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Application of DEA in school evaluation

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ABSTRACT

Deficiency in educational resources is a main issue that current education development confronts. Research on how to optimize educational resources allocation is of great significance. The paper carries out analysis of data envelopment analysis (DEA) method while introduces it into school evaluation, and puts forward determination of evaluated school efficiency input and output indicators. Then combine with collected relevant data, it makes relative evaluations on school.

KEYWORDS

DEA; Educational resources; Connotation of efficiency; Principle of evaluation.

INTRODUCTION

Educational circles started studying on school efficiency nearly around the fifties of 20th century, most of which adopted individual element analysis method and regressive production function method. However, school evaluation is an issue that gets involved in multiple elements input and output, and evaluation on its efficiency is a very complicated issue. In recent years, efficiency researches mostly adopt leading surface analysis method, from which DEA is a kind of non-parameter analysis method. DEA is a relative effective data envelopment analysis method in evaluating departments which is put forward by operational research expert A.Charnes and W.W. Cooper and other scholars, it has following advantages: No need to presuppose concrete production function; it is suitable to handle with multi-input and multi-output evaluation issues; it can not only acquire resources usage status, but also acquire improvement information, therefore DEA is widely used in every system efficiency evaluation. The paper will adopt it to make evaluations o n school.

MIDDLE SCHOOL EFFICIENCY CONNOTATION

The word efficiency is from natural science, and is subsequently introduced into economics. In educational field, efficiency is transplanted from economics, which refers to utilization level of resources in educational production process that is:

$$\text{Efficiency} = \frac{\text{Educational achievement (Quantity and quality)}}{\text{Educational resources usage and consumption}}$$

It is thus clear that education efficiency is not simply input and output or cost and profit correlation, which reflects input and output、quantity and quality、efficacy and value as well as others uniform relationships. In micro-efficiency research, it most directly adopts Farrel scholar’s technical efficiency 、pure technical efficiency and scale efficiency and other concepts. The paper will make evaluations on one region’s several schools according to middle school resources input and output.

DEA AND ITS EVALUATION PRINCIPLE ANALYSIS

Set it has n piece of department or enterprises that go in for a same production activity (that is decision-making unit), every decision-making unit has m types of elements inputs and s types of outputs, its observed value is:

$$\begin{array}{ll} v_1 & 1\rightarrow \\ v_2 & 2\rightarrow \\ v_3 & 3\rightarrow \\ & \\ v_i & i\rightarrow \\ & \\ v_m & m\rightarrow \end{array}\begin{pmatrix} x_{11}, x_{12}, x_{13}, \cdots x_{1j} \cdots x_{1n} \\ x_{21}, x_{22}, x_{23} \cdots x_{2j} \cdots x_{2n} \\ x_{31}, x_{32}, x_{33} \cdots x_{3j} \cdots x_{3n} \\ \cdots\cdots\cdots\cdots\cdots\cdots \\ x_{i1}, x_{i2}, \cdots\cdots\cdots x_{ij} \cdots x_{in} \\ \cdots\cdots\cdots\cdots\cdots\cdots \\ x_{m1}, x_{m2} \cdots\cdots\cdots x_{mj} \cdots x_{mn} \end{pmatrix} \begin{array}{ll} u_1 & 1\rightarrow \\ u_2 & 2\rightarrow \\ u_3 & 3\rightarrow \\ & \\ u_r & r\rightarrow \\ & \\ u_s & s\rightarrow \end{array}\begin{pmatrix} y_{11}, y_{12}, y_{13} \cdots y_{1j} \cdots y_{1n} \\ y_{21}, y_{22}, y_{23} \cdots y_{2j} \cdots y_{2n} \\ y_{31}, y_{32}, y_{33} \cdots y_{3j} \cdots y_{3n} \\ \cdots\cdots\cdots\cdots\cdots\cdots \\ y_{r1}, y_{r2}, y_{r3} \cdots y_{rj} \cdots y_{rn} \\ \cdots\cdots\cdots\cdots\cdots\cdots \\ y_{s1}, y_{s2}, y_{s3} \cdots y_{sj} \cdots y_{sn} \end{pmatrix}$$

x_{ij} ——The j piece of decision making unit to the i type of inputs total amount $x_{ij} \geq 0$.

y_{rj} ——The j pieces of decision making unit to the r type of outputs total amount $y_{ij} \geq 0$ 。

v_i ——The *I* type of inputs measurement (that is also called weight coefficient).

u_r ——The r type of outputs measurement(that is also called weight coefficient).

(Among them, i=1, 2, ...m;j=1, 2.......n;r=1, 2, ...p)

x_{ij}, y_{rj} are known data, which can be obtained according to historical information or predicted data. v_i, u_r are variables that correspond to weight coefficients $v = (v_1, v_2 \cdots v_m)^T$, $u = (u_1, u_2 \cdots, u_p)^T$, every decision making unit has corresponding efficiency evaluation index :

$$h_j = \frac{\sum_{r=1}^{p} u_r y_{rj_0}}{\sum_{1}^{m} v_i x_{ij_0}}, \quad j = 1, 2, \cdots, n \tag{1}$$

In theory, we can take proper weight coefficients v and u. Let them meet:

$h_j \le 1, \; j = 1, 2, \cdots, n$ 。

Now to the j_0 decision making unit, it proceeds with efficiency evaluation $(1 \le j_0 \le n)$, using weight coefficients v and u as variables, using the j_0 decision making unit efficiency indicator as objective, using all decision making units efficiency indicators $h_j \le 1$ as constraints, and then forms into following optimization model: $\max h_{j0} = \frac{\sum_{r=1}^{p} u_r y_{rj0}}{\sum_{1}^{m} v_i x_{ij0}}$, it lets

$$\begin{cases} \frac{\sum_{R}^{P} u_r y_{rj}}{\sum_{i}^{m} v_i x_{ij}} \le 1, \; j = 1,2,3,\ldots.n \\ v = (v_1, v_2, \cdots v_m)^T \ge 0 \\ u = (u_1, u_2, \cdots u_p)^T \ge 0 \end{cases} \quad \textbf{(2)}$$

It is not hard to see that utilize above model's evaluation decision making unit j_0 is effective or not is in relation to other decision making units. For convenience sake, record $\boldsymbol{y_{rj_0}}$ as $\boldsymbol{y_{r0}}, \boldsymbol{x_{ij0}}$ as x_{j0}, similarly, record Y_{j0} as Y_0, record X_{j0} as X_0, use matrix notation, it has $\max V_p = \frac{U^T Y_0}{V^T X_0}$

$$(\bar{p}) \text{ let} \begin{cases} \frac{U^T Y_0}{V^T X_0} \le 1, \; j = 1,2,\ldots\ldots n \\ V \ge 0, U \ge 0. \end{cases} \quad \textbf{(3)}$$

Among them $X_j = (x_{1j}, x_{2j}, \ldots\ldots x_{mj})^T$, $Y_j = (y_{1j}, y_{2j,\ldots\ldots} y_{mj})^T > 0$ J= 1, 2, …n,

($\bar{p}$)is a fractional programming, using Charnes-- Cooper, it can be converted into an equivalent linear programming problem:

$$t = \frac{1}{V^T X_0}, w = tV, u = tU, \quad \textbf{(4)}$$

$$\text{Then it has: } \begin{cases} \frac{U^T Y_0}{V^T X_0} = u^T Y_0 \\ \frac{U^T Y_j}{V^T X_J} = \frac{u^T Y_j}{w^T X_j} \le 1, \; j = 1,2,,\ldots,n \\ w^T x_0 = 1, w \ge 0, u \ge 0. \end{cases} \quad \textbf{(5)}$$

Therefore the fractional programming ($\bar{p}$) changes into : $\max V_p = u^T Y_0$,

$$(\bar{p}) \text{ let} \begin{cases} w^T X_j - u^T Y_j \geq 0, j = 1,2,,......,n \\ w^T X_0 = 1, w \geq 0, u \geq 0. \end{cases} \quad \textbf{(6)}$$

Theorem 1 Fractional programming and linear programming are equivalent in the following significances:

If V^0, U^0 are optimal solution of ($\bar{p}$), then $w^0 = t^0 V^0, u^0 = t^0 V^0,$ that is an optimal solution of (p),

And optimal values are equal. Among them, $t^0 = \dfrac{1}{V^{0T} X_o}$

(2)If w^0, u^0 are optimal solution of ($\bar{p}$), then V^0, U^0 are also optimal solution of($\bar{p}$), and optimal values are equal

Definition 1 If among linear programming ($\bar{p}$) optimal solution, it has w^0, u^0 that meet $V_p = u^{0T} Y_0 = 1,$ then it calls decision making unit j_0 is weak DEA that is effective.

Definition 2 If linear programming ($\bar{p}$) optimal solution $w^0 > 0, u^0 > 0$ meet $V_p = u^{0T} Y_0 = 1,$ then it calls decision making unit j_0 is DEA that is effective. By definition, it is clear that if decision making unit j_0 is DEA that is effective, then j_0 surely is weak DEA that is effective.

Obviously linear programming($\bar{p}$) dual programming is : $\min V_D = \theta,$

$$\text{(D) let} \begin{cases} \sum_{j=1}^{n} X_j \lambda_j + S^- = \theta X_0 \\ \sum_{j=1}^{n} Y_j \lambda_j - S^+ = Y_0 \\ \lambda_j \geq 0 \; j = 1,2,,.....,n \\ S^+ \geq 0, S^- \geq 0, \theta hasnoconstra\text{int}\, s. \end{cases} \quad \textbf{(7)}$$

Theorem2 Both linear programming($\bar{p}$) and dual programming (D) have optimal solution and optimal values.

Theorem 3 For dual programming (D), it has:

(1)If(D)optimal value $V_D = 1$, then decision making unit j_0 is weak DEA that is effective; and vice versa.

(2) If(D) optimal value $V_D = 1$, and its optimal value λ^0 , S^{0-} , S^{0+} , θ^0 , all have S^{0-}=0, S^{0+}=0,

then decision-making unit j_0 is DEA that is effective; and vice versa.

DEA METHOD INDICATORS SELECTION IN SCHOOL EFFICIENCY EVALUATION

So-called school evaluation refers to efficiency in utilizing resources. One of premises that apply DEA method is it ought to be the same attribute evaluation unit, so school efficiency evaluation firstly should determine a certain standard, and select schools that conform to standards, such as one region's key middle school and so on.

To sum up, according to China's current middle schools' supervising status, make analysis and synthesis of all kinds of indicators that reflect middle schools' education work, select evaluation input and output indicators as :

1. Input indicator X:faculty ;educational fund ; apparatus, total amount of books and reference materials;And average scores of students' enrollment.
2. Output indicator Y:graduate enrolment rate ;graduate average scores ; Graduate moral education pass rate.

It ought to point out that in order to increase evaluation model's efficacy, when select input and output indicators in different periods and different regions, it should select from reality.

In the following, it illustrates every input and output indicator data collection and handling :

(1) Educational fund:Following state and society allocated school annual running funds or evaluation stage's whole fund.

(2) Faculty:Weighting the number of people in school's each level job title and taking the sum, from which every level weight should be determined by experts.

(3) Apparatus, total amount of books and reference materials:School possessed whole apparatus, books and reference materials that are converted into RMB.
(4) Average scores of students enrollment:It refers to results that graduate total score in entrance unified examination at that time divides by number of people.
(5) Graduate average scores:It is obtained according to whole graduates graduate unified scores divide by number of graduate.
(6) Graduate enrolment rate: Calculate according to probability that graduate qualifies to enter into the third-grade college.
(7) Graduate moral education pass rate: It refers to proportion that number of people without being punished by school and have no social crime of graduate.

Below is one region sever schools resources inputs and outputs relevant data(refers to TABLE 1) :

TABLE 1 : One region seven schools resources inputs and outputs relevant data

School Indicator	School 1	School 2	School 3	School 4	School 5	School 6	School 7
Educational fund(ten million)	3	2.5	2.7	2.9	2	2.3	5
Faculty(People)	87	76	79	80	70	88	80
Apparatus, books and reference materials total amount(ten million)	3	2.5	2.7	2.9	2	2.5	5
Students' enrollment scores	7.8	7.2	7.6	7.7	7	7.7	7.5
Graduate average scores	440	412	450	420	360	375	374
Graduate enrolment rate	0.7	0.6	0.8	0.65	0.75	0.53	0.45
Graduate moral education pass rate	1	0.99	1	1	0.96	0.98	0.74

MODEL ANALYSES

In the following, according to above collected relevant data, we make concrete analysis and establish relative models.

According to model (7)and relevant data, establish school 1 DEA model

School 1 DEA model is : $\min V_D = \theta$

$$s.t\begin{cases} 3\lambda_1 + 2.5\lambda_2 + 2.7\lambda_3 + 2.9\lambda_4 + 2\lambda_5 + 2.3\lambda_6 + 5\lambda_7 + s^- = 3\theta \\ 87\lambda_1 + 76\lambda_2 + 79\lambda_3 + 80\lambda_4 + 70\lambda_5 + 88\lambda_6 + 80\lambda_7 + s^- = 87\theta \\ 3\lambda_1 + 2.5\lambda_2 + 2.7\lambda_3 + 2.9\lambda_4 + 2\lambda_5 + 2.5\lambda_6 + 5\lambda_7 + s^- = 3\theta \\ 7.8\lambda_1 + 7.2\lambda_2 + 7.6\lambda_3 + 7.7\lambda_4 + 7\lambda_5 + 7.7\lambda_6 + 7.5\lambda_7 + s^- = 7.8\theta \\ 440\lambda_1 + 412\lambda_2 + 450\lambda_3 + 420\lambda_4 + 360\lambda_5 + 375\lambda_6 + 374\lambda_7 - s^+ = 440 \\ 0.7\lambda_1 + 0.6\lambda_2 + 0.80\lambda_3 + 0.65\lambda_4 + 0.75\lambda_5 + 0.53\lambda_6 + 0.45\lambda_7 - s^+ = 0.7 \\ \lambda_1 + 0.99\lambda_2 + \lambda_3 + \lambda_4 + 0.96\lambda_5 + 0.98\lambda_6 + 0.74\lambda_7 - s^+ = 1 \end{cases}$$

School 2 DEA model is: $\min V_D = \theta$

$$s.t\begin{cases} 3\lambda_1 + 2.5\lambda_2 + 2.7\lambda_3 + 2.9\lambda_4 + 2\lambda_5 + 2.3\lambda_6 + 5\lambda_7 + s^- = 2.5\theta \\ 87\lambda_1 + 76\lambda_2 + 79\lambda_3 + 80\lambda_4 + 70\lambda_5 + 88\lambda_6 + 80\lambda_7 + s^- = 76\theta \\ 3\lambda_1 + 2.5\lambda_2 + 2.7\lambda_3 + 2.9\lambda_4 + 2\lambda_5 + 2.5\lambda_6 + 5\lambda_7 + s^- = 2.5\theta \\ 7.8\lambda_1 + 7.2\lambda_2 + 7.6\lambda_3 + 7.7\lambda_4 + 7\lambda_5 + 7.7\lambda_6 + 7.5\lambda_7 + s^- = 7.2\theta \\ 440\lambda_1 + 412\lambda_2 + 450\lambda_3 + 420\lambda_4 + 360\lambda_5 + 375\lambda_6 + 374\lambda_7 - s^+ = 412 \\ 0.7\lambda_1 + 0.6\lambda_2 + 0.80\lambda_3 + 0.65\lambda_4 + 0.75\lambda_5 + 0.53\lambda_6 + 0.45\lambda_7 - s^+ = 0.6 \\ \lambda_1 + 0.99\lambda_2 + \lambda_3 + \lambda_4 + 0.96\lambda_5 + 0.98\lambda_6 + 0.74\lambda_7 - s^+ = 0.99 \end{cases}$$

School 3 DEA model is: $\min V_D = \theta$

$$s.t\begin{cases}3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.3\lambda_6+5\lambda_7+s^-=2.7\theta\\87\lambda_1+76\lambda_2+79\lambda_3+80\lambda_4+70\lambda_5+88\lambda_6+80\lambda_7+s^-=79\theta\\3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2..5\lambda_6+5\lambda_7+s^-=2.7\theta\\7.8\lambda_1+7.2\lambda_2+7.6\lambda_3+7.7\lambda_4+7\lambda_5+7.7\lambda_6+7.5\lambda_7+s^-=7.6\theta\\440\lambda_1+412\lambda_2+450\lambda_3+420\lambda_4+360\lambda_5+375\lambda_6+374\lambda_7-s^+=450\\0.7\lambda_1+0.6\lambda_2+0.80\lambda_3+0.65\lambda_4+0.75\lambda_5+0.53\lambda_6+0.45\lambda_7-s^+=0.8\\\lambda_1+0.99\lambda_2+\lambda_3+\lambda_4+0.96\lambda_5+0.98\lambda_6+0.74\lambda_7-s^+=1\end{cases}$$

School 4 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.3\lambda_6+5\lambda_7+s^-=2.9\theta\\87\lambda_1+76\lambda_2+79\lambda_3+80\lambda_4+70\lambda_5+88\lambda_6+80\lambda_7+s^-=80\theta\\3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.5\lambda_6+5\lambda_7+s^-=2.9\theta\\7.8\lambda_1+7.2\lambda_2+7.6\lambda_3+7.7\lambda_4+7\lambda_5+7.7\lambda_6+7.5\lambda_7+s^-=7.7\theta\\440\lambda_1+412\lambda_2+450\lambda_3+420\lambda_4+360\lambda_5+375\lambda_6+374\lambda_7-s^+=420\\0.7\lambda_1+0.6\lambda_2+0.80\lambda_3+0.65\lambda_4+0.75\lambda_5+0.53\lambda_6+0.45\lambda_7-s^+=0.65\\\lambda_1+0.99\lambda_2+\lambda_3+\lambda_4+0.96\lambda_5+0.98\lambda_6+0.74\lambda_7-s^+=1\end{cases}$$

School 5 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.3\lambda_6+5\lambda_7+s^-=2\theta\\87\lambda_1+76\lambda_2+79\lambda_3+80\lambda_4+70\lambda_5+88\lambda_6+80\lambda_7+s^-=70\theta\\3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.5\lambda_6+5\lambda_7+s^-=2\theta\\7.8\lambda_1+7.2\lambda_2+7.6\lambda_3+7.7\lambda_4+7\lambda_5+7.7\lambda_6+7.5\lambda_7+s^-=7\theta\\440\lambda_1+412\lambda_2+450\lambda_3+420\lambda_4+360\lambda_5+375\lambda_6+374\lambda_7-s^+=360\\0.7\lambda_1+0.6\lambda_2+0.80\lambda_3+0.65\lambda_4+0.75\lambda_5+0.53\lambda_6+0.45\lambda_7-s^+=0.75\\\lambda_1+0.99\lambda_2+\lambda_3+\lambda_4+0.96\lambda_5+0.98\lambda_6+0.74\lambda_7-s^+=0.96\end{cases}$$

School 6 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.3\lambda_6+5\lambda_7+s^-=2.3\theta\\87\lambda_1+76\lambda_2+79\lambda_3+80\lambda_4+70\lambda_5+88\lambda_6+80\lambda_7+s^-=88\theta\\3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.5\lambda_6+5\lambda_7+s^-=2.5\theta\\7.8\lambda_1+7.2\lambda_2+7.6\lambda_3+7.7\lambda_4+7\lambda_5+7.7\lambda_6+7.5\lambda_7+s^-=7.7\theta\\440\lambda_1+412\lambda_2+450\lambda_3+420\lambda_4+360\lambda_5+375\lambda_6+374\lambda_7-s^+=375\\0.7\lambda_1+0.6\lambda_2+0.80\lambda_3+0.65\lambda_4+0.75\lambda_5+0.53\lambda_6+0.45\lambda_7-s^+=0.53\\\lambda_1+0.99\lambda_2+\lambda_3+\lambda_4+0.96\lambda_5+0.98\lambda_6+0.74\lambda_7-s^+=0.98\end{cases}$$

School 7 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.3\lambda_6+5\lambda_7+s^-=2.4\theta\\87\lambda_1+76\lambda_2+79\lambda_3+80\lambda_4+70\lambda_5+88\lambda_6+80\lambda_7+s^-=73\theta\\3\lambda_1+2.5\lambda_2+2.7\lambda_3+2.9\lambda_4+2\lambda_5+2.5\lambda_6+5\lambda_7+s^-=2.1\theta\\7.8\lambda_1+7.2\lambda_2+7.6\lambda_3+7.7\lambda_4+7\lambda_5+7.7\lambda_6+7.5\lambda_7+s^-=7.5\theta\\440\lambda_1+412\lambda_2+450\lambda_3+420\lambda_4+360\lambda_5+375\lambda_6+374\lambda_7-s^+=374\\0.7\lambda_1+0.6\lambda_2+0.80\lambda_3+0.65\lambda_4+0.75\lambda_5+0.53\lambda_6+0.45\lambda_7-s^+=0.65\\\lambda_1+0.99\lambda_2+\lambda_3+\lambda_4+0.96\lambda_5+0.98\lambda_6+0.74\lambda_7-s^+=0.94\end{cases}$$

Make evaluations on school 1, apply lingo programming, result is:0.9620

Similarly, it can get model 2、3、4、5、6、7 programming. And computational programming statistics is as (TABLE 2):

TABLE 2 : Computational results

School Value	School 1	School 2	School 3	School 4	School 5	School 6	School 7
θ	0.9620	1	1	0.9599	1	0.9275	0.9925

In these seven schools, school 2, 3, 5 θ=1, so school 2, 3, 5are effective that belong to the same level schools, and are superior to other schools (that are school 1, school 4, school 6, school 7)

In the following, we make evaluations on the rest two schools:

TABLE 3 : Rest schools' data

School Indicator	School 1	School 4	School 6	School7
Educational fund	3	2.9	2.3	5
Faculty	87	80	88	80
Apparatus, books and reference materials total amount	3	2.5	2.5	5
Students enrollment scores, enrollment average scores	7.8	7.7	7.7	7.5
Students graduating average scores	440	420	375	374
Graduate enrolment rate	0.7	0.6	0.53	0.45
Graduate moral education pass rate	1	1	0.79	0.74

School 1 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.9\lambda_4 2.3\lambda_6+5\lambda_7+s^-=3\theta\\87\lambda_1+80\lambda_4+88\lambda_6+80\lambda_7+s^-=87\theta\\3\lambda_1+2.9\lambda_4+2.5\lambda_6+5\lambda_7+s^-=3\theta\\7.8\lambda_1+7.7\lambda_4+7.7\lambda_6+7.5\lambda_7+s^-=7.8\theta\\440\lambda_1+420\lambda_4+375\lambda_6+374\lambda_7-s^+=440\\0.7\lambda_1+0.65\lambda_4+0.53\lambda_6+0.45\lambda_7-s^+=0.7\\\lambda_1+\lambda_4+0.98\lambda_6+0.74\lambda_7-s^+=1\end{cases}$$

School 4 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.9\lambda_4+.3\lambda_6+5\lambda_7+s^-=2.9\theta\\87\lambda_1+80\lambda_4+88\lambda_6+80\lambda_7+s^-=80\theta\\3\lambda_1+2.9\lambda_4+2.5\lambda_6+5\lambda_7+s^-=2.9\theta\\7.8\lambda_1+7.7\lambda_4+7.7\lambda_6+7.5\lambda_7+s^-=7.7\theta\\440\lambda_1+420\lambda_4+375\lambda_6+374\lambda_7-s^+=420\\0.7\lambda_1+0.65\lambda_4+0.53\lambda_6+0.45\lambda_7-s^+=0.65\\\lambda_1+\lambda_4+0.98\lambda_6+0.74\lambda_7-s^+=1\end{cases}$$

School 6 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.9\lambda_4+.3\lambda_6+5\lambda_7+s^-=3\theta\\87\lambda_1+80\lambda_4+88\lambda_6+80\lambda_7+s^-=88\theta\\3\lambda_1+2.9\lambda_4+2.5\lambda_6+5\lambda_7+s^-=2.5\theta\\7.8\lambda_1+7.7\lambda_4+7.7\lambda_6+7.5\lambda_7+s^-=7.7\theta\\440\lambda_1+420\lambda_4+375\lambda_6+374\lambda_7-s^+=375\\0.7\lambda_1+0.65\lambda_4+0.53\lambda_6+0.45\lambda_7-s^+=0.53\\\lambda_1+\lambda_4+0.98\lambda_6+0.74\lambda_7-s^+=0.98\end{cases}$$

School 7 DEA model is: $\min V_D=\theta$

$$s.t\begin{cases}3\lambda_1+2.9\lambda_4+2.3\lambda_6+5\lambda_7+s^-=5\theta\\87\lambda_1+80\lambda_4+88\lambda_6+80\lambda_7+s^-=80\theta\\3\lambda_1+2.9\lambda_4+2.5\lambda_6+5\lambda_7+s^-=5\theta\\7.8\lambda_1+7.7\lambda_4+7.7\lambda_6+7.5\lambda_7+s^-=7.5\theta\\440\lambda_1+420\lambda_4+375\lambda_6+374\lambda_7-s^+=374\\0.7\lambda_1+0.65\lambda_4+0.53\lambda_6+0.45\lambda_7-s^+=0.45\\\lambda_1+\lambda_4+0.98\lambda_6+0.74\lambda_7-s^+=0.74\end{cases}$$

Established models get computational results as (TABLE 4) :

TABLE 4 : Computational results

School Value	School 1	School 4	School 6	School7
θ	1	1	1	0.9030

By above results, it gets that school 1 and school 4 and school 6 are effective, therefore they are schools of the same level. Thereupon, it gets conclusions:

The first type of schools are:School 2, school 3 and school 5;The second type of schools are :School 1, school 4 and school 6.

The third type of school is:School 7.

CONCLUSION

By above analysis, it gets conclusion that among the region these same levels schools' efficiencies, they have certain differences, school 2, school 3 and school 5 resources utilization efficiency is obviously higher than school 1 and school 4, cause for the latter is because faculty and other aspects allocation is not ideal, these schools efficiencies are lower. By

LINGO running programming, we can also get corresponding improvement measures; optimize schools' allocation to provide certain references for how to improve school resources efficiency in future. Schools' inputs should select resources allocation that suitable to themselves according to their practical situations, not blindly pursuing big and more, neither just evaluating schools merits by enrolment rate, evaluations of schools merits should be evaluated according to their inputs and outputs status.

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