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Research Article

Comparison among Selected Journal Quality Indicators of Mechanical Engineering Journals

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ABSTRACT

Objective: This paper investigated the possibility of advocating usage of SCImago Journal Rank (SJR), Eigenfactor Score and H5 index indicators as alternative to the Journal Impact Factor (JIF) for quality assessment in the field of mechanical engineering. Researchers and librarians concerns of methods of scientific journal ranking regarding publication language, analysis time and self-citation impact amongst other factors are addressed through suggested alternatives. **Method:** The SJR, ES, H5 index and JIF scores and ranking order of mechanical engineering journals were downloaded from the relevant websites. Pearson and Spear man's correlation coefficients were calculated to test linear and monotonic hypotheses for association between different journal quality metrics. Selected coefficients were adopted for assessing linear and monotonic relationships of chosen variables and ranking values, respectively. **Result:** A very strong positive correlation was found between the scores and ranking order based on the SJR, ES, H5 and JIF of selected journals. Hence, academics and researchers in mechanical engineering are encouraged to use the SJR, ES and H5 indicator as an alternative to JIF for evaluation and judgment of scientific journals in the area.

Keywords: Journal rank, Bibliometric indicators, Impact factor, SCImago indicator, Eigen factor score, H5-Index, Qs, Mechanical engineering journals.

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INTRODUCTION

Determination of the quality of research is an important factor for all the researcher, librarians and academicians. Qualities of the journals are mainly determined by various indicators such as Journal Impact Factor (JIF), Eigenfactor Score (ES), SCImago Journal Rank indicator (SJR) and H5-index indicator. Most acceptable parameter in scientific world is Journal impact factor (JIF) which was first given Eugene Garfield. This is the main quantitative measure of journal quality and calculated yearly by Institute for Scientific Information (ISI) which is now a part of Thomson Reuters.

The research work undertaken herein compares reputable journal research quality indicators accepted by scientific and academic communities for evaluation and judgment of scientific journals in the field of mechanical engineering. Indicators of value encompassed: Journal Impact Factor (JIF) and other bibliometric indicators that are employed to appraise quality ranking for journals using more algorithms that are complex and other databases.

Chosen journals were listed, and their associated information retrieved by mounting and matching their international standard serial number (ISSN). Efforts were made to use JIF, SJR and ES quality indexes for ranking and refereeing quality of mechanical engineering journals. All journals were evaluated regarding their JIF, ES, SJR and H5 index correlations between indices were reached through Pearson statistical correlation of SPSS software. All journals examined have the premier standard of quality as being indexed in pronounced and esteemed databases such as: Web of Science (WoS) and Scopus. JIF ranged between 16.784 to 0.045 ES varied between 0.01245 to as low as 0.00017, JSR oscillated between 8.176 and 0.131 and H5 dithered between 61 and 13. A high Pearson's (r) statistical correlation was observed between JIF and SJR indicators for journals in this category (r = 0.941), while it is moderate between JIF and H5 (r=0.639) and it went for a low value

Table 1: Bibliometric journal indicators at a glance.[2,3,4,5,6,7]

Factor definition	Method of detection and time window	Advantages and drawbacks	Availability
Impact Factor or Eugene Garfield[1] factor (IF): the recorded number of citations within a certain year (for to the items published in the journal during the two preceding years), divided by the number of such items (this would be the equivalent of the average citation rate of an item during the first and second calendar year after the year of publication[6]), or number of current citations to articles published in a specific journal in a two-year period divided by the total number of articles published in the same journal in the corresponding two year period.[8]	• Calculated annually by Institute for Scientific Information (ISI). • Uses two previous years.	✓ Most popular. ✓ Used extensively by leading journals in their advertising. • Inclusion of citations of articles those are not included in denominator of calculation formula (editorials, letters, etc.). • Analysis period of only 2 years. • Inclusion of self-citations. • Lack of evaluation of quality of origin of citation or risk of manipulation. • English language bias	
SCImago research laboratory Journal Rank (SJR) index	• Uses for its calculations citations from Scopus indexed journals for quality assessment, applying PageRank algorithm on Scopus database [Elsevier]. • Uses three previous years.	✓ Includes more journals. ✓ Covers a longer period for including citations (3 years). ✓ Limits self-citations. ✓ Weighs citations according to importance of journal where they were published, using an algorithm similar to that of Google PageRank ✓ A free open source product i.e. anyone can access it online. ✓ Emphasizes those sources that are used by prestigious titles. ✓ Allows ranking ones'own customized set of sources, regardless of their subject fields.	Freely available
Eigen factor score (ES): reflects both the number of citations and the prestige of citation source	• Ranks journals by an algorithm similar to that of Google's Page Rank using the Web of Science (WoS) indexed journals for quality assessment. • Uses five previous years.	✓ Reflects both number of citations and the prestige of citation source. • Assigns journals to a single category, making it more difficult to compare across disciplines. • Isn't much different than raw citation counts.	Freely available
H-index (h5-index and h5-median): Is the largest number h such that at least h articles in that publication were cited at least h times each? The h-core of a publication is a set of top cited h articles from the publication. The h-median of a publication is the median of the citation counts in its h-core. The h-median is a measure of the distribution of citations to the articles in the h-core.[11]	• Currently provided by Scopus, (WoS), and Google Scholar Citations.[12] • Uses Google Scholar Metrics.	✓ Provided by Scopus, Web of Science (WoS), and Google Scholar Citations.	

1. The founder of the Institute for Scientific Information (ISI).

between JIF and ES values (r = 0.470).Spearman's rho statistical correlation recorded a high correlation between JIF and SJR indicators for journals in Mechanical Engineering (coefficient value = 0.874) and correlation is rather moderate between JIF and both of H5 and ES rankings (coefficient values of 0.794 and 0.752, respectively).

The main objective of this study is to evaluate the currently published scientific journal in field of Mechanical Engineering (2015) with emphasis in terms of JIF, Eigenfactor Score (ES), SCImago Journal Rank indicator (SJR), and H5 index. Particular mechanical engineering journals were chosen from their category within Web of Science. The 2015 JIFs and ESs are

obtained from Journal Citation Report and the SJR and H5 index from the SCImago Journal and country rank website.

Literature review

Availing research material and findings to academicians, scientists, postgraduate students and researchers is of significance for credited research findings, citation implications, in-depth scholarly research work, advanced studies and extensive research fields or other basic sciences.

Research evaluation is of merit to different professional societies, individual scientists and researchers, scholarly institutions, funding organizations, technical enterprises, academic librarians and authors while targeting reputed journals for publication.[1] Prestigious mechanical and energy engineering scientific journals must satisfy research publishing quality criteria. Such criteria usually are measured through scientometrics tools. Use of bibliometric indicators in the evaluation of research and scientific journals has its pros and cons.as to be discussed. Currently used bibliometric and scientometrics indicators include: journal impact factor (JIF), Eigen factor Score (ES), and SCImago Journal Rank indicator (SJR). Table 1 gives an overall summary as related to these indicators.

Guerrero-Bo tea, and Moya-Anegónb,[9] suggested a new size-independent indicator of scientific journal prestige, the SJR indicator. This indicator takes into account not only the prestige of the citing scientific journal but also its closeness to the cited journal using the cosine of the angle between the vectors of the two journals' co-citation profiles.

Several parameters affect the number of citations of a journal. These elements incorporate: journal history, journal's indexing in an accredited database, rate of international cooperation, and country of publication.[10,4]

Objectives of the study

In this study, the quality metrics and factors of mechanical engineering specific journals were compared. The main objective of this research work was to identify database coverage of mechanical engineering journals in Scopus and Web of Science and to compare and assess the bibliometric factors of mechanical engineering journals as per JIF, ES, SJR and H5 indicators. Various research articles of different research groups have been discussed in this article and attempts were made to compare the reputation of journals in terms of JIF, ES, SJR and H5 indicators. These citation impact indicators are key factor to judge the quality of most reputed journals within all reviewed mechanical engineering journals.

MATERIALS AND METHODS

Certain Mechanical Engineering journals were chosen and used for this research work. Relevant information was extracted from their source databases as derived from the journal ranking section of SCImago journal and country ranking website.[1] and from Web of Science[2] (WoS) Core Collection official website and citations. ISI indexed journals were used for computation of potential impact factor. The 2015 JIFs and ESs were obtained from Journal Citation Report® (JCR) through WoS. The 2015 SJR and H5 indicators, provided by the SCImago Journal and country rank provided by Scopus and Google Scholar Citations (GSC) metrics under the category of "Mechanical engineering". Journals with JIFs and ESs were tabulated and information regarding their ranking in the SJR indicator list was retrieved by matching their international standard serial number (ISSN). Likewise, journals with the SJR indicators also were listed and their ranking was detected in the inventory of journal JIFs.

The ranks of each journal according to each metric were also provided and compared statistically. The correlations between the extracted indices were evaluated using Pearson's and Spearman's correlation coefficients. In general, Pearson correlation calculates the linear relationship between two continuous variables while Spear man's correlation calculates the monotonic relationship between two continuous or ordinal variables. Both coefficient values can be in range from −1 to +1. For example, if variables of data are increasing by consistent value and form a perfect line then both coefficient values will be +1 but if both variable are increasing with inconsistent vales then Pearson coefficient will be positive but less than +1. On the other hand, Spearman's coefficients remain same. But in case of random or non-existent value both coefficients will nearly be zero but while getting a perfect line with decreasing relationship value both coefficients will be represented as negative (−1) value. All analysis was conducted using Statistical Package for the Social Sciences (SPSS) 21.0, version 2012.

RESULTS AND DISCUSSIONS

Ranking of the journals according to all four indices (IF, ES, SJR and H5) were matched and compared. Correlations between indices were evaluated using Pearson and Spear man's correlation. All analyses were performed using SPSS 21.0 version 2012. In overall, 131 journals were listed and identified with mechanical engineering as the specific scope and focus. All selected journals were indexed in ISI and Scopus together with rankings of the mechanical engineering journals according to SCImago, IF, and ES in 2015. Table 2 reflects the ISI and Scopus indexed information in the 131 picked mechanical engineering journals.

Detailed information for each journal is summarized in Table 2 clearly shows that none of the selected mechanical engineering

1 At http://www.scimagojr.com/

2 At http://www.accesowok.fecyt.es/

Table 2: Comparative rankings of Mechanical Engineering journals by 2015 JIF, ES, SJR and H5.

	Journal Impact Factor		Eigenfactor score		SCImago Journal Rank		H5-Index	
Journal	Value	Rank	Value	Rank	Value	Rank	Value	Rank
PROGRESS IN ENERGY AND COMBUSTION SCIENCE	16.784	1	0.01245	13	8.176	1	57	2
INTERNATIONAL JOURNAL OF PLASTICITY	5.623	2	0.01752	7	4.694	2	52	7
COMBUSTION AND FLAME	4.168	3	0.02625	3	3.12	3	56	3
PROCEEDINGS OF THE COMBUSTION INSTITUTE	4.12	4	0.01709	8	2.796	4	51	9
IEEE-ASME TRANSACTIONS ON MECHATRONICS	3.851	5	0.01217	14	2.305	6	52	7
INTERNATIONAL JOURNAL OF MACHINE TOOLS and MANUFACTURE	3.315	6	0.00787	23	2.746	5	40	13
APPLIED THERMAL ENGINEERING	3.043	7	0.03213	2	1.718	12	54	6
NONLINEAR DYNAMICS	3	8	0.01922	5	1.511	17	50	10
WIND ENERGY	2.891	9	0.00557	35	1.236	29	36	18
INTERNATIONAL JOURNAL OF HEAT AND MASS TRANSFER	2.857	10	0.04695	1	1.749	11	61	1
JOURNAL OF SANDWICH STRUCTURES and MATERIALS	2.852	11	0.00111	83	1.392	22	14	88
Advances in Applied Mechanics	2.833	12	0.00076	95	0.801	53	55	4
MECHANICAL SYSTEMS AND SIGNAL PROCESSING	2.771	13	0.01589	10	1.887	9	55	4
INTERNATIONAL JOURNAL OF THERMAL SCIENCES	2.769	14	0.01617	9	1.665	14	50	10
INTERNATIONAL JOURNAL OF IMPACT ENGINEERING	2.646	15	0.00747	24	1.976	7	33	25
International Journal of Precision Engineering and Manufacturing-Green Technology	2.545	16	0.00032	117	1.316	26	27	38
INTERNATIONAL JOURNAL OF MECHANICAL SCIENCES	2.481	17	0.01123	17	1.464	20	33	25
Nano scale and Micro scale Thermo physical Engineering	2.39	18	0.00086	93	0.836	47	0	127
WEAR	2.323	19	0.01794	6	1.552	15	38	15
INTERNATIONAL JOURNAL OF REFRIGERATION-REVUE INTERNATIONALE DU FROID	2.291	20	0.00841	21	1.421	21	38	15
JOURNAL OF AEROSOL SCIENCE	2.278	21	0.00618	30	1.702	13	27	38
TRIBOLOGY INTERNATIONAL	2.259	22	0.0138	11	1.467	19	36	18
Archives of Civil and Mechanical Engineering	2.194	23	0.00219	62	0.94	40	22	52
INTERNATIONAL JOURNAL OF FATIGUE	2.162	24	0.01164	15	1.784	10	34	24
EXPERIMENTAL THERMAL AND FLUID SCIENCE	2.128	25	0.01149	16	1.389	23	40	13
JOURNAL OF SOUND AND VIBRATION	2.107	26	0.02296	4	1.494	18	43	12
THEORETICAL AND APPLIED FRACTURE MECHANICS	2.025	27	0.00211	63	0.835	48	17	68
AEROSOL SCIENCE AND TECHNOLOGY	1.953	28	0.00876	19	1.922	8	32	28
JOURNAL OF MICROELECTROMECHANICAL SYSTEMS	1.939	29	0.00834	22	0.847	45	31	30
International Journal of Mechanics and Materials in Design	1.926	30	0.00108	84	0.835	48	13	91
MECHATRONICS	1.871	31	0.00553	36	1.019	37	35	22
DRYING TECHNOLOGY	1.854	32	0.00415	40	0.67	67	28	35
FATIGUE and FRACTURE OF ENGINEERING MATERIALS and STRUCTURES	1.838	33	0.00361	45	1.185	30	22	52
TRIBOLOGY LETTERS	1.758	34	0.00859	20	1.051	34	31	30
INTERNATIONAL JOURNAL OF HEAT AND FLUID FLOW	1.737	35	0.00718	26	1.131	32	28	35
JOURNAL OF HEAT TRANSFER-TRANSACTIONS OF THE ASME	1.723	36	0.01018	18	1.024	36	35	22
JOURNAL OF FLUIDS AND STRUCTURES	1.709	37	0.00721	25	1.282	27	31	30
MECHANISM AND MACHINE THEORY	1.689	38	0.0061	31	1.264	28	33	25
JOURNAL OF VIBRATION AND CONTROL	1.643	39	0.00544	37	0.667	68	36	18

Key: NA = Not available.

Table 3: Bivariate correlation between four indicators for ranking of mechanical engineering journals.

Correlation statistic	Coefficient value	Sig.
Pearson's r between JIF and ES values	0.470	.000
Pearson's r between JIF and SJR values	0.941	.000
Pearson's r between JIF and H5 values	0.639	.000
Spearman's rho between JIF and ES rankings	0.752	.000
Spearman's rho between JIF and SJR rankings	0.874	.000
Spearman's rho between JIF and H5 rankings	0.794	.000

journals had the same ranking to compare different indicators in all four classifications and metrics indices. All the analyzed journals have the highest standard of quality since they are indexed in the two most prestigious and reputable databases, WoS and Scopus.

The 131 selected journals were categorized with mechanical engineering as the specific scope and concentration. All journals were indexed in WoS and Scopus databases. In form of JIF the most cited top three journals were Progress in energy and combustion science (JIF 16.784), International journal of plasticity (JIF 5.623) and Combustion and flame (JIF 4.168). These journals were closely followed by Proceedings of the combustion institute (JIF 4.12). In contrast, the lowest citations were scored by Tribology and lubrication technology (JIF 0.082) and Sound and vibration (JIF 0.045).

As per Eigenfactor Score the journals that ranked top three (3) ones were International journal of heat and mass transfer (ES 0.04695), Applied thermal engineering (ES 0.03213)and Combustion and flame (ES 0.02625). Tail of ES is recorded for Advances in vibration engineering (ES 0.00007) and Isi bilimi ve teknigi dergisi-journal of thermal science and technology (ES 0.00008).

SJR indicator incidentally coincided with JIF for ranking top three (3) Progresses in energy and combustion science (SJR 8.167) International journal of plasticity (SJR 4.694) and Building and Combustion and flame (SJR 3.12). Likewise, Sound and vibration concluded tail of list (SJR 0.131).

H5-indexfor ranking top three (3) journals recorded for International Journal of Heat and Mass Transfer (H5 = 61), Progress in Energy and Combustion Science (H5 = 57) and Combustion and Flame (H5 = 56).

Table 3 displays a bivariate correlation between the four (4) indicators (JIF, ES and SJR) for ranking of Mechanical Engineering journals. As shown in Table 3 there is a high Pearson's (r) statistical correlation between JIF and SJR indicators for journals in this category (r = 0.941), while it is moderate between JIF and H5 (r=0.639) and it went for a low value between JIF and ES values (r = 0.470). With respect to Spearman's rho statistical correlation a high correlation existed between JIF and SJR indicators for journals in Mechanical engineering (coefficient

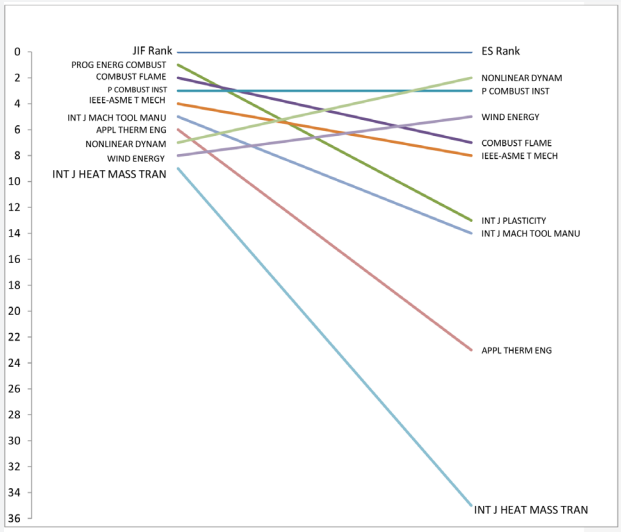

Figure 1: Bump chart for top 10 JIF ranked Mechanical Engineering journals in comparison with ES ranking.

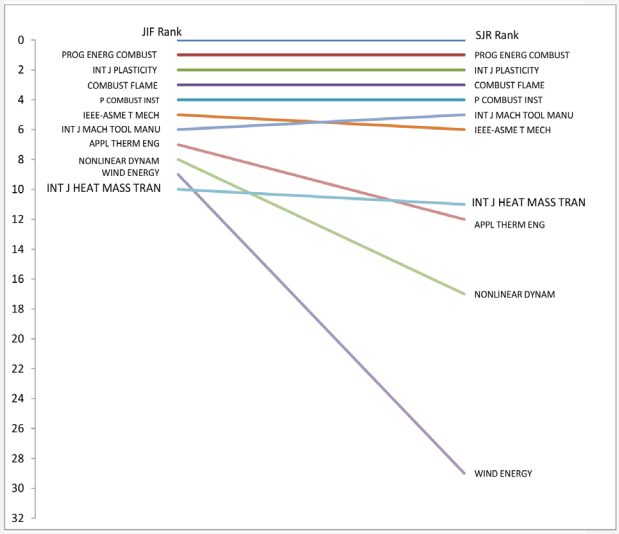

Figure 2: Bump chart for top 10 JIF ranked Mechanical Engineering journals in comparison with SJR ranking.

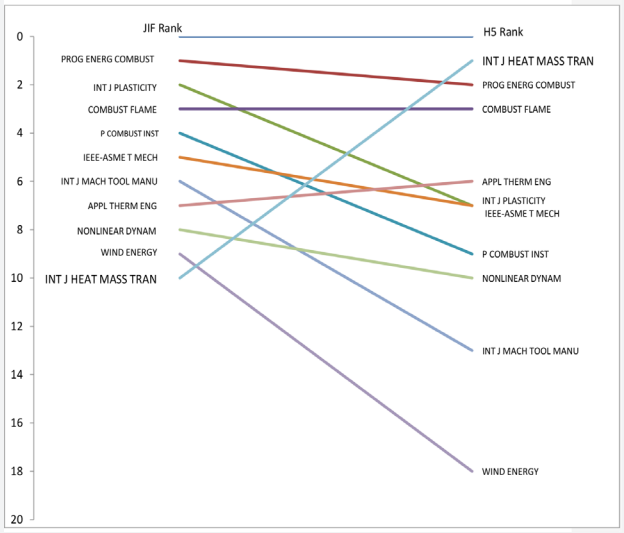

Figure 3: Bump chart for top 10 JIF ranked Mechanical Engineering journals in comparison with H5 ranking.

value = 0.874) and correlation is rather moderate between JIF and both of H5 and ES rankings (coefficient values of 0.794 and 0.752, respectively).

Gathered research data and information revealed that use of the SJR index does not remarkably modify the system classification of journals compared to the JIF or its method of computation. Since SCImago Journal and Country Rank is free access, this suggests that both SJR and H5 may be considered alternative to the JIF. This finding is in agreement with García-Pachónand Arencibia-Jorge [2014] and Ahmed, *et al*. [2016].

Figure 1 Shows a bump chart for top ten JIF ranked mechanical engineering journals in comparison with ES ranking. The Figure clearly depicts the changing pattern of both indicators for the selected mechanical engineering journals. Applied Thermal Engineering and International Journal of Heat and Mass Transfer paraded the highest variations among this clan.

Figure 2 Illustrates a bump chart for top ten JIF ranked mechanical engineering journals in comparison with SJR ranking. The Figure clearly describes the changing features of both indicators for the selected mechanical engineering journals. Nonlinear Dynamics journal and wind energy journal displayed the premier disparities among this set of portrayed journals.

Figure 3 Demonstrates a bump chart for top ten JIF ranked mechanical engineering journals in comparison with H5 journal ranking. The Figure clearly designates the varying features of both indicators for the selected mechanical engineering journals. International Journal of Machine Tools and Manufacture journal and wind energy journal presented the leading discrepancies among this group of tested journals.

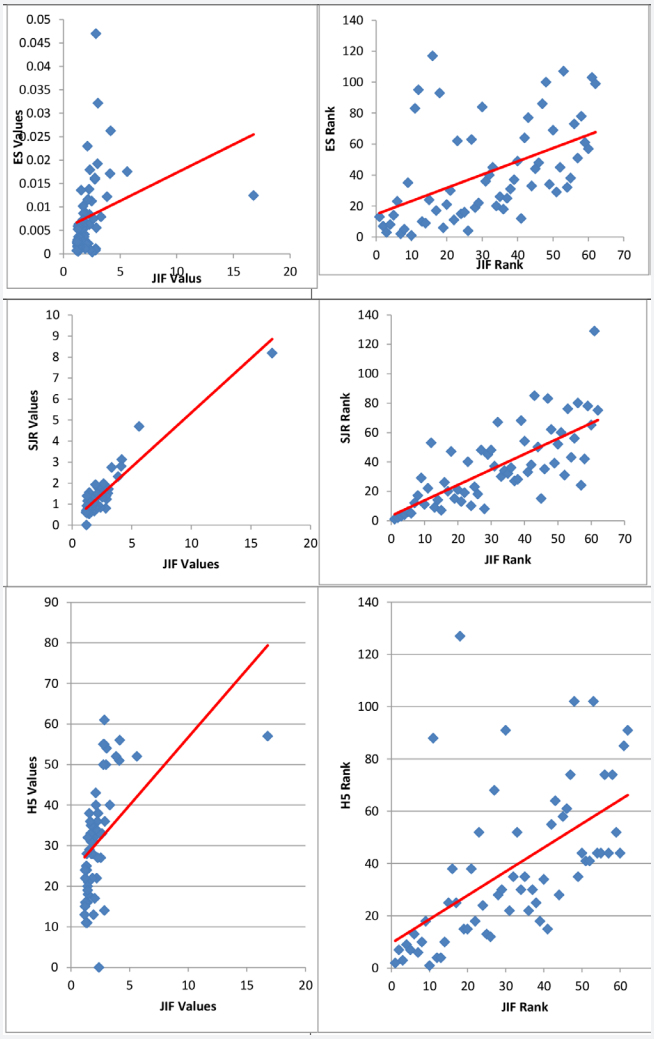

Figure 4: Scatter plots showing correlation between JIF, ES, SJR and H5 Index (values and rankings) as well as their fit lines for 70 mechanical engineering journals.

Figure 4 reveals a scatter plots showing correlation between JIF, ES, SJR and H5 Index (values and rankings) as well as their fit lines for the selected mechanical engineering journals. Direct correlation between JIF and ES, and JIF and SJR (values and rankings) indicates strong possibility of better journal assessment. While ranking signified a clear linear relationship, values between indices were not as clear.

CONCLUSIONS

From this research study for the four (4) mechanical engineering bibliometric research quality indices (JIF, SJR,ES and H5), the Journal Impact Factor (JIF) was found to be the main index used by researchers for ranking the mechanical engineering journals. Since several drawbacks inherit upon sole usage of JIF, both SJR and ES could be more accurate quality indexes for mechanical engineering journals. In this study, Pearson's and Spearman's statistical correlations coefficients

were successfully applied to know the relationship between the variables. Due to high Pearson's and spears man's statistical correlations between JIF and SJR indicators the use of such a combination can elevate credibility of journal assessments. All journals were indexed in WoS and Scopus databases. JIF ranged between 16.784 and 0.045, ES varied from 0.01245 to as low as 0.00017, JSR oscillated between 8.176 and 0.131and H5 dithered between 61 and 13 for the studied 131 mechanical engineering journals. A high Pearson's (r) statistical correlation was observed between JIF and SJR indicators for journals in this category (r = 0.941), while it is moderate between JIF and H5 (r=0.639) and it went for a low value between JIF and ES values (r = 0.470). Spears man's rho statistical correlation recorded a high correlation between JIF and SJR indicators for journals in mechanical engineering (coefficient value = 0.874) and correlation is rather moderate between JIF and both of H5 and ES rankings (coefficient values of 0.794 and 0.752, respectively). Therefore, it would be great impact to use these four (4) recommended indices when assessing quality of mechanical engineering or other journals. These citation and impact factor indices would be of paramount importance for librarians, researchers, academicians, authors and mechanical engineers a like when pursuing prestigious journals for publishing their future works.

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CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

ABBREVIATION USED

JIF: journal impact factor; ES: Eigen factor Score; SJR: SCImago Journal Rank; ISSN: International Standard Serial Number; WoS: Web of Science; ISI: Institute for Scientific Information; GSC: Google Scholar Citations; SPSS: Statistical Package for the Social Sciences.

SUMMARY

The main objective of this study is to evaluate currently published scientific journals in the field of Mechanical Engineering using JIF, Eigen Score (ES), SCImago Journal Rank (SJR), and H5 indexes. Particular mechanical engineering journals were chosen from their category within Web of Science. Related JIFs and ESs are obtained from Journal Citation Report and the SJR and H5 index from the SCImago Journal and country rank website. Availing research material and findings to academicians, scientists, postgraduate students and researchers is of signifi¬cance for credited research findings, citation implications, in-depth scholarly research work, advanced studies and extensive research fields or other basic sciences. In this study, the quality metrics and factors of mechanical engineering specific journals were compared. The main objective of the research work is to identify database cover¬age of selected journals in Scopus and Web of Science and to assess bibliometric factors as per JIF, ES, SJR and H5 indicators. Ranking of the journals according to all four indices (IF, ES, SJR and H5) were matched and compared. Correlations between indices were evaluated using Pearson and Spearman's correlation. All analyses were performed using SPSS 21.0 ver¬sion 2012. In overall, 131 journals were listed and identified with mechanical engineering as the specific scope and focus.

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Highlights:

The mechanical Engineering Journals are important to users for research publications.

A high Pearson's (r) correlation was observed between JIF and SJR indicators.

It was moderate between JIF and H5 and, it went low between JIF and ES values.

Spearman's rho correlation recorded a high value between JIF and SJR indicators.

Endnotes:

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