MEASURING EFICIENCY OF WOMENS TECHNICAL INSTITUTUIONS BY USING CCR MODEL THROUGH DEA APPROACH

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ABSTRACT

In the present emerging global economy, the focus has been shifted from manufacturing to service sector necessitating the quality assessment in service sector as an important issue. Education sector, especially Technical Education System (TES), is characterized as highly process oriented, intangibility and multistake holder situations. Therefore difficulty arises in evaluating quality of education being imparted aggregating the input and output components in such situations for obtaining an overall performance measure. Selected technical institutions under JNTU are assessed for their service quality using DEA and suggestion is put forward for the non-performing institutions. The result shows significant difference between the conventional system of evaluation and DEA methods.This paper presents an overview of efficiency in Technical Institutions and the measurement thereof, it includes a review of main techniques that can be used to measure the efficiency in technical institutions. In this paper we analyze the efficiency for Women's technical institutions by using CCR Model.

Keywords : Data Envelopment Analysis, Efficiency measurement,returns to scale CCR Model.

1 INTRODUCTION

As Boussofiane and Dyson indicate profitability should not be the only performance measure even for profit making organizations. They argue that environment factors outside the company control can affect it. Thus, when the unit of analysis is an organization, public or private without profitable aims, subject to multiple objectives and whose outputs cannot always be expressed in quantitative terms, the assessment of its activity needs a combination of performance indicators.

2 REVIEW OF LITERATURE

The chapter contains a summary of all the literature that is relevant to the topics covered in the remainder of the paper. The topics covered are efficiency measurement, technical efficiency, relative efficiency measurement, Data Envelopment Analysis (D.E.A), the inclusion of undesirable outputs in efficiency measurement and finally a section in efficiency and DEA

2.1 Efficiency Measurement

The traditional measure of efficiency determines a score based on the ratio of the output that was obtained from the process and the inputs or resources that were used by the process. The traditionally efficiency score was thus given as in equation below.

$$\text{Efficiency} = \frac{\text{Output}}{\text{input}} \underline{\hspace{2cm}}(1)$$

This measure of efficiency had its own drawbacks, some of which are described below.

1) Inability of the model to incorporate multiple inputs and outputs.
2) Real life scenarios that incorporate multiple inputs and outputs.

3) Environmental factors that affect the process under study cannot be easily modeled.

4) As a contribution of (1) above, in the presence of multiple inputs and outputs, varying units of the variables cannot be handle

3. RETURNS TO SCALE

These efficiency measures are based on constant returns to scale technology (CRS). This implies that the production technology under consideration is such that an increase in all the inputs by some proportion results in an increase in all the outputs by the same proportion. The variable returns to scale result in a non- proportionate change (increase or decrease) in the outputs. The three types of returns to scale and the difference between the input-reducing and the output-increasing measures are illustrated on figures by considering the Decision making Units DMUS A, B, C&D.
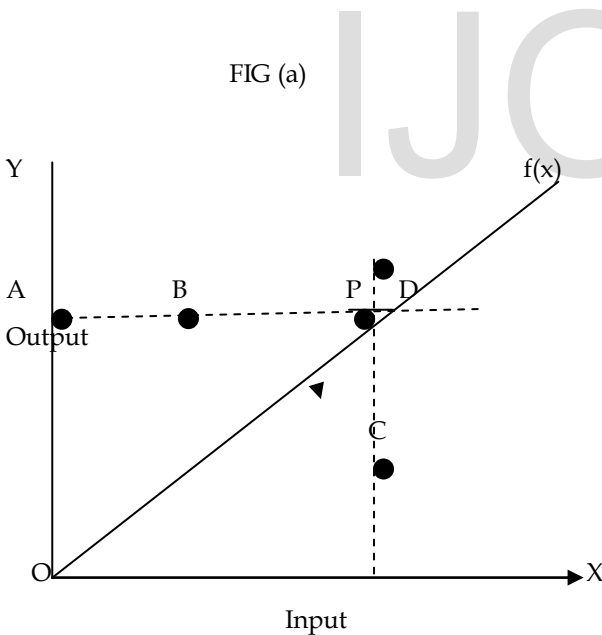
FIG (a)

CONSTANT RETURNS TO SCALE

In above figures, a production of a single output is illustrated graphically. In fig (a) it can be seen that the function f(x) is a straight line and has a single slope. Hence for every unit increase in the input that goes into the process, the output produced increases by a constant proportional quantity, hence it represents constant returns to scale (CRS).

4 DATA ENVELOPMENT ANALYSIS

Data Envelopment Analysis is a relatively new "data oriented" approach for evaluating the performance of a set of peer entities called Decision Making Units (DMUS) which convert multiple inputs into multiple outputs. The definition of a DMU is generic and flexible. Recent years have seen a great variety of applications of DEA for use in evaluating the performances of many different kinds of entities engaged in many different activities in many different contexts in many different countries. These DEA applications have used DMUS of various forms to evaluate the performance of entities, such as hospitals, US Air force wings, Universities, Cities and Courts, business firms, and others, including the performance of countries, regions etc. Because it requires very few assumptions, DEA has also opened up possibilities for use in cases which have been resistant to other approaches because of the complex (often unknown) nature of the relations between the multiple inputs and multiple outputs involved in DMUS.

5. CCR MODEL

Charnes, Cooper and Rhodes introduced a measure of efficiency for each DMU that is obtained as a maximum of a ratio of weighted outputs to weighted inputs. The weights for the ratio are determined by the restriction that the similar ratios for every DMU have to be less than or equal to unity, thus reducing thus reducing multiple inputs and outputs to a single "virtual" input and "virtual" output without requiring preassigned weights. The efficiency measure is then a function of the weights of the "virtual" input-output combination. Formally the efficiency measure for DMU_0 can be calculated by solving the following mathematical programming problem:

$$Max \ h_o(u,v) = \frac{\sum_r U_r Y_{ro}}{\sum_i V_i X_{io}} \quad \text{subjected to}$$

$$\frac{\sum_r U_r Y_{rj}}{\sum_i V_i X_{ij}} \le 1 \qquad r=1,2,........s; \ j=1,2,.......n; \ i=1,2,.......m$$

$$U_r, V_i \ge 0 \quad for \ all \ i \ \& \ r$$

Where x_{ij} = the observed amount of input of the i_{th} type of the j_{th} DMU ($x_{ij} > 0$, i= 1,2,…..m, j= 1,2,…..n) and y_{rj} = the observed amount of output of the r_{th} type for the j_{th} DMU ($y_{rj} > 0$, r = 1,2,….s, j = 1,2,…..n).

The variables u_r and v_i are the weights to be determined by the above programming problem. However, this problem has an infinite number of solutions since if (u*,v*) is optimal then α (αu*,αv*), one can select a representative solution (u,v) for which

$$\sum V_i X_{i0} = 1$$

to obtain a linear programming problem that is equivalent to the linear fractional programming problem. Thus, the denominator in the above efficiency measure h_0 is set to equal one and the transformed linear problem for DMU_0 can be written

Min $z_0 = \Theta_0$

Subject to

$\sum_{i=1}^{n} \lambda_j y_{rj} \geq y r_0,$ r= 1,2……………s

$\Theta_0 x_{i0} - \sum_{i=1}^{n} \lambda_j x_{ij} \geq 0 ,$ i= 1,2,………….m

$\lambda_j \geq 0,$ j= 1,2,………….n

Both above linear problems yield the optimal solution Θ^*, which is the efficiency score (so called technical efficiency or CCRefficiency) for the particular DMU_0 and efficiency scores for all of them are obtained by repeating them for each DMU_j, j= 1,2,….n. The value of Θ is always less than or equal to unity (since when tested, each particular DMU_0 is constrained by its own virtual input-output combination). DMUs for which $\Theta^* < 1$ are relatively inefficient and those for which $\Theta^* = 1$ are relatively efficient, having their virtual input-output combination points on the frontier. The frontier itself consists of linear facts spanned by efficient units of the data, and the resulting frontier production function has no unknown parameters.

6. Empirical Investigation :

10 Women's Technical Institutions under JNTU Hyderabad

have been selected for collection of data. All the 10 colleges are exposed to a common frontier. The overall technical efficiency measured by constant returns to scale is calculated to each of the technical institutions

Table : Statistic by CCR Model

Result of analysis	CCR Score
	Women's
No. of efficient institutions	5
No. of inefficient institutions	5
Average efficiency result	0.9318
Standard deviation	0.08025
Maximum efficiency result	1
Minimum efficiency result	0.831

7. Summary & Conclusion

A technique has been presented which employs Data Envelopment Analysis to select the most desirable institutions from a list of the technical institutions, within the context of this analysis and assumptions, it is shown that of these 10 institutions evaluated, 5 women's institutions are found to be "near efficient". One of the advantages of using DEA is that for the DEA efficient. In other words, DEA can inform the decision-maker which alter5natives are consistently the best when several attributes are considered, but it also provides information as to how much improvement is needed for each alternative to with respect to inputs and outputs.

The impetus for this research is not necessarily to assist the investor in choosing the best institution. The motivation for this analysis is to show how Data Envelopment Analysis can be used to assist with the multi-criteria problem of selecting which institution is preferable. The technique can provide a single composite score for each alternative, which has simplifying value

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