Performance Evaluation of government Primary Schools in South India

N Kartik[1], Dr. K A Venkatesh[2,], Dr. R Mahalakshmi[3]

[1,3]Department of Computer Science, Presidency University, Bangalore, India
[2]Department of Mathematics, Myanmar Institute of Technology, Mandalay, Myanmar

Abstract - Education plays an important role in the socio-economic development of the county. India's education systems have improved which has been one of the important contribution for the economic development of the country. Under the Indian Constitution, free and compulsory education is provided as a fundament right to children between the age of 6 and 14. This paper examines the the efficiency scores and ranks primary government schools in South India for the academic year 2016-17.

Keywords - DEA, MCDA, Performance

I. INTRODUCTION

Over the past few years, the Indian Education system has improved drastically and which has played an important role in the economic development of the country. In our daily routine, we take so many decisions considering various constraints at that particular time. For example, if we want to purchase a product we may compare the cost or quality of the product and decide. But in the real world, there are decisions which have to be taken considering a different criterion's this kind of decisions are called Multi Criteria Decision Analysis. There are various MCDA techniques like TOPSIS, DEA, AHP, VIKOR etc. used to make decisions each of them having their own advantages and disadvantages. MCDA techniques are applied in various fields like banking, performance evaluation, education, route selection etc. In this paper, we have applied the Data Envelopment Analysis (DEA) to rank the performance of various government schools.

II. REVIEW OF LITERATURE

Data Envelopment Analysis (DEA) is used to measure the performance entity of the set of alternatives or DMU (Decision Making Units) which is data-oriented performance evaluation method. DEA model deals with system efficiency which uses input/ output for determining the overall efficiency of a DMU. Non-beneficial criteria are taken as input while Beneficial criteria are considered as output. A DMU is considered inefficient if it fails to attain maximum output and minimum input. For vector normalization of each criterion the performance values in is divided by rooted sum of squares of all the values for the particular criteria the value obtained is known as a normalized performance value. An LPP method is used to solve the solution using minimization techniques. All the efficient DMU gets the value 1. DEA models have gained popularity because of the capability to measure the efficiency of multiple inputs and outputs DMU's without assigning prior weights to inputs and outputs.

[1]Authors used DEA techniques with slacks to find the efficiency of various departments. A department is said to be efficient if it has the value 1. All the inefficient departments are calculated for slack value. Slack-based measure helps in determining input surplus and output shortage. With this inefficient departments can be given advice so that they can become effective.

[2]Authors used for evaluation of teaching staff using DEA. All the staff was evaluated by finding a relative efficiency score. Teachers who scored an efficiency score of 1 were considered for promotion and those who scored very less were given suggestion for improvement. Also, the results were used for further recruitment and training.

[3]Authors have used Joint DEA maximization. Colleges are measured for teaching and research efficiency separately considering different inputs and output criteria's for each objective. The overall efficiency of college would be whichever is higher in teaching or research because few colleges may not focus on both. If the research and teaching efficiency both are 1 that means they are concentrating on both and also doing well. Colleges can be benchmarked based on if they concentrate on research or teaching or both.

[4]Authors used for finding the efficiency of various colleges under university there were too many variations in the efficiency. Many colleges performed very well and many did not perform well. The correlation coefficients among the inputs were not high. The author later identified that few important parameters were missing which may improve the performance of the institutes drastically.

[5] Authors used DEA-CCR model for measuring technical efficiency and differences among 348 schools. The study also helped in preparing school wise report and suggestion for improvements. Four different models were constructed in each model no inputs were added. The study indicated that there is some impact of the house environment on the school's performance.

[6] Author used Higher Education Institutes information for ranking different DMU's. The outputs predicted by this model are gradqual- which takes both qualitative and quantitative factor into consideration, number of postgraduates and research. Later they found that library and staff information was not affecting much on the efficiency score and ranking of DMU.

[7]DEA approach for applied to find the efficiency of different states of India. Factor analysis was applied to identify the inter-relationships between variables. The states

were classified into three categories- states which need to focus on enrollment and educational performance, increase enrollment, increase educational performance.

[8] The efficiency of public schools was calculated using DEA-CCR and DEA-VRS model. Based on the availability of data inputs teachers, administrative staff and rooms were shortlisted. Here rooms were considered as non-discretionary input. Four different models was built to estimate the efficiency. Model with input as teachers, rooms and output as students was selected since this was the only model which can be estimated consistently over the four levels of schooling and the two time periods

Table 1: Applications of DEA

Objective	DMU's	Inputs	Outputs
[1]Improving the Efficiency Performance of Departments	Departments	Number of Lecturers, Number of Students	Number of Research, Number of Graduates
[2]Performance evaluation of teaching staff	Staff	Salary, Facility provided, Seniority	Courses taught, Number of sections, number of students, research paper prepared, community activities
[3] Efficiency assessment of universities through data envelopment analysis	Colleges	Teaching- Number of staff, Number of students, Average students qualification, University Expenditure	Number of graduates, Average graduates results, graduation rate, graduates employment rate
		Research- Expenditure, no of research staff, avg research staff qualification, no of research students, research grants	No of graduated from research, no of publications, no of awards, no of intellectual properties
[4]Efficiency analysis of various colleges under university	Colleges	Full time teachers and student ratio, Part time teachers and student ratio, Non-teaching staff and student ratio	Average marks attained by passed students, no of first class, Percentage of students passed in the examination in relation to intake capacity, no of depts
[5]Efficiency analysis of schools using DEA	Schools	%available teaching facilities, physical facilities, ancillary facilities, Teacher qualification	Average marks in EVS, mathematics, Language
		index, experience index, Number of students per teacher, Average attendance of students in school, Parents education occupation index	
[6]Efficiency of different University in Australia	University	UG qualification, PG, Staff, Capital, Library, admin	Graduate, post graduates, Research
[7] Benchmarking educational development efficiencies of the Indian states	States	No of primary school, no of schools with appropriate infrastructure, student/ classroom ratio, % of teacher with graduate and higher qualification, % of professional trained teacher	Gross Enrolment Ratio, Percentage of students who have passed with marks over 60%
[8]Find efficiency of public school	Schools	Teachers, room	Students

III. DATA AND METHODOLOGY

There are numerous Multi Criteria Decision Analysis methods available to find efficiency. In this study, we deployed one version of DEA called CCR model and the analysis is based on the secondary data collected from the website of [9] District Information System for Education (DISE)

We used DEA to find the efficiency of primary schools, with respect to its peer group. The general Charnes, Cooper and Rhodes (CCR) model is given as: (fractional version)

$$Max_{u,v}\, Z = \frac{1}{v_1 X_{1,0} + v_2 X_{2,0} + \cdots + v_m X_{m,0}}$$

Subject To:

$$v_1 X_{1,0} + v_2 X_{2,0} + \cdots + v_m X_{m,0} \geq 0$$

$$v_j \geq 0$$

There are total of 107 educational districts (DMU) of south India selected for the study. All the schools are considered as DMU. There are 13 schools from Andhra Pradesh, 34 schools from Karnataka, 2 schools from Goa, 14 schools from Kerala, 30 schools from Tamil Nadu, 4 schools from Puducherry and 10 schools from Telangana. Only the schools which have a minimum enrolment of 50 are considered for the study.

For the DEA technique various input considered are:
1. Road - No of schools which can be reached by proper road

2. Playground- Number of schools with playground
3. Boundary Wall- Number of schools with boundary wall
4. Drinking water- Number of schools with drinking water facility
5. Electricity- Number of schools with electricity
6. Computers- Number of schools with computers
7. Mid-day Meals- Number of schools which provide mid-day meals in campus

Table 2: Descriptive statistics of input variables

	School	Road	Playground	Boundary wall	Drinking water	Electricity	Computer	Midday meal
Min	10	14	5	12	15	15	15	10
1Q	472	566.5	357	455	623.5	596	95	472
Median	838	891	537	667	963	934	285	827
Mean	1088	1211	720.4	809.6	1233.3	1192	321.6	1078
3Q	1416	1558.5	1034	1088.5	1554.5	1527	457	1404
Max	3994	4258	2158	2388	4401	4385	1522	3977

Table 3: Correlation Matrix

	Road	Playground	Boundary wall	Drinking water	Electricity	Computer	Midday Meal
Road	1.0	.9068	.9318	.9932	.9937	.3058	.9806
Playground	.9068	1.0	.8842	.9079	.8909	.4397	.8572
Boundary wall	.9318	.8842	1.0	.9275	.9273	.4283	.8784
Drinking water	.9932	.9079	.9275	1.0	.9899	.2919	.9796
Electricity	.9937	.8909	.9273	.9899	1.0	.2844	.9789
Computer	.3058	.4397	.4283	.2919	.2844	1.0	.1871
Midday Meal	.9806	.8572	.8784	.9796	.9789	.1871	1.0

IV. RESULTS AND DISCUSSION

The relative efficiency of schools was calculated. The results show that two of the schools from Puducherry is leading with an efficiency score of 1. Since both have the efficiency score of 1 they are ranked 1and these two schools becomes most efficient schools.

Table 4: Ranks of DMU's based on Efficiency

State	Efficiency	Rank	State	Efficiency	Rank
Py1	1	1	Kl9	0.055556	49
Py3	1	1	TN24	0.055556	50
Ka16	0.652174	3	Ap7	0.054545	51
Ka25	0.6	4	Ap9	0.053381	52
Ka15	0.555556	5	Ap10	0.053191	53
Ka34	0.535714	6	Kl1	0.052632	54
Ka27	0.441176	7	TN27	0.048077	55
Ka31	0.333333	8	Ap3	0.047771	56
Ka17	0.326087	9	Ap12	0.047468	57
GOA2	0.326087	10	TN26	0.046729	58
Ka24	0.319149	11	TN18	0.046154	59
Ka33	0.319149	12	TN9	0.046012	60
Ka7	0.3125	13	Ap11	0.045872	61
Ka13	0.306122	14	Ka20	0.045317	62
Ka10	0.3	15	Tel7	0.045045	63
Ka22	0.267857	16	TN22	0.044643	64
Ka29	0.263158	17	TN13	0.044248	65
Ka32	0.238095	18	TN2	0.041322	66
Ka8	0.230769	19	TN25	0.040872	67
Ka21	0.230769	20	Ap6	0.040541	68
Ka23	0.208333	21	Tel3	0.040541	69
Ka18	0.197368	22	TN5	0.039164	70
Py4	0.197368	23	TN19	0.038265	71
Ka30	0.174419	24	TN21	0.037879	72
Ka2	0.172414	25	TN20	0.037406	73
GOA1	0.168539	26	TN29	0.037313	74
Ka5	0.157895	27	TN16	0.037129	75
Ka14	0.157895	28	Ap5	0.036145	76
Ka6	0.153061	29	TN23	0.035714	77
Ka1	0.151515	30	Tel9	0.034325	78
Ka9	0.135135	31	Tel8	0.033482	79
Ka19	0.128205	32	Kl11	0.032967	80
Ap2	0.11811	33	TN6	0.032895	81
Kl3	0.111111	34	Kl12	0.032751	82
Ka12	0.107143	35	Ka11	0.031621	83
Ap1	0.106383	36	Ap13	0.031513	84
Ka26	0.092593	37	TN15	0.031315	85
Py2	0.086705	38	TN30	0.03112	86
Tel10	0.081522	39	Kl10	0.03012	87
Ka28	0.078947	40	Kl7	0.028626	88
Tel1	0.073529	41	Kl8	0.028355	89
TN11	0.073171	42	TN17	0.027881	90
Ka4	0.069444	43	TN28	0.027372	91
Ka3	0.067568	44	TN8	0.027174	92
Tel2	0.067568	45	TN10	0.025862	93
TN14	0.064378	46	Kl13	0.02551	94
Ap8	0.060729	47	Kl6	0.024876	95
Tel4	0.055762	48	Ap4	0.024311	96
TN12	0.023772	97	Kl4	0.019043	103
Kl2	0.023715	98	Kl5	0.016322	104
Kl14	0.023438	99	Tel5	0.016129	105
TN4	0.023438	100	Tel6	0.013699	106
TN1	0.022762	101	TN7	0.010213	107
TN3	0.021898	102			

V. CONCLUSION AND FUTURE WORK

In this research efficiency scores of different schools were calculated. State wise inefficient schools can be addressed to improve the efficiency and also individually schools can be given feedback so that country as a whole can improve the primary education system which is the starting stage of education

VI. ACKNOWLEDGMENT

VII. REFERENCES

[1]. D. Abdullah, Tulus, S. Suwilo, S. Efendi, Hartono, and C. I. Erliana, "A Slack-Based Measures for Improving the Efficiency Performance of Departments in Universitas Malikussaleh," Int. J. Eng. Technol., vol. 7, no. 2, pp. 491–494, 2018.

[2]. T. N. A.-F. and A. S. Alidi, "Evaluating Teaching Staff: Data Envelopment Analysis," vol. 200, no. 520, pp. 25–29, 1991.

[3]. C. T. Kuah and K. Y. Wong, "Efficiency assessment of universities through data envelopment analysis," Procedia Comput. Sci., vol. 3, pp. 499–506, 2011.

[4]. S. K. Jana, "Efficiency Analysis of Higher Education Institutes : A Study on Colleges under Vidyasagar University

in West Benga ....,'' Sch. J. Econ. Bus. Manag., no. January, pp. 35–40, 2017.

[5]. P. Tyagi, S. Prasad, and S. P. Singh, "Efficiency analysis of schools using DEA : A case study of Uttar Pradesh state in India."

[6]. J. Johnes, "Data envelopment analysis and its application to the measurement of efficiency in higher education," Agric. Agric. Sci. Procedia, vol. 6, no. 2, pp. 491–494, 2018.

[7]. V. Gourishankar and P. Sai Lokachari, "Benchmarking educational development efficiencies of the Indian states: a DEA approach," Int. J. Educ. Manag., vol. 26, no. 1, pp. 99–130, 2012.

[8]. N. A. Burney, J. Johnes, M. Al-enezi, and M. Al-musallam, "The efficiency of public schools : the case of Kuwait," Educ. Econ., vol. Vol. 21, N, no. February 2014, pp. 360–379, 2014.

[9]. "District Report Cards", Udise.in, 2019. [Online]. Available: http://udise.in/drc.htm. [Accessed: 10- Feb- 2019]