DESIDOC Journal of Library & Information Technology, Vol. 41, No. 1, January 2021, pp. 37-41, DOI : 10.14429/djlit.41.1.16670

Impact of Expanding Window from Three Years to Five Years for Research Performance Parameter in India Rankings

J P Singh Joorel[#,*], Hiteshkumar Solanki[#], Abhishek Kumar[#], Dharmesh Shah[#], Raja V[#], Kruti Trivedi[#], Pallab Pradhan[#] and Priyanka Singh[$]

[#] *Information and Library Network Centre (INFLIBNET), Infocity, Gandhinagar - 382 007, India*
[$] *National Board of Accreditation, New Delhi - 110 003, India*
[*] *E-mail: jpsjoorel@gmail.com*

ABSTRACT

The India Rankings 2020 was announced the 5th annual edition of ranking for higher educational institutions in India based on National Institutional Ranking Framework (NIRF). The impact of NIRF among institutions is progressive on their output, outcomes, and outreach to the society. The government of India is also concentrating on several policy decisions in the education sector based on the results of India Rankings. This paper is focused on the study of Research Performance (RP) parameter on India Rankings while expanding five-years window instead of three-years window. Moreover, the study is also focused on Pearson correlation between three-years research performance score and five-years RP score and weighted score of institutions. It is attempted to derive the Spearman rank correlation between RP rank and overall rank based on all parameters score.

Keywords: NIRF; India rankings; RPC; Research outcome; Research output; Evaluation framework; Assessment period

1. INTRODUCTION

The Indian higher education system is the one of the largest systems in global education scenario. The Higher Education Institutions (HEIs) plays a vital role to impart knowledge in three major fields namely Teaching, Research and Services. It is important to made critical assessment of teaching learning output, research outcome and service impact made on academic, research and social communities by HEIs. The Ministry of Education (MoE), then the Ministry of Human Resource Development (MHRD) initiated the ranking exercise to rank all HEIs in India in 2015. The National Institutional Ranking Framework (NIRF) was developed with five major broad parameters namely Teaching, Learning & Resources (TLR), Research and Professional Practice (RP), Graduation Outcomes (GO), Outreach and Inclusivity (OI) and Perception (PR). It was assigned with different weightage of each broad parameter according to their importance in higher education system.

Research is divided into long-term research and short-term research since it is continuous process. The Spearman Correlation between ranks by research performance parameter and all parameters for engineering, management, pharmacy, overall and university category are 0.86, 0.75, 0.84, 0.81 and 0.79, respectively as reported in India Ranking 2019 Report.[1] The spearman rank correlation between research parameter and all parameters is positively correlated with ranked institutions in India Ranking. NIRF is considered the three-years window for publications, citations, patents, and sponsored research funding to assess the research performance of HEIs. However, the world-class ranking models also developed with various academic and research performance parameters and the popular global ranking framework captured research performance data for different time windows from three to eleven years. The idea of this pilot study is to explore the impact of expanding windows from three-years to five-years for Research Performance (RP) parameter in India Rankings.

Received : 21 December 2020, Revised : 07 January 2021
Accepted : 13 January 2021, Online published : 11 February 2021

2. LITERATURE REVIEW

Mussard and James carried out the analysis of three international ranking systems, namely Academic Ranking of World Universities (ARWU), QS World University Rankings (QS) and Times Higher Education (THE) World University Rankings and discussed about the strengths and weaknesses of ranking parameters used in three ranking models.[2] This study describes parameters and divides them into two categories. Subsequently, it describes the matrix of correlation between parameters. FWCI (Field-Weighted Citation Impact) is one of the parameters; it described in this study, FWCI is a recognised metric to measure the average impact of publications. FWCI is calculated based on the number of citations; five-year publications data has been used for FWCI calculation on this study. Klochkov described the comparison of Indian university performance as a result of international rankings (QS and THE Ranking systems), as well as in the number and quality of publications.[3] This study compares the Delhi University with

another university at the number of the five years (2013-2017) publications and citations data. This study identifies that the FWCI parameter is crucial for THE Ranking.

Tabassum described the system of developing a global university ranking prediction system by examining all the university performance indicators.[4] This study has used five-years training data set for analysis of influential performance indicators. With the help of the proposed algorithm, several calibrated performance indicators are examined, and the total rank score is generated based on the specific weighting of each performance indicator. Safón analysed the existence of intra-ranking and inter-ranking reputational effects in two very different international rankings systems (ARWU and THE).[5] Data from these two rankings between 2010 and 2018, and the application of ordinal regressions, provide evidence that both rankings are together substantial, creating intra and mutual reputational effects over time. The review explains various international ranking systems, plus it shows the selecting length of data is critical for the ranking.

In view of above, it has been observed that the underlying parameters under research output (publications, citations, patent, etc.) plays vital role in any ranking framework across the globe. Moreover, it is highly correlated with overall ranking. It is also observed that the international ranking agencies, mentioned above, are considering the five years of data for the benchmarking to the Institutions. So, this study focused on both aspects i.e., research output as a parameter & expanding window of research output parameter from three to five years and further derived the trends of its impact on overall ranking.

3. OBJECTIVES OF THE STUDY

First and foremost, objective of this study is to find out the impact of expanding window from three-years to five-years for Research Performance parameter in India Rankings. Especially, the study focuses on the following major objectives:

- To find out the correlation between research performance score of three-years window and research performance score of five-years window
- To measure the spearman rank order correlation between ranks of institutions based on its total score for three-years window and five-years window
- To analyse the correlation between three-years window and five-years window for various rank band such as top 10 ranked, top 25 ranked, top 50 ranked, top 100 ranked, top 150 ranked and all institutions
- To assess the impact of three-years window to five-years window for research performance parameter.

4. METHODOLOGY

The top 200 ranked institutions have been drawn from participated institutions of overall category in India Ranking 2020. A total of 183 institutions have been considered for the study based on consecutive participation of last three-years ranking exercise i.e. (IR 2018, IR 2019, and IR 2020). The number of publications, number of citations, number of highly cited publications have been collected for previous five calendar year (i.e., 2014 to 2018) from Clarivate Analytics' Web of Science and Elsevier's Scopus database. The number of patents published, and number of patents granted have been fetched from Clarivate Analytics' Derwent Innovation database for the considered five calendar year. For the five-years calendar research source data, three calendar years (i.e., 2016, 2017 and 2018) research output data have been used from IR 2020 ranking database. The research parameter data have been used from IR 2018 and IR 2019 ranking database for rest of two calendar years 2014 and 2015, respectively. The data of other parameters (i.e., TLR, GO, OI and PR) have been collected from IR 2020 ranking database.

The NIRF methodology has been implemented on considered institutions for three-years window and five-years window separately. The exploratory analysis and confirmative analysis have been adopted to fulfill the objectives and testing the hypotheses. In exploratory analysis, the Pearson correlation analysis has been applied to measure correlation coefficient between three-years window RP score and five-years window RP score. It has been also used to derive correlation coefficient between weighted score of all parameters for both windows. The strength of rank consistency between each window has been calculated by using Spearmen rank order of correlation.

The study emphasis to set up hypotheses on expanding window from three-years to five-years using confirmative analysis. The hypotheses have been set up for this study as mentioned below:

- The five-years window is more effective on research performance score as compared to the three-years window
- The five-years window is more impactful on weighted score of all parameters as compared to the three-years window.

In confirmative analysis, the Kolmogorov-Smirnov test has been applied to check the normality of difference between score of each window. In case of normally distributed score, the Student's paired t-test have been applied to confirm effective performance on research parameter of five-years window as compared to three-years window. The Wilcoxon signed rank test has been appropriately applied for confirmative testing of hypothesis in case of non-normally distributed score. The open-source R package[9] has been used for testing of hypothesis in this study.

Due to non-consecutive participation of previous three years ranking, this study is restricted to only 183 out of top 200 ranked institutions in overall category. The proposed idea of expanding windows has not been implemented in other subject categories like engineering, management, pharmacy, colleges, etc. It would be considered a minor limitation of the study.

5. RESULTS AND DISCUSSIONS

The correlation analysis and hypothesis testing techniques have been used for exploratory and confirmative analysis of expanding window from three-years to five-years on research performance parameter.

5.1 Correlation Analysis on Research Performance

The spearman rank correlation co-efficient is 0.9903

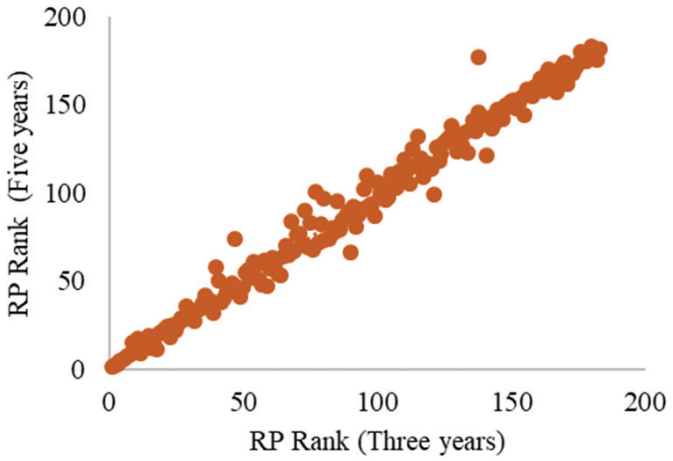

Figure 1. Spearman correlation of three-years RP rank v/s five-years RP rank.

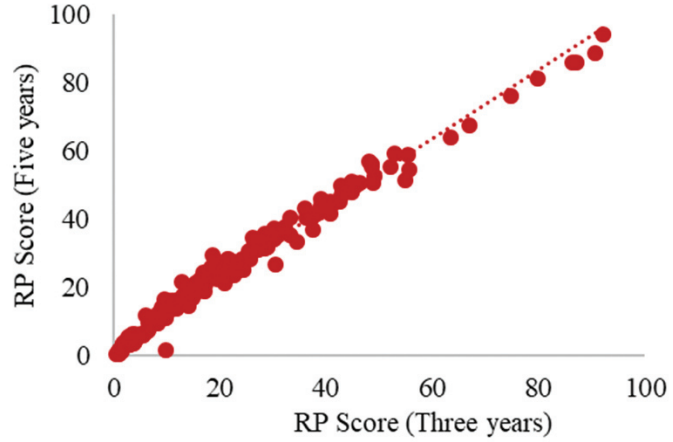

Figure 2. Pearson correlation of three-years RP score v/s five-years RP score.

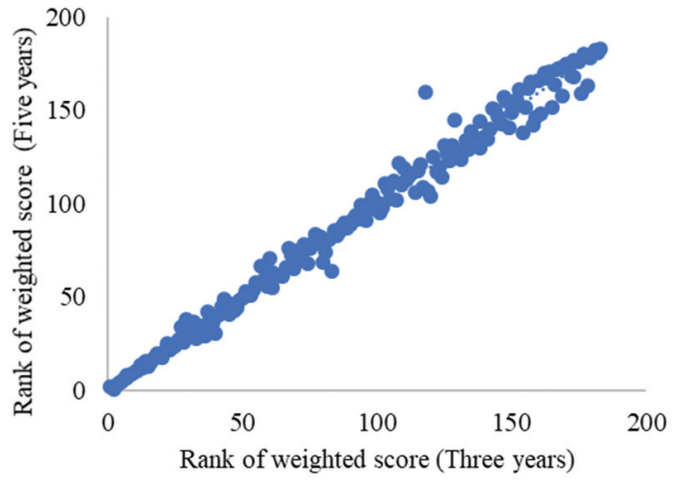

Figure 3. Spearman correlation of three-years all parameters rank v/s five-years all parameters rank.

between RP rank of each considered windows. The positive linear correlation between RP rank of each window has been obtained as depicted in (Fig. 1). It signifies the RP rank remained consistent for majority of institutions.

The Pearson correlation co-efficient between RP score of each window is 0.9900. It also signifies that there is a strong positive linear correlation between RP score of each window as shown in Fig. 2.

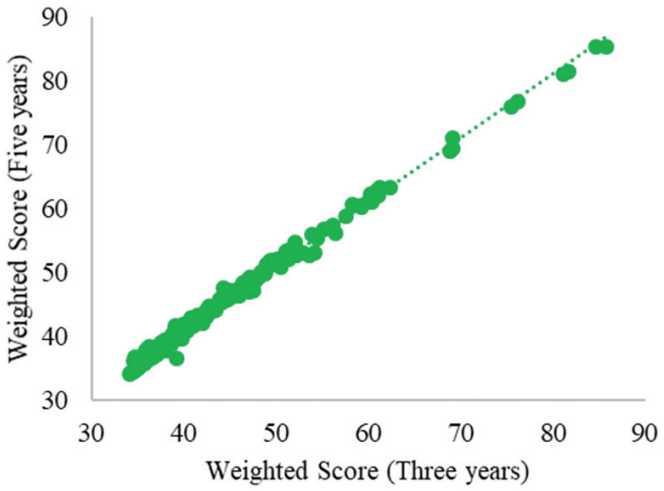

Figure 4. Pearson correlation of three-years weighted score v/s five-years weighted score.

5.2 Correlation Analysis on Weighted Score of All Parameters

The Spearman rank correlation co-efficient is 0.9923 for all parameters rank for each window. It may be inferred from the Fig. 3 there is a positive linear correlation between all parameters rank of each time window. The dramatically changes in ranking positions has been captured for very few institutions.

The Pearson correlation co-efficient is 0.9970 between weighted score of all parameters for both considered windows. As depicted in the Fig. 4, there is a strong positive linear correlation between all parameters weighted score of each time window.

5.3 Correlation Analysis on Various Rank Band

The spearman rank correlation between three-years RP rank and five-years RP Rank for top 10 ranked institutions, top 25 ranked institutions, top 50 ranked institutions, top 100 ranked institutions, top 150 ranked institutions, and all considered ranked institutions remained 0.9097, 0.9154, 0.9354, 0.9679, 0.9837 and 0.9903, respectively. The spearman correlation of RP rank becomes stronger as rank band increases and rest of analysis reflects minor deviations as rank increases as shown in Fig. 5.

Table 1 presents the correlation analysis on various rank band of institutions between three-years window and five-years window.

5.4 Statistical Significance of Research Performance Score

The minimum difference, maximum difference, and mean difference of research performance (RP) score between each window are -11.040, 8.530 and -3.403 respectively, whereas the first quartile, third quartile and median of the difference of RP score between both windows are -5.250, -1.630 and -3.410 respectively.

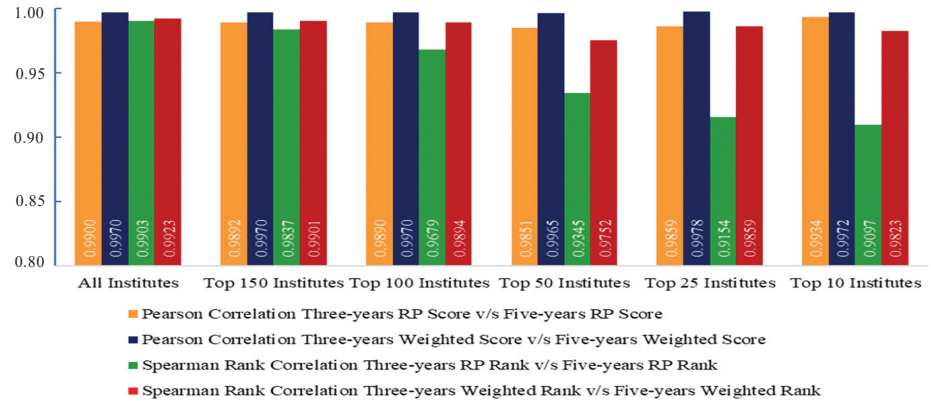

Figure 5. Correlation between three-years window and five-years window for various rank band.

Table 1. Correlation analysis between three-years window and five-years window for various rank band

Rank band	Pearson correlation		Spearman rank correlation	
	Three-years RP score v/s five-years RP score	Three-years weighted score v/s five-years weighted score	Three-years RP rank v/s five-years RP rank	Three-years weighted rank v/s five-years weighted rank
All institutions	0.9900	0.9970	0.9903	0.9923
Top 150 institutions	0.9892	0.9970	0.9837	0.9901
Top 100 institutions	0.9890	0.9970	0.9679	0.9894
Top 50 institutions	0.9851	0.9965	0.9345	0.9752
Top 25 institutions	0.9859	0.9978	0.9154	0.9859
Top 10 institutions	0.9934	0.9972	0.9097	0.9823

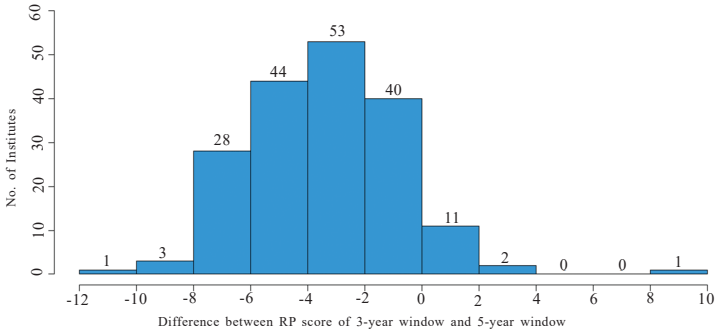

Figure 6. Histogram of RP score.

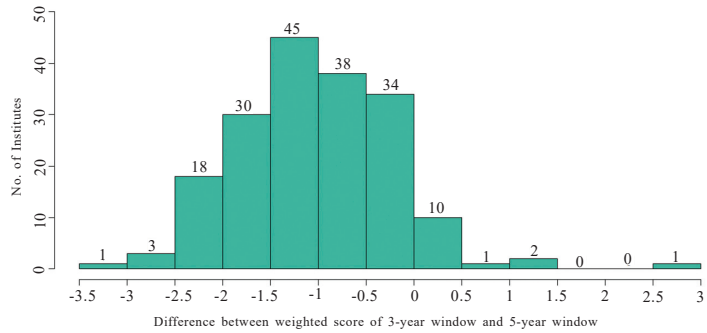

Figure 7. Histogram of all parameters weighted score.

The histogram of difference between RP score for each window depicted in Fig. 6. It represents RP score increased for 169 institutions in five-years window, whereas RP score remains unchanged or is decreased for rest of institutions.

The test statistic of Kolmogorov-Smirnov test is 0.14754 and p-value is 0.03724 at 0.05 level of significance. Since the p-value is less than 0.05, the difference between RP score for both windows have not been followed normal distribution. Therefore, the Wilcoxon signed rank test have been applied to check the significant median difference of RP score between both windows. In this subsequent process, the test statistic of Wilcoxon signed rank test is 587.5 and p-value is near to zero at 0.05 level of significance. Henceforth, there are sufficient evidence to conclude that the five-years window gives more impact on RP score rather than the three-years window.

5.5 Statistical Significance for All Parameters Weighted Score

The minimum difference, maximum difference and mean difference between both windows weighted score of all parameters are -3.310, 2.550 and -1.021 respectively, whereas the first quartile, third quartile and median of the difference between weighted score for both windows are -1.575, -0.490 and -1.020 respectively.

Figure 7 depicted that the histogram of difference between three-years window weighted score and five-years window weighted score. The histogram represents weighted score is increased for 169 institutions in five-years window, whereas weighted score remains unchanged or is decreased for rest of institutions.

The test statistic of Kolmogorov-Smirnov test for difference between weighted score of each window is 0.087432 and p-value is 0.4863 at 0.05 level of significance. Since the p-value is greater than 0.05, it indicates the difference of weighted score between both windows are normally distributed. Therefore, the Student's paired t-test have been used to test the significant mean difference of weighted score between both considered windows. In this subsequent process, the test statistic of paired t-test is -17.272 and p-value is near to zero with 182 degree of freedom and at 0.05 level of significance. Hence, there are enough evidence to conclude that the five-years window gives more impact on weighted score of all parameters compared to the three-years window.

6. CONCLUSIONS

This study provides the cause-and-effect relationship between research performance rank of institutions and all

parameters rank for overall category. It also reveals the major significant and remarkable observations that are as follows:

- The research performance rank remains consistent for majority of institutions with highly positive spearman rank correlation of 0.9903 between three-years window and five-years window of research performance data.
- The Pearson correlation coefficient of all parameter score between three-years window and five-years window of research performance data is 0.9970 with strong linear positive correlation.
- Five-years window gives more significant impact on research performance parameter score and improves significant rank by all parameters as compared to three-years window with 92.35 per cent of institutions are benefited.

REFERENCES

1. NIRF Team, India Rankings 2019: Process of consolidation continues. Department of Higher Education, Ministry of Human Resource Development, Government of India 2019.
2. Mussard, M. & James, A.P. Engineering the global university rankings: Gold standards, Limitations and implications, *IEEE Access*, 2018, **6**, 6765–6776. doi: 10.1109/ACCESS.2017.2789326.
3. Klochkov, Y. Analysis of the publication activity of university researchers. *In* Proceedings - 2019 Amity International Conference on Artificial Intelligence. 2019. pp. 74-79. doi: 10.1109/AICAI.2019.8701280.
4. Tabassum, A.; Hasan, M.; Ahmed, S.; Tasmin, R.; Abdullah, D.M. & Musharrat, T. University ranking prediction system by analyzing influential global performance indicators. *In* 2017 9th International Conference on Knowledge and Smart Technology: Crunching Information of Everything, 2017. pp. 126–131. doi: 10.1109/KST.2017.7886119.
5. Safón, V. Inter-ranking reputational effects: An analysis of the academic ranking of world universities (ARWU) and the times higher education world university rankings (THE) reputational relationship. *Scientometrics*, 2019, **121**(2), 897–915. doi: 10.1007/s11192-019-03214-9.

CONTRIBUTORS

Prof J.P. Singh Joorel is currently working as Director, Information and Library Network Centre, An IUC of UGC, Gandhinagar. Prior to joining Director, INFLIBNET, was working as Professor of Statistics in the University of Jammu, Jammu. He has vast experience in teaching and research. He is a principal investigator of several projects / initiatives of the Ministry of Education (MoE) and UGC.
He is responsible for end-to-end conceptualisation.

Mr Hiteshkumar Solanki is currently working as a Scientist-C (CS) in the Information and Library Network Centre, Gandhinagar. His areas of interest are Statistical Analysis, Research Data Management, Digital Repositories, and e-Resource Management.
In this study he has contributed designing the research concept and research methodology.

Dr Abhishek Kumar is currently working as a Scientist-D (CS) in the Information and Library Network Centre, Gandhinagar.
He is responsible for designing of the study.

Mr. Dharmesh Shah is currently working as a Scientific and Technical Officer (Computer Science) at Information and Library Network (INFLIBNET) Centre, Gandhinagar. His main area of interest is Software Development, Database Administrator and Server Management.
He contributed to the development of a data capturing system.

Mr Raja V. is currently working as a Scientist-C (CS) in the Information and Library Network Centre, Gujarat. His areas of interest include Cloud Computing, Server Administration and Networking.
In this study, he has worked for data verification.

Dr Kruti Trivedi is currently working as Scientist-D (LS) at Information and Library Network Centre, Gandhinagar, Gujarat. Her area of interest is e-resource management, Bibliometric Analysis and University Ranking.
She has provided research data related to publication, citation, and highly cited papers.

Mr Pallab Pradhan is currently working as a Scientist-C (LS) at the Information and Library Network (INFLIBNET) Centre, Gandhinagar, Gujarat. His areas of interest are Altmetrics & Bibliometrics Analysis, Scholarly Communication, Research Data Management Services, and Reference Management tools etc.
He is responsible for patent data.

Dr Priyanka Singh is currently working as Senior Manager in National Board of Accreditation, Delhi. Her area of interest includes Rankings, educational technology, and Accreditation.
In this study, she has contributed by designing the study.