DECIPHERING CITATION INDICES: IMPLICATIONS FOR ASSESSING RESEARCH QUALITY IN MANAGEMENT

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Abstract:
Background- Effective measurement of impact has been the most important criterion to evaluate the quality of research. Unfortunately, less focus has been given towards assessing and improving the quality of research by academicians, universities, government regulatory bodies and industry professionals especially in the field of management. The evaluation of quality of the research has a significant role on applicability and implementation of research findings. The evaluation of quality of the research has a significant role on applicability and implementation of research findings.
Objective-This research has made an attempt to understand various citation indices which are determinant of quality research. The objective of this paper is to provide the detailed understating of quality parameters to be considered while evaluating and writing research proposals to increase the acceptability and applicability of research to society at large. Additionally, impact of international collaboration (IC), Journal Impact Factor (JIM), Author's Prior Publication Success (APPS) is tested against the H Index (HI).
Methodology- The research is descriptive Primary and secondary in nature. The research methodology included a sample of 204 researchers from Mumbai's management education sector, employing regression analysis to explore variable relationships.
Results- The findings highlight the pivotal roles of international collaboration, journal impact factor, and author's prior publication success in bolstering the h-index, while publication length's impact on citation count appears negligible. Overall, factors such as journal impact factor, article length, self-citations, and prior publication success contribute to citation indices' assessment.

Key Words:
Research, Citation, Index, Quality Measures, Citation Database, Quantitative, Indices

1.1 Introduction-

Powerful estimation of effect of research has been the main model to assess the nature of exploration. Lamentably, less focus has been given towards evaluating, improving the nature and quality of research by researchers of different segments of the society. The focus of business education has become increasingly circumscribed-less and less relevant to the practitioners. (Harvard business Review, May 2005). There is the intense need to increase the awareness of the value of rigorous research. Business schools in India are growing rapidly. However, if they have to make meaningful contributions to business education, research and practice, they must be rooted in high quality research that is indigenous in its promptings and directions. Research must provide cutting-edge knowledge and methods and valid indigenous conceptual frame, theories to guide practice and also to create a vibrant research community. Few will disagree that the state of current management research is quite dismal. Researchers in India replicate the research practices that are already been established in the west (Naresh Khatri, Abhoy Ojha, Management research in India, IIMB business review, 2012). It has been realized that there is a need to create an awareness of various measures adopted by different citation databases with which the impact and quality of research is assayed. Changing Technology, Industry 4.0, Education 4.0 created need for research institutions been instrumental in bringing about a sea change in the individuals, societies and nations.

1.2 Literature Review:

In 1960, Eugene Garfield's Institute for Scientific Information (ISI) presented the first citation index for papers published. Among citation indices, Science Citation Index (SCI), and later the Social Sciences Citation Index (SSCI) and then Arts and Humanities Citation Index (AHCI) are the best known. Automated citation indexing was presented first by CiteSeer in 1997.

Julian Warner (2000) observed weak correlation between citation analysis and research quality of contributions by researchers. The research rejected the proposal of replacing peer review by citation analysis. The research advocated the combination of methods for assessing the quality of research work [1]. Brinn, T., Jones, M. J., & Pendlebury, M. (2000) in their research cited a survey of UK accounting Academics saying that researchers perceive peer reviews, more important than citation indices [2].

Kostoff, R. N. (2002) suggested components for credible citation analysis of research quality of different team of researchers contributed in similar area of research. The research initiated the need of process for comparison of team out with normalization base of similar papers. Today, filed waited citation index (FWCI) is used to measure quality of research in similar areas. The h-index was developed by J.E. Hirsch and published in Proceedings of the National Academy of Sciences of the United States of America 102 (46): 16569-16572 November 15 2005 which reflected the productivity of authors based on their publication and citation records. Nieminen, P., Carpenter, J., Rucker, G., & Schumacher, M. (2006) concluded that quality measures and appropriate statistical analysis are not associated with number of citations in case of medical science research. Journal in which the study is published, it's credibility and identity are as important as statistical reporting [4]. Metric based research assessments are more common among Library and information science practitioners [5]. Citation counts are correlated with citation performers and do not significantly correlate with number of authors [6]. Ale Ebrahim, N., Salehi, H., Embi, M. A., Habibi, F., Gholizadeh, H., Motahar, S. M., & Ordi, A. (2013) suggested different techniques and ideas to increase citation count of the research. Researchers Pasterkamp, G., Rotmans, J., de Kleijn, D., & Borst, C. (2007) proved that citation frequency is significantly influenced by geographical origin of research articles. This research also criticized inclusion of self-citation which misguides research impact. Self-citation practices later on were criticized in many researches and hence citation data base such as scopus and web of science initiated calculating citation impact without considering self-citation. Journal's Impact Factor, Length of research article, Journal's self-citation, Author's Prior publication success affects citation Index [9]. These factors were presented by researcher Vanclay, J. K. in 2013 in his research paper which has received 101 citations as per Google Scholar and 59 citations as per Scopus database record. Work presented by Kostoff, R. (1998) is considered to be a major contribution with 276 citations till 2021 and concludes that Reference to intellectual contribution could be positive or negative and also involves systematic bias such as 'Pied Piper Effect'. Todd, P. A., & Ladle, R. J. also supported this research with similar findings in year 2008. Reference analysis is probably going to be most dependable when information is totaled and at the exceptionally referred to end of the circulation [14]. We can find that although these facts were known since long, dependency of citation database on reference analysis as quality assessment remained unaffected in addition to the development of few indices such as m-index, Field waited citation index, citation per capita and international collaboration. Franceschini, F., Maisano, D., & Mastrogiacomo, L. (2015) presented methodology for comparison of research publications taking in to consideration of omitted citations. This research needs significant attention of citation databases as it also reveals Type I error possibility of data bases while calculation of citation index. Expanded utilization of citation indicators in research assessment and subsidizing may infer less consideration regarding these other exploration quality measurements, like strength/credibility, innovation societal value and cultural worth [16]. Research assessment ought to rather zero in on the interaction of how examination is led and boost practices that help open, straightforward, and reproducible exploration [17]. Thelwall, M., & Fairclough, R. (2015) concluded from their research that "The strength of the relationship estimated between citation counts and research quality metrics diminishes generously for sets of articles from various fields. The strength of the connection estimated between citation counts and research quality metrics is just precise for homogeneous arrangements of articles" [18]. Not a single citation indicator is predominant except for that the h-Index (which incorporates productivity of Journal) and Field waited citation Index (FWCI)-

which intends to standardization for field impacts, might be the best right now [19]. Papers that draw in excess of a perceptible yet field subordinate edge of references in the underlying time frame after distribution are typically among the top one & the most profoundly referred to papers for their field and year [20].

1.3 Key Citation Indices and their assessment-
1.3.1 Citation:
A citation is when one paper explicitly refers to another paper. There is indication in the text of the paper and full reference is given in the bibliography. E.g. (Tinker and Tailor, 1973). The process whereby the impact or "quality" of an article is assessed by counting the number of times other authors mention it in their work. In order to measure the impact of research conducted by the author, Data Bases calculate/count the numbers of times research is cited by others. For a detailed analysis of research impact of an particular author else publication done by the author, different data bases are searched to find our cited references in Web of Science, Scopus, Google Scholar. Citation is defined as "An intellectual reference to a published or unpublished source by quoting of a book, author or an existing publication in support of a fact." More precisely, a citation is an abbreviated alphanumeric expression (e.g. [Newell84]) embedded in the body of an intellectual work that denotes an entry in the bibliographic references section of the work for the purpose of acknowledging the relevance of the works of others to the topic of discussion at the spot where the citation appears. Generally, the combination of both the in-body citation and the bibliographic entry constitutes what is commonly thought of as a citation (whereas bibliographic entries by themselves are not).

1.3.2 h-index
The h-index was developed by J.E. Hirsch and published in Proceedings of the National Academy of Sciences of the United States of America 102 (46): 16569-16572 November 15 2005. It reflects the productivity of authors based on their publication and citation records. "A scientist has index h if h of his/her Np papers have at least h citations each and the other (Np-h) papers have no more than h citations each" (Hisrch 2005).

Example- An h-index of 25 tells us that an author has written 25 papers which have each been cited at least 25 times. A h-index of 20 means that an academic has published at least 20 papers that have received at least 20 citations each. The h-index thus combines an assessment of both quantity (number of papers) and an approximation of quality (impact, or citations to these papers). The h-index is a number intended to represent both the productivity and the impact of a particular scientist or scholar, or a group of scientists or scholars (such as a departmental or research group). Part of the purpose of the h-index is to eliminate outlier publications that might give a skewed picture of a scientist's impact. For instance, if a scientist published one paper many years ago that was cited 9,374 times, but has since only published papers that have been cited 2 or 3 times each, a straight citation count for that scientist could make it seem that his or her long-term career work was very significant. The h-index, however, would be much lower, signifying that the scientist's overall body of work was not necessarily as significant.

Different databases will give different values for the h-index. This is because each database must calculate the value based on the citations it contains. Since databases cover different publications in different ranges of years, the h-index result therefore varies. What is considered a "good" h-index may differ depending on the scientific discipline. A number that is considered low in one field might be considered quite high in another field. The h-index reflects not just the number of papers, or the number of citations; it has some indication of the number of well-cited papers. This provides an interesting complement to other performance metrics, since it is not influenced by a single highly-cited paper.The h-index, like any other citation-based metric, is dependent on the subject area considered, as well on as the time since publication of important works. The h-index in the Citation Report reflects citations as of the most recent database update, so it could vary upon subsequent analyses.

1.3.3 i10 index
i10 index refers to the number of papers with 10 or more citations. It was introduced in July 2011 by Google as part of their work on Google Scholar, a search engine dedicated to academic and related papers.It is the number of publications with 10 or more than 10 citations.

Example

If Publication 1 has 15 citations

Publication 2 has 7 citations

Publication 3 has 0 citations

Publication 4 has 11 citations

Publication 5 has 30 citations

Then i10 index would be…3; Because 3 of publications has reached or crossed 10 citations. Higher the index number, better the research profile.

However, it is restricted to Google Scholar and the scholar that one is looking for must have a Google scholar profile. i5 index is also calculated on the similar grounds.

1.3.4. g-index

Given a set of articles ranked in decreasing order of the number of citations that they received, the g-index is the unique largest number such that the top g articles received together at least g2 citations.

A g-index of 20 means that and academic has published at least 20 articles that combined have received at least 400 citations. However, unlike the h-index these citations could be generated by only a small number of articles. For instance, an academic with 20 papers, 15 of which have no citations with the remaining five having respectively 350, 35, 10, 3 and 2 citations would have a g-index of 20, but a h-index of 3 (three papers with at least 3 citations each). H-index Accounts for the performance of author's top articles. It helps to make more apparent the difference between authors' respective impacts. The inflated values of the G-Index help to give credit to lowly-cited or non-cited papers while giving credit for highly-cited papers and debate continues whether g-Index is superior to h-Index. Might not be as widely accepted as h-Index.

1.3.5 Average Number of Citations

The average number of citations per paper is calculated by dividing the total number of citations by the total number of papers. This can be a very useful metric to assess the average impact for a journal or author. However, it is only correct if you have carefully merged all stray citations into a master record and have unchecked all irrelevant publications.

1.3.6 International collaboration

Number of Papers with international collaborations. Designing and conducting international collaborative research provides opportunities to generate knowledge, enhance the external validity of research completed elsewhere, extend the range of applicability of existing research, and develop mutually beneficial relationships that can contribute to solving global problems. The underlying premise is that psychologists working with colleagues from other countries can accomplish more than those same people working apart. When such collaboration works, it creates synergy and fosters ways of addressing research questions, extending existing research to other populations, constructing meaning and drawing implications that would not have been otherwise possible. This also means that both partners optimize use of their resources and find solutions to intractable problems. At least this is the hope — and often the promise. Furthermore, the expectation is that the research would be mutually beneficial to stakeholders across national boundaries and facilitate sustainable solutions to world problems.

1.3.7 m-Index

In order to compare scientists at different stages of their career, Hirsch presented the "m parameter", which is the result of dividing h by the scientific age of a scientist (number of years since the author's first publication). The m-index is defined as h/n, where n is the number of years since first published paper of the scientist

1.3.8 The Field-Weighted Citation Impact

(FWCI) score comes from the Scopus database and shows how the article's citation count compares to similar articles in the same field and timeframe. A score of 1.00 means the article is cited as it would be expected, greater than 1.00 the article is doing better than expected, and less than 1.00 the article is underperforming. Field-Weighted Citation Impact (FWCI) is the ratio of the total citations actually received and the total citations that would be expected based on the average of the subject field. However, number of research papers in similar area is uncertain.

1.3.9 HG Index

hg-index is geometric mean of h and g index. This is to characterize the scientific output of researchers which is based on both h-index and g-index to try to keep the advantages of both measures as well as to minimize their disadvantages.

The hg-index of a researcher is computed as the geometric mean of his
h- and g-indices, that is:

1.3.10 A-Index

Jin12, a bibliometrician from China tried to solve the problem of not counting upon articles having a larger number of citation indicated by Egghe that high citations should be counted somehow. He tried to solve the problem by taking the mean of the citations of h papers of h-core. Therefore, the A-index is:

$$A = \frac{1}{h}\sum_{i=1}^{h} c_i$$

Where c_i is the citations of ith paper of h- papers arrangedknnnnnn, in descending order of citations. A-index is equal to h-index if all the cis are equal to h. Jim el al12 showed that $A > g > h$.

1.3 Research Methodology-

The research methodology employed a sample size of 204, drawn from researchers in management education based in Mumbai. Hypotheses were tested through regression analysis to investigate the relationships between key variables. Data collection involved obtaining information on international collaboration, journal impact factor, author's prior publication success, publication length, and citation count. Statistical analysis determined significant positive influences of international collaboration, journal impact factor, and author's prior publication success on the h-index, while publication length showed no significant correlation with citation count.

The research is descriptive primary and secondary in nature. Detailed literature review is conducted on highly cited and significant research papers from citation databases.

1.4 Hypothesis-

Hypothesis H1: International Collaboration (IC) positively influences h-Index (HI) as collaborative research tends to have broader impact and visibility.

Hypothesis H2: Journal Impact Factor (JIF) positively affects h-Index (HI), as research published in high-impact journals tends to garner more citations.

Hypothesis H3: Author's Prior Publication Success (APPS) positively influences h-Index (HI), as researchers with a track record of successful publications are likely to have higher h-index values.

Hypothesis H4: Publication Length (PL) is positively correlated with Citation Count (CC), suggesting that longer articles tend to attract more citations.

1.5 Analysis and Results:

Hypothesis	Coefficient	t-value	df	Sig. (2-tailed)	Result
H1 (IC → HI)	0.37500	4.16	204	0.0001	Accept
H2 (JIF → HI)	0.240	3.25	204	0.001	Accept
H3 (APPS → HI)	0.310	3.80	204	0.0003	Accept
H4 (PL → CC)	0.100	1.75	204	0.081	Reject

Source	Sum of Squares	df	Mean Square	F	Sig.

Regression	53.028	3	17.676	58.621	<0.001
Residual	48.302	200	0.242		
Total	101.330	203			

The regression analysis revealed significant findings regarding the relationships between the independent variables (International Collaboration, Journal Impact Factor, Author's Prior Publication Success, and Publication Length) and the dependent variables (h-Index and Citation Count).

Hypothesis H1 (IC → HI): The coefficient of 0.37500 with a t-value of 4.16 and a p-value of 0.0001 indicates a significant positive relationship between International Collaboration (IC) and the h-Index (HI). This suggests that collaborative research efforts contribute to higher h-index values, emphasizing the importance of cooperation in academic endeavors.

Hypothesis H2 (JIF → HI): With a coefficient of 0.240, a t-value of 3.25, and a p-value of 0.001, the analysis demonstrates a significant positive association between Journal Impact Factor (JIF) and the h-Index (HI). This implies that publications in high-impact journals are likely to lead to higher h-index values, highlighting the influence of journal prestige on academic recognition.

Hypothesis H3 (APPS → HI): The coefficient of 0.310, accompanied by a t-value of 3.80 and a p-value of 0.0003, indicates a significant positive correlation between Author's Prior Publication Success (APPS) and the h-Index (HI). This suggests that researchers with a history of successful publications tend to achieve higher h-index values, underscoring the importance of past academic achievements in predicting future impact.

Hypothesis H4 (PL → CC): The coefficient of 0.100, coupled with a t-value of 1.75 and a p-value of 0.081, reveals a non-significant relationship between Publication Length (PL) and Citation Count (CC). Consequently, this hypothesis is rejected, suggesting that the length of research articles does not significantly influence the number of citations received.

1.5 Conclusion

These results indicate that international collaboration, journal impact factor, and author's prior publication success have a significant positive influence on the h-index. However, publication length does not significantly correlate with citation count. Journal's Impact Factor, Length of research article, Journal's self-citation, Author's Prior publication success affects citation Index. Only Citation counts doesn't not indicate the impact of the research in terms of its utility and benefits to the society. Reference to intellectual contribution could be positive or negative and also involves systematic bias such as 'Pied Piper Effect'. Citation index for niche areas of research will always be less and FWCI standalone is not sufficient to conclude the quality of research in niche areas. Different citation data base calculates different citation numbers for same research. Oldest paper and authors will always have higher citations. Quality research ignored by group of researchers can remain ignored as more cited papers gets more citation and importance. Author citing another researcher may not agree with the findings, methods used and may have criticized the work. citation frequency is significantly influenced by geographical origin of research articles. Self-citation misguides the overall research impact in citation data base especially in Google Scholar. Well known citation data bases indicated poor citation record for the research conducted in the local language or specific research on culture, mythology and traditions.

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