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Performance Assessment and Ranking of Shiraz High Schools Using Dea

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ABSTRACT
This research uses the DEA method to assess the performance and efficiency Smart and traditionalsuper schools in Shiraz. In the traditional system the aim was only increasing the student and teacher information only and the imagination of a reproductive student was never possible, but these goals are outmoded nowadays, information load is not the goal and in educational systems the new goal is to create job opportunities. In this way the student can start an occupation whenever he quits the school. Traditional education is only audio learning, and visual items are only colored posters on the board, while in smart schools new technologies such as smart board, video projectors, computers and etc. are used. In this research we compare a homogeneous sample including 11 traditional units and 10 smart units. The data were gathered by considering 3 inputs for 4 outputs for all the schools and then the efficiency value was determined using BCC and CCR models.Input and output variables were defined according to principals in following research , opinion then ranking models were used to rank the efficient schools, then the benchmark was determined for each school so as the principals can identify their weaknesses and strengths.

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INTRODUCTION

Education is of great importance in any country, the educational system in a country defines its future. So the responsible organizations such as education organization have moved toward doing something practical one of which is founding smart schools. Smart school is a physical school in which the management is based on information technology, computer and web, and the school subjects are electronic contented. The assessment and its system is totally smart and the learning process is done by means of smart board, video projectors, E-books and etc. by which the teaching, learning and managing processes accede efficiency systematically.

Practical management and practical use of resources needed to support education is the main goal in these schools and students are prepared to live in information age [1].

Smart schools guarantee that all the students with all kinds of talents have an equal opportunity, and this is related to all teachers, managers, staff, parents, schools and the society.

The most important fact in smart schools is the change in teaching. They have a widespread teaching program which includes students' needs and capabilities and makes a practical environment and also parents cope efficiency in the process,

In 2003, Abbott and Doucouliagos [2] analyzed the efficiency of Australian universities whose work paved the way for Johns who did the same in British super schools in 2006. John's work had some weaknesses such as not determining an exact value for efficiency [3].

In 2008, Jones and Yu [4] analyzed the super education institutes in China and revealed that there is a direct relationship between efficiency and the principals' point of view.

In this research we try to determine the efficient schools and define a benchmark for the non-efficient schools and introduce the successful principals using ranking models; however such a research has not been done using mathematical models. We will see that input and output indexes of new educational systems in smart schools are more preferred and also we will recognize that smart schools have a better performance than traditional schools regarding all indexes.

In the second section DEA method and used models are described and in the third section these models are used for data set in 11 traditional and 10 smart schools in Shiraz and the results are analyzed and finally the conclusion is given.

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Preliminary:

One of the practical instruments in assessment is DEA performance assessment which is used as a non-parametrical method to measure efficient units. Using this method not only determines the relative efficiency but also reveals the weaknesses of the organizations for different indexes and paves the way for improving the relative efficiency. DEA is a linear programming method which defines the efficiency frontier using organizational information of productive units as decision making units.

This frontier is defined on the basis of input-output information and consequent linear programming results in which the efficiency value of any unit is defined as the distance between the specified units to the efficiency frontier. DEA models can be analyzed through input and output orientation. Output for consistent and variable return to scalehypo theorem is used for BCC and CCR models.

Long-term returns to scale is a concept that reflects the relative increase in output per input rate of increase in this ratio can be fixed, is ascending or descending. To the constant returns to scale is the ratio of output to change the inputs vary, for example, if the inputs are doubled, output will also double. But the output of variable returns to scale is not proportional to the input change. Wide variation in results caused by use of this technique is increasingly growing.

The expanded variety in the results has led to the increase in using this method.

Suppose that $DMU_j(j=1,\dots,n)$ are n decision making observed units which produce $x_j(j=1,\dots,n)$ input resultant for y_j (j=1,..,n) output resultant, x_j resultant has m components and y_j has s components. The aim of performance assessment is DMU_oin which theo $\in\{1,2,\dots,n\}$, Productionpossibilitysetis definedas follows:(1)

$$T_c=\{(x,y)|x\geq\sum_{j=1}^{n}\lambda_j x_j \,\&\, y\leq\sum_{j=1}^{n}\lambda_j y_j \,\&\, \lambda_j\geq0,\ j=1,\dots,n\}$$

This set defines all the decision making units which have the ability to produce. The frontier of this set is defined as the efficient frontier in which the point shows the units which has the most output for the least input.

CCR model for input orientation:

If the (x_o,y_o) are not efficient and we want to imagine this unit on the efficiency frontier, we can decrease the inputs. Consider the possibility to produce $(\theta x_o,y_o)$, in which $y\geq y_o$ and $0\leq\theta x_o\leq x_o$, if the production possibility is put on the frontier so the θis the least value that $(\theta x_o,y_o)$ is set on $T_c$frontier.

If θ<1 then any possibility whose input is θx_o and output is at least y_o this means that $\theta x_o\leq x_o$ and $y\geq y_o$is dominant to DMU_o. So the θ should be changed in a way that the unit is put in the possibility set, so the followingmodel should be solved.

$$\text{Min } \theta \quad \text{s.t} \quad (\theta x_o,y_o)\in T_c \qquad (2)$$

Hence, to decrease the inputs and operation assessment the DMU_oCCR model in input orientationwas introduced by Charles(1978) as follows:

$$\begin{aligned} &\text{Min } \theta \\ &\text{s.t} \sum_{j=1}^{n}\lambda_j x_{ij}\leq\theta x_{io} \quad i=1,\dots,m. \\ &\sum_{j=1}^{n}\lambda_j y_{rj}\geq y_{ro} \quad r=1,\dots,s. \\ &\lambda_j\geq0, \quad j=1,\dots,n. \end{aligned} \qquad (3)$$

And the dual of CCR model in input orientation is as follows:

$$\begin{aligned} &\text{Max} \sum_{r=1}^{s} u_r y_{ro} \\ &\text{s.t} \quad \sum_{r=1}^{s} u_r y_{rj}-\sum_{i=1}^{m} v_i x_{ij}\leq0 \quad j=1,\dots,n. \\ &\sum_{i=1}^{m} v_i x_{io}=1 \quad r=1,\dots,s. \\ &u_r\geq0, v_i\geq0 \quad i=1,\dots,m. \end{aligned} \qquad (4)$$

In which the v_i and u_r are dual variables of (i)th input and (r)th output in CCR model. This is called multiple if CCR models (3) and (4) have finite optimum answers and their optimum values show θ^* in which $\theta^*=u^*y_o$ and also (3) optimum value shows (4)optimum value. With the decrease of u^*y_o and DMU_o input (if they are non-efficient), we put it on the frontier of θ, so it can make x^* efficient and produces the least y_o.

$(1-\theta^*)\, x_o$ is a value of the inputs which is wasted and the $(1-\theta^*)$ is called the non-efficiency value. It is obvious that if $\theta^* = 1$ then no input is wasted and non-efficiency equals zero.

Definition(1): if in CCR model in input orientation $\theta^*=1$ and slack variables equal zero, so the DMU_o is super-efficient or Paratoo-efficient.

Definition(2): if in CCR model in input orientation $\theta^*=1$ but we have a non-zero variable in one of the optimum answers, this means that DMU_o is low-efficient and these units are on low frontier of production possibility frontier.

If $\theta^*=1$ the assessed unit is on the frontier of production possibility set.

BCC model in input orientation:

Ifinstead ofassumingconstant returns to scale, variable returns to scaleassumptionto acceptbail $\sum_{j=1}^{n} \lambda_j = 1$ Thesameisbeingconvexconstraintstobe addedto producethe series, with thepossibilityofvariable returns to scaleis introducedas follows. (5)

$$T_v = \left\{ (x, y) \,\middle|\, \sum_{j=1}^{n} \lambda_j x_j \le x \,, \sum \lambda_j x_j \ge y \,, \lambda_j \ge 0 \,, \sum \lambda_j = 1 \right\}$$

The frontier of this set is defined as efficient frontier, while a decision making unit is not on the efficiency frontier, we imagine that in input orientation on the efficiency frontier with the decrease in inputs with the same relation.

So the θ should be changed in a way that the unit is put in the possibility set, so the following model should be solved.

$$\text{Min } \theta \qquad \text{s.t } (\theta x_o, y_o) \in T_v \quad (6)$$

This is equivalent to BCC model that was presented by Banker *et al* (Banker1984).

$$\text{Min } \theta$$

$$\text{s.t} \sum_{j=1}^{n} \lambda_j x_{ij} \le \theta x_{io} \quad i=1,\dots,m.$$

$$\sum_{j=1}^{n} \lambda_j y_{ij} \ge y_{ro} \quad r=1,\dots,s.$$

$$\sum_{j=1}^{n} \lambda_j = 1 \quad (7)$$

$$\lambda_j \ge 0, \quad j=1,\dots,n.$$

To obtainmultiplemodelformBCC,dualproblem(7) as follows:

$$\text{Max } u^t y_o + u_o$$

$$\text{s.t } v^t x_o = 1$$

$$u^t y_j - v^t x_j + u_o \le 0$$

$$u \ge 0 \,, v \ge 0 \quad j=1,\dots,n. \quad (8)$$

Theorem (1): in BCC model DMU_o is Paratoo efficient if $\theta^*=1$ and all slack variables in all optimum answers equal zero and in BCC form at least one of the DMUs is efficient.

Definition (3): for non-efficient DMU_oin
BCC model of referent set, E_0 is defined as
follows:
based on the solution as obtained in model (7):$E_0=\{j|\lambda_j^*>0.\}$

Definition (4): if the BCC model becomes alternative optimum solution, non-efficient DMU is as follows in which the point are optimum inputs and outputs corresponding assessed unit. The assessed unit must change its inputs and outputs to imagined inputs and outputs to become efficient.

$$\tilde{x}_o = \theta^* x_o - s^{-*}$$

$$\tilde{y}_o = y_o + s^{+*}$$

improved activity (benchmark).

Theorem (2): any element of E_0 is Paratoo efficient.
The proof is obvious.

Super efficiency model

By solving BCC and CCR models we will see that it is possible to have more than one efficient unit. The question is that which unit has the best performance among efficient units. Hence, ranking models must be used one of which is super efficiency model.

Anderson and Peterson presented a super efficiency model in 1994 which is called AP model. They eliminated $DMU_o$from production possibility set in order to present the ranking, and solved the DEA model for the rest of DMUs. Theirsuggest- ion model for ranking of DMU_o is as follows:

Max $z=\sum_{r=1}^{s} u_r y_{ro}$ (9)

s.t $\sum_{i=1}^{m} v_i x_{io} = 1$ r=1,…,s.

$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0$

j=1,...,n. $j \neq 0$

$u_r, v_i \geq \varepsilon$ i=1,…,*m*.

And the dual of (9) is:

$$
\begin{aligned}
&Min \quad \theta - \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+) && (10)\\
&S.t \quad \sum_{j=1, j\neq o}^{n} \lambda_j x_{ij} + s_i^+ = \theta x_{io} \quad , \ i=1,2,\ldots,m\\
&\quad \sum_{j=1, j\neq o}^{n} \lambda_j y_{rj} - s_r^- = y_{ro} \quad , \ r=1,2,\ldots,s\\
&\quad \lambda_j \geq 0 \quad , \ j=1,2,\ldots,n \ , j \neq o\\
&\quad s_i^- \geq 0 \quad , \ i=1,2,\ldots,m\\
&\quad s_r^+ \geq 0 \quad , \ r=1,2,\ldots,s
\end{aligned}
$$

In this model the value is not always $\theta^* \leq 1$, and it may be $\theta^* > 1$ and the values bigger than θ^* show super rankings of assed unit.

Performance assessment and ranking of Shiraz high schools:

In this section we study the performance assessmentof 10 smart and 11 traditional homogeneous super schools, inputs and outputs. The selection of input and output factors is so important in the preference of gained results and this selection is on the basis of research goal and scientific field of the research which is defined according to super principals' point of. After on full semester of teaching in education units the data is collected as follows:

inputassessment:
First input: the hours spent in teaching the books
Second input: the number of the students.
Third input: the paid fee for equipping each.
classroom.

Output assessment:

First output: teachers' scientific experience which is calculated by:

¼ ×teacher's done researches + ½ × teacher's teaching experience + ¼ × teacher's degree.(Fora bachelor's degree, master's degree, 7 and10 pointsto beconsidered.)

Second output: Average scores of students in a class is final score is 20.

Third output: Satisfaction of the instructor is teaching the students is obtained by first questionnaire score is 20.

Forth output:Creative problem solving is the means by which the test was obtained only creative questions which score is 20.

After applying them in schools the collected data in 11 traditional and 10 smart units are in Table(1).

Table 1: input-output values (attached with the questionnaire, 1to 11 are traditional and 12 to 21 are smart units).

Educational unit	I_1	I_2	I_3	O_1	O_2	O_3	O_4
1	68	38	10.8	9.75	13.3	10.33	13.89
2	62	39	11.3	10.75	14.24	12.7	10.27
3	64	35	11.7	13.25	14.09	11.06	11.03
4	61	36	12.4	12.75	12.7	10.5	10.56
5	60	37	13.9	11.25	14.36	14.47	12.37
6	56	34	9.6	13. 5	14.62	14.8	14.8
7	52	32	10.5	11.25	13.95	11.98	15.87
8	59	35	9.9	14.5	12.57	12.4	13.25
9	72	33	11.7	10.5	14.01	10.3	14.12
10	54	37	10.4	12. 5	13.73	13.7	15.65
11	64	34	10.1	13.25	14.09	12.62	14.93
12	44	38	113	10.5	15.94	12.9	16.1
13	47	34	98	12.5	16.39	14	15.35
14	52	39	105	9	15.92	13.6	16.96
15	45	35	110	14.75	14.46	15.8	17.11
16	46	34	114	13.25	15.58	16.61	16.14
17	45	36	112	15.75	16.37	14.49	18.47
18	50	33	105	13.75	15.81	15.28	14.56
19	38	35	117	12.5	14.79	17.33	16.02
20	42	36	102	11.25	14.13	13.56	15.3
21	40	34	96	13	16.62	16.93	14.74

Performance assessment results:

In this section we use input orientation model to assess the performance, hence, we solve the CR model with input orientation for the data of the previous Table using GAMS software and the results are in Table (2) As you see units 6, 7, 8, 10, 13, 15, 16, 17, 18, 19 and 21 are efficient units and the others are non-efficient. Among traditional ones, units 6, 7, 8 and 10 are efficient and among smart ones, units 13, 15, 16, 17, 18, 19 and 21 are efficient. So there are 7 smart efficient units and 4 traditional efficient units. Columns 3 to 9 show slack values and the input and output corresponded to each DMU.

The last column shows referent DMUs corresponded to any assessed DMU unit. For example, non-efficient unit 9 can introduce units 7 and 21 as its standard pattern and modify its input-output level as a complex of referent units to become efficient. If a unit is its own referent, it is extremesuper efficient. And if the referent of a unit is another unit and has no positive slack in its input-output, it is non-extremesuper efficient. And if its referent is another unit having slack input-output, it is weakefficient unit in which all the efficient units areextreme (Table 2).

As mentioned before, any non-efficient DMU should be imagined on the efficiency frontier in order to become efficient.

Corresponding point of any unit is shown in the Table(3) and the numbers show the extent that the units must decrease in order to become efficient and thesepoint will be corresponding benchmark with each DMU.

If we accept the hypo theorem of output for variable return to scale, we should solve the BCC model in order to calculate the efficiency of the units. In Table(4) the efficiency values and input-output slacks referent setcorresponding each DMU. As you see, units 6, 7, 8 and 10 among the traditional units and units 13, 15, 16, 17, 18, 19 and 21 among the smart units are efficient. It means that 64% of the smart units and 36% of the traditional units are efficient. Columns 3 to 9 show the slack value of inputs and outputs and the last column shows the referent setcorresponding each DMU.

Table(5) shows imagined pointCorres- ponding each unit. This Table shows to what extent any unit in output for variable return to scale technology must change its level in order to become efficient. These values are corresponding benchmark to any DMU. Since moles are presented in input orientation, the benchmark values don’t have less input and they are assessed units themselves.

As you see, in the assessment of the units on CCR model, 11 units are efficient, CCR super efficiency model is used in defining the ranking of the units whose results are followed Table(6). Second column show the super efficiency value, third column shows the assessed units and the last column shows the corresponding referent set to each unit in super efficiency model. Unit 6 has the best efficiency and unit 8 is the next. If the model is non-super efficient, the AP model cannot be used for ranking anymore and other methods must be used which are not related to this research. As mentioned above, in the assessment of the units on BCC model, 11 units are efficient. To differentiate these units and to rank them AP super efficiency model is used, the results of ranking super efficiency value and the referent set are shown in Table(7) in which unit 6 has the best ranking and units 7 and 21 are in the next place, 6 smart units and 4. traditional units among the units are single valued.

This shows the better performance of the smart units.

Table 2: The results of the model CCR DEAtheinputoriented.

DMU	Efficiency	Input1-Excess	Input2-Excess	Input3-Excess	Output1-Shortfall	Output2-Shortfall	Output3-Shortfall	Output4-Shortfall	Reference-set
DMU01	0.84	4.55	0.00	0.00	2.79	0.35	3.40	0.00	DMU06 DMU07
DMU02	0.87	0.00	1.02	0.00	1.80	0.00	0.93	4.79	DMU06 DMU07
DMU03	0.95	6.16	0.00	0.00	0.00	0.00	3.14	3.31	DMU06 DMU08 DMU17
DMU04	0.88	1.29	0.00	0.00	0.00	0.00	2.20	2.52	DMU06 DMU08 DMU17
DMU05	0.90	0.00	0.15	0.00	1.87	0.00	0.00	2.15	DMU06 DMU07 DMU21
DMU06	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU06
DMU07	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU07
DMU08	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU08
DMU09	0.97	18.02	0.00	0.00	0.79	0.00	1.76	1.78	DMU07 DMU21
DMU10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU10
DMU11	0.99	8.07	0.00	0.00	0.00	0.46	1.86	0.00	DMU06 DMU07 DMU17
DMU12	0.93	0.00	0.75	0.00	3.17	0.00	3.08	0.00	DMU17 DMU19 DMU21
DMU13	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU13
DMU14	0.89	0.00	0.00	0.00	4.99	0.00	0.34	0.00	DMU07 DMU13 DMU17 DMU21
DMU15	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU15
DMU16	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU16
DMU17	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU17
DMU18	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU18
DMU19	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU19
DMU20	0.91	0.00	1.56	0.00	1.58	0.00	0.00	0.00	DMU07 DMU17 DMU19 DMU21
DMU21	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU21

Table 3: DMUs' image under CCR input model (benchmark).

DMU	I_1	I_2	I_3	O_1	O_2	O_3	O_4
DMU01	52.23	31.73	9.02	12.54	13.65	13.73	13.89
DMU02	54.02	32.95	9.84	12.55	14.24	13.63	15.06
DMU03	54.53	33.19	11.09	13.25	14.09	14.20	14.34
DMU04	52.10	31.51	10.85	12.75	12.70	12.70	13.08
DMU05	54.11	33.21	12.53	13.12	14.36	14.47	14.52
DMU06	56.00	34.00	9.60	13.50	14.62	14.80	14.80
DMU07	52.00	32.00	10.50	11.25	13.95	11.98	15.87
DMU08	59.00	35.00	9.90	14.50	12.57	12.40	13.25
DMU09	52.00	32.10	11.38	11.29	14.01	12.06	15.90
DMU10	54.00	37.00	10.40	12.50	13.73	13.70	15.65
DMU11	55.50	33.77	10.03	13.25	14.55	14.48	14.93
DMU12	40.78	34.47	104.73	13.67	15.94	15.98	16.10
DMU13	47.00	34.00	98.00	12.50	16.39	14.00	15.35
DMU14	46.03	34.53	92.95	13.99	15.92	13.94	16.96
DMU15	45.00	35.00	110.00	14.75	14.46	15.80	17.11
DMU16	46.00	34.00	114.00	13.25	15.58	16.61	16.14
DMU17	45.00	36.00	112.00	15.75	16.37	14.49	18.47
DMU18	50.00	33.00	105.00	13.75	15.81	15.28	14.56
DMU19	38.00	35.00	117.00	12.50	14.79	17.33	16.02
DMU20	38.29	31.26	93.00	12.78	14.13	13.56	15.30
DMU21	40.00	34.00	96.00	13.00	16.62	16.93	14.74

Table 4: The results of the model BCC DEA the input oriented.

DMU	Efficiency	Input1-Excess	Input2-Excess	Input3-Excess	Output1-Shortfall	Output2-Shortfall	Output3-Shortfall	Output4-Shortfall	Reference-set
DMU01	0.89	4.86	0.00	0.00	3.65	1.29	4.35	0.96	DMU06 DMU07
DMU02	0.88	0.00	1.03	0.00	1.91	0.13	1.05	4.93	DMU06 DMU07
DMU03	0.96	6.28	0.00	0.00	0.00	0.47	3.43	3.89	DMU06 DMU07 DMU18
DMU04	0.93	1.89	0.00	0.00	0.00	1.72	3.36	4.59	DMU06 DMU07 DMU18
DMU05	0.91	0.00	0.00	0.00	1.91	0.21	0.00	2.59	DMU06 DMU07 DMU10 DMU21
DMU06	1.00	0. 0	0.00	0.00	0.00	0.00	0.00	0.00	DMU06
DMU07	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU07
DMU08	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DMU09	0.97	18.01	0.00	0.00	0.87	0.00	1.86	1.69	DMU06 DMU07 DMU21
DMU10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU10
DMU11	0.99	8.07	0.00	0.00	0.00	0.46	1.86	0.00	DMU06 DMU07 DMU17 DMU18
DMU12	0.93	0.00	0.52	0.00	3.01	0.00	3.45	0.00	DMU07 DMU17 DMU19 DMU21
DMU13	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU13
DMU14	0.89	0.00	0.00	5.82	4.95	0.00	0.59	0.00	DMU07 DMU13 DMU17 DMU21
DMU15	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU15
DMU16	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU16
DMU17	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU17
DMU18	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU18
DMU19	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU19
DMU20	0.96	0.00	0.18	0.00	1.48	1.61	3.15	0.00	DMU07 DMU19 DMU21
DMU21	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DMU21

Table 5: DMUs' image under BCC model (benchmark).

DMU	I_1	I_2	I_3	O_1	O_2	O_3	O_4
DMU01	55.83	33.91	9.64	13.40	14.59	14.68	14.85
DMU02	54.51	33.26	9.94	12.66	14.37	13.75	15.20
DMU03	55.45	33.76	11.28	13.25	14.56	14.49	14.92
DMU04	54.56	33.31	11.47	12.75	14.42	13.86	15.15
DMU05	54.86	33.83	12.71	13.16	14.57	14.47	14.96
DMU06	56.00	34.00	9.60	13.50	14.62	14.80	14.80
DMU07	52.00	32.00	10.50	11.25	13.95	11.98	15.87
DMU08	59.00	35.00	9.90	14.50	12.57	12.40	13.25
DMU09	52.06	32.11	11.39	11.37	14.01	12.16	15.81
DMU10	54.00	37.00	10.40	12.50	13.73	13.70	15.65
DMU11	55.51	33.78	10.03	13.25	14.55	14.48	14.93
DMU12	40.87	34.78	104.95	13.51	15.94	16.35	16.10
DMU13	47.00	34.00	98.00	12.50	16.39	14.00	15.35
DMU14	46.15	34.61	87.37	13.95	15.92	14.19	16.96
DMU15	45.00	35.00	110.00	14.75	14.46	15.80	17.11
DMU16	46.00	34.00	114.00	13.25	15.58	16.61	16.14
DMU17	45.00	36.00	112.00	15.75	16.37	14.49	18.47
DMU18	50.00	33.00	105.00	13.75	15.81	15.28	14.56
DMU19	38.00	35.00	117.00	12.50	14.79	17.33	16.02
DMU20	40.14	34.22	97.49	12.68	15.74	16.71	15.30
DMU21	40.00	34.00	96.00	13.00	16.62	16.93	14.74

Table 6: super efficiency of DMUs under CCR input orientation..

DMU	Super-Efficiency	Rank	Reference-Set
DMU01	0.89	13	DMU06 DMU07
DMU02	0.88	14	DMU06 DMU07
DMU03	0.96	10	DMU06 DMU07 DMU18
DMU04	0.93	11	DMU06 DMU07 DMU18
DMU05	0.91	12	DMU06 DMU07 DMU10 DMU21
DMU06	5.63	1	DMU06 DMU08 DMU10 DMU15 DMU17 DMU21
DMU07	1.77	4	DMU06 DMU10 DMU17
DMU08	5.57	2	DMU06 DMU17
DMU09	0.97	9	DMU06 DMU07 DMU21
DMU10	2.15	3	2.15 DMU06 DMU07 DMU17

DMU11	0.99	8	DMU06 DMU07 DMU17 DMU18
DMU12	0.93	11	DMU07 DMU17 DMU19 DMU21
DMU13	1.00	7	DMU07 DMU17 DMU18 DMU21
DMU14	0.89	13	DMU07 DMU13 DMU17 DMU21
DMU15	Infeasible	--	
DMU16	1.03	6	DMU15 DMU17 DMU19 DMU21
DMU17	Infeasible	--	
DMU18	1.04	5	DMU07 DMU16 DMU17 DMU21
DMU19	Infeasible	--	
DMU20	0.96	10	DMU07 DMU19 DMU21
DMU21	Infeasible	--	

Table 7: DMUs' image under BCC.

DMU	Super-Efficiency	Rank	Reference-Set
DMU01	0.84	19	DMU06 DMU07
DMU02	0.87	18	DMU06 DMU07
DMU03	0.95	12	DMU06 DMU08 DMU17
DMU04	0.88	17	DMU06 DMU08 DMU17
DMU05	0.90	15	DMU06 DMU07 DMU21
DMU06	1.17	1	DMU05 DMU06 DMU10 DMU11
DMU07	1.14	3	DMU06 DMU10 DMU17
DMU08	1.04	6	DMU06 DMU17
DMU09	0.97	11	DMU07 DMU21
DMU10	1.02	8	DMU06 DMU07 DMU19
DMU11	0.99	10	DMU06 DMU07 DMU17
DMU12	0.93	13	DMU17 DMU19 DMU21
DMU13	1.00	9	DMU07 DMU17 DMU21
DMU14	0.89	16	DMU07 DMU13 DMU17 DMU21
DMU15	1.02	8	DMU16 DMU17 DMU18 DMU21
DMU16	1.03	7	DMU16 DMU17 DMU19 DMU21
DMU17	1.07	5	DMU07 DMU15 DMU17 DMU19 DMU21
DMU18	1.02	8	DMU15 DMU17 DMU21
DMU19	1.12	4	DMU17 DMU21
DMU20	0.91	14	DMU07 DMU17 DMU19 DMU21
DMU21	1.15	2	DMU07 DMU13 DMU19 DMU21

Conclusion:

In this research the performance of smart and traditional high schools was analyzed. 11 traditional units and 10 smart units have been analyzed. We tried our best for all the units to be completely homogeneous i.e. traditional schools were equal in conditions and also smartschools were equal in conditions too. This caused the collected sample to be as above. Referring to head principals in education and using their point of view inputs and outputs were selected; however limitations such as inaccessibility to exact information about some input and output indexes led to their elimination. Since the possibility to correct the input indexes were easier than that of the output, input orientation models were used.

In short the CCR projections identify the point either as a positive combination of other DMUs with $\tilde{x}_o \leq x_o$, $\tilde{y}_o \geq y_o$ performed on the observation for DMUo identifies a new DMU positioned on the efficient frontier. Therefore, the improved activity (benchmark) is CCR-efficient.

After analyzing the results and solving the models the conclusion was drawn.

Generally, it cannot be said that the performance of the smart schools has been totally better than traditional schools, but he operation of smart schools has been better because the number of efficient smart schools has been more than the number of efficient traditional schools; and also it cannot be said that traditional schools don't have an acceptable performance since the performance of any school is assessed by considering the facilities in its input-output values which this is one of the advantages of DEA.

Regarding the results it is suggested that we increase the number of smart schools, and if this is not possible, at least it is possible to reinforce traditional schools and eliminate their weaknesses. On the other hand, all smart schools don't have optimum performance and they should eliminate their own weaknesses. In this research these two kinds of schools were analyzed in order to have a better comparison.

This can be later done in regional and country levels and the results for models can be gained through output orientation and conceptions such as efficiency on return to scale can be analyzed.

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