, Italy, Spain, and Switzerland • US journals register significant difference from those of Spain • Those of Switzerland significantly differ from almost all the other 30 countries considered in the analysis except Israel, China, Denmark, Singapore
Veterinary Sciences	Netherlands Journals register a significant difference in citation compared to Brazil, France, Germany, India, Italy, Turkey, US and UK

On the whole, it could be seen that journals of Netherlands origin score higher than several other countries, and they also register a statistically significant difference in all the subject categories where a significant F Ratio is obtained.

Indian journals as a whole accrue significantly lesser mean Total Citations compared to those of Netherlands, Switzerland, the US, the UK as a whole, and so also in specific subjects, namely Engineering, Environmental Science, Medicine, Pharmacology, Toxicology, and Pharmaceutical, Social Sciences, and Veterinary Sciences.

Journals in other subject categories, published from India, are not significantly different from those of other countries, suggesting that for the articles published in Indian journals in those subjects are not at a disadvantage in terms of Total Citation yield. It is also to be noted that but for the publications of four countries mentioned above, it does not make a difference if the Indian articles are published in journals of other country origin. In general, they fare just as well as those of Indian journals. The results indicate the subjects in which we may venture publishing more journals for accommodating Indian contributions with possible citation yield as good as those from other countries.

Citations Per Document

Similar analysis carried out on variable CitesPerDoc for country-wise journal groupings and also subject-wise grouping under countries show a more complex pattern (Table 8.4).

Main Anova for CitesPerDoc inclusive of all the journals is statistically significant ($F(30, 21997)=16.237$, $MSE=24.218$, $p<.000$) indicating journals of certain countries tend to accrue more CitesPerDoc than the others as a group. Post hoc analyses show that as general rule journals of Switzerland, Netherlands, the US and the UK differ significantly on this count from those of other countries. They tend to accrue significantly higher CitesPerDoc. Even among them journals originating from Netherlands accrue higher CitesPerDoc than all the other countries, including those of the US and the UK.

Table 8.4 One way Anova CitesPerDoc vs Country-wise Journals

	Journals considered for TotalCites
Australia	219
Austria	52
Belgium	125
Brazil	363
Canada	264
China	622
Czech Rep.	189
Denmark	36
Finland	44
France	524
Germany	1612
Greece	59
India	494
Israel	12
Italy	487
Japan	456
Mexico	110
Netherlands	2071
Norway	30
Poland	353
Portugal	53
Russia	393
Singapore	118
South Korea	242
Spain	560
Sweden	43
Switzerland	515
Taiwan	88
Turkey	208
UK	5479
US	6207
Total	22028

One way Anova CitesPerDoc vs Country-wise journals

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11796.712	30	393.224	16.237	.000
Within Groups	532730.822	21997	24.218		
Total	544527.533	22027			

Country	CitesPerDoc (- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)
Australia	-Netherlands; -Switzerland; -UK; -US
Austria	-Netherlands; -Switzerland; -US
Belgium	-Germany, -Netherlands; -Switzerland; -UK; -US
Brazil	-Germany, -Netherlands; -Switzerland; -UK; -US
Canada	-Netherlands; -Switzerland; -UK; -US
China	-Germany, -Netherlands; -Switzerland; -UK; -US
Czech Rep.	-Germany, -Netherlands; -Switzerland; -UK; -US
Denmark	-Netherlands
Finland	-Netherlands; -UK; -US
France	+Spain; -Germany,-Netherlands; Switzerland; -UK; -US
Germany	+Belgium;+Brazil;+China;++Czech. Rep;+France;+India; +Italy; +Japan; +Mexico; +Poland; +Russia; +Spain; +Turkey; -Netherlands; -UK; -US
Greece	-Netherlands; -US
India	-Germany, -Netherlands; -Switzerland; -UK; -US
Israel	
Italy	-Germany, -Netherlands; -Switzerland; -UK; -US
Japan	-Germany, -Netherlands; -Switzerland; -UK; -US
Mexico	-Germany, -Netherlands; -Switzerland; -UK; -US

Netherlands	+Australia, +Austria, +Belgium, +Brazil, +Canada, +China, +Czech Republic, +Denmark, +Finland, +France, + Germany, +Greece, + India, + Italy, +Japan, +Mexico, + Norway, +Poland, + Portugal, + Russia, +Singapore, +South Korea, +Spain, +Switzerland, +Taiwan, +Turkey, + UK, + US
Norway	-Netherlands; -UK; -US
Poland	-Germany, -Netherlands; -Switzerland; -UK; -US
Portugal	-Netherlands; -Switzerland; -UK; -US
Russia	-Germany, -Netherlands; -South Korea; -Switzerland; -UK; -US
Singapore	-Netherlands; -UK; -US
South Korea	+France;+Russia;+Spain; -Netherlands; -Switzerland; -UK; -US
Spain	-Germany, -Netherlands; -Korea; -Switzerland; -UK; -US
Sweden	
Switzerland	Australia, Belgium, Brazil, Canada, China, Czech Republic, France, India, Italy, Japan, Mexico, Netherlands, Poland, Russia, Spain, Turkey, the US
Taiwan	-Netherlands; -UK; -US
Turkey	-Germany, -Netherlands; -Switzerland; -UK; -US
UK	+Australia, +Austria, +Belgium, +Brazil, +Canada, +China, +Czech Republic, +Finland, +France, +Germany, +India, +Italy, +Japan, +Mexico, -Netherlands, +Norway, +Poland, +Portugal, +Russia, +Singapore, +South Korea, +Spain, +Taiwan, +Turkey
US	+Australia, +Austria, +Belgium, +Brazil, +Canada, +China, +Czech Republic, +Finland, +France, +Germany, +Greece, +India, +Italy, +Japan, +Mexico, -Netherlands, +Norway, +Poland, +Portugal, +Russia, +Singapore, +South Korea, +Spain, +Switzerland, +Taiwan, +Turkey

A careful look at the post hoc results also indicates the following:

- Journals of Germany show a significant positive difference compared with those of Belgium, Brazil, China, Czeck. Rep., France, India, Italy, Japan, Mexico, Poland, Russia, Spain, Turkey.
- Journals of Switzerland differ from Australia, Belgium, Brazil, Canada, China, Czech Rep, France, India, Italy, Japan, Mexico, Netherlands, Poland, Russia, Spain, Turkey, US
- Journals of the UK score higher than all the other countries except Denmark, Greece, Israel, Netherlands, Sweden, Switzerland and the US.
- Journals of the US score higher than all others except Denmark , Greece, Israel, Netherlands, Switzerland and the UK
- 12 journals of Israel and 43 of Sweden, as the post hoc analysis show, are as good as others. However, they do not tend to outdo others in CitesPerDoc.

The lesson from the analysis for Indian scholars is that higher citation per document can be expected if they publish in journals of the US, the UK, Netherlands, Germany or Switzerland origin, otherwise the articles can as well be published in Indian journals and they do not accrue any less CitesPerDoc just because of that.

Pecking order of journals for higher CitesPerDoc is those published in Netherlands, the US, the UK, Switzerland, Germany, and the others

This analysis was extended to all the subject categories. Short summary Anova results is presented in Table 8.5 for a quick overview. Unlike TotalCites, CitesPerDoc is statistically significant in all the subject grouping excepting (1) Biochemistry, Genetics and Molecular biology (2) Energy (3) Health professionals (4) Multidisciplinary, and (5) Neuroscience.

The results suggest that even when considered at the subject level the journals of some countries tend to accrue significantly higher CitesPerDoc compared to those of others. Subject-wise summary of these differences is presented in Table 8.5

Table 8.5 Country-wise Subject Journals Vs Citations per Document

Country-wise Journals X Citations per Document	Between Groups (Countries	Within Groups (Journals)	Total	F Ratio	Significance P <
Country-wise Journals *Vs* CitesPerDoc (Total Journals)	**30**	**21997**	**22027**	**16.237**	**.000**
Country-wise Journals X CitesPerDoc (**Agricultural and Biological Sciences)**	30	1754	1784	11.248	.000
Country-wise Journals *Vs* CitesPerDoc (**Arts and Humanities)**	29	3262	3291	9.495	.000
Country-wise Journals *Vs* CitesPerDoc (**Biochemistry, Genetics and Molecular Biology)**	24	1775	1799	.705	NS
Country-wise Journals *Vs* CitesPerDoc (**Business, Management and Accounting)**	23	1152	1175	5.037	.000
Country-wise Journals *Vs* CitesPerDoc (**Chemical Engineering)**	20	504	524	4.070	.000
Country-wise Journals *Vs* CitesPerDoc (**Chemistry)**	20	690	710	3.213	.000
Country-wise Journals *Vs* CitesPerDoc (**Computer Science**)	24	1360	1384	7.436	.000
Country-wise Journals *Vs* CitesPerDoc (**Decision Sciences**)	15	311	326	2.321	.004
Country-wise Journals *Vs* CitesPerDoc (**Dentistry)**	14	161	175	4.388	.000
Country-wise Journals *Vs* CitesPerDoc (**Earth and Planetary Sciences)**	25	991	1016	3.858	.000
Country-wise Journals *Vs*	21	863	884	5.761	.000

CitesPerDoc (**Economics, Econometrics and Finance)**					
Country-wise Journals *Vs* CitesPerDoc (**Energy)**	16	355	371	1.417	NS
Country-wise Journals *Vs* CitesPerDoc (**Engineering)**	28	2423	2451	9.457	.000
Country-wise Journals *Vs* CitesPerDoc (**Environmental Science)**	28	1218	1246	3.279	.000
Country-wise Journals *Vs* CitesPerDoc (**Health Professions**)	20	456	476	.606	NS
Country-wise Journals *Vs* CitesPerDoc **(Immunology and Microbiology)**	18	466	484	3.307	.000
Country-wise Journals *Vs* CitesPerDoc (**Materials Science)**	17	1030	1047	4.405	.000
Country-wise Journals *Vs* CitesPerDoc (**Mathematic)**	24	1216	1240	5.064	.000
Country-wise Journals *Vs* CitesPerDoc (**Medicine)**	30	6372	6402	11.996	.000
Country-wise Journals *Vs* CitesPerDoc (**Multidisciplinary)**	11	69	80	.681	NS
Country-wise Journals *Vs* CitesPerDoc (**Neuroscience)**	18	497	515	1.090	NS
Country-wise Journals *Vs* CitesPerDoc (**Nursing)**	20	546	566	2.308	.001
Country-wise Journals *Vs* CitesPerDoc (**Pharmaceutics)**	20	584	604	4.887	.000
Country-wise Journals *Vs* CitesPerDoc (**Physics and Astronomy)**	20	942	962	2.992	.000
Country-wise Journals *Vs* CitesPerDoc (**Psychology)**	21	1065	1086	5.514	.000
Country-wise Journals *Vs* CitesPerDoc (**Social Sciences)**	30	5298	5328	11.759	.000
Country-wise Journals *Vs* CitesPerDoc (**Veterinary Sciences)**	17	169	186	4.394	.000

Post hoc analysis of the country-wise data for journals falling under different subject categories is summarized below:

Agricultural and Biological Sciences	• Articles published in journals of Netherlands origin yield significantly higher citations per doc compared to Austria, Brazil, Switzerland, Czeck. Rep., Finland, France, Germany, India, Italy, Japan, Mexico, Poland, Russia, South Korea, Spain, Turkey, the UK and the US • Journals from Switzerland show the difference with those of India, Russia • UK journals score significantly higher than the journals of Austria, Brazil,

	Switzerland, France, Germany, India, Italy, Mexico, Poland, Russia, Spain, Russia, and Turkey • Those of US score higher than Brazil, Switzerland, India, Italy, Japan, Netherlands, Russia, Spain.
Arts and Humanities	• Journals of Netherlands score higher than those from Belgium, Canada, France, Italy, Spain • Journals of the UK score higher than those of Belgium, Brazil, Czeck.Rep, France, Germany, Poland, Spain • Journals of the US give significantly higher yield compared to those of Belgium, Brazil, Czeck. Rep., France, Germany, Italy, Poland, Russia, and Spain • Journals published in India are as good on this variable as any other country journals in CitesPerDoc
Biochemistry, Genetics and Molecular Biology	Not Significant
Business, Management and Accounting	Journals from Netherlands have registered significant difference compared to those of Australia, Brazil, India, Singapore, Spain, Switzerland, the UK and the US
Chemical Engineering	Journals from Netherlands, the US and the UK differ significantly from those of China, India, Japan, Russia, Czeck Rep.
Chemistry	Journals of the UK register a significant difference from those of China, Japan, Russia
Computer Science	Journals of the US and Netherlands register statistically significant difference from those of Australia, China, France, India, Italy, Japan, Russia, Switzerland, South Korea and also those of UK
Decision Sciences	Journals of Germany show a significant positive difference from those of Netherlands
Dentistry	The UK journals register a positive significant difference from those of Australia, India, Japan, Portugal and Spain
Earth and Planetary Sciences	Journals of Netherlands and the US indicate a significant positive difference from those of Brazil, China, Japan, Portugal, and Russia
Economics, Econometrics and Finance	Journals of Netherlands, the US, and the UK register positive and significant difference from those of France, Germany, Russia, Spain
Energy	Not Significant
Engineering	Journals of the US, the UK and Netherlands register a significant positive difference from those of 15 other countries in the select list
Environmental Science	Netherlands journals indicate a significant positive difference from those of Brazil, China, Germany, India, Japan, Poland, Russia
Health Professions	Not Significant
Immunology and Microbiology	Journals of the US and UK show the difference from those of Russia

Materials Science	Journals of the UK and Netherlands register statistically significant difference from those of China, Japan, Russia
Mathematics	Journals of Netherlands, the UK, and the US show a statistically significant difference from journals of seven other countries in the list, namely India, France, China, Italy, Japan, Poland, and Russia
Medicine	Journals of Netherlands, the UK and the US indicate a significant positive difference from those of 14 other countries Journals of Switzerland also register the difference against those of France, India, Japan, Russia, Spain, Turkey
Multidisciplinary	Not Significant
Neuroscience	Not Significant
Nursing	The US, the UK and Netherlands journals differ in positive direction from those of France
Pharmaceutics	Significant difference is found among journals of Netherlands (from those of India, Japan), from those of the UK (China, India, Japan) and the US (India)
Physics and Astronomy	There is a significant difference between the Journals from Netherlands (differ significantly from those of Russia, China), the US (differ from China), UK (differ from China, Russia)
Psychology	Journals of Netherlands (differ from France, Brazil) the US (differ from France, Germany, Italy, Brazil) and UK (differ from France) stand apart from those of the other countries
Social Sciences	Journals of Switzerland, Netherlands, the US, and UK differ from most of the other countries. Exception to these are journals from Austria, Denmark, Finland, Greece, India, Israel, Norway, Sweden, Taiwan, Turkey
Veterinary Sciences	Journals of Netherlands differ from Brazil, France, India, Italy, and Turkey. The UK journals also registered statistically significant difference with those of Turkey

Implications for India

For better CitesPerDoc Indian contributions have to aim of publishing in Journals from Germany, Netherlands, Switzerland, the UK or the US in Agriculture. But for those, Indian journals are equally good in terms of citation yield per document.

CitableDocs in the following subjects can as well be published in Indian journals: Arts; Biochemistry; Chemistry; Decision Sciences, Earth Sciences, Economics, Energy, Health professions; Immunology; Material Science, Multidisciplinary, Neuroscience; Nursing, Physics, Psychology.

In others subjects, journals of Netherlands could be the first choice, followed by those from the US and the UK for better CitesPerDoc. But for these, it does not make a difference if they are published elsewhere in other subjects also.

Details of the subject-wise analysis, including number of journals considered in the analysis, Anova summary and the post hoc results for both TotalCites and CitesPerDoc are presented in the following pages.

Table 8.6 Agricultural and Biological Sciences

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Australia	37	37
Austria	8	8
Belgium	4	4
Brazil	73	73
Canada	15	15
China	54	53
Czech Rep.	24	24
Denmark	2	2
Finland	16	16
France	40	40
Germany	168	167
Greece	4	4
India	60	60
Israel	2	2
Italy	41	41
Japan	52	50
Mexico	16	16
Netherlands	213	213
Norway	4	4
Poland	40	39
Portugal	3	3
Russia	38	37
Singapore	2	2
South Korea	16	15
Spain	30	30
Sweden	3	3
Switzerland	43	43
Taiwan	6	6
Turkey	18	18
UK	379	379
US	382	381
Total	1793	1785

One way Anova TotalCites vs Country of journal origin in **Agricultural and Biological Sciences**

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	556911254.634	30	18563708.488	.600	.958
Within Groups	54549910516.707	1762	30959086.559		
Total	55106821771.341	1792			

One way Anova CitesPerDoc vs Country of journal origin in Agricultural and Biological Sciences

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	955.055	30	31.835	11.248	.000
Within Groups	4964.442	1754	2.830		
Total	5919.497	1784			

	TotalCites*	CitesPerDoc*
Australia	(NS)	-UK
Brazil		-Germany;-Netherlands; -UK; -US
China		-Netherlands; -UK; -US
Czech Rep.		-Netherlands
Finland		-Netherlands
France		-Netherlands; -UK; -US

Germany		+India; +Russia;-Netherlands; -UK;
India		-Germany; -Netherlands; -Switzerland; -UK; -US
Italy		-Netherlands; -UK; -US
Japan		-Netherlands; -UK; -US
Mexico		-Netherlands; -UK;
Netherlands		+Australia; +Brazil; +Switzerland; +Check. Rep.; +Finland; +France; +Germany; +India; +Italy; +Japan; +Mexico; +Poland; +Russia; +South Korea; +Spain; +Turkey ;+the UK;+the US
Poland		-Netherlands; -UK;
Russia		-Germany; --Switzerland; -Netherlands; -UK; -US
South Korea		-Netherlands
Spain		-Netherlands; -UK; -US
Switzerland		+India; +Russia
Turkey		-Netherlands; -UK
UK		+Australia; +Brazil; +Switzerland; +France; +Germany; +India; +Italy; +Japan; +Mexico; +Poland; +Russia; +Spain; +Turkey; -Netherlands
US		+Brazil;+Switzerland;+India;+Italy, +Japan;;+Russia;+Spain; -Netherlands
(- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)		

Table 8.7 Arts and Humanities

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of journals	
	Total Citations	Citations per Doc
Australia	38	36
Austria	14	14
Belgium	77	77
Brazil	41	41
Canada	58	57
China	11	10
Czech Rep.	45	45
Denmark	9	9
Finland	13	13
France	146	145
Germany	227	223
Greece	6	6
India	14	14
Italy	144	141
Japan	7	7
Mexico	17	17
Netherlands	270	270
Norway	7	7
Poland	56	55
Portugal	17	17
Russia	41	39
Singapore	3	3
South Korea	13	13
Spain	208	204
Sweden	11	41
Switzerland	28	28
Taiwan	11	41
Turkey	12	12
UK	899	894
US	879	873
Total	3322	3292

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Arts and Humanities

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22045720.057	29	760197.243	.231	1.000
Within Groups	10852128178.601	3292	3296515.243		
Total	10874173898.658	3321			

One way Anova CitesPerDoc vs Country of journal origin in Arts and Humanities

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	246.388	29	8.496	9.495	.000
Within Groups	2918.741	3262	.895		
Total	3165.129	3291			

Country	TotalCites*	CitesPerDoc*
Belgium		-Netherlands; -UK; -US
Brazil		-UK; -US
Canada		-Netherlands; -UK; -US
Czech Rep.		-UK; -US
France		-Netherlands; -UK; -US

Germany		UK; -US
Italy		-Netherlands; -UK; -US
Netherlands		+Belgium; +Canada; +France; +Italy; +Spain
Norway		
Poland		-UK; -US
Russia		-UK; -US
Spain		-Netherlands; -UK; -US
UK		+Belgium; +Brazil; +Chech Rep; +France; +Germany; +Poland; +Spain
US		+Belgium; +Brazil; +Czech Rep; +France; +Germany; +Italy; +Poland; +Russia; +Spain
(- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)		

Table 8.8 Biochemistry, Genetics and Molecular Biology

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Cites per doc
Australia	6	6
Austria	2	2
Brazil	11	11
Canada	10	10
China	47	46
Czech Rep.	10	10
Denmark	3	3
France	19	19
Germany	152	151
Greece	14	14
India	50	50
Italy	21	21
Japan	43	42
Netherlands	265	264
Poland	20	20
Russia	42	41
Singapore	5	5
South Korea	26	25
Spain	9	9
Sweden	3	3
Switzerland	76	76
Taiwan	2	2
Turkey	10	10
UK	447	446
US	515	514
Total	1808	1800

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Biochemistry, Genetics and Molecular Biology

3	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1523238198.943	24	63468258.289	1.141	.289
Within Groups	99219994566.879	1783	55647781.585		
Total	100743232765.822	1807			

One way Anova CitesPerDoc vs Country of journal origin in Biochemistry, Genetics and Molecular Biology

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3436.827	24	143.201	.705	.851
Within Groups	360675.917	1775	203.198		
Total	364112.744	1799			

Table 8.9 **Business, Management and Accounting**

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Cites per doc
Australia	10	10
Belgium	4	4
Brazil	7	7
Canada	5	5
China	4	4
Czech Rep.	4	4
Denmark	2	2
France	16	16
Germany	60	58
Greece	3	3
India	16	14
Italy	6	5
Japan	5	5
Netherlands	78	75
Poland	6	6
Russia	5	5
Singapore	11	11
South Korea	2	2
Spain	12	12
Switzerland	31	31
Taiwan	7	7
Turkey	3	2
UK	533	532
US	357	356
Total	1187	1176
Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category		

ANOVA

One way Anova TotalCites vs Country of journal origin in Business, Management and Accounting

Citations 4	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	114283445.877	23	4968845.473	2.662	.000
Within Groups	2170868291.317	1163	1866610.741		
Total	2285151737.195	1186			

One way Anova CitesPerDoc vs Country of journal origin in Business, Management and Accounting

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	410.904	23	17.865	5.037	.000
Within Groups	4085.729	1152	3.547		
Total	4496.632	1175			

Country	TotalCites*	CitesPerDoc*
Australia		-Netherlands
Brazil		-Netherlands
France	-Netherlands	-US
Germany	-Netherlands	-Netherlands; -US
India		-Netherlands
Netherlands	+France; +Switzerland; +UK; +US	+Brazil; +India; +Singapore; +UK; +US
Singapore		-Netherlands
Spain		-Netherlands
Switzerland	-Netherlands	-Netherlands
UK	-Netherlands	
US	-Netherlands	+Germany; +France

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.10 Chemical Engineering

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Australia	2	2
Belgium	2	2
Brazil	3	3
Canada	2	2
China	40	40
Czech Rep.	2	2
France	5	5
Germany	52	52
India	14	14
Italy	8	8
Japan	16	16
Netherlands	79	79
Poland	6	6
Russia	14	14
Singapore	3	3
South Korea	16	16
Switzerland	17	17
Taiwan	2	2
Turkey	2	2
UK	117	117
US	125	123
Total	527	525

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Chemical Engineering

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1999989756.150	20	99999487.807	1.048	.403
Within Groups	48289177978.674	506	95433158.061		
Total	50289167734.824	526			

One way Anova CitesPerDoc vs Country of journal origin in Chemical Engineering

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	893.652	20	44.683	4.070	.000
Within Groups	5533.444	504	10.979		
Total	6427.097	524			

Country	TotalCites*	CitesPerDoc*
China		-Netherlands; -UK; -US
India		-Netherlands; -UK
Japan		-Netherlands; -UK
Netherlands		+China; +India; +Japan
Russia		-Netherlands; -UK
UK		+India; +Japan
US		+China

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.11 Chemistry

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Australia	3	3
Brazil	10	10
Canada	4	4
China	33	33
Czech Rep.	2	2
France	5	5
Germany	72	72
India	16	16
Italy	4	4
Japan	22.	22
Mexico	3	2
Netherlands	122	122
Poland	7	7
Russia	28	28
Singapore	3	3
South Korea	11	11l
Spain	3	3
Switzerland	17	17
Turkey	4	4
UK	150	150
US	194	193
Total	713	711

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Chemistry

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4822486415.977	20	241124320.799	1.924	.009
Within Groups	86709716233.953	692	125303058.142		
Total	91532202649.930	712			

One way Anova CitesPerDoc vs Country of journal origin in Chemistry

SUBJECT 6	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	975.585	20	48.779	3.213	.000
Within Groups	10476.169	690	15.183		
Total	11451.754	710			

Country	TotalCites*	CitesPerDoc*
China		-UK
Germany	-UK	
Japan		-UK
Russia		-UK
UK	+Germany	+China; +Japan; +Russia

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.12 Computer Science

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Australia	12	12
Austria	5	5
Brazil	5	5
Canada	7	7
China	50	50
Czech Rep.	6	6
Denmark	4	4
France	14	14
Germany	108	107
India	18	17
Italy	13	13
Japan	28	27
Netherlands	206	206
Norway	2	2
Poland	12	12
Portugal	3	3
Russia	17	17
Singapore	28	27
South Korea	23	22
Spain	13	13
Sweden	3	3
Switzerland	44	44
Taiwan	11	11
Turkey	2	0
UK	317	314
US	445	444
Total	1396	1385

Some of the 31 countries selected do not figure in this analysis as they less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Computer Science

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	189740714.808	25	7589628.592	1.732	.014
Within Groups	6001973829.545	1370	4381002.795		
Total	6191714544.352	1395			

One way Anova CitesPerDoc vs Country of journal origin in Computer Science

SUBJECT 7	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	963.881	24	40.162	7.436	.000
Within Groups	7344.937	1360	5.401		
Total	8308.818	1384			

Country	TotalCites*	CitesPerDoc*
Australia		-Netherlands
China		-Netherlands; -US
France		-Netherlands; -US
India		-Netherlands; -US
Italy		-Netherlands
Japan		-Netherlands; -UK; -US
Netherlands		+Australia; +China; +France; +India; +Italy; +Japan; +Russia; +Switzerland; +Uk
Russia		-Netherlands; -US
South Korea		-Netherlands

Switzerland		-Netherlands; -US
UK		+Japan; -Netherlands; -US
US		+China; +France; +India; +Russia; +Switzerland; +UK
(- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)		

Table 8.13 Decision Sciences

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Brazil	2	2
Canada	4	4
France	2	2
Germany	31	30
India	4	4
Italy	2	2
Japan	2	2
Netherlands	43	43
Poland	3	3
Singapore	4	4
South Korea	2	2
Spain	3	3
Switzerland	12	12
Taiwan	5	5
UK	116	116
US	95	93
Total	330	327

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Decision Sciences

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	70685836.565	15	4712389.104	2.488	.002
Within Groups	594727677.208	314	1894037.189		
Total	665413513.773	329			

One way Anova CitesPerDoc vs Country of journal origin in Decision Sciences

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	197.821	15	13.188	2.321	.004
Within Groups	1767.243	311	5.682		
Total	1965.064	326			

Country	TotalCites*	CitesPerDoc*
Germany	-Netherlands	-Netherlands
Netherlands	+Germany; +Switzerland; +UK; +US	+Germany
Switzerland	-Netherlands	
UK	-Netherlands	
US	-Netherlands	

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.14 Dentistry

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Brazil	10	10
Canada	2	2
France	4	3
Germany	11	11
India	14	14
Italy	5	5
Japan	8	8
Netherlands	11	11
Poland	4	4
South Korea	5	5
Spain	7	7
Switzerland	5	5
Turkey	4	4
UK	42	42
US	45	45
Total	177	176

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Dentistry

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10314394.834	14	736742.488	1.884	.032
Within Groups	63359151.742	162	391105.875		
Total	73673546.576	176			

One way Anova CitesPerDoc vs Country of journal origin in Dentistry

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	71.199	14	5.086	4.388	.000
Within Groups	186.616	161	1.159		
Total	257.815	175			

Country	TotalCites*	CitesPerDoc*
Australia		-UK
India		-UK
Japan		-UK
Poland		-UK
Spain		-UK
UK		+Brazil; +India; +Japan; +Poland; +Spain

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.15 Earth and Planetary Sciences

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	15	15
Austria	4	4
Belgium	4	4
Brazil	23	23
Canada	16	16
China	79	78
Czech Rep.	12	12
Denmark	2	2
Finland	7	7
France	25	25
Germany	114	113
India	21	21
Italy	25	25
Japan	29	28
Mexico	9	9
Netherlands	107	106
Poland	28	28
Portugal	3	3
Russia	35	35
South Korea	9	9
Spain	20	20
Switzerland	24	24
Taiwan	5	5
Turkey	6	6
UK	198	197
US	202	202
Total	1022	1017

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Earth and Planetary Sciences

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	258475826.923	25	10339033.077	1.461	.067
Within Groups	7047383147.351	996	7075685.891		
Total	7305858974.274	1021			

One way Anova CitesPerDoc vs Country of journal origin in Earth and Planetary Sciences

SUBJ 10	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	748.000	25	29.920	3.858	.000
Within Groups	7685.124	991	7.755		
Total	8433.124	1016			

Country	TotalCites*	CitesPerDoc*
Brazil		-US; -Netherlands
China		-US; -Netherlands
India		-Netherlands
Japan		-Netherlands
Netherlands		+China; +Brazil; +India; +Japan; +Poland; +Russia
Poland		-Netherlands
Russia		-US; -Netherlands
US		+China; +Brazil; +Russia

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.16 Economics, Econometrics and Finance

Journal distribution, Anova Summary, Post hoc LSD analysis results.

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	9	9
Belgium	6	6
Brazil	8	8
Canada	4	4
Czech Rep.	10	10
France	18	18
Germany	82	82
Greece	3	3
India	8	8
Italy	16	16
Mexico	5	5
Netherlands	114	114
Poland	9	9
Russia	16	15
Singapore	9	9
South Korea	7	7
Spain	23	23
Switzerland	19	19
Taiwan	2	2
Turkey	5	5
UK	299	297
US	218	216
Total	890	885

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Economics, Econometrics and Finance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21178016.816	21	1008476.991	4.116	.000
Within Groups	212665209.809	868	245006.002		
Total	233843226.625	889			

One way Anova CitesPerDoc vs Country of journal origin in Economics, Econometrics and Finance

11	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	303.205	21	14.438	5.761	.000
Within Groups	2162.742	863	2.506		
Total	2465.947	884			

Country	TotalCites*	CitesPerDoc*
France	-Netherlands	-Netherlands; -US
Germany	-Netherlands	-Netherlands; -US
Netherlands	+FRANCE;+GERMANY;; +ITALY; +RUSSIA; +SPAIN; +SWITZERLAND	+France; +Germany; +Russia
Russia	-Netherlands	-Netherlands; -US
Spain	-Netherlands	-Netherlands; -US
UK	-Netherlands	+Germany
US	-Netherlands	+Russia; +Spain

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.17 Energy

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Belgium	3	3
Canada	9	9
China	39	39
France	2	2
Germany	28	27
Greece	2	
India	6	6
Italy	5	5
Japan	8	8
Netherlands	53	53
Poland	3	3
Russia	9	9
Singapore	2	2
South Korea	2	2
Switzerland	7	7
Turkey	3	3
UK	85	85
US	110	109
Total	376	372

Some of the 31 countries selected do not figure in this analysis as they less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Energy

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1476206454.483	17	86835673.793	1.440	.115
Within Groups	21588724914.996	358	60303700.880		
Total	23064931369.479	375			

One way Anova CitesPerDoc vs Country of journal origin in Energy

12	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	611.690	16	38.231	1.417	.130
Within Groups	9577.253	355	26.978		
Total	10188.943	371			

Table 8.18 Engineering

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Australia	12	12
Austria	5	5
Belgium	4	3
Brazil	14	14
Canada	16	15
China	198	198
Czech Rep.	12	12
Denmark	4	4
Finland	4	4
France	34	34
Germany	176	175
Greece	4	3
India	41	41
Italy	28	27
Japan	110	109
Mexico	3	3
Netherlands	257	256
Norway	4	4
Poland	44	44
Russia	33	33
Singapore	17	17
South Korea	51	48
Spain	22.	22
Sweden	3	3
Switzerland	60	60
Taiwan	16	16
Turkey	17	17
UK	573	571
US	705	702
Total	2467	2452

Some of the 31 countries selected do not figure in this analysis as they less than 2 journals under the category

ANOVA					
One way Anova TotalCites vs Country of journal origin in Engineering					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1673581547.865	28	59770769.567	3.827	.000
Within Groups	38077192316.920	2438	15618208.498		
Total	39750773864.786	2466			

One way Anova CitesPerDoc vs Country of journal origin in Engineering

13	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1621.724	28	57.919	9.457	.000
Within Groups	14840.000	2423	6.125		
Total	16461.724	2451			

Country	TotalCites	CitesPerDoc
Australia		-Netherlands
Brazil		-Netherlands
China	-Netherlands	-Netherlands; -UK; -US
Czech Rep.		-Netherlands
France	-Netherlands	-Netherlands; -UK; -US
Germany	-Netherlands	-US
India	-Netherlands	-Netherlands; -UK; -US
Italy	-Netherlands	-Netherlands

Japan	-Netherlands	-Netherlands; -UK; -US
Netherlands	+China; +France; +Germany;+India; +Italy; +Japan; +Poland; +Russia; +Korea; +Switzerland; +US; +UK	+Australia; +Chna; +Czech Rep +France; +Germany; +India; +Japan; +Poland; +Russia; +Korea; +Spain; +Switzerland; +Taiwan; +Turkey; +UK; +US
Poland	-Netherlands	-Netherlands
Russia	-Netherlands	-Netherlands
South Korea	-Netherlands	-Netherlands
Spain		-Netherlands
Switzerland	-Netherlands	
Taiwan		-Netherlands
UK	-Netherlands	+France; Indial; Japan; -Netherlands
US	-Netherlands	+China; France; Germany; India; Japan, -Netherlands
(- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)		

Table 8.19 Environmental Science

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	23	23
Austria	4	4
Belgium	4	4
Brazil	26	26
Canada	13	13
China	37	35
Czech Rep.	11	11
Denmark	4	4

Finland	11	11
France	18	18
Germany	124	123
Greece	3	3
India	39	37
Italy	22	22
Japan	21	20
Mexico	8	8
Netherlands	156	154
Poland	22	22
Portugal	3	3
Russia	21	20
Singapore	3	3

South Korea	8	8
Spain	11	11
Sweden	2	2
Switzerland	31	31
Taiwan	3	3
Turkey	8	8
UK	327	327
US	295	293
Total	1258	1247
Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category		

One way Anova TotalCites vs Country of journal origin in Environmental Science

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	886527007.124	28	31661678.826	2.213	.000
Within Groups	17579575906.132	1229	14303967.377		
Total	18466102913.256	1257			

One way Anova CitesPerDoc vs Country of journal origin in Environmental Science

14	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1036.259	28	37.009	3.279	.000
Within Groups	13748.465	1218	11.288		
Total	14784.724	1246			

Country	TotalCites	CitesPerDoc
Brazil		-Netherlands
China		-Netherlands
Germany	-Netherlands	-Netherlands
India	-Netherlands	-Netherlands
Japan		-Netherlands
Netherlands	+India; +Germany; +US; +UK	Brazil; China; Germany; India; Japan; Poland; Russia
Poland		-Netherlands
Russia		-Netherlands
UK	-Netherlands	
US	-Netherlands	
(- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)		

Table 8.20 Health Professions

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	9	9
Belgium	2	2
Brazil	7	7
Canada	10	10
Czech Rep.	4	4
France	9	9
Germany	31	30
India	5	5
Italy	8	8
Japan	5	5
Netherlands	48	48
Poland	8	8
Russia	2	2
Singapore	2	2
South Korea	5	5
Spain	23	21
Sweden	2	2
Switzerland	4	4
Turkey	4	4
UK	118	118
US	174	174
Total	480	477

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Health Professions

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	24063168.274	20	1203158.414	1.008	.451
Within Groups	547974340.558	459	1193843.879		
Total	572037508.831	479			

One way Anova CitesPerDoc vs Country of journal origin in Health Professions

15	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	232.510	20	11.625	.606	.909
Within Groups	8749.140	456	19.187		
Total	8981.650	476			

Table 8.21 Immunology and Microbiology

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	2	4
Brazil	4	
Canada	3	3
China	10	10
Czech Rep.	4	4
France	6	6
Germany	31	31
India	13	13
Italy	8	8
Japan	8	7
Netherlands	80	80
Poland	5	5
Russia	19	19
South Korea	13	13
Spain	6	6
Switzerland	17	17
Taiwan	2	2
Turkey	4	4
UK	130	128
US	125	125
Total	490	485

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Immunology and Microbiology

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	295995516.197	19	15578711.379	1.770	.024
Within Groups	4136393803.199	470	8800837.879		
Total	4432389319.396	489			

One way Anova CitesPerDoc vs Country of journal origin in Immunology and Microbiology

16	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	772.680	18	42.927	3.307	.000
Within Groups	6048.471	466	12.980		
Total	6821.151	484			

Country	TotalCites	CitesPerDoc
Russia		-UK; -US
UK		+Russia
US		+Russia

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.22 Materials Science

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Brazil	9	9
Canada	2	2
China	83	83
France	12	12
Germany	92	91
India	17	17
Japan	48	47
Mexico	2	2
Netherlands	149	149
Poland	15	15
Russia	34	34
Singapore	11	11
South Korea	23	23
Spain	5	5
Switzerland	29	29
Turkey	3	3
UK	241	241
US	276	275
Total	1051	1048

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Materials Science

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2090932462.837	17	122996027.226	2.265	.002
Within Groups	56088293084.811	1033	54296508.311		
Total	58179225547.648	1050			

One way Anova CitesPerDoc vs Country of journal origin in Materials Science

17	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1307.664	17	76.921	4.405	.000
Within Groups	17984.659	1030	17.461		
Total	19292.323	1047			

Country	TotalCites	CitesPerDoc
China	-Netherlands	-Netherlands; -UK
Japan		-Netherlands; -UK
Netherlands	+China	+China; +Japan; +Russia
Russia		-Netherlands; -UK
UK		+China; +Japan;+Russia

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.23 Mathematics

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	2	2
Austria	3	3
Brazil	6	6
Canada	16	15
China	32	32
Czech Rep.	7	7
France	22	22
Germany	163	162
Greece	3	3
India	22.	22
Italy	23	23
Japan	21	21
Mexico	2	
Netherlands	167	167
Norway	2	2
Poland	24	24
Russia	30	30
Singapore	33	33
South Korea	13	13
Spain	10	10
Sweden	3	3
Switzerland	60	60
Taiwan	7	7
Turkey	8	6
UK	209	209
US	361	359
Total	1249	1241

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Mathematics

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	99960514.097	25	3998420.564	2.071	.002
Within Groups	2361423072.797	1223	1930844.704		
Total	2461383586.894	1248			

One way Anova CitesPerDoc vs Country of journal origin in Mathematics

18	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	339.528	24	14.147	5.064	.000
Within Groups	3396.755	1216	2.793		
Total	3736.283	1240			

Country	TotalCites	CitesPerDoc
China		-Netherlands; -US
France		-Netherlands; -UK; -US
Germany	-Netherlands	
Italy		-Netherlands
Japan		-Netherlands; -US
Netherlands	+Germany	+China; +France; +India; +Italy; +Japan; +Poland; +Russia
Poland		-Netherlands; -US
Russia		-Netherlands; -UK; -US
UK		+India; +Russia
US		+China; +Russia

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.24 Medicine

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	52	50
Austria	6	6
Belgium	19	19
Brazil	89	88
Canada	90	89
China	141	141
Czech Rep.	52	52
Denmark	10	9
Finland	4	4
France	166	165
Germany	462	460
Greece	28	28
India	185	183
Israel	7	7
Italy	163	162
Japan	185	184
Mexico	27	27
Netherlands	577	577
Norway	3	3
Poland	117	115
Portugal	10	10
Russia	117	115
Singapore	25	25
South Korea	89	85
Spain	154	151
Sweden	11	11
Switzerland	176	175
Taiwan	21	21
Turkey	US	UK
UK	1436	1429
US	1912	1909
Total	6438	6403

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Medicine

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1628653450.039	30	54288448.335	3.359	.000
Within Groups	103555852275.592	6407	16162923.720		
Total	105184505725.632	6437			

One way Anova CitesPerDoc vs Country of journal origin in Medicine

19	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4907.837	30	163.595	11.996	.000
Within Groups	86897.857	6372	13.637		
Total	91805.694	6402			

Country	TotalCites	CitesPerDoc
Brazil		-Netherlands; -UK; -US
Canada		-UK
China		-Netherlands; -UK; -US
Czech Rep.		-Netherlands; -UK; -US
France		-Netherlands; -UK; -US, -Switzerland
Germany		-UK; -US
India	-US	-Netherlands; -UK; -US, -Switzerland
Italy		-Netherlands; -UK; -US
Japan	-Netherlands; -US	-Netherlands; -UK; -US, -Switzerland
Netherlands	+Japan	+Brazil; +China; +Czeck Rep; +France;

		+India;+Italy; +Japan; +Poland; +Russia; +Spain; +Turkey
Poland		-Netherlands; -UK; -US -Switzerland
Russia		-Germany; -Netherlands; -UK; -US, -Switzerlnad
Spain		-Netherlands; -UK; -US
Switzerland		+France; +India+Japan+Russia; +Spain; +Turkey
Turkey		-Netherlands; -UK; -US -Switzerland
UK		+Brazil; +Canada; +China; +Czech Rep; +France; +Germany; +India; +Italy; +Japan; +Poland; +Spain; +Turkey
US	+Japan	+Brazil; +China; +Czeck Rep; +France; +Germany; +India; +Italy; +Japan; +Poland; +Russia; +Spain; +Turkey

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.25 Multidisciplinary

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	2	2
Brazil	3	3
China	16	16
Germany	5	5
India	7	7
Japan	4	4
Netherlands	7	7
Singapore	3	3
Switzerland	2	2
Taiwan	2	2
UK	12	12
US	18	18
Total	81	81

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Multidisciplinary

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9561561185.833	11	869232835.076	.735	.701
Within Groups	81595893109.006	69	1182549175.493		
Total	91157454294.840	80			

One way Anova CitesPerDoc vs Country of journal origin in Multidisciplinary

20	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	137.609	11	12.510	.681	.752
Within Groups	1267.826	69	18.374		
Total	1405.435	80			

Table 8.26 Neuroscience

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Brazil	7	7
Canada	3	3
China	6	6
France	7	7
Germany	36	36
Greece	2	2
India	6	6
Italy	4	4
Japan	3	3
Mexico	2	2
Netherlands	86	86
Poland	4	4
Russia	5	5
South Korea	10	9
Spain	2	2
Switzerland	41	41
Turkey	6	6
UK	133	133
US	154	154
Total	517	516

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Neuroscience

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	135154952.688	18	7508608.483	1.091	.358
Within Groups	3427341484.945	498	6882211.817		
Total	3562496437.633	516			

One way Anova CitesPerDoc vs Country of journal origin in Neuroscience

21	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	529.666	18	29.426	1.090	.358
Within Groups	13413.771	497	26.989		
Total	13943.438	515			

Table 8.27 Nursing

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	14	11
Brazil	9	9
Canada	9	9
China	3	3
Czech Rep.	2	2
France	25	24
Germany	18	18
Greece	3	3
India	5	5
Italy	8	8
Japan	3	3
Netherlands	46	46
Poland	2	2
Russia	3	3
Singapore	3	3
South Korea	9	8
Spain	17	17
Switzerland	8	8
Taiwan	3	3
UK	153	153
US	229	229
Total	572	567

Some of the 31 countries selected do not figure in this analysis as they less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Nursing					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	33851641.697	20	1692582.085	1.340	.147
Within Groups	696157501.302	551	1263443.741		
Total	730009142.998	571			

One way Anova CitesPerDoc vs Country of journal origin in Nursing

22	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	120.979	20	6.049	2.308	.001
Within Groups	1431.119	546	2.621		
Total	1552.098	566			

Country	TotalCites	CitesPerDoc
France		-US; -UK; -Netherlands
Netherlands		+France
UK		+France
US		+France

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.28 Pharmaceutics

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	4	4
Belgium	3	3
Brazil	5	5
Canada	6	6
China	20	20
Czech Rep.	2	2
France	7	7
Germany	35	35
Greece	3	3
India	74	74
Italy	5	5
Japan	15	15
Netherlands	78	78
Poland	5	4
Russia	2	2
South Korea	9	9
Spain	11	11
Switzerland	20	20
Turkey	9	9
UK	122	122
US	172	171
Total	607	605

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

ANOVA

One way Anova TotalCites vs Country of journal origin in Nursing

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	231457932.733	20	11572896.637	2.945	.000
Within Groups	2302690391.300	586	3929505.787		
Total	2534148324.033	606			

One way Anova CitesPerDoc vs Country of journal origin in Nursing

23	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	525.726	20	26.286	4.887	.000
Within Groups	3140.960	584	5.378		
Total	3666.686	604			

Country	TotalCites	CitesPerDoc
China		-UK
India	-UK; - Switzerland; -Netherlands	-Netherlands; -Switzerland; -UK; -US
Japan		-Netherlands; -UK
Netherlands	+Netherlands	+India; +JAPAN; +SPAIN
Spain		-Netherlands
UK	+INDIA	+China; +India; +Japan
US		+India

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.29 Physics and Astronomy

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations Total Citations	Citations per Doc
Australia	2	2
Brazil	5	5
Canada	4	4
China	59	59
France	9	9
Germany	86	86
Greece	2	2
India	14	14
Italy	6	6
Japan	25	25
Mexico	3	3
Netherlands	147	147
Poland	13	13
Russia	45	45
Singapore	22	22
South Korea	11	11
Spain	2	2
Switzerland	29	29
Turkey	4	4
UK	215	215
US	261	260
Total	964	963

Some of the 31 countries selected do not figure in this analysis as they less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Physics and Astronomy

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1414229138.300	20	70711456.915	1.350	.139
Within Groups	49406499841.471	943	52392894.848		
Total	50820728979.771	963			

One way Anova CitesPerDoc vs Country of journal origin in Physics and Astronomy

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	874.130	20	43.706	2.992	.000
Within Groups	13760.074	942	14.607		
Total	14634.204	962			

Country	TotalCites	CitesPerDoc
China		-Netherlands; -UK; -US
Netherlands		+Russia +China
Russia		-Netherlands; -UK
UK		+China; +Russia
US		+China

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.30 Psychology

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Australia	5	5
Austria	2	2
Belgium	4	4
Brazil	20	19
Canada	6	6
Czech Rep.	4	4
France	38	38
Germany	50	50
India	7	6
Italy	21	21
Japan	6	6
Mexico	4	4
Netherlands	75	75
Poland	11	11
Portugal	4	4
Russia	6	5
South Korea	3	3
Spain	31	30
Switzerland	22	21
Turkey	4	4
UK	262	262
US	508	507
Total	1093	1087

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Psychology

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	58301025.622	21	2776239.315	3.308	.000
Within Groups	898955155.509	1071	839360.556		
Total	957256181.131	1092			

One way Anova CitesPerDoc vs Country of journal origin in Psychology

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	507.174	21	24.151	5.514	.000
Within Groups	4664.369	1065	4.380		
Total	5171.543	1086			

Country	TotalCites	CitesPerDoc
Brazil	-Netherlands; -Switzerland	-Netherlands; -US
France	-Netherlands; -Switzerland	-Netherlands; -UK; -US
Germany	-Netherlands; -Switzerland	-US
Italy	-Netherlands; -Switzerland	-US
Netherlands	+Brazil; +France; +Germany; +Italy; +Spain; +UK; +US	+France
Spain	-Netherlands; -Switzerland	
Switzerland	+Brazil; +France; +Germany; +Italy; +Spain; +US	
UK	-Netherlands	+France
US	-Netherlands; -Switzerland	+France; +Germany; +Italy

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Table 8.31 Social Sciences

Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals		Germany	279	276	South Korea	26	25
	Total Citations	Citations per Doc	Greece	10	9	Spain	225	221
Australia	68	66	India	42	41	Sweden	19	19
Austria	20	20	Israel	3	3	Switzerland	61	61
Belgium	58	57	Italy	143	141	Taiwan	23	23
Brazil	88	87	Japan	23	23	Turkey	37	37
Canada	71	70	Mexico	37	36	UK	1754	1746
China	23	21	Netherlands	412	407	US	1551	1545
Czech Rep.	55	55	Norway	14	14	Total	5376	5329
Denmark	8	8	Poland	62	61	Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category		
Finland	13	13	Portugal	25	25			
France	154	152	Russia	63	58			
Germany	279	276	Singapore	9	9			

One way Anova TotalCites vs Country of journal origin in Social Sciences

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	50632251.812	30	1687741.727	6.465	.000
Within Groups	1395295335.652	5345	261046.835		
Total	1445927587.464	5375			

One way Anova CitesPerDoc vs Country of journal origin in Social Sciences

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1142.889	30	38.096	11.759	.000
Within Groups	17164.699	5298	3.240		
Total	18307.588	5328			

Country	TotalCites	CitesPerDoc
Australia	-Netherlands; - Switzerland;	-US
Austria	- Switzerland;	
Belgium	-Netherlands; - Switzerland;	-Netherlands; -UK; -US

Brazil	-Netherlands; - Switzerland;	-Netherlands; -UK; -US
Canada	- Switzerland;	-Netherlands; -UK; -US
Czech Rep.	-Netherlands; - Switzerland;	-Netherlands; -UK; -US
Finland	- Switzerland;	
France	-Netherlands; - Switzerland;; -UK; -US	-Netherlands; -UK; -US
Germany	-Netherlands; - Switzerland;; -UK	-Netherlands; -UK; -US
India	- Switzerland;	
Italy	-Netherlands; - Switzerland;; -UK	-Netherlands; -UK; -US
Japan	-CH	
Mexico	-CH	-US
Netherlands	+Australia; +Belgium, +Brazil; +Czeck Rep; +France; +Germany; +Italy; +Spain; +Switzerland; +US	+Belgium; +Brazil; +Canada; +Czech Rep; +France; +Germany; +Italy; +Poland; +Russia; +Spain
Norway	- Switzerland; Switzerland;	
Poland	-Netherlands; - Switzerland;	-Netherlands; -UK; -US
Portugal	- Switzerland;	
Russia	- Switzerland;	-Netherlands; -UK; -US
South Korea	-Switzerland	
Spain	-Netherlands; -Switzerlan; -UK; -US	-Netherlands; -UK; -US
Sweden	-Switzerland	
Switzerland	+Australia; +Austria; +Belgium; +Brazil; +Canada; +Czech Rep.; +Finland; +France; +Germany; +India; +Italy; +Japan; +Mexico; +Netherlands; +Norway; +Poland; +Portugal; +Russia; +South Korea; +Spain; +Sweden; +Taiwan; +Turkey; +UK; +US	
Taiwan	-Switzerland	
Turkey	-Switzerland	
UK	+France; Germany; Italy; Spain; Switzerland	+Belgium; +Brazil; +Canada; +Czech Rep; +France; +Germany; +Italy; +Poland; +Russia; +Spain
US	+Spain; +Switzerland	+Australia; +Belgium; +Brazil; +Canada; +Czech Rep; +France; +Germany; +Italy; +Mexico; +Poland; +Russia; +Spain
(- preceding the country indicates significantly less than, + preceding the country indicates significantly more than)		

Table 8.32 Veterinary Sciences
Journal distribution, Anova Summary, Post hoc LSD analysis results

	No of Journals	
	Total Citations	Citations per Doc
Brazil	16	16
Canada	6	6
China	3	3
Czech Rep.	2	2
France	6	6
Germany	17	17
India	9	8
Italy	6	6
Japan	4	4
Mexico	2	2
Netherlands	22	22
Poland	3	3
South Korea	3	3
Spain	2	2
Switzerland	3	3
Turkey	7	7
UK	48	48
US	29	29
Total	188	187

Some of the 31 countries selected do not figure in this analysis as they have less than 2 journals under the category

One way Anova TotalCites vs Country of journal origin in Veterinary Sciences

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	31209041.835	17	1835825.990	2.526	.001
Within Groups	123546338.654	170	726743.169		
Total	154755380.489	187			

One way Anova CitesPerDoc vs Country of journal origin in Veterinary Sciences

27	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	45.603	17	2.683	4.394	.000
Within Groups	103.170	169	.610		
Total	148.773	186			

Country	TotalCites	CitesPerDoc
Brazil	-Netherlands	-Netherlands; -UK
France	-Netherlands	-Netherlands
India	-Netherlands	-Netherlands
Italy	-Netherlands	-Netherlands
Netherlands	+Brazil; +France; +Germany; +India; +Italy; +Turkey; +US; +UK	+Brazil; +France; +India; +Italy; +Turkey
Turkey	-Netherlands	-Netherlands; -UK
UK	-Netherlands	+Turkey
US	-Netherlands	

(- preceding the country indicates significantly less than,
+ preceding the country indicates significantly more than)

Chapter 9

High 'citation impact' countries – A Case analysis of Immunology

In the previous chapters various analyses attempted were at the macro level –

- TotalCites and CitesPerDoc accrued to journals included in Scopus, along with other relevant variables;
- TotalCites and CitesPerDoc accrued to countries making up 90% of the CitableDocs in Scopus, along with relevant variables;
- Citation impact in the context of country origin of the journals. This analysis also confined to countries making up 90% of the CitableDocs in Scopus.

The current analysis focused on a specific subject - Immunology - for the year 2018, to understand nuances of citation intensity focusing on authors in general and international collaboration, in particular. The analysis specifically explores the following questions for four countries – Denmark, Netherlands, Sweden, and Switzerland – which have shown lower uncitedness (along with a few others) than the 32 country average (see Chapter 4 Graphs 4.27 and 4.36). Incidentally, these countries were also high on intenational collaboration in publication. The data pertaining to India on the subject were also considered for the same year for purposes of comparison. All the relevant data were collected in June of 2020 from Scopus database.

Documents in Scopus

Table 9.1 presents distribution of CitableDocs on immunology for the year 2018 indexed in Scopus for the selected countries. As could be seen total Indian publications in the database is more than twice that of Netherlands and Switzerland; thrice as much as Sweden; almost four folds that of Denmark. Total citation yield for Indian contributions compare favorably with the other countries in the context. The average yield, however, is approximately one-third of the other countries. Indian contributions are several times more than the others in document types - articles, book chapter, book, review and also editorials.

Table 9.1 Document type-wise distribution of immunology publications for 2018						
	Denmark	Netherlands	Switzerland	Sweden		India
Article	358	653	605	458		1307
Book		1				14
Book Chapter	1	8	10	2		257
Conference Paper	3	9	12	2		1
Editorial	5	9	7	4		13
Erratum	6	11	8	9		6
Letter	15	39	10	27		7
Note	8	9	20	7		6
Review	53	92	72	56		153
Short Survey		1	3	1		2
Unclassified	3	10	0	6		3
Total CitableDocs	437	842	747	572		1769
Total Citations	4728	7961	6657	5157		5924
Mean Citations	10.82	9.45	8.91	9.02		3.35

The first noticeable indicator of the possible difference in the nature of content could be noticed in mean number of authors per publication (**Table 9.2**). Maximum and minimum number of authors remains the same for all the five countries, possibly because the same extensive multi-country study figures against all of them. However, the citation intensity for Denmark, Switzerland, Sweden, and Netherlands is twice or more than that of Indian publications, indicating the extensive nature of the studies. Possibly Indian publications are narrowly focused. Despite the variation in number of total publications, total extent of authorial involvement remains more or less the same for India and Netherlands. The number is not far behind for Switzerland.

Table 9.2 Author related details of Immunology CitableDocs					
	No. of Authors				
	Denmark	Switzerland	Sweden	Netherlands	India
Total Documents	452	747	572	842	1769
Total Author Entities	4847	7001	5353	8305	8370
Mean Authors	10.72	9.37	9.36	9.86	4.73
Minimum	1	1	1	1	1
Maximum	184	184	184	184	184

As we understand, researchers may publish more than one article in a year, and **Table 9.3** captures this information. Distinct author information was processed using Scopus Author Id associated with the publications. Distinct authors figuring in Indian publication were more than that of Netherlands. As we know international collaboration is generally high among these countries. The author data was processed to understand how many were local to the country and how many came from one of the other three countries in the analysis (Table 9.3). Netherlands had almost 50.0% of the authorial presence in their publication from the other three countries; Switzerland 53.39%; Denmark 77.33%; and Sweden 65.59%, as could be seen. In fact, major proportion of authorial contribution in publication comes from outsiders and in the case of Denmark it is considerably high, being more than three-fourths of the total.

Table 9.3 Colloborator author country affiliation for Immunology (2018)

	Total authors	Distinct authors	Collaborative Authors				
			Netherlands	Switzerland	Denmark	Sweden	Total Collaborating authors
Netherlands	8305	7193	-	1494	1277	1374	4145
Switzerland	7000	6321	1494	-	1175	1068	3737
Denmark	4848	4315	1277	1175	-	1297	3749
Sweden	5354	4813	1374	1068	1068	-	3510
India	8369	7328					

The four European countries in the context are getting the benefit of the same number of author contributions as that of India because of collaboration. The analysis also shows that because of this collaboration they get the benefit of the same articles appearing against multiple countries in the context and the associated citation impact benefit to the extent of 25.5% - of the 24,503 total citations and the publications common to these countries were calculated to yield 6,236 citations.

Distribution of author occurrence among Immunology articles (2018) of Netherlands, Switzerland, Denmark, Sweden

No of Occurrence (same names appearing in different articles)	Authors
1	13859
2	2264
3	549
4	629
Total	17301

- Total articles on immunology in 2018 by Switzerland, Denmark, Netherlands, Sweden : 2343
- Total citations: 24503
- Average citation per publication: 10.46
- Same article appearing against more than one country (among the four) 290
- Cumulative citation score for those 290 articles: 6236
- Collaboration benefit: 6236/24503 = 25.45%

Analysis was taken further to consider citation distribution among the respective country publication. For the purposes of better appreciation of the trends, the citation categories were collapsed to 11 groups and ranged from 0 citations to 10 or more. As we can notice in **Table 9.4** more than one-third of Indian publications have received no citations, compared to smaller proportion of articles in that citation category for the other four. At the other end considerable proportion of their publication (65% - 85%) falls in the category of 10 or more citations, whereas it was only 7.4% of the total for India. In 10 or more citations category Indian publications are less than the others even in absolute numbers. Most of our cited publications have secured 1 to 4 citations, and fewer of them on the higher end.

Apart from the international collaboration 'bonus' (same citation getting posted against many) the variation could be an indication of topics chosen to research by Indian researchers, or their perceived depth or cutting edge nature in the research information in the publication.

Table 9.4 Grouping of CitableDocs in immunology (2018) based on citation intensity

	Denmark	**Switzerland**	**Sweden**	**Netherlands**	**India**
Cited by	Frequency Percent	Frequency Percent	Frequency Percent	Frequency Percent	Frequency Percent
0	26 1.5%	67 3.8%	60 3.4%	75 4.2%	653 36.9%
1	45 2.5%	65 3.7%	64 3.6%	88 5.0%	311 17.6%
2	33 1.9%	68 3.8%	59 3.3%	64 3.6%	185 10.5%
3	33 1.9%	68 3.8%	48 2.7%	82 4.6%	145 8.2%
4	44 2.5%	64 3.6%	36 2.0%	60 3.4%	106 6.0%
5	29 1.6%	59 3.3%	37 2.1%	54 3.1%%	75 4.2%
6	28 1.6%	35 2.0%	35 2.0%	48 2.7%	51 2.9%
7	30 1.7%	38 2.1%	34 1.9%	42 2.4%	59 3.3%
8	18 1.0%	37 2.1%	21 1.2%	43 2.4%	36 2.0%
9	11 .6%	28 1.6%	25 1.4%	37 2.1%	17 1.0%
10 or more	140 83.2%	218 70.1%	153 76.3%	249 66.5%	131 7.4%

The analysis was taken ahead to understand the role in international collaboration. For the purpose lead position (first author) in the publication was tabulated and also the citation yield because of that.

Table 9.5 International collaboration and citation accretion

(Figures in brackets are % of the total in the citation category for the respective countries)

Cited by	Denmark		Switzerland		Sweden		Netherlands		India	
	Domestic	International Collab	Domestic	International Collab	Domestic	International Collab	Domestic	International Collab	Domestic	International Collab
0	12 (46.15%)	14 (53.85%)	24 (35.82%)	43 (64.18%)	1 (1.67%)	59 (98.33%)	24 (32.00%)	51 (68.00%)	572 (87.60%)	81 (12.40%)
1	13 (28.89%)	32 (71.11%)	17 (26.15%)	48 (73.85%)	38 (59.38%)	26 (40.63%)	31 (35.23%)	57 (64.77%)	257 (82.64%)	54 (17.36%)
2	8 (24.24%)	25 (75.76%)	25 (36.76%)	43 (63.24%)	15 (25.42%)	44 (74.58%)	19 (29.69%)	45 (70.31%)	140 (75.68%)	45 (24.32%)
3	7 (21.21%)	26 (78.79%)	13 (19.12%)	55 (80.88%)	16 (33.33%)	32 (66.67%)	25 (30.49%)	57 (69.51%)	108 (74.48%)	37 (25.52%)
4	11 (25.00%)	33 (75.00%)	15 (23.44%)	49 (76.56%)	11 (30.56%)	25 (69.44%)	18 (30.00%)	42 (70.00%)	82 (77.36%)	24 (22.64%)
5	10 (34.48%)	19 (65.52%)	13 (22.03%)	46 (77.97%)	11 (29.73%)	26 (70.27%)	13 (24.07%)	41 (75.93%)	55 (73.33%)	20 (26.67%)
6	9 (32.14%)	19 (67.86%)	13 (37.14%)	22 (62.86%)	8 (22.86%)	27 (77.14%)	10 (20.83%)	38 (79.17%)	33 (64.71%)	18 (35.29%)
7	4 (13.33%)	26 (86.67%)	6 (15.79%)	32 (84.21%)	13 (38.24%)	21 (61.76%)	6 (14.29%)	36 (85.71%)	34 (57.63%)	25 (42.37%)
8	3 (16.67%)	15 (83.33%)	8 (21.62%)	29 (78.38%)	3 (14.29%)	18 (85.71%)	11 (25.58%)	32 (74.42%)	25 (69.44%)	11 (30.56%)
9	1 (9.09%)	10 (90.91%)	7 (25.00%)	21 (75.00%)	6 (24.00%)	19 (76.00%)	12 (32.43%)	25 (67.57%)	11 (64.71%)	6 (35.29%)
10 >	20 (14.29%)	120 (85.71%)	47 (21.56%)	171 (78.90%)	44 (28.76%)	109 (71.24%)	46 (18.47%)	203 (81.53%)	72 (54.96%)	59 (45.04%)
Total	98 (22.43%)	339 (77.57%)	188 (25.17%)	559 (74.97%)	166 (29.02%)	406 (70.98%)	215 (25.53%)	627 (74.47%)	1389 (78.52%)	380 (21.48%)

Table 9.5 presents data on number of publications with international collaboration and the local authors in different citation categories ranging from 0 to 10 or more.

As could be seen approximately 20% of Indian contributions had international collaboration compared to 77% for Denmark; 77% for Switzerland; 71% for Sweden and 75% for Netherlands. (This is different from authorial presence in Table 9.3)

Only 15% of our publications with international collaboration fall in 10 or more citation category, whereas it is 27% in case of Sweden. Such collaborations range from 30% to 35% for the other three countries. About 20% of our papers with international collaboration yield 0 citations. So the international collaboration does not seem to be the decisive factor in citation yield as borne out by the data, at least for India.

The analysis also explored whether being in lead in international collaboration (as indicated by being lead author country affiliation) makes a difference in citation yield (**Table 9.6**). In 56.05% of the international collaboration Indian researcher was the lead author, where as it was 24.26% for Denmark; 33.57% for Switzerland; 33.74% for Sweden; and 36.52% for Netherlands. In our international collaborative research projects we have been in lead in more than half the cases. The data shows that when Indian researchers were in the lead, almost in 25% of those collaborative publications the citation yield was 0 and in 10.8% of the cases it was 10 or more per publication. The comparative figure for the other four countries, when they were in the lead, was around 30.0% in 10 or more citation yield category. The distribution points to factors other than publication quality in play in citation yield. Yet, that would need a peer review of the contributions. Mere dependence on citations to determine the quality of the article would have their problems.

Table 9.6

Grouping of articles with international collaboration in Immunology (2018) based on citation yield vis-à-vis First / Co-author details

(Figures in brackets are % of the total in the citation category for the respective countries)

	Denmark		**Switzerland**		**Sweden**		**Netherlands**		**India**	
Citations	Lead Author	Co-author	Lead Author	Co-author	Lead Author	Co-author	Lead Author	Co-author	Lead Author	Co-author
0	3 (21.43)	11 (78.57)	17 (39.53)	26 (60.47)	11 (18.64)	48 81.36)	23 (45.10)	28 (54.90)	53 (65.43)	28 (34.57)
1	13 (40.63)	19 (59.38)	22 (45.83)	26 (54.17)	13 (50.00)	13 (50.00)	17 (29.82)	40 (70.18)	35 (64.81)	19 (35.19)
2	9 (36.00)	16 (64.00)	15 (34.88)	28 (65.12)	16 (36.36)	28 (63.64)	15 (33.33)	30 (66.67)	32 (71.11)	13 (28.89)
3	9 (34.62)	17 (65.38)	15 (27.27)	40 (72.73)	12 (37.50)	20 (62.50)	25 (43.86)	32 (56.14)	18 (48.65)	19 (51.35)
4	8 (24.24)	25 (75.76)	15 (30.61)	34 (69.39)	9 (36.00)	16 (64.00)	16 (38.10)	26 (61.90)	11 (45.83)	13 (54.17)
5	5 (26.32)	14 (73.68)	14 (30.43)	32 (69.57)	4 (15.38)	22 (84.62)	17 (41.46)	24 (58.54)	9 (45.00)	11 (55.00)
6	7 (36.84)	12 (63.16)	7 (31.82)	15 (68.18)	10 (37.04)	17 (62.96)	12 (31.58)	26 (68.42)	7 (38.89)	11 (61.11)
7	10 (38.46)	16 (61.54)	12 (37.50)	20 (62.50)	9 (42.86)	12 (57.14)	13 (36.11)	23 (63.89)	15 (60.00)	10 (40.00)
8	7 (46.67)	8 (53.33)	13 (44.83)	16 (55.17)	8 (44.44)	10 (55.56)	14 (43.75)	18 (56.25)	8 (72.73)	3 (27.27)
9	2 (20.00)	8 (80.00)	4 (19.05)	17 80.95)	4 (21.05)	15 (78.95)	11 (44.00)	14 (56.00)	2 (33.33)	4 (66.67)
10 or more	33 (27.50	87 (72.50)	54 (31.76)	117 (68.24)	41 (37.61)	68 (62.39)	66 (32.51)	137 (67.49)	23 (25.84)	36 (74.16)
Total	106 (31.27)	233 (68.73)	188 (33.69)	371 (66.31)	137 (33.74)	269 (66.26)	229 (36.52)	398 (63.48)	213 (56.05)	167 (43.95)

Citation yield for CItableDocs in journals of overlapping SJR

The analysis was taken one step further to understand whether the publications of the five countries yield overlapping citations when they are published in similar SJR category journals. SJR is represented in decimal places based on a complex formula. For the purpose of this analysis the SJR for the journals were rounded off to the base integer. Publications of five countries were grouped into 7 categories namely, 0 or less than 1 SJR; between 1 and <2;2 to<3; 3 to <4; 6 or more. There were no publication for the select countries in SJR 5 and its fraction category journals. In effect we have six categories.

Seven one-way Anova were carried out to understand the mean difference for country publications for each of the SJR category. The purpose was to know whether the citation yield distribution is statistically the same in the broad band of SJR for different countries in the context (Table 9.7). The results indicate that four of the seven Anovas are significant, implying statistically significant difference in citation yields for CitableDocs of these five different countries.

The analyses using Fisher's LSD, which compare each country in the context with the others, show that there is a significant mean difference in citation yield in three of the six categories of SJR. The post hoc analysis show that Indian publications, compared to others in the analysis, accrue significantly lesser citations even when they are published in journals of overlapping SJR. This could be noted in SJR category less than 1; between 1 and 2, and 3 and 4. The Anova for the total (irrespective of the SJR Categories) also returns a significant F Ratio (F= (4,4362) 61.53, MSE = 162.74 P<.000) for the overall distribution. Indian publications get significantly less citation yield compared to the other four countries individually, whereas such difference is present for only for Denmark,among the other four. Citations of Netherlands, Sweden and Switzerland do not differ when published in journls of overlapping SJR.

Table 9.7 n, mean citations, and Anova details vis-à-vis SJR categories of CitableDocs											
	India		Denmark		Switzerland		Sweden		Netherlands		Avova results
SJR	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	
.00	280	.84	280	12.17	33	4.82	11	6.64	20	4.90	F (4,619) = 18.85, MSE = 240.15 P< .000
1.00	1386	3.38	246	6.17	353	5.53	301	5.51	398	5.31	F (4,2679) = 16.04, MSE = 52.35 P <.000
2.00	44	6.07	50	8.78	109	6.88	81	8.60	84	7.88	F (4,363) = 1.22, MSE = 64.83 NS
3.00	27	11.19	30	20.07	59	9.80	30	10.80	45	9.71	F (4,186) = 2.95, MSE = 214.20 P<.000
4.00	5	14.60	8	11.50	27	11.44	11	22.91	23	11.70	F (4,69) = 1.41, MSE = 209.76 NS
6.00	27	13.37	97	20.67	166	17.52	138	15.59	272	16.11	F (4, 695) = .94, MSE = 583.85 NS
Total	1769	3.35	437	10.82	747	8.91	572	9.02	842	9.45	F (4,4362) = 61.53,MSE = 162.74 P<.000

0 Anova Summary Citation Yield & LSD for Select Countries * SJR <1

	Sum of Squares	df	Variance	F	p
Between Groups	18105.1481	4	4526.2870	18.8482	0.0000
Within Groups:	148649.6750	619	240.1449		
Total	166754.8231	623			

Fisher's LSD post-hoc analysis*					
SJR	Denmark	Netherlands	Sweden	Switzerland	India
<1	+India +Netherlands +Sweden +Switzerland	-Denmark	-Denmark	-Denmark	-Denmark -Netherlands -Sweden -Switzerland
*Fisher's LSD post-hoc analysis compares means of every country in the context with all the others. The results could be both '-' indicating the mean citations are significantly less, or '+' indicating that the mean citations are significantly high compared to the country in the context. The results presented in the Table capture the essential information where such a difference exists. The statistics is worked out based on the n, mean, and the within groups variance.					

Anova Summary Citation Yield & LSD for Select Countries * SJR between 1 and <2

	Sum of Squares	df	Variance	F	p
Between Groups	3358.7896	4	839.6974	16.0393	0.0000
Within Groups:	140252.3827	2679	52.3525		
Total	143611.1723	2683			

Fisher's LSD post-hoc analysis*					
SJR	Denmark	Netherlands	Sweden	Switzerland	India
1 and <2	+India	+India	+India	+India	-Denmark -Netherlands -Sweden -Switzerland
*Fisher's LSD post-hoc analysis compares means of every country in the context with all the others. The results could be both '-' indicating the mean citations are significantly less, or '+' indicating that the mean citations are significantly high compared to the country in the context. The results presented in the Table capture the essential information where such a difference exists. The statistics is worked out based on the n, mean, and the within groups variance.					

Anova Summary Citation Yield & LSD for Select Countries * SJR between 2 and < 3

	Sum of Squares	df	Variance	F	p
Between Groups	315.8575	4	78.9644	1.2180	0.3027
Within Groups:	23533.5699	363	64.8308		
Total	23849.4275	367			

Anova Summary Citation Yield & LSD for Select Countries * SJR between 3 and < 4

	Sum of Squares	df	Variance	F	p
Between Groups	2523.8297	4	630.9574	2.9457	0.0216
Within Groups:	39840.8153	186	214.1979		
Total	42364.6450	190			

Fisher's LSD post-hoc analysis*					
SJR	Denmark	Netherlands	Sweden	Switzerland	India
3 and <4	+India +Netherlands +Sweden +Switzerland	-Denmark	-Denmark	-Denmark	-Denmark
*Fisher's LSD post-hoc analysis compares means of every country in the context with all the others. The results could be both '-' indicating the mean citations are significantly less, or '+' indicating that the mean citations are significantly high compared to the country in the context. The results presented in the Table capture the essential information where such a difference exists. The statistics is worked out based on the n, mean, and the within groups variance.					

Anova Summary Citation Yield for Select Countries * SJR between 4 and < 5

	Sum of Squares	df	Variance	F	p
Between Groups	1200.9590	4	300.2398	1.4314	1.4314
Within Groups:	14473.3976	69	209.7594		
Total	15674.3566	73			

Anova Summary Citation Yield for Select Countries * SJR 6 >

	Sum of Squares	df	Variance	F	p
Between Groups	2184.7688	4	546.1922	0.9355	0.4427
Within Groups:	405776.8299	695	583.8516		
Total	407961.5987	699			

Anova Summary Citation Yield for Select Countries * SJR

	Sum of Squares	df	Variance	F	p
Between Groups	40052.9624	4	10013.2406	61.5282	0.0000
Within Groups:	709881.7920	4362	162.7423		
Total	749934.7544	4366			

Fisher's LSD post-hoc analysis*

SJR	Denmark	Netherlands	Sweden	Switzerland	India
Total	+India +Netherlands +Sweden +Switzerland	-Denmark	-Denmark	-Denmark	-Denmark -Netherlands -Sweden -Switzerland

*Fisher's LSD post-hoc analysis compares means of every country in the context with all the others. The results could be both '-' indicating the mean citations are significantly less, or '+' indicating that the mean citations are significantly high compared to the country in the context. The results presented in the Table capture the essential information where such a difference exists. The statistics is worked out based on the n, mean, and the within groups variance.

Even when Indian researchers in the subject area published in higher ranking journals, and also when the outcome is of international collaborative work the citation impact tends to be significantly low. The reasons for this phenomenon cannot be attributed to low quality of research output. Perhaps it is in the incorrect perception by the peer group, Mathew Effect in operation, or plain bias in citation practices that is in the play.

The analysis above showed only one part of the story – collaboration among the four countries. However, these four countries have collaborated with nearly 40 different countries as shown in Table 9.8.

Table 9.8 Collaborative publications in immunology among OECD countries during 2018									
	Netherlands	**Switzwerland**	**Denmark**	**Sweden**		**Netherlands**	**Switzwerland**	**Denmark**	**Sweden**
Australia	41	29	32	30	**Korea**	6	7	16	4
Austria	39	32	15	20	**Latvia**	1	1	1	3
Belgium	62	33	26	24	**Lithuania**	3	2	1	2
Canada	63	49	27	36	**Luxembourg**	4	3	4	5
Chile	4	5	3	5	**Mexico**	14	8	4	9
Colombia	5	5	3	3	**Netherlands**		65	45	61
Czech Republic	11	20	13	13	**New Zealand**	4	4	6	3
Denmark	45	38		63	**Norway**	30	16	25	43
Estonia	5	2	3	5	**Poland**	14	11	12	9
Finland	25	12	8	19	**Portugal**	29	19	12	15
France	114	107	46	55	**Slovak Republic**				
Germany	185	188	89	84	**Slovenia**	8	5	5	4
Greece	14	8	10	10	**Spain**	49	42	28	29
Hungary	11	10	10	8	**Sweden**	61	36	63	
Iceland	2	1	1	2	**Switzerland**	65		38	36
Ireland	14	13	6	4	**Turkey**	12	6	4	3
Israel	14	14	9	8	**UK**	175	149	76	103
Italy	92	66	44	47	**US**	228	201	131	120
Japan	17	15	21	18					

Collaborartion has proved for these countries to be force multiplier as far as citations are concerned. International research collaboration as foreign relations strategy and citation benefit needs a careful analysis. The practice of collaborative publications has helped in accuring 'citation bonus' for these countries.

Chapter 10

Tail-end citations -A Case analysis of Economics

The present study also analyzed the relevant data to examine the tail-end citations. The analysis addressed whether 'low citation' and 'no citation' impact are different? The subject chosen for the purpose was economics. Publications indexed in Scopus for the UK and India under the subject Economics for the years 2014 and 2015, along with frequency of citations, were considered at the first stage.

Tabulation of the relevant data was done using the relevant Scopus records in June 2020. The analysis aimed to understand whether the uncited publications and those with marginal tail-end citations – defined to include up to three citations per document – were statistically different. For this analysis the data relating to the forward link citations were considered a crucial factor. Forward link refers to citing document receiving citaitons. Forward link would be zero for uncited articles; could be one (cited) or zero (uncited) for those articles cited once, and so on.

Forward citations data were identified by going through each record in the context to tabulate the status of their follow up citations in Scopus. The citation data was matched with the existence or otherwise of the forward links.

The research question tested was that the tail-end citation could be chance occurrence. The main purpose of the citations carrying forward the knowledge content of the cited articles is nullified, if those cited less often ends up with no further links. In such cases their citation impact is as good as that of uncited publications. The analysis was carried out using chi-square statistic. The analysis was also extended to examine the association of SJR and citation yield at the tail end for both the countries using Anova. As comparative analysis was not the intention the data were examined separately for the countries.

The UK

The UK had 3,585 indexed articles on economics for the years 2014 and 2015 in Scopus. The CitableDocs included articles, books, book chapters, editorials, erratum, letters, note, review, short summary (Table 10.1). This Table also provides citation frequencies.

The frequency distribution indicates that a substantial proportion, among the indexed records, was journal articles (85.27%). Books and book chapters made up around 6% each of the total. The remaining document types were in small numbers.

Table 10.1 Document and citation frequency-wise distribution of Economics publications for UK (2014-2015)

Citations	Article	Book	Book Chapter	Conf erence Paper	Editorial	Erratum	Letter	Note	Review	Short Survey
0	202	21	344	5	75	4	5	27	54	3
1	177	23	165	0	22	0	2	12	32	1
2	166	15	91	3	9	2	0	10	18	1
3	151	20	55	2	3	0	0	5	7	0
4 or more	1523	99	140	8	27	0	0	5	48	3
Total	2219	178	795	18	136	6	7	59	159	8

The analysis was carried out to understand the extent of citations having false links in the very next hop.

Table 10.2 Distribution of Tail-end Citations X Forward Citation Links

Citations / Forward links	0	1	2	3	Total
0	740	182	265	276	1463
1 or more	0	152	367	453	972
Total	740	434	632	729	2435

X^2 = 713.8 df =3 p<.00

Obviously all the 0 cited documents had 0 further links. The figures varied for those cited 1-3 times. Table 10.2 presents frequency distribution of this analysis for the entire set of publications under economics for the years 2014-2015. X^2 values (x^2 = 713.8 df =3 p<.00) show a significant statistical association in distribution indicating 0 cited articles are a different group in itself and the observation is not a chance happening.

Even when those publications with three citations were taken off from the analysis and the tail-end was redefined to include only those with 0, and those with 1-2 citations collapsed into one category, the X^2 values shows to be significant (X^2 = 515.81 df =1 p <.00) indicating uncited articles are significantly different from those which are cited one or more times.

These tail-end documents of the indexed records were analyzed by juxtaposing the SJR of the journal they were published into account, to know whether SJRs as a variable impacts the tail-end (Table 10.3). Anova carried out for the select group of records with 0 to 3 cites with SJR, reveals a significant F ratio (F=11.082 (3,880), MSE= .424 p<.000), indicating a significant statistical difference among the group with varying tail-end citations. Mean SJR tend to be significantly different for those which are in different tail-end citation categories.

Table 10.3 ANOVA Tail-end citations Vs SJR

Tail-end Citation Category	No	Mean SJR
0	322	.48599
1	213	.63056
2	192	.71296
3	157	.82729
Total	884	.63074

Anova summary for Tail-end Citation categories Vs SJR

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	14.110	3	4.703	11.082	.000
Within Groups	373.475	880	.424		
Total	387.585	883			

Multiple Comparisons LSD

Dependent Variable: SJR

(I) Citedby		Mean Difference (I-J)	Std. Error	Sig.
0	1	-.144565*	.057537	.012
	2	-.226970*	.059401	.000
	3	-.341299*	.063413	.000
1	3	-.196734*	.068525	.004

*. The mean difference is significant at the 0.05 level.

The post-hoc analysis using Fisher's LSD showed that publications in economics from the UK relating to 2014-2015 with 0 citations differ significantly from those with 1, 2, or 3 citations. So also those with 1 citation differ from those with 3;

The analysis indicates that 0 cited (uncited) articles are not a chance factor. They tend to behave differently from the other groups even at the tail end. But that is not the case for those with citations 1 and 2. Their difference is not statistically significant, so with citations 2 and 3.

India

Similar analysis was also carried out for Indian economics CitableDocs indexed in Scopus for the years 2014 and 2015. In all there were 2,164 indexed records under the category. Of those, articles made up 40%, followed by Review (25.9%), letter (11.9%), Book chapter (11.6%), and others (Table 10.4). Citable docs from *Economic and Political Weekly* for the years made up 61.2% of the total. The rest of the documents came from over 200 different sources, including 18 journals.

Table 10.4 Document & citation frequency-wise distribution of Economics CitableDocs for India (2014-2015)

	Arti cle	Book	Book Chap ter	Conf erence Paper	Edito rial	Erra tum	Letter	Note	Review	Short Survey
0	263	12	155	3	18	3	248	74	244	34
1	171	5	54	6	2	0	8	14	133	10
2	106	3	22	3	0	0	1	6	74	2
3	65	6	12	1	1	0	0	3	32	2
4 or more	260	6	10	9	2	0	0	2	77	2
Total	865	32	253	22	23	3	257	99	560	50

Source	Frequency	Percent
Economic and Political Weekly	1324	61.2
203 other sources with 10 or less articles	840	38.8
Total	2164	100.00

CitableDocs were grouped into categories, viz., 0, 1, 2, 3, 4 or more citations.
The subset of data belonging to tail-end in citation terms were taken for further analysis. Those documents with citations 0 to 3 were analyzed for possible significant statistical association along with the false links information. Distribution of these values is presented in Table 10.5. The data shows the cross table of citation groups and false links in respective categories.

Chi square analysis carried on the distribution shows a significant X^2 value (X^2 = 928.7 df 3 p <.000) indicating that there is a significant statistical association between tail-end citation groups when considered with their respective forward links. The same result was found to exist even when the citation categories were collapsed into two groups – 0 and 1-2 (in this analysis those CitableDocs with 3 citations were eliminated). X^2 value of 818.7 (df 1 p <.000) show that uncited articles do fall into different category and cannot be equated with other low-cited groups.

Table 10.5 Distribution of Tail-end Citations X Forward Citation Links					
Cited by / Further Links	0	1	2	3	Total
0 Further links	1054	177	69	27	1327
1 or more links	0	226	148	95	469
	1054	403	217	122	1796
X^2 928.7 df = 3 p<.00					

These tail-end citations were analyzed, as was done in the context of economics publications of the UK using Anova for testing the mean difference with citation category groups as dependent and SJR as the independent variable.

Summary Anova Table (Table 10.6) show significant F ratio (F=3.413 (3, 1435), MSE= 0.014, p<.017) indicating a statistically significant difference among the groups. Post-hoc analysis using Fisher's LSD show that there is a significant difference between groups with citation 0 and those with 1 or 2.

Table 10.6 Anova summary citation frequency (0,1,2,3) Vs SJR					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.139	3	.046	3.413	.017
Within Groups	19.448	1435	.014		
Total	19.586	1438			

Dependent Variable:	SJR			
LSD				
(I) CITEDBY		Mean Difference (I-J)	Std. Error	Sig.
0	1	-.019295*	.007609	.011
	2	-.020783*	.009430	.028
*. The mean difference is significant at the 0.05 level.				

The results indicate that tail-end citations in economics for the sample data show a statistically significant difference, and they cannot be viewed as a chance occurrence, even when we consider the forward link information.

Given the above results we need to make a careful study of the uncited CitableDocs. Though uncited CitableDocs are not a bad thing (Garfield, 1991), this should concern both our authors and editors of the Scopus indexed Indian journals.

Chapter 11

Publishers-wise citation distribution in Scopus

Who publishes the journals indexed in Scopus and how the journals and citations are distributed across publishers is an interesting and relevant detail. To examine this publisher and citation related information was collated from the Scopus indexed list of journals for the year 2018 made available by Scopus through *https://www.scimagojr.com* . Publishing houses sometimes operate in different countries through their subsidiaries (e.g. Sage Publications India Pvt Ltd., Elsevier Urban and Partner sp) and even form joint ventures (e.g. Wiley-Liss Inc, Blackwell-Wiss.-Verl, Brunner - Routledge (US)). Such joint ventures, for the purpose of the current analysis, were normalized by grouping the titles under the more popular publisher name in the context. The corresponding data collected in the context include citable Documents published by journals, total citations and average citations per documents accrued to them during 2016-2018. The analysis used Anova statistic with Fisher's LSD as the post hoc analysis to understand the statistical significance of distribution.

Scopus claims an independent review mechanism for journal selection for indexing in its database. New suggestions from the publishers are said to be evaluated by the international experts using broadly defined quantitative and qualitative measures. Apart from the minimum criteria of availability of ISSN, English language abstract, and publicly available publication ethics in the journal, the criteria mentioned include - Journal Policy, along with type of peer review; geographical distribution of editors; authors; content; Journal standing in terms of citedness of journal articles in Scopus; editor standing; publishing regularity; and online availability. Usage of abstract and full text is also considered for retention of the journals in the list once they are selected. https://www.elsevier.com/solutions/scopus/how-scopus-works/content/content-policy-and-selection .Thus, visibility, commercial prospect, and acceptable production standards are the criteria that stand out for inclusion of journals in Scopus.

Journal titles included in Scopus are published by Academies, societies, local and international commercial publishers. Table 11.1 presents details on clustering of journals across publishers and associated details. In 2018 Scopus indexed 24,690 journals. Publisher stakes in Scopus, in terms of titles included, range from single journal to as many as 2,114 of Elsevier imprint. Single title from the publisher make up almost one-fourth (5,877 titles, 23.88%) of the journals included in Scopus. Those with 1-4 journals make up 33.33% (6, 855 titles) of the total journals.

The data shows that the top three publishers own 4,769 (19.37%) of the total journals in Scopus. These are Elsevier, Taylor & Francis, and Springer. Each of these business houses published over 1,000 plus indexed journals. The next three publishers, in descending order of titles indexed – Sage, Wiley, and

Blackwell - owned Journal titles ranging from 500-999 making up 9.14% of the journals indexed in Scopus. These six top publishers cumulatively publish **36.04% of** the total citable docs, and these have accounted for 42.29% of the citations accrued during 2016-2018 period.

A total of 19 distinct publishers owned journals ranging from 100-499 indexed in Scopus. These cumulatively work out 16.54% of the total in the database. Thus, the top 25 publishers managed about 45% of the total journals in Scopus. Together they published 50.99% of the total Citable Documents and accrued slightly over 60% of the total citations during 2016-2018.

At the other end of the journal distribution in Scopus were those publishing one journal. There were 5,877 of those making up 23.89% of the total. They contributed 15.13% of the articles to Scopus, and got a citation yield of 5.20% of the total.

Publishers with 1 to 4 journals indexed in Scopus made up 6,827 (33.33%) in number and contributed 23.69% of citable articles. They had accrued during the years only 10.57% of the total citations.

The above trends indicate that some commercial publishers with a large chunk of journals indexed in Scopus accrue more citations as opposed to those at the other end where the citable documents and the citations accrued do not match correspondingly. Varying number of titles owned by publishers, their corresponding citable documents in Scopus, and citation data is presented in Table 11.1. The distribution is explicit in being skewed towards a few top publishers both in terms of journal ownership, total citable documents, and total citations.

Major publishers represented in Scopus are shown in Table 11.2. As could be seen Elsevier has 8.59% of the total journals, 17.86% of citable publications, and 24.92% of the citations. There seems to be an undue advantage for the Scopus publishers in coverage and citations.

Table 11.1 Clustering of Journals and corresponding Citable Documents (2016-2018), and Citations (2016-2018)							
Journals in Scopus	No Publishers	Titles	% Titles	Citable_Docs	%citable Docs(3 Yrs)	Total_Citations	%Total Citations(3 Yrs)
1000+	3	4769	19.37	1731397	26.88	5630226	31.30
500_999	3	2253	9.14	590335	9.16	1977578	10.99
400	1	466	1.89	140448	2.18	320420	1.78
300	3	982	3.99	175077	2.72	539274	3.00
200	6	1467	5.96	309342	4.80	779503	4.33
100	9	1153	4.70	338596	5.26	1684877	9.37
50_99	18	1184	4.81	451651	7.01	1723711	9.58
40	6	264	1.07	189324	2.94	856754	4.76
30	21	691	2.81	123413	1.92	283894	1.58
20	37	846	3.44	202866	3.15	545574	3.03
10	85	1139	4.63	320249	4.97	800779	4.45
5_9	190	1193	4.85	342316	5.31	947320	5.27
4	105	420	1.71	130355	2.02	199103	1.11
3	218	654	2.66	154919	2.40	297775	1.66
2	625	1250	5.08	267300	4.15	466993	2.60
1	5879	5877	23.89	974233	15.13	936342	5.20
	7209	24608	100.00	6441821	100.00	17990123	100.00

Table 11.2 Major publishers, their Journals (2018), and the corresponding Citable Documents and Citations in (2016-2018)						
Publishers	Titles	% Titles	Citable_ Docs	%citable Docs(3 Yrs)	Total_ Citations	%Total Citations
Elsevier	2114	8.59	1150426	17.86	4483735	24.92
Taylor & Francis	1271	5.16	186786	2.90	334671	1.86
Springer	1384	5.62	394185	6.12	811820	4.52
Wiley	890	3.61	315644	4.9	1224471	6.81
SAGE	818	3.32	127099	1.97	284025	1.58
Blackwell	545	2.21	147592	2.29	469082	2.61
Kluwer Academic	466	1.89	140448	2.18	320420	1.78
CUP	344	1.40	48743	0.76	85548	0.48
Routledge	323	1.31	31384	0.49	44689	0.25
OUP	315	1.28	94950	1.47	409037	2.27
Emerald	288	1.17	32046	0.50	57779	0.32
Lippincott Williams & Wilkins	261	1.06	100035	1.55	291623	1.62
Bio Med Central	250	1.02	86988	1.35	290011	1.61
Inderscience	230	0.93	17006	0.26	13778	0.08
Walter de Gruyter	223	0.91	25771	0.40	29833	0.17
Hindawi	215	0.87	47496	0.74	96479	0.54
Bentham Science	170	0.69	18945	0.29	32052	0.18
IEEE	149	0.61	99895	1.55	520881	2.90
Brill Academic Publishers	147	0.60	8145	0.13	3846	0.02
W. B. Saunders	122	0.50	37805	0.59	112512	0.63
Haworth Press	118	0.48	9609	0.15	10478	0.06
Carfax Publishing	115	0.47	16363	0.25	31201	0.17
Medknow Publications	115	0.47	26747	0.42	30771	0.17
Maney Publishing	114	0.46	12428	0.19	14967	0.08
Nature Publishing Group	103	0.42	108659	1.69	928169	5.16
Major Publishers	11090	45.05	3285195	51.00	10931878	60.79
Others	13518	54.95	3156626	49.00	7058245	39.21
Total	24608	100.00	6441821	100.00	17990123	100.00

Anova statistic was used to understand whether the citations per document for the journals differ significantly across the publishers. Citation per document was computed by dividing total citations by citable documents. As some of the journals in the list were new additions the corresponding data was not available for some journals and they were eliminated from the analysis. Initially the sample was divided into two groups, namely major publishers with 100 plus journals in Scopus and the rest of the publishers. The Anova summary is presented in Table 11.3. The analysis reveals a significant F Ratio

(F=421.975 (1,24444), MSE=22.064 p<.000) indicating that the mean citations per document accrued to major publishers with large number of journals in Scopus tend to be significantly more citations per document compared with the minor publishers. Publishing houses through their promotional policies seems to have an influence of how the journal content is perceived by the users.

Table 11.3

ANOVA Summary: Publisher Groups *vs* Citations Per Document

	No of Journals	Mean citations per document			Sum of Squares	df	Mean Square	F	Sig.
Major publishers with 100+ journals	11191	2.3149		Between Groups	9310.608	1	9310.608	421.975	.000
Others	13255	1.0762		Within Groups	539341.017	24444	22.064		
Total	24446	1.6432		Total	548651.625	24445			

The analysis of CitesPerDoc was carried forward taking top 25 publishers who play a major role in Scopus contents to understand whether significant variations manifest among these publishers within the group. Anova carried out for this group (Table 11.4) also reveal a significant F Ratio (F=20.261 (24,11166) MSE=40.069 p<.000) indicating that some publishers within this elite group tend to accrue significantly higher citations per document than the others. Post hoc analysis of the Anova using Fisher's LSD was carried out to understand which of the publishers differ significantly within the group. Fishers LSD test is a set of individual publisher-wise t tests with all the others to know the statistical difference in distribution, in our context of citations per document. The test computes the pooled SD from all the groups. The resultant mean difference could be – and + in the matrix. Significant '– ' value indicates that the citations per document in journals of that publisher is significantly less than the other in contention. The LSD analysis results are presented in Table 11.5

Table 11.4 Distribution of titles and Anova summary: Major Publishers *vs* Citation per Document

Publisher	No of Titles	Mean Citations Per Document
Bentham Science	169	1.07
Bio Med Central	274	3.08
Blackwell	557	2.56
Brill	147	0.34
CUP	343	1.31
Carfax	119	1.68
Elsevier	2107	3.55
Emerald Group	286	1.57
Haworth	149	1.03
Hindawi	215	1.70
IEEE	173	5.01
Inderscience	230	0.69
Kluwer	476	2.12
Lippincott	261	2.16
Maney Publishing	114	0.87
Medknow	115	1.13
Nature	102	12.00
OUP	315	2.54
Routledge	323	1.27
Sage	817	1.94
Springer	1283	1.87
Taylor & Francis	1268	1.53
W. B. Saunders	122	2.51
Walter De Gruyter	339	0.83
Wiley	887	2.86
Total	11191	2.31

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19483.548	24	811.815	20.261	.000
Within Groups	447405.893	11166	40.069		
Total	466889.441	11190			

As could be seen from the results six publishers stand out among the 25 top contributors to Scopus. These are Bio Med Central (250 titles indexed in Scopus), Blackwell (545), Elsevier (2114), IEEE (149), Nature Publishing (103), and Wiley (890). These publishers register a significantly higher citations per document compared to the others in this select group. Bio Med central, IEEE and Nature Publishing are specialized narrowly focused publishers with relatively lesser number of journals among the select top contributor. Though Blackwell journals tend to score significantly higher citations per document than the 10 other publishers in this group, they also accrue significantly less than the five others in the group, including Elsevier. Wiley journals score significantly higher on 15 other publishers in this group. Wiley's CitesPerDoc in Scopus is significantly less than Elsevier. Only Elsevier tends to score consistently high on all the others, excepting the five among them. Two of these are Nature and IEEE, both specialized publishers. And, for the other three the difference is not statistically significant. This indicates relative greater influence exercised by Elsevier in Scopus citation world. Scopus is also published by Elsevier.

Publisher interest in citations does not seem to play out differently in Science Citation Index Expanded, a rival Citation Indexing product. SCI Expanded indexes currently 9,500 journals. These bear imprint of 1,752 distinct publishers (https://mjl.clarivate.com/collection-list-downloads). As was computed from the data, the top 20 of these, more or less, overlap with that of Scopus in proportion of publisher representation. These include Elsevier (16.20% of the total), Springer (13.24%), Wiley (9.81%) These three make up almost 40% of the coverage. The other publishers with more than 100 titles in the source are – Taylor and Francis, Sage, Bio Med Central, Lippincott, Williams and Wilkins, Oxford Univ. Press, IEEE and Cambridge Univ. Press. These top 10 publishers in this source publish 58.36% of the total journals indexed. M/s Clarivate claim to be publisher-independent citation database, most probably referring to them not having any interest in the journals indexed. However, given the skewed distribution of title ownership in the index the publishers-wise skewed citation distribution may hold good there as well.

Journal publishing is an expensive endeavor. In that competitive market citation plays an important promotional role. And, hence the publisher interest in citations. Despite varying motivations to cite and several objection in the scholarly literature about its validity as quality measure, its utility to the publishers also seem to keep the practice in vogue. Some publishers actively participate in the process. In public accounts, M/s Elsevier has described the value they add to publications through their investment, including “coordinating the review, consideration, added *text and references*, and production and distribution mechanisms” (The STM Report, 2018).

Most of the major publishers instruct authors on sharing and promoting their articles as an important part of research (for instance https://www.elsevier.com/authors/journal-authors/submit-your-paper/sharing-and-promoting-your-article). Along with fostering the exchange of scientific information they also seem to serve the publisher interest in promoting their journals. Commercial publishers exploit this feature well. This has to be seen in the context of Journal production which is an expensive commercial proposition with an eye on the profit margins. For some of these publishers profit margin is estimated to be 30% and could be as high as 50% in some cases (The STM Report, 2018).

There are at least two commercial services for the purpose of promotion and citation seeking currently in operations - **Kudos and Impactstory. Kudos (https://info.growkudos.com/)** aims to help expand readership of research publications and increase citations, via a structured process that includes writing a lay summary and using social media effectively. ImpactStory (https://profiles.impactstory.org) facilitates creation of online profiles of research outputs to track the altmetric impacts. Citation has willy-nilly transformed into a management tool.

Citation index is an important discovery tool. By obtaining citation advantage through clustering of titles by major publishers, and subsequently positioning their products as the high impact conveyors they influence the scholarly information use.

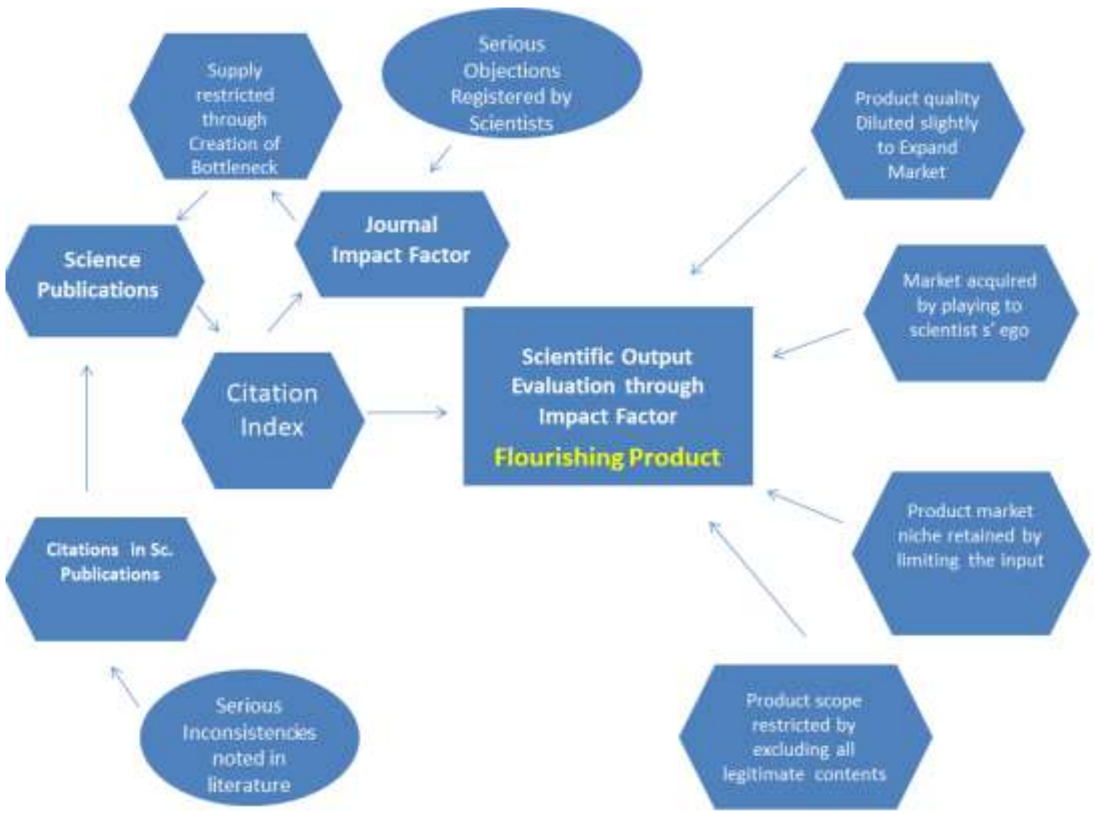
Table 11.5: Publisher-wise matrix of mean citation comparisons (LSD analysis results)$

	BENTHAM SCIENCE	BIOMED CENTRAL	BLACKWELL	Brill	CUP	CARFAX	ELSEVIER	EMERALD GROUP	HAWORTH	HINDAWI	IEEE	INDERSCIENCE	KLUWER	LIPPINCOTT 0	MANEY Publishing	MEDKNOW	NATURE	OUP	ROUTLEDGE	SAGE	SPRINGER	TAYLOR & Francis	W. B. SAUNDERS	WALTER DE GRUYTER	WILEY
BENTHAM SCIENCE		-2.00	-1.49				-2.48*				-3.93*						-10.93*	-1.47*							-1.79*
BIOMED CENTRAL	2.00 *			2.73*	1.77*	1.40*		1.50*	2.05*	1.38*	-1.93*	2.39*	.96*		2.20*	1.95*	-8.92*		1.81*	1.14*	1.20*	1.54*		2.24*	
BLACKWELL	1.49 *			2.22*	1.26*		-.98*	.99*	1.53*		-2.44*	1.8*			1.69*	1.43*	-9.43*		1.30*		.693*	1.03*		1.73*	
Brill		-2.73	-2.22*				-3.20*			-1.35*	-4.66*		-1.77*	-1.81*			-11.66*	-2.20*		-1.60*	-1.53*	-1.19*	-2.16*		-2.52*
CUP		-1.77	-1.26*				-2.24*				-3.70*						-10.69*	-1.24*							-1.55*
CARFAX		-1.40*					-1.87*				-3.33*						-10.32*								
ELSEVIER	2.48*		.98*	3.20*	2.24*	1.87*		1.98*	2.52*	1.85*	-1.46*	2.86*	1.43*	1.39*	2.67*	2.42*	-8.45*	1.00*	2.28*	1.61*	1.67*	2.012*		2.71*	.69*
EMERALD GROUP		-1.5*	-.99*				-1.98*				-3.44*						-10.43*	-0.97							-1.29*
HAWORTH		-2.05*	-1.54*				-2.52*				-3.98*						-10.97*	-1.52*							-1.83*
HINDAWI		-1.38*		1.35*			-1.85*				-3.31*	1.01					-10.30*								-1.17*
IEEE	3.94*	1.93*	2.44*	4.66*	3.70*	3.33*	1.46*	3.44*	3.98*	3.31*		4.32*	2.89*	2.85*	4.13*	3.88*	-6.99*	2.46*	3.74*	3.069*	3.138*	3.47*	2.50*	4.17*	2.15*
INDERSCIENCE		-2.39*	-1.88*				-2.86*				-4.32*		-1.43*	-1.47*			-11.31*	-1.86*		-1.25*	-1.19*		-1.82*		-2.18*

KLUWER		-.96*		1.77*			-1.42				-2.89*	1.43*				0.99	-9.88*							1.29*	-.74*
LIPPINCOTT				1.81*			-1.39*		1.13		-2.85*	1.47*					-9.84*							1.32*	
MANEY Publishing		-2.20*	-1.69*				-2.67*				-4.13*						-11.13*	-1.67*					-1.63*		-1.99*
MEDKNOW		-1.95*	-1.44*				-2.42*				-3.88*						-10.87*	-1.41*							-1.73*
NATURE	10.93*	8.92*	9.44*	11.66*	10.69*	10.32*	8.45*	10.43*	10.97*	10.30*	6.99*	11.31*	9.88*	9.84*	11.12*	10.87*		9.46*	10.73*	10.06*	10.13*	10.47*	9.49*	11.16*	9.13*
OUP	1.47*			2.20*	1.24*		-1.00*		1.52*		-2.46*	1.86*			1.67*	1.42*	-9.46*		1.28*			1.01*		1.70*	
ROUTLEDGE		-1.81*	-1.30*				-2.28*				-3.74*						-10.73*	-1.28*					-1.24		-1.59*
SAGE		-1.14*		1.59*			-1.61*				-3.069*	1.25*					-10.06*							1.10*	-.92*
SPRINGER		-1.20*	-.69*	1.53*			-1.67*				-3.13*	1.19*					-10.13*							1.039*	-.99*
TAYLOR & Francis		-1.54*	-1.03*	1.19*			-2.01*				-3.47*						-10.46*	-1.01*							-1.33*
W. B. SAUNDERS				2.14*							-2.50*	1.82*			1.63*		-9.49*		1.24					1.67*	
WALTER DE GRUYTER		-2.24*	-1.73*				-2.71*				-4.17*		-1.29*	-1.32*			-11.16*	-1.71*		-1.10*	-1.04*		-1.67*		-2.03*
WILEY	1.79*			2.52*	1.55*		-.69*	1.29*	1.83*	1.16*	-2.15*	2.18*	.74*		1.99*	1.73*	-9.14*		1.60*	.92*	.99*	1.33*		2.02*	

$ Only the statistically significant figures are shown

The commercial interest in retaining the product brand and making it a niche for the elite representation and consumption is a tested management practice. Market for diamond, a luxury product, is a case in point. There is sufficient literature to demonstrate that the market is cleverly constructed and retained through creating customer perception, production control by the diamond industry cartel (Bergenstock & Maskulka, 2001; Spar, 2006; Why Diamonds are Expensive, 2018 https://www.wpdiamonds.co.uk/why-diamonds-are-expensive/) Citation as a concept and its current commercial play out is summarized in the following diagram.



The citation databases publisher controls the input, output and product features; makes participation in the process desirable, and create a sustainable demand base for the product. We may have to examine whether this serves the larger purpose of science and technology in our context, namely contributing in service of society

Chapter 12
Summary and conclusions

Academic establishments and funding agencies around the world are increasingly interested in assessing the quality of academic output. Most judgments about research are based on perceived quality of the publications.

There are two approaches to such evaluations – qualitative and quantitative.

Qualitative approach is grounded in peer review. The approach is said to suffer from subjectivity, conservatism, corporatism, and conflict of interest.

The quantitative approach comes with bibliometrics. Citation impact of scholarly publications is at the core of these measures.

There are two competing theories of citing behavior, namely the normative theory of citation behavior and the social constructivist view. Both are situated within the broader social theories of science.

Normative theory basically states that scientists give credit to colleagues whose work they use by citing that work. Citations are expected to represent cognitive influence on scientific work. Constructivists argue that the cognitive content of articles has little influence on how they are received. Scientific knowledge is socially constructed through the manipulation of political and financial resources and the use of rhetorical devices. Scientists have complex citing motives that, depending on the intellectual and practical environment, are variously socially constructed. Citing is an aid to persuasion.

The Current Study

This study examined the factors associated with scholarly impact from a select macro and micro perspectives. This study was exploratory in nature. The analyses were intended to provide evidence-base and policy lead.

Objectives

The objectives of the study were to -

6. Examine the S&T publication patterns and their subject-wise distribution for major S&T publishing countries.
7. Analyze the overall citation patterns and their subject-wise trends.
8. Capture and analyze the comparative data on bibliometric and non-bibliometric variables for the identified countries.

9. Identify cases of publication impact and the factors associated with them from different countries.
10. Develop evidence-based macro understanding for impact and what can be the learning from the international experience for Indian science.

Data and Methods

The data for the analysis were sourced from Scopus citation database. Apart from their citation database, the Scopus data is also made available by the publishers in ScimagoJr.com – a public domain source for different time periods. Both the sources were used in the study.

This study considered the following variables drawn from Scopus for various analyses:

Author:	✓	For analysis on international collaboration and its association with the citation variables
Title:	✓	For the main analysis on subject-wise distribution of citable documents (derived through journal categorization into subjects) and its relations to citation variables
	✓	Reference per Document in citable documents
Journal:	✓	Journal country affiliation and its relations with citation variables
	✓	Subject-wise journal ownership across the countries and its relation to citation variables
	✓	Scimago Journal Ranking (SJR) of journals for analysis pertaining to citation variables
Imprint:	✓	Country-wise distribution of citations and its association with bibliographic and non-bibliographic variables
	✓	Publisher clustering in Scopus and the citation distribution among them
Other variables:	✓	Economic and infrastructure related variables like GDP(PPP) per capita, Total R&D investment Per capita, R&D investment in business, University Index, … and their relations with citation variables

Time period considered for the macro analysis of total citations was three-year period (2016-2018) as obtained from Scimagojr database.

The entire set of journal output and the associated citation related data were analysed to learn the functional relationship between citation variables and a set of other bibliographic variables.

Scopus classifies its contents under 27 broad subject headings. The analyses were also carried out subject-wise, apart from those for the total dataset. Some of the documents fall in more than one category, as the journals and the other source materials span more than one subject.

Country-wise citation related analyses were narrowed down to the countries making up the top 90% of the scholarly literature output. This limited the countries in the analysis to 32. This was done to make the analyses viable without leaving out any major contributor to research output. India is part of these countries.

Two micro analyses were carried out – (a) to understand the citations in the context of international collaborations using 2018 data pertaining to Immunology for select set of countries, including India; (b) to evaluate the validity of tail-end citations. This analysis used 2014-2015 data relating to Economics pertaining to India and the UK.

The analysis attempted the following

1. Extent of publication – Total publications for all the subject areas included in Scopus and in different subject areas as categorized by the database;
2. Extent of cited and uncited documents – Total publications for all the subject areas and also separately for all the subject areas as cateorised by the database;
3. Bivariate relations between total citations and Citations per documents published in different journals and a set of independent variables such as references per document, Total citable documents;
4. Multivariate analysis of Total Citations and Citations per Document published in different journals as per their country affiliations and a set of independent variables such as Citable documents, SJR, International Collaboration, References per Document, and economy, Infrastructure related variables;
5. Multivariate analysis Total Citations and Citations per Document in different journals as per their subject categorization and a set of independent variables such as Citable Documents, SJR, International Collaboration, References per Document, and economy, Infrastructure related variables;
6. Mean difference in Citations and Citations per Document in journals published by countries making up top 90% of the S&T literature;
7. Analysis of International Collaboration related data for a narrower subject for the year 2018 for high impact countries, namely Switzerland, Netherlands, Denmark, Sweden, and India to understand how collaboration makes a difference in citation yield;
8. Analysis of publications under economics of the UK and India for the years 2014 and 2015 to understand the features of tail end citation distribution;
9. Analysis of journal clustering on publishers along with distribution of citable documents and citations among them.

Statistical techniques used for the analyses

The following statistical methods were used to analyze the data:

- Linear regressions for both bivariate and multivariate analyses;
- Anova measure to understand the mean difference in total citations and Citations per document in journals and also also for the articles on immunology;
- Chi Square analysis to explore the association between tail-end citations

Data were analyzed using SPSS.

Extent of scholarly literature

Scholarly literature as indexed by Scopus for the period 1996-2018 includes output from 239 countries. Despite the vast representation, publications of 32 countries make up the top 90% of the output in Scopus. Ranked in descending order the US makes up 22.26% of the total, followed by China (10.88%), the UK (6.36%), Germany (5.57%), Japan (5.07%), France (3.91%), Canada (3.22%), Italy (3.22%), India (3.08%), and the others.

In the subject-wise distribution the US and China occupy the dominant positions in almost all the subjects groupings.

Being cited is the key to scholarly impact. China and the US figure as the top two countries on this variable. In that, those of the US have been increasingly getting cited and those of China remaining uncited despite being included in the database. Proportion of uncited records for the other countries is relatively low, but so are their research contributions in the database.

The contributions of Australia, Belgium, Canada, Denmark, Finland, Israel, Netherlands, Norway, Singapore, Sweden, and Switzerland have higher than average citedness per document.

Analysis of citations

Data for the analyses were collected both at the journals level and also at the country level. Data were analyzed for tracing the journal level behavior in accruing Total Cites and CitesPerDoc. Country level analysis included both citation related data and other national economy data of relevance in the context.

The variables identified for the analyses were the following

Extent of Citable Docs; TotalCites; TotalRefs; RefPerDoc; International Collaboration; Scimago Journal Ranking (SJR); CitesPerDoc - both Journal-wise and Country-wise. Both CitableDocs and CitesPerDocs were restricted to three-year period 2016-2018. This was done to bring in currency to the analyses carried out. The analyses included basically 24,690 journals and the corresponding data.

Total Citations

The model with four independent variables, namely Total CitableDocs, articles with International Collaboration, RefPerDoc, and SJR were regressed against TotalCites. The selected four predictor variables collectively explained 70.7% of the variance with an R^2 value of .707. All the four independent variables were contributing significantly to the variation. CitableDocs explained the major variance, followed by SJR, International Collaboration and RefPerDoc, in that order.

CitableDocs uniquely explained 78.1% of the observed variance in the model (as derived from the part correlation), followed by SJR, which accounted for 20.1%. Articles with international collaboration on its own accounted for 0.8% of the total, and RefPerDoc -0.7% of the accounted variance.

ß values in the model suggest that every unit increase in CitableDocs results in .789** unit increase in Citations. The corresponding figures for SJR was ß 0.218**.

The same set of four predictor variables were regressed against TotalCites for articles in each of the 27 subject categories identified by Scopus.

The results indicate the following

- The four chosen independent variables explain a high degree of variance ranging from 97.7% (R^2 .977) for Agricultural and Biological Sciences to 27.8% (R^2 =.278) for Economics. The explained R^2 for journals in two subject groupings were .9 and above; it was .8 and above for eight subjects; and ranged from .6 to .7 in eleven subject categories; .4 to .5 for Total Cites in three subject groupings of journals. Both Business Management (R^2 .308) and Economics (R^2 .288) have less variance explained by predictor variables in the context. F value for all the 27 subjects were significant.
- Presence of CitableDocs in the journals explain substantial portion of the variance in all the subject groups. ß values for this variables is .5 and above in all the subject categories, except Economics. It is as high as .977 for Agriculture, indicating that with every one unit increase in CitableDocs in Scopus results in .977 unit increase in Total Cites.
- The extent of International Collaborative articles in journals as a variable does not bear high influence on Total Cites in all the subjects.

- SJR makes a substantial and statistically significant difference in all the subjects in accruing total citations.

The results on the whole reveal that citations accrued to articles in journals in different subjects depend mostly on the number of CitableDocs published in the journals indexed in Scopus. Higher the number, greater the citations accrued.

Considering the trend of CitableDocs playing an important role in accruing citations, Indian journals can expand their content base, albeit being within the editorial norms of the scholarly journal.

Actual and estimated citations to Indian journals

Total citations accrued to 499 Indian journals during 2016-2018 period was 93,380. As per the estimates based on regression equation derived in the multivariate model using four predictor variables this should have been 154,803 citations. There was a shortfall of 61,423 going by the larger trends in Scopus indexed journals. This is so despite indexed Indian journals passing the publisher quality benchmark. Contributions in Indian journals are less preferred for citations, as indicated by the data.

CitesPerDoc

It is not the total citations, but the higher citation impact of what is published, considering countries and their respective scholarly academic base comes in varying size. To understand this aspect, bivariate and multivariate regressions were worked out as in the case of Total Cites.

The variables used for this analysis were- Total CitableDocs, RefperDoc, and International collaboration. SJR, and TotalCitations. CitesPerDoc was calculated for the years 2016-2018 by dividing the Total Citations for the journals for the three years with their corresponding total CitableDocs.

Multivariate linear regression analysis with five predictor variables was worked out for the entire set of journals. Regression coefficient (R^2 =.863) indicate that the five predictor variables account for 86.3% of the total variance in CitesPerDoc.

In the order of magnitude of variance accounted the other four predictor variables were – SJR(β .810**), TotalCitations (β .402**), RefperDoc (β .112**), and International Collaboration (β .038**). The result indicates that high impact for CitableDocs is a function of the Publication appearing in journals with high SJR more than the other variables.

The Regression analyses for CitesPerDoc for 27 subjects show statistically significant results. Total Variance accounted for vary from a low of 7.6% (for Biochemistry, Genetics & Molecular biology) to a high of 96.8% (Energy). Most of the models indicate R^2 of .8 or .9 . Exceptions to this trend are

Biochemistry, Genetics & Molecular biology (R^2 .76) and, Earth and Planetary Science (R^2 .446), Mathematics (R^2 .594), and Neuroscience (R^2 .273). SJR accounts for major variance in all subject groupings.

The results indicate that SJR's influence on citesperdoc is the most in all cases, and ß value ranges from .27 to 19.896 in explaining the possible influence on CitesPerDoc across subjects.

Interestingly, the extent of CitableDocs with international collaboration contribute significantly only for 13 of the 27 subjects, and in none of the instances it accounts for a substantial variance, highest ß value being .208** for Business Management.

TotalCites accrued for journals in the subject do not seems to result it in high citesperdoc in all subjects.

Actual and estimated CitesPerDoc for Indian journals

It was noted earlier that there is a huge difference in estimated and actual citations accrued for Indian journals in Scopus. Similar calculation in the context of CitesPerDoc was carried out based on regression equation derived in the multivariate model. The results indicate that the mean CitesPerDoc for Indian journals was 0.650 against the estimated value of 0.720. Scholarly contributions in our journals are less frequently cited that the estimated figures based on the world trends. Inclusion of Indian journals in Scopus after careful editorial selection does not seem to have helped them.

Analysis of citations at country level

This analysis was carried out for 32 countries (out of 239 in the database) which made up 90% of the total S&T output. Data pertaining to these variables were collected from IMD World Competitiveness Yearbook 2019 online database and the data were the latest available for the variables. As the data pertaining to Iran was not included in IMD WCY (2019), the country had to be excluded from the analysis.

Multivariate linear regression with the predicator variables - Researchers in R&D per capita; Total expenditure in R&D per capita ($); University Education Index, GDP (PPP) per capita, Citable Documents with Total Citations as criterion variable returned R^2 of .991. Beta values significant in the context were University Education Index (ß .231**), GDP (PPP) (per capita) (ß .052*), and CitableDocs (ß .820**)

Total CitableDocs on its own contributed 47.6% of the variance explained by the model. The ß value indicates that every unit increase in CitableDocs result in Total Cites increasing by .820 units. Next in the order is University Education Index which explained 13.3% of the variance on its own. These two are followed by GDP (PPP) per capita as the predictor.

When the same predictor variables were regressed against CitesPerDoc, the model could explain 57.4% (R^2 .574) of the variance with Total expenses on R&D per capita (ß 2.026**) and GDP (PPP) per capita (ß .407**) coming out significant.

The results indicate the following:

- If we want higher citation figures against the country we can rely on publishing more citable documents, focus on university education standards, and economic development as reflected in GDP(PPP).
- However, this does not result in higher CitesPerDoc. It is the higher R&D Expenditure that matters more along with better economic development as reflected in GDP (PPP).
- Higher number of CitableDocs does not result in higher CitesPerDoc. This could be explained by relative depth of R&D and resultant publications could attract researcher attention as they set the agenda and would be at the cutting edge of science. It is so because higher CitesPerDocs, as the results show, has significant functional relations with total expenditure on R&D
- As we have not been able to invest more on R&D, it is better to focus on greater CitableDocs and the resultant increase in total citations.

Estimated and actual citations to Indian contributions

Indian scholarly contributions have appeared both in Indian and foreign journals. During 2016-2018 our contributions had accrued 1,939,535 total citations against the estimate of 2,471,399 based on unstandardized beta coefficients in the regression model based on 31 country data. We accrued 531,864 citations less. Our Cites PerDoc was only 4.33 for the period as against the estimate of 4.68 based on Regression equation for CitesPerDoc, a shortfall of 0.35 per citable documents. Being certified by Scopus does not seem to help reach the expected citation levels. This trend points to the play out of varying user perception of similar research output, Mathew effect in short.

Are journals of some countries better than the others in citation yield?

This analysis explored possible mean difference in Total Cites among the journals of the 31 (of the 32) countries making up the top 90% of the total citable documents in Scopus, using Anova statistic. The analysis intended to understand whether the country origin of journals published form these top countries (when considered collectively) differ significantly in their Total Cites and also CiesPerDoc yields. The analysis intended to understand the variations in citations which could be due to differing user perception of the journals of certain country origin.

The number of journals included in Scopus from these countries varies, so also their subject focus. The analysis initially examined the difference for the total set of journals across the subjects. At the second stage journals for each of the 27 subject categories identified by Scopus was treated separately to understand the TotalCites and CitesPerDoc behavior corresponding to country of journal origin.

The data included 22,166 (out of total 24,608 from all the countries in Scopus) journals grouped under 31 countries for analysis on total citations, and 22,028 for CitesPerDoc. This variation in number is because several of these journals in Scopus belonging to one or the other of these counties did not have the relevant citation data, being new in the list. The citation data was for the years 2016-2018.

Total Citations

The main Anova inclusive of all the journals showed significant F Ratios indicating that there exists a statistically significant difference in Total Cites yield among country-wise grouping of journals. In other words, the citations accrued to the citable articles in journals from the countries making up top 90% of the output vary significantly across their country-wise groupings. CitableDocs in journals of some country origin tend to accrue more citations than the others. There seems to be a country of origin unique preferred characteristic in journals that could be facilitating greater citations.

Post-hoc analysis carried out using Fisher's LSD show that significant difference is noticeable mainly among the journals of Netherlands, the US, the UK and to some extent those of Switzerland. Journals from these countries show a tendency to accrue more citations when compared with the others.

The analysis was taken forward to explore the possible mean difference in TotalCites for subject-wise categorization of the journals from these countries. The results indicate that 13 of the 27 country-wise subject grouping of the journals show a significant statistical difference.

Indian journals accrue significantly lesser mean citations compared to those of Netherlands, Switzerland, the US, the UK as a whole, and so also in specific subjects, namely Engineering, Environmental Science, Medicine, Pharmacology, Toxicology, and Pharmaceutical, Social Sciences, and Veterinary Sciences.

Implication for Indian scholars is that, when their articles are published in the journals from the Netherlands, the US, the UK and Switzerland they have a greater chance of accruing more citations.

For subject categories not mentioned above journals published from India are not significantly different from those of other countries in terms of citation yield.

Citesperdoc

Similar analysis carried out on variable CitesPerDoc for country-wise journal groupings and also their subject-wise groupings show a more complex pattern.

Main Anova for CitesPerDoc inclusive of all the journals is statistically significant indicating journals of certain countries tend to accrue more CitesPerDoc than the others. Post hoc analyses show that as general rule journals of Switzerland, Netherlands, the US and the UK differ significantly on this count from those of other countries. They tend to accrue significantly higher CitesPerDoc. Even among them journals originating from Netherlands accrue higher CitesPerDoc than all the other countries, including those of the US and the UK.

This analysis was extended to all the subject categories. Unlike in Total Citations, Anova for CitesPerDoc was statistically significant in most of the subject groupings.

Pecking order of journals for higher CitesPerDoc is those published in Netherlands, the US, the UK, Switzerland, Germany, and the others

Implications for Indian scholars for better citation accrual

- For better CitesPerDoc Indian contributions have to aim at publishing in Journals from Germany, Netherlands, Switzerland, the UK or the US in Agriculture. But for these, publishing in Indian journals are equally good.
- CitableDocs in the following subjects can as well be published in Indian journals for better CitesPerDoc: Arts; Biochemistry; Chemistry; Decision Sciences, Earth Sciences, Economics, Energy, Health professions; Immunology; Material Science, Multidisciplinary, Neuroscience; Nursing, Physics, Psychology
- In others subjects those of Netherlands could be the first choice, followed by the US and the UK. If our scholars cannot publish in these journals, they can as well publish in Indian journals, as publishing elsewhere does not make a difference.

Analyses of data for countries with high citation impact

Journals indexed in Scopus are considered to be of overlapping standard. Yet, there is a perceived difference in their quality as indicated in their citation yields. In no case they seem to favor Indian journals where most of our scholarly output gets published. This could also be due to inherent unfavorable outlook towards scholarly publishing from India. This aspect was explored with a case analysis of publications in Immunology for the year 2018. This analysis also explored the international collaboration, collaboration advantage, and desirability of publication in journals of higher SJR.

The analysis specifically explored the following questions for four countries – Denmark, Netherlands, Sweden, and Switzerland – which have shown high citedness than the 32 country average. Incidentally, these countries are also high on intenational collaboration in Citable Docs. The data pertaining to India on the subject were also considered for the same year for comparison. All the relevant data were collected in June of 2020 from Scopus database.

Total Indian publications on immunology is more than twice that of Netherlands and Switzerland, and thrice as much as Sweden and almost four folds that of Denmark. Total citation yield for Indian contributions compare favorably with the other countries in the context.

	Total Docs	Total authors	Distinct authors	Collaborative Authors				Total Collaborating authors
				Netherlands	Switzerland	Denmark	Sweden	
Netherlands	842	8305	7193	-	1494	1277	1374	4145
Switzerland	747	7000	6321	1494	-	1175	1068	3737
Denmark	452	4848	4315	1277	1175	-	1297	3749
Sweden	572	5354	4813	1374	1068	1068	-	3510
India	1769	8369	7328					

However, the citation intensity for Denmark, Switzerland, Sweden, and Netherlands is twice or more than that of Indian publications. Despite the variation in number of total publications, extent of total authorial involvement remains more or less the same for India and Netherlands because of international collaboration. The number is not far behind for Switzerland. Mean number of authors for Indian contributions was 4.73 as against 10.72 for those of Denmark, and 9 and a fraction above for the other three.

The author data was processed to understand how many were local to the country and how many came from one of the other three countries in the analysis. Netherlands had almost 50.0% of the authorial presence in their publication from other three countries; Switzerland 53.39%; Denmark 77.33%; and Sweden 65.59%. In fact, major proportion of authorial contribution in publication comes from outsiders and in the case of Denmark it is considerably high, being more than three-fourths of the total.

The four European countries in the context are getting the benefit of the same number of author contributions as that of India because of collaboration. The analysis also shows that because of this collaboration they get the benefit of the same articles appearing against multiple countries in the context and the associated citation impact benefit is to the extent of 25.5%.

The analysis was taken ahead to understand international collaboration, lead position (first author) in the publication and the citation yield for those publications.

Approximately 20% of Indian contributions had international collaboration compared to 77% for Denmark; 77% for Switzerland; 71% for Sweden and 75% for Netherlands. (International collaboration here includes all the countries these have collaboration with)

When these publications were cross tabulated for citation yield with categories 0,1, …'10 and more', it was noticed that the international collaboration *per se* does not seem to be the decisive factor in citation yield as borne out by the data, at least for India.

In our international collaborative research projects we have been in lead in more than half the cases.

The tabulated citation data shows that when Indian researchers were in the lead, almost for 25% of those collaborative publications the citation yield was 0 and so it goes. The distribution points to factors other than publication quality in play in citation yield.

The analysis was taken one step further to understand whether the publications of the five countries yield overlapping citations when they are published in journals of similar SJR category.

The analyses show that there is a significant mean difference in citation yield in three of the six categories of SJR. The post hoc analysis show that Indian publications compared to others in the context accrue significantly lesser citations even when they are published in journals of overlapping SJR. Indian publications get significantly less citation yield compared to the other four countries individually. No such statistical difference was present for Denmark, Netherlands, Sweden and Switzerland. Indian research publications, despite being in the 'same company' seem to get significantly different citation impact. It is not where you publish, who you are seem to matter for citation yield.

Are tail-end citations chance occurrence?

Present study also analyzed relevant data to examine the characteristics of tail-end citations. The subject chosen for the purpose was economics. Publications indexed in Scopus for the UK and India under the heading Economics for the years 2014 and 2015, along with frequency of citations, were considered.

The analysis was carried out using chi-square statistic.

The analysis indicate that the 0 cited publications in Scopus are significantly different in characteristics than those with 1, 2, or 3 citations. They are not chance occurrence.

Publisher clustering and citation distribution in Scopus

Who publishes the journals in Scopus and how the journals and citations are distributed across publishers is an interesting and relevant detail.

The data shows that the top three publishers own 4,769 (19.37%) of the total journals in Scopus. These are Elsevier, Taylor & Francis, and Springer. Each of these business houses published over 1,000 plus indexed journals. The next three publishers, in descending order of titles indexed – Sage, Wiley, and Blackwell - owned Journal titles ranging from 500-999 making up 9.14% of the journals indexed in Scopus. These six top publishers cumulatively publish **36.04% of** the total citable docs, and these have accounted for 42.29% of the citations accrued during 2016-2018 period.

Major publishers, their Journals, and the corresponding Citable Documents, and Citations in 2016-2018						
Publishers	Titles	% Titles	Citable Docs	% Citable Docs	Total_ Citations	%Total Citations
Elsevier	2114	8.59	1150426	17.86	4483735	24.92
Other major commercial publishers	8976	36.46	2134769	33.14	6448143	35.87
Others	13518	54.95	3156626	49.00	7058245	39.21
Total	24608	100.00	6441821	100.00	17990123	100.00

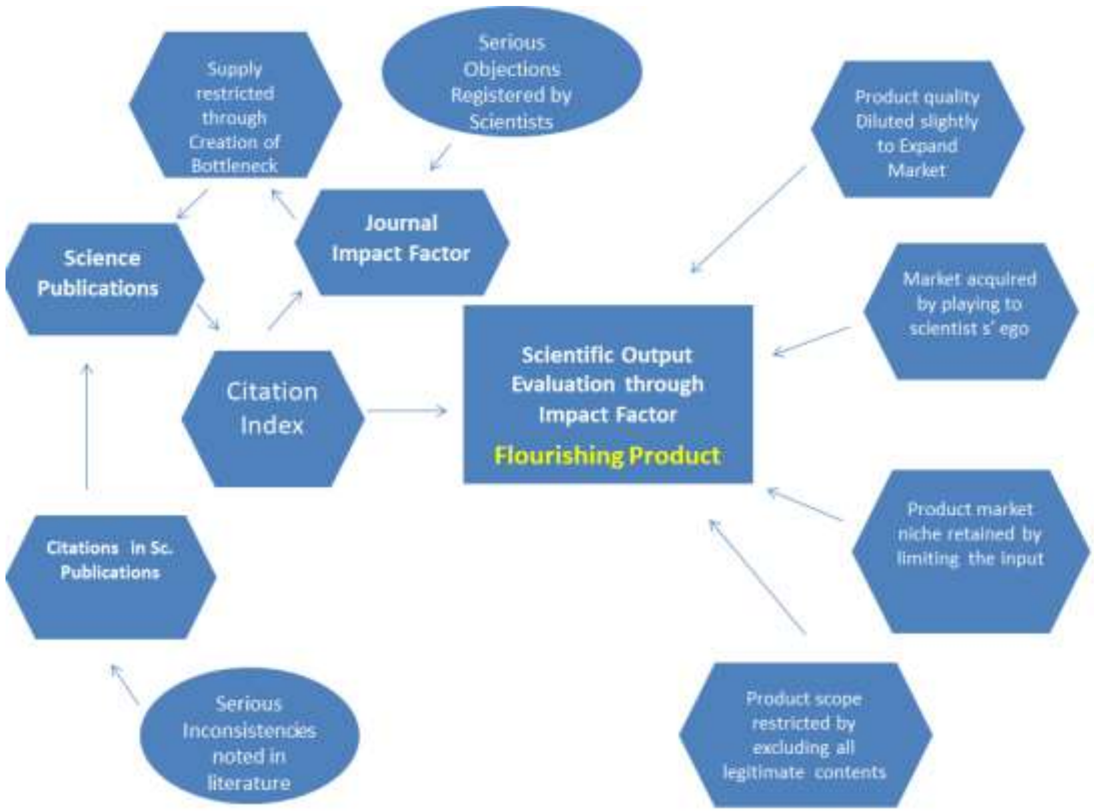
The top 25 publishers made up 45.07% of the total journals in Scopus. Together they published 50.99% of the Total Docs indexed and accrued 60.77% of the total citations during 2016-2018 period.

At the other end of the journal distribution were those publishing one journal. There are 5877 of those making up 23.88% of the total, contributing 15.12% of the articles to Scopus, and got a citation yield of 5.20% of the total.

The distribution is explicit in being skewed towards a few top publishers both in terms of journal ownership, total CitableDocs, and TotalCites.

The data also showed that Elsevier has 8.59% of the total journals, 17.86% of citable publications, and 24.92% of the citations. There seems to be an undue advantage for the Scopus publishers in coverage, and also citations.

Considering the above, a small cluster of commercial entities making up much of contents in Scopus could fine tune the product to the desired end. The commercial interest in retaining the product brand and making it a niche one for the elite representation and consumption is a tested management practice. Given the above trend promoting citation as a concept and its current commercial play out is summarized in the following diagram.



Services associated with impact factor are flourishing products, despite reservations about its validity in the scholarly discourse. For various reasons the journals inclusion to these commercial citation indices are restricted through bottlenecks, which in turn downgrades the excluded journal and their contents. This influences the citation accrual for these journals. The source content of these indices is selectively increased from different countries to suit the product placement possibilities. To add to these, the primary consumers of the product are acquired through rewards and recognition by these index publishers. Excluding the possible citations from competing, but excluded, journals from the citation database completes the process and defines the desirable scholarly output universe.

Thus, the citation databases publisher controls the input, output and product features; makes participation in the process desirable, and create a sustainable demand base for the product. We may have to examine whether this serves the larger purpose of science and technology in our context, namely contributing in service of society

Being part of the Scopus database is important for citations. Journals included in Scopus are controlled by the publishers. Citations to the documents, which are not part of Scopus journal base, by the CitableDocs of Scopus indexed journals are excluded by the database. Thus, the database gives no scope for understanding the impact of scholarly contribution, if 'they' are not part of the Scopus select universe. In this way the CitableDocs and the TotalCites make an 'exclusive club'.

CitesPerDoc depends most on SJR. SJR is prestige of the journals. This prestige is a construct of the scholars themselves. The chances of an average journal (included in Scopus) from a developing country being in the top of this 'prestige' heap is not feasible and so higher CitesPerDoc from the CitableDocs in the journals from developing country like India is very less probable. Among the 4,533 Scopus indexed journals which have SJR one or more, Brazil has 4, China 25, India 3, Mexico 1, and Turkey 0. These are the countries which are in the middle and lower income bracket. To contrast this are the journals from the US in this category are (1773) 28.55%; the UK (1502) 27.39%; Switzerland (120) 23.30%; Netherlands (719) 34.72%; Germany (256) 15.88%; Denmark (4) 11.11%. We have to understand that these journals are the product of the local research culture, and this culture sets the standards for science.

Conclusions

Citation measures are much researched and yet the concept is embroiled with contestations in scholarly discourse. Despite the controversies there is no easy escape from the citation benchmark as of now. We also have to be cognizent that citation and impact are products of commercialization of scholarly publishing. Pursuit of knowledge is only a part of this venture.

For the western science citation as a proxy for quality has certain convenience. However, from what we see in Leiden Manifesto (http://www.leidenmanifesto.org/) and San Francisco DORA (https://sfdora.org/) there is resistance to it. All the while citation studies pointing to its lack of consistent results indicating that citation impact could at best be a 'school of thought'. All the same cost of producing science, need for easy criterion for academic evaluation, and also publisher interest have continued the citation narrative.

Citation to scholarly publications is a 20th century phenomenon. Assessing the quality of science contributions through citations, consequently, is a new paradigm. Popularity and acceptance of citations as indicators of quality is reflective of Thomas Kuhn's argument that scientists' view of reality not only contain subjective elements but result from group dynamics, revolutions' in scientific practice and changes in paradigms (Kuhn, 1962). As Khun mentions 'Paradigm debates are not really about relative problem solving ability, though for good reasons they are usually couched in those terms.'

Bibliometric analysis based on citations is rooted in positivist methods. In positivist worldview science was seen as the way to get at truth, to understand the world well enough, so that we might predict and control it. The positivists believed in empiricism – the idea that observation and measurement as the core of the scientific endeavor. Eugene Garfield engaged in citation analysis as a predictive tool (Garfield & Malin, 1968). He also engaged with his distractors who were soon to appear on the horizon discrediting the method and observations with equally strong arguments. The distractors took the post-positivist or constructivist methods. They believed that we each construct our view of the world based on our perception of the world. Studies conducted on the scientists as participant observers (Latour & Woolgar, 1979; Latour, 1987) have given us the nuanced understanding of how the citations work while writing, and also how the scientists choose to publish in a certain journal as against the others in the pecking order.

Knowledge and reality are actively created by social relationships and interactions, social constructivists would contend. These interactions also alter the way in which scientific episteme is organized. The reality is constructed through human activity. Members of a society together invent the properties of the world (Kukla, 2000). For the social constructivist, reality cannot be discovered: it does not exist prior to its social invention. And, knowledge is also a human product, and is socially and culturally constructed (Ernest, 1999; Gredler, 1997; Prawat & Floden, 1994). Individuals create meaning through their interactions with each other and with the environment they live in. Learning is a social process. It does not take place only within an individual, nor is it a passive development of behaviors that are shaped by external forces (McMahon, 1997). Power plays an exaggerated role in the production of knowledge and consciousness (Kincheloe, 2001, 2005, 2008).

Constructivists primarily differ at the level of ontology rather than at the level of epistemology. They believe that there is an external reality, as they accept reality as a construct of human mind. Therefore, reality is perceived to be subjective. This plays out in the citation studies context in terms of choosing 'A' over 'B' to cite, or journal 'A' over 'B' to publish in. This value judgement by peer reviews and even editors (for desk rejection) has many examples. One near home being the journal Science's rejection of paper on the discovery of water on moon by ISRO scientists, till it was later confirmed by NASA instrument on Chandrayaan (Sarkar & Ahmed, 2020). When what is cited – the basic data in citation analysis – come with this value judgement, the conclusion based only on the analysis of citations could be suspect to that extent.

Being part of the Scopus (or WoS) database is important for citations. Journals included in Scopus are controlled by the publishers. Citations to the documents, which are not part of Scopus journal base, by the CitableDocs of Scopus indexed journals are excluded from the database. Thus, the database gives no scope for full understanding the impact of scholarly contribution, if 'they' are not part of the Scopus select universe. In this way the CitableDocs and the TotalCites make an 'exclusive club'.

CitesPerDoc depends mostly on SJR. As we know SJR is prestige or brand image of the journals. This prestige is a construct of the scholars themselves. The chances of an average journal (included in Scopus) from a developing country being in the top of this 'prestige' heap is not feasible and so higher CitesPerDoc from the CitableDocs in the journals from developing country like India is very less probable. In 2018, among the 4,533 Scopus indexed journals, which had SJR one or more, Brazil owned 4, China 25, India 3, Mexico 1, and Turkey 0. These are the countries which are in the middle and lower income bracket. To contrast this journals from the US in this category were 1773 (28.55% of the US total); the UK 1502 (27.39%); Switzerland 120 (23.30%); Netherlands 719 (34.72%); Germany 256 (15.88%). We have to understand that these journals are the products of the local research culture, and this culture sets the standards for science.

Constructivist proposition is also established with the statistically significant influence of GDP (PPP) per capita and R&D expenditure per capita of the countries on CitesPerDoc, examined in the analysis. On both the criteria developing countries score low.

The analysis of data on immunology in the study also holds this out clearly. The chances of contributions with international collaboration getting cited is less for Indian publications falling in this category. The analysis also holds out that even when Indian contributions appear in the journals of broadly overlapping SJR categories the citation accrual is significantly less. This trend supports the social constructivist argument of citations, as against the normative theory.

If Indian scientific contributions need such a recognition we need to work hard in multiple fronts of economy, as CitesPerDoc is a function of higher GDP(PPP) per capita, as also greater expenditure on Research and Development. It is only then we can enter the elite club. Without that even publications in higher SJR would run short on this.

The question is whether we can make a good scholarly contribution in the context of low investment or from the less developed countries? Though it is theoretically possible, chances of them getting cited is low as the analysis from the Scopus data suggest. The analysis of data on immunology in the present research holds this out clearly. The chances of contributions with international collaboration getting cited is less for Indian publications falling in this category. The analysis also holds out that even when Indian contributions appear in the journals of broadly overlapping SJR categories the citation accrual is significantly less.

However, given the lukewarm acceptance of Indian scholarly publications as demonstrated in the analyses, the appropriate question could be how does it serve our science and what the society looks from such pursuits. The analysis shows that there is a pecking order among the journals and author affiliations. The source and also the contributions of some countries are preferred in citation terms than the others suggest the play out of social constructivist view of knowledge growth and citation practice. In that scheme of things both Indian citable documents and Indian journals do not figure prominently. It is so across the subjects. In such a context perhaps promotion of wider local science base and generating locally relevant knowledge needs priority, apart from engaging with contemporary science and technology in general. Nonetheless, this has to be approached strategically with a longer term perspective. As we are engaged in that we have to acquire the best practices in scholarly journal management, among others.

We may consider the following in the light of the study outcome:

Our science policies have aimed at making India one of the top five in science output. There has been significant improvement in our science publication ranking over the years. Further improvement in the ranking is possible by broad basing the acceptable science contributions through channels for such output than going by the citation impact. Citation indices have their own limitations and business interests. Our national yardstick need not abide by them only.

Broad basing and accommodating our contributions has to be approached strategically. Though the country has sufficiently large number of journals in different disciplines they do not measure up to the expected standards. There is a need to equip our journals and develop the required skills among those who manage them. At present journal editing is often pursued largely as an add on job among the academics. The required skills, including design and marketing aspect, are often found wanting. Improvement on this front to match with the established journals has to go with sufficient investment in skill development through specialized programmes, and also opportunities to pursue with the newly acquired skill as a career.

We have to evaluate our journals, handhold their improvement, and enhance their acceptability. In fact, while doing so, our journals can pre-empt the expected changes in the citation world. At present a citation is a blunt instrument without any indication of author's intent in citing. There have been suggestions to improve the value of citations by 'typing' them in a structured way. One such initiative is

CiTO, the citation typing ontology (shotton, 2010). CiTO defines 23 relationships between citing and cited document, including 10 distinct factual relationships and 13 rhetorical relationships, under sub-heads positive, negative, and neutral. It also defines several sub-classes. Authors and journals adopting suggested structural process would help understanding the citation impact better. Similarly Brand et al. (2015) define 14 contributor roles in their CRediT taxonomy, including conceptualization, methodology, validation, investigation, data curation, writing, visualization, project administration, etc. Scholarly impact would gain greater authenticity with these improvements.

There is a need for our policy makers to get acquainted with science evaluation through citations and the like. The need for such knowledge has also been emphasized by Balaram (2013) in his Current Science editorial. Absence of the required understanding could be seen in NIRF ratings where varying weights are assigned to institutional contributions getting indexed in Web of Science, Scopus, Google Scholar, etc. (https://www.nirfindia.org/Docs/Ranking-Framework-for-Managment-Institutions.pdf). Varying weights are not meaningful in the context, so also merely counting our contributions indexed in Scopus or WoS. The journal inclusion policy of these sources is guided by the publisher interests and the associated citations confine to the selected sources only. At present Indian contributions cited by contributions in journals not listed by Scopus do not get any credit.

Lingua franca of scholarly publication is English. Though academic scholars are usually well versed with the language, our idiom and diction are usually not comparable to the native speakers. There are not many programmes on scholarly writing in the country. Potential scholars need to be trained sufficiently in ideation and writing skills to compete in the contemporary world of scholarship.

Scholarly research and output needs public funding. Currently several agencies under union and state governments provide grand-in-aid for such efforts. Evaluation for such support could include the publication record. Currently the available indices of national contributions are limited and not publicly accessible. A crowd sourced central database of publications from the scholars seeking research funding may be encouraged. Records of such a database can also come of use for categorizing scholars into different levels. In doing so we have to take a careful look at the evaluation practices like Sistema Nacional de Investigadores (National System of Researchers) adopted by Mexico as the country's main instrument for stimulating competitive research in science and technology. SNI is a cornerstone of the higher education system in Mexico, and is authorized to rank both research and researchers.

In pursuing 'Scopus indexed' and over emphasizing the citation impact we may lose out on the scholarly contributions with a local idiom and also those that address our local concerns. In the short term we may emphasize on scholarly productivity, expand the science base through higher budget allocations, and adopt measures that would bring in public scrutiny, accountability of scholarly contributions, short of citations.

Topics for further research:

The following are the topics we may explore further:

- Adoptability of alternative measures to grade academic researchers, such as National System of Researchers (SNI) in Mexico.
- Comparative study of articulation of research output and technical writing styles of Indian researchers and others who have greater citation impact.
- Innovativeness of researchers in science and technology

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