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Ranking of The Colleges in India: A Study of The Elite Club

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ABSTRACT

The National Institutional Ranking Framework (NIRF) comes out with rankings of top degree colleges of countries on the basis of certain broad parameters. A lot of uproar surrounds this ranking. Here we attempt at to look into this ranking though a critical lens. From the aggregative analysis we see that all the broad parameters - 'Teaching, Learning & Resources', 'Research and Professional Practice', 'Graduation Outcomes', 'Outreach and Inclusivity' and 'Perception' have some positive influence on overall rank at 5 % level of significance. The present study also digs deep into these parameters and segregates the sub-parameters as per the production technology perspective. In fact, the distinct segmentation of the sub-parameters into inputs and outputs allows us to conduct data envelopment analysis for preparing the ranks for the colleges. The ranks that we find through this approach show some divergence from the NIRF ranks. Some move up the ladder while some falter down. From the resource generation standpoint, the results also show scope for improvements. The study shows that about 40 % of the top 100 colleges in the country are operating less than efficiently. However, this study only includes the elite 100 colleges in India and examines the resource conversion gap.

Keywords: Ranking; NIRF ranking; Rank consistency; Efficiency analysis; Kendall's tau; Data efficiency

1. INTRODUCTION

Ranking the Higher Educational Institutions (HEIs) has become a standard custom throughout the world. Rankings provide straight forward information about the quality and affairs of an institution. It also simplifies and clarifies matters for the interested parties[1]. This type of evaluation is also very challenging as different higher educational institutes have their own peculiarities, distinct strengths or weaknesses, varied sizes, programs, disciplines and resources. The socio-economic condition of the locality where the institution is situated also bears huge importance in the estimation of ranks[2].

The National Institutional Ranking Framework (NIRF) under the aegis the Ministry of Human Resource Development (MHRD) has released the ranking of Higher Educational Institutes (HEIs) in the country for the latest available year, i.e., year 2023. In this paper we are bothered about only the ranks given to the top 100 colleges in India by the NIRF[3]. We attempt at analysing the ranks at the aggregative level and also check the concordance of the overall ranks with the ranks attributed to different parameters. The distinct separation of the parameters alongside the different sub-parameters into inputs and outputs provides us the chance to conduct non-parametric Data Efficiency Analysis (DEA).This efficiency study allows us to come out with our own ranking of the colleges. Notably, application of DEA technique in education sector is a well-known practice since the early phase of DEA development. Studies on various types of academic institutions including primary and secondary educational institutions, colleges, universities, departments, training institutes used DEA techniques. In India, there is some modicum of literature on the efficiency studies on education sector. The present study utilises the NIRF data and conducts non-parametric DEA technique. It also checks the concordance of college ranks in different sub-parameters with that of the grand rank and among the ranks in different sub-parameters.

Efficiency studies, particularly of the academic institutions, are of huge significance as the higher educational institutes in India are plagued with huge resource crunch. Proper allocation of funds and effective utilisation of the paltry academic resources warrant a thorough efficiency examination which deals with resource use pattern. Majority of the studies on HEIs put emphasis on the quality of education and gave very less emphasis on the role of efficiency. The present study analyses the technical efficiency of top 100 colleges in India using the data provided by the NIRF.

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The paper is divided in six sections. Brief literature and the data used to conduct this exercise, are explained in section 2 and section 3 respectively. In Section 4, we embark upon using a sophisticated efficiency analysis tool. The parameters which contain both some inputs and outputs pertinent to the education sector, allow us to carry out non-parametric data efficiency analysis here. The underlying methodology is provided here. We also look into the consistency of the overall rank in this section. The findings of the efficiency results are kept in section 5. Finally, we conclude in section 6.

2. LITERATURE REVIEW

Several studies have assessed the indicators of the ranking system in the field of higher education. Nassa[4], *et al.* studied the performance of HEIs during the period 2016 to 2020 on various performance yardsticks. The study came to the conclusion that over the five years, parameters such as the number of publications including the highly-cited publications and citations by the institutions have grown in importance. Mukherjee[5] investigated the feasibility of the factor 'research and professional practice' in the NIRF ranking by examining the research credentials of scientists from five top-notch Central Universities in India for a period of three years. The study recommended that an altogether different type of ranking framework should be there for universities that focus chiefly on research and development and for those which concentrate primarily on teaching.

Verma[6], *et al.* studied the Ranking of eight National Institutes of Technology (NITs) in the northeast region of India. They found that NIT Silchar, Assam emerged as the best performer in various categories such as web pages, internal and external links, Web Impact Factor, and obviously grabbed the top rank among all NITs. In a study, Mondal Singh[7], *et al.* assessed the contributions put forward by the best 25 universities in different sub-parameters, as prescribed by NIRF. The study showed that the Bangalore-based Indian Institute of Science secured top score in the parameter 'Teaching, Learning, and Resources' and ranked first in the university category. On the other hand, Jawaharlal Nehru University attained the top score in 'Graduation Outcomes' and 'Outreach and Inclusivity' categories, but it was ranked second.

Ray[8] employed DEA and regression modelling technique to estimate efficiency in Connecticut's public schools. The study reveals that productivity varies significantly across district due to socio-economic divergences, while managerial efficiency variation is less than the DEA results suggest. Sengupta[9], *et al.* analyses school data from an Indian district, revealing significant discrepancies in deprivation, social, and policy indicators, which adversely affect the efficiency of the primary school education system. Arshad[10] uses TIMSS 2011 data from 40 countries and DEA method to calculate the level of technical efficiency. The study found that almost all the members of the Organisation of Islamic Cooperation are technically inefficient in using their educational resources.

Mohapatra[11] evaluates India's efficiency in class 10 levels using two outputs and five inputs. Out of 23 states, only 10 were efficient, with Goa turning out to be the most super-efficient state. The study suggests that all super-efficient states can lower their input use while remaining efficient, potentially improving the country's educational standard. Ghose[12] evaluates the efficiency of primary and upper primary education in India In her study, she considered both output and input-oriented measures of technical efficiency. The study identifies factors affecting efficiency, such as central grants, infrastructure at the school level, social indicators, and policy variables.

Prathap[13] analysed the 2019 scores from NIRF for the elite 100 colleges from the construct validity perspective. The study found disproportionately high regional biasness among the top 100 colleges. They found that in 2019, 82 % of the top 100 colleges in India were from Tamil Nadu, Delhi, and Kerala only. They also identified that the parameter 'perception' used as a parameter is flawed with potential biasness. They suggested that the application of the input-output model-based X-score, might offer a precise result.

In fact, there is no ubiquitously accepted ranking procedure. Different researchers are of diverse opinions regarding the selection of ranking procedure and the importance of parameters. But, nowadays, the DEA technique, Stochastic Frontier Analysis and free disposal hull are frequently used in analysing the efficiency of the HEIs across the globe[14-16]. Here we employ DEA technique. Additionally, we check rank consistency so as to acquire some idea about the concordance of overall score with the scores obtained under different parameters. This concordance checking actually provides some solid theoretical justification for taking recourse to the efficiency analysis.

3. DATA USED: NIRF RANKING FRAMEWORK

The NIRF has published the ranking of educational institutions including the colleges in the country latest for the year 2023. Five parameters-Teaching, Learning & Resources (TLR), Research & Professional Practice (RP), Graduation Outcomes (GO), Outreach & Inclusivity (OI) and Perception (PR) – have been used for the determination of ranks. Each of these parameters includes several other sub-parameters. A particular weighting system, as given in GOI[17] is used to arrive at the aggregate score for an institution. On the basis of aggregate score, the incumbent institutions are ranked. The paper is built upon using data from various sub-parameters of the aforementioned broad parameters to arrive at our own ranks of colleges.

Since there is lack of comprehensive third-party database for carrying out such a gigantic exercise across the breadth and width of the country, relevant information are sought by the NIRF from the higher educational institutions. Different HEIs report information in the specific format in the NIRF portal. To ensure that a reporting institution does not resort to unethical practices, the NIRF has also been empowered to conduct

physical verification. Additionally, NIRF can access some internationally recognised databases such as Indian Citation Index, Web of Science, Scopus or other suitable sources it the metrics if it deems fit to do so in the interest of rationalisation necessitated by the exigencies or the nature of the data encountered.

The parameters used for the estimation of the grand score can be distinctly categorised into inputs and outputs. This allows us to conduct non-parametric data envelopment analysis. In the *model 1,* we take some sub-parameters from the broad parameters '*Teaching, Learning & Resources (TLR)*' and '*Outreach & Inclusivity (OI)*' as inputs. These include sub-parameters 'Student Strength (SS)', Faculty-student ratio (FSR)', 'Faculty with Quality and Experience (FQE)', 'Financial Resources and their Utilisation (FRU)' hailing from the broad parameter '*Teaching, Learning & Resources* (TLR)'. The inputs emanating from the broad parameter include '*Outreach and Inclusivity (OI)*' include 'Region Diversity (RD)', 'Women Diversity (WD)', 'Economically & Socially Challenged Students (ESCS)', 'Facilities for Students who are Physically Challenged (PCS)'. So, there are eight inputs. For selection of outputs, we relied upon the broad parameters-*Research & Professional Practice* (RP), *Graduation Outcomes* (GO) and *Perception* (PR). From Research & Professional Practice (RP), we have chosen 'Combined metric for Publications (PU)', 'Combined metric reflecting Quality of Publications (QP)' and from Graduation Outcomes (GO), we have picked 'Combined metric for Placement, Higher Studies, and Entrepreneurship (GPH)', 'Metric for University Examinations(GUE)', 'Median Salary(MS)' as outputs. Score obtained in *Perception* (PR), has also been taken as an output. So, there are six outputs. In *model 2*, we have dropped the output variable Perception (PR), because of its subjective nature. All other inputs and outputs have remained the same in model 2. Classification of inputs and outputs are given in Table 1 for easy reference. This classification is upon the methodological framework provided by the Source: NIRF, Ministry of Human Resource Development[9].

Table 1. Classifiation of inputs and outputs

	Broad parameter	Inputs	Outputs
Model 1	Teaching, Learning & Resources (TLR)	'Student Strength (SS)', Faculty-student ratio (FSR)', 'Faculty with Quality and Experience (FQE)', 'Financial Resources & their Utilisation (FRU)'	-
	Outreach and Inclusivity (OI)	'Region Diversity (RD)', 'Women Diversity (WD)', 'Economically & Socially Challenged Students (ESCS)', 'Facilities for Students who are Physically Challenged (PCS)'	-
	Research and Professional Practice (RP)	-	'Combined metric for Publications (PU)', 'Combined metric reflecting Quality of Publications (QP)'
	Graduation Outcomes (GO)	-	'Combined metric for Placement, Higher Studies, and Entrepreneurship (GPH)', 'Metric for University Examinations(GUE)', 'Median Salary(MS)'
	Perception (PR)		Perception (PR)
Model 2	Teaching, Learning & Resources (TLR)	Student Strength (SS)', Faculty-student ratio (FSR)', 'Faculty with Quality and Experience (FQE)', 'Financial Resources & Utilisation (FRU)'	--
	Outreach and Inclusivity (OI)'	'Region Diversity (RD)', 'Women Diversity (WD)', 'Economically & Socially Challenged Students (ESCS)', 'Facilities for Students who are Physically Challenged (PCS)'	'Outreach and Inclusivity (OI)'
	Research and Professional Practice (RP)	--	'Combined metric for Publications (PU)', 'Combined metric reflecting Quality of Publications (QP)'
	Graduation Outcomes (GO)	-	'Combined metric for Placement, Higher Studies, and Entrepreneurship (GPH)', 'Metric for University Examinations(GUE)', 'Median Salary(MS)'

Source: Prepared by the authors with NIRF data

4. METHODOLOGY

The study focuses on developing ranking of the 100 colleges based on the data provided in the NIRF set up. We resort to the output-oriented DEA technique to derive our ranks for the elite 100 colleges. The paper also attempts at to look into the consistency of NIRF ranks by employing simple statistical technique.

4.1 Use of Non-Parametric DEA Analysis

In order make an efficiency analysis, it is necessary to treat education as a production exercise where inputs are turned into outputs. Given the education technology, one can gauge the ability of an institution to transform inputs more efficiently than others. Since the production technology in higher education is not exactly specified, the use of non-parametric DEA is perhaps the only feasible way out here.

Some attempts have been initiated across the globe to evaluate the efficiency level of public universities and the HEIs. Studies have been conducted that applied DEA method so as to have some information about the operations of UK universities[18-19]. Later, Abbott and Doucouliagos[20] and Avkiran[21] used DEA to ascertain the efficiency levels in universities in Australia. Cadavid[22], *et al.,* conducted an efficiency analysis of 32 public universities in Columbia for the year 2012. The universities were then ranked using Pareto efficient cross efficiency model.

In India, usage of DEA methodology for examining the efficacy of HEIs is comparatively less. Tyagi, Yadav and Singh[23] resorted to the DEA technique to assess the performance of nineteen academic departments of the Indian Institute of Technology, Roorkie. Various combinations of inputs and outputs such as academic and non-academic staff, number of enrolled students, operating expenses, development and research aspects were used to judge the performance of various departments.

More recently, Srinivasan[24], *et al.,* used the NIRF data to construct efficiency using DEA method. This method emphasises on the perception aspect of the NIRF scheme. It uses the fuzzy method to transform multiple inputs and outputs into a single virtual input and single virtual output for each HEI. The efficiency of each HEI "is obtained as the ratio of this single virtual output to single virtual input and it is a function of the corresponding multipliers."

Once we are able to zero in on the inputs and outputs, we can embark upon the non-parametric DEA. Notably, this linear programming method aids in the construction of a piece-wise linear set. This actually serves as the envelope of a set of observed input and output variables..

Following Ray[25], suppose 'N' represents the number of Decision Making Units (DMUs). Also consider that by using '*h*' number of inputs, each DMU produces 'g' number of outputs. The input basket applicable to typical DMU t is given by - $x_t = (x_{1t}, x_{2t}, L, x_{ht})$ and the output bundle produced is represented by $y_t = (y_{1t}, y_{2t}, \ldots, y_{gt})$ Now, it is assumed that the production function under consideration exhibits constant returns to scale (CRS)..

In such situation, if is feasible then for any is also feasible.Here, the production possibility frontier under the assumption of CRS can be symbolised as–

$$T^{CRS} = \{(x, y) : x \geq \sum_{j=1}^{N} \lambda_j x^j ; y \leq \sum_{j=1}^{N} \lambda_j y^j ; \lambda_j \geq 0; (j = 1, \cdots \quad \text{.....(a)}$$

Here λ_j is feasible and is for all .

For any DMU, the mathematical solution of the below mentioned liner programming problem proves the estimate of the output oriented technical efficiency

Max ϕ

Subject to $\sum_{j=1}^{N} \lambda_j y_{rj} \geq \phi y_{rt}; (r = 1, 2, \cdots, g)$

$$\sum_{j=1}^{N} \lambda_j x_{ij} \leq x_{it}; (i = 1, 2, \cdots, h)$$

$$\sum_{j=1}^{N} \lambda_j = 1, \lambda_j \geq 0; (j = 1, 2, \cdots, N) \quad \text{.....(b)}$$

Knowing , the maximum value of , by solving equation (b), output oriented TE of firm can be determined by using equation (c).

$$TE_0^{ct} = TE_0^{ct}(x^t, y^t) = 1/\phi^* \quad \text{.....(c)}$$

Where ϕ^* is the solution to equation (b), which shows the maximum value of ϕ. Also, y^* can be considered as the maximum outputbundle that can be produced from the input bundle x^t and is defined as $y^* = \phi^* y^t$.

Under ϕ CRS, and ϕ^* can be estimated by solving equation (b) along without the constraint $\sum_{j=1}^{N} \lambda_j = 1$ taking into consideration the CRS frontier (equation a). With knowledge of , determination of technical efficiency of the firm can be ascertained.

4.2 Use of Kendall's tau (τ) Test for Checking Rank Consistency

We also check the concordance of college ranks attained under different types of metric with that of the grand ranking and among the metrics. For doing that we use non-parametric Kendall's tau (τ) test26. Kendell's tau is a coefficient that represents the degree of concordance between two sets of ranked data on the same set of individuals. Tau-a is used for non-tied ranks, which we are taking into consideration here. Kendell's tau(τ) can be mathematically depicted as the following:

$$\tau = \frac{C - D}{C + D}$$

where C and D are the numerical number of

concordant pairs and the discordant pairs respectively. For a concordant pair, ($x2$-$x1$) and ($y2$-y) have the same sign. For a discordant ($x2$-$x1$) pair and ($y2$-$y1$) have the opposite signs Kendall's measure is regarded as suitable measure for studying the degree of association among three or more sets of rankings.

5. FINDINGS

From the results obtained from non-parametric efficiency analysis, it is observed that in both model 1 and model 2, about 40 % of the top colleges are operating less than efficiently (Table 2). In model 1, 27 % of the colleges and in model 2, 29 % of the elite colleges are 'moderately efficient' (efficiency score more than equal to 0.90 but less than unity). In both the models, 9 % of the colleges are 'less efficient' (efficiency score more than equal to 0.80 but less than 0.90). In model 1, 3 % colleges are 'least efficient' (efficiency score less than 0.80), whereas this figure is 4 % in case of model 2. This actually reveals the fact that there is huge scope for improvement given the existing resources of these elite colleges in India. This does not provide a very bright picture of our higher education system. There is huge scope for improvement given the existing resources.

Table 2. Distribution of efficiency scores

Efficiency scores	Efficiency model 1 -Frequency	Efficiency model 2- Frequency	Level of efficiency
Score<0.80	3	4	Least efficient
0.80≤Score<0.85	3	5	Less efficient
0.85≤Score<0.90	6	4	
0.90≤Score<0.95	13	18	Moderately efficient
0.95≤Score<1	14	11	
Score=1	61	58	Efficient
Total	100	100	

Source: Author's calculation

Table 3. Some basic statistics of efficiency scores

Statistic	Model 1	Model 2
Mean	0.965	0.960
STDEV	0.062	.0671
CV	6.455	6.996
MIN	0.664	0.645
Max	1	1
Skewness	-2.426	-2.256
Kurtosis	9.671	8.694

Source: Author's calculation

From table 3 we find that there is not much difference between the values of some basic statistics of efficiency score derived in the two models.

Also, we see discernible changes in the NIRF ranks of the colleges from that of our ranks. Tamil Nadu-based PSGR Krishnammal College for Women, , which grabbed fourth rank in NIRF yardstick, falters down to the sixty sixth rank as per DEA ranking (Model 1). Similarly, Atma Ram Sanatan Dharm College, New Delhi, which gets a NIRF rank of sixth, falls down to sixty seventh rank as per DEA ranking (Model 1). On the contrary, Scottish Church College, West Bengal (NIRF rank 100) moves up the ladder to seventy third position (Model 1).

From model 2, we see that Presidency College, Tamil Nadu, the third top ranked colleges, moves down to ninety seventh rank in our ranking. Again, Queen Mary`s College, Tamil Nadu (NIRF rank 60), gets thirty second rank as per DEA ranking (Model 2).

Now, if we look at the relationships between overall NIRF ranks and the ranks on broad parameters, we see that all these broad parameters have positive correlation with the overall ranks at 5% level of significance. This provides justification of utilising these broad parameters in influencing the overall rank of an HEI (Table 4).

Table 4. Consistency of NIRF ranks: overall rank VS ranks on broad parameters

	Overall	Teaching, learning & resources	Research and professional practice	Graduation outcomes	Outreach and inclusivity	Perception
Overall	1					
Teaching, Learning & Resources	0.2899* 0.0000	1				
Research and Professional Practice	0.3345* 0.0000	-0.0483 0.4784	1			
Graduation Outcomes	0.3077* 0.0000	0.0558 0.4128	-0.1655* 0.0148	1		
Outreach and Inclusivity	0.1994* 0.0033	0.1099 0.1058	-0.1461* 0.0315	0.2368* 0.0005	1	
Perception	0.3982* 0.000	0.0489 0.4728	0.1667* 0.0141	0.1244 0.0669	0.0416 0.5414	1

Source: Author's calculation

Now, if we look at the pair wise concordance, we find positive statistical relationship between 'Research and Professional Practice' and 'Perception. Quite naturally, excellence in research and quality publication activities has positive bearing on the subjective parameter 'Perception'. Also, there is statistically positive concordance between 'Outreach and Inclusivity' and 'Graduation Outcomes'. This signifies that increased diversity in the college level is translated to better placement, enhanced salary and transition to top universities. However, there is negative statistical relationship between 'Research and Professional Practice' and 'Graduation Outcomes', which is not quite natural. Same kind of unusual negative relation is seen between 'Research and Professional Practice' and 'Outreach and Inclusivity' too.

Here it is also to be noted that though non- parametric DEA approach is indeed very useful in examining the efficiency level of academic institutions, but it is also very sensitive to the presence of outliers. Presence of extreme value in data can significantly impact results. The study, though involves the top 100 colleges in the country, shows perceptible variations in the data set.

Moreover, here, we are actually analysing the performance of top 100 colleges in India as per the NIRF report card. As per the All India Survey of Higher Education Final Report 2021-22, 42,825 colleges responded in the survey and of which 25,719 colleges (60.1 %) are General in nature (GOI 2022). So, the top 100 colleges with enhanced infrastructure, finance and other facilities do not provide much information about the real picture of the college education in India. It is ordinarily believed that there is not much novelty in the better performance of this elite club. Technically speaking, these institutes should have higher efficiency score. In fact, in both the models that we have derived, the efficiency score of majority of the colleges lie above 80 %. This actually instigated us to set a higher standard of efficiency level. We have selected the colleges in the efficiency range ($0.90 \leq Score < 1$) as moderately efficient, colleges in the efficiency range ($0.80 \leq Score < 0.90$) as Less efficient and colleges in the efficiency range ($Score < 0.80$) as least efficient.

6. CONCLUSION

Even among the top 100 colleges in the country, with more financial and physical facilities, around 40 % colleges are operating less than efficiently. This actually reveals that there is huge scope for improvement given the existing resources of these elite colleges in India.

We see some topsy-turvy in the DEA ranks designed by us with that of the NIRF ranks. But, obviously the grand ranking that we framed has fair degree of converging trend also. Whatsoever, ranking is essential and it may also seem reasonable but with some caution. There is an urgent need to demarcate between First Boys and the last boys[27], and particularly the last girls. They must have to be judged, but on a different footing. In this case, efficient use of resources could be a good parameter.

It is unethical and impossible to judge a Lilliputian and a Brobdingnagian[28]. In fact, this discourse of elite HEIs (only top 100 colleges in the country) does not provide a great idea about the measure of college education in the country as a whole. A study encompassing a sizable majority of the colleges can only provide better insights.

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