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Performance evaluation and finding target for production managers using central resource allocation in DEA

DR.VAHIDREZA MIRABI

PROFESSOR OF ISLAMIC AZAD UNIVERSITY, TEHRAN

CENTRAL BRANCH, DEPARTMENT OF BUSINESS MANAGEMENT

vrmirabi@yahoo.com

ABDOLMAHDI SHIRSHAMSI

ISLAMIC AZAD UNIVERSITY, QESHM INTERNATIONAL BRANCH , PHD STUDENT OF BUSINESS MANAGEMENT

mshirshamsi@gmail.com

Abstract

Today, managers at all organizations are looking for optimal use of facilities and capacities are available, study of performance evaluation and also to find a suitable model for decision making units is very important. One of the important tasks in any organization management is decision-making, mistakes and inaccuracies in the decision-making requires payment of an error, the global competition to seize the market on the one hand and limited natural resources on the other hand, Improving efficiency and finding a suitable model as the best and most effective method aims to achieve economic growth and industrial production and its decision in this regard, please plays a key role. The aim of this paper is a case study of the performance of managers in the field of dairy products using a central resource allocation is evaluated in DEA and we find suitable target for inefficient managers to improve its performance.

Keywords: efficient, DEA, manager, central resource allocation.

1. Introduction

One of the important tasks in any organization management is decision-making. It is so important that some management experts such as Herbert Simon management decisions are synonymous [2]. Most decisions managers are influenced by various factors quantitative and qualitative that these factors are often in conflict with each other and they try to be undertaken between several options to choose the best option. Mistakes and inaccuracies in the decision-making requires payment errors. The powers of management is higher, the higher will be the cost of a wrong decision [1]. Nowadays, managers in every organization try to make optimal use of the resources and capacities available to them. Performance evaluation of DMUs and finding suitable targets that are consistent with the surrounding environment and practicable, as well, is critical. Using multi objective models and interactive methods is undoubtedly essential to achieving the goals of an organization. So in this paper we obtain efficiency of each unit by DEA and then obtain an efficient target for inefficient unit that by using it, managers can improve the performance of the unit for sure. Hosseinzade lotfi et al. [5], Yang et al. [9], Lozano and Villa [6], Hadad et al.[4] carried out research on obtaining the target using MOLP. The centralized resource allocation BCC model (CRA-BCC) has been introduced by Lozano and Villa (2004) that by solving one model instead of n models, the projection is obtained for all DMUs.

In the research we're trying to find what kind of phenomenon or to search idea's people about the phenomenon, we must act to ask questions and where we want to find relationship or correlation between two or more distinct phenomena, we study our hypothesis [2]. Due to this, as well as the conceptual model, instead of stating hypotheses, research questions are as follows:

1) How can performance be evaluated Hormozgan dairy production factory production manager and determine efficient and inefficient units?
2) Is it possible to solve one model instead of n models, the projection is obtained for all DMUs?

2. Overview of DEA and CRA

2.1. BCC Model

Consider *n DMUs* with *m* inputs and *s* outputs. The input and output vectors of *DMUj* (*j* = 1,…, *n*) are $X_j = (x_{1j}, \dots, x_{mj}), Y_j = (y_{1j}, \dots, y_{sj})$, respectively, where $X_j \geq 0, X_j \neq 0, Y_j \geq 0, Y_j \neq 0$. We define the most general production possibility set T as follows:

$$T = \{(X,Y): X \geq \sum_{j=1}^{n} \lambda_j X_j \, , Y \leq \sum_{j=1}^{n} \lambda_j Y_j \, , 1\lambda = 1, \lambda \geq 0\}$$

When a $DMU_o \, , o \in \{1,2,\dots,n\}$, is under evaluation, we use the input-oriented DEA model proposed by Banker (1984) as follows:

$$\theta^*_{BCC} = Min\ \theta$$
$$s.t. \sum_{j=1}^{n} \lambda_j X_j \le \theta X_o$$
$$\sum_{j=1}^{n} \lambda_j Y_j \ge Y_o$$
$$\sum_{j=1}^{n} \lambda_j = 1$$
$$\lambda_j \ge 0 \qquad j = 1,\dots,n.$$

The evaluated DMU_o is efficient if and only if $\theta = 1^*$ and all slack variables in the optimal solution are zero in problem (1).

2.2. Central Resource Allocation (CRA)

The centralized resource allocation BCC model (CRA-BCC) has been introduced by Lozano and Villa (2004) that by solving one model instead of n models, the projection is obtained for all DMUs. (CRA-BCC) is a Data envelopment analysis (DEA)-type model as follows:

$$\begin{aligned} &Minimize && \theta \\ &subject\ to \\ &&\sum_{t=1}^{n}\sum_{j=1}^{n} \lambda_{jt} x_{ij} \le \theta \sum_{j=1}^{n} x_{ij}\,, && \forall\, i \\ &&\sum_{t=1}^{n}\sum_{j=1}^{n} \lambda_{jt} y_{rj} \le \sum_{j=1}^{n} y_{rj}\,, && \forall r \\ &&\sum_{j=1}^{n} \lambda_{jt} = 1, && \forall t \\ &&\lambda_{jt} \ge 0\,, \theta\ free. && \forall j,t \end{aligned} \qquad (2)$$

Once the model is solved, the corresponding vector $(\lambda^*_{1t}, \dots, \lambda^*_{nt})$ defines for each DMU_t the operating point at which it should aim. The inputs and outputs of each such point can be computed as

$$\bar{x}_{it} = \sum_{j=1}^{n} \lambda^*_{jt} x_{ij}\ , \qquad \forall i$$
$$\bar{y}_{rt} = \sum_{j=1}^{n} \lambda^*_{jt} y_{rj}\ , \qquad \forall r.$$

That For any DMU_t, the operating point onto which it is projected by Model CCR/Radial/Input-oriented $(\bar{x}_{1t}, \bar{x}_{2t}, \dots, \bar{x}_{mt}, \bar{y}_{1t}, \bar{y}_{2t}, \dots, \bar{y}_{st})$ is Pareto Efficient [6].

3. Case study: Dairy production factory in Hormozgan

This study is a research practical (implementation) in term of result, is a descriptive study in terms of purpose, and is a quantitative research in term of data. The case study of this research is a Dairy production factory in Hormozgan. The factory dairy products including milk, cream, cheese, curd, flavored milk, yogurt and butter milk. Eight Production Manager are responsible in the factory's production lines. Each product manager is defined a decision-making unit (DMU) and are showed with DMU1, DMU2,…, DMU8. Each unit has six inputs and one output. The amount of raw material as the first input (X1), the cost of raw materials as the second input (X2), the number of workers per shift as the third(X3), Crop conditions in the market as the fourth input (X4) that the measure is determined by sales and marketing unit, depending on the needs of the market and customers, the status of the devices as the fifth inputs (X5) that the measure is characterized by the maintenance unit, and with Check the devices and facilities, is reported, , The number of shifts as the sixth input (X6), the number of shifts by units planner for the manufacture of the product market can be determined. The amount of net profit as output (Y1) is considered. Xij is i-th input of j-th unit and Yrj is r-th output of j-th unit. About eight production manager of dairy factory have been reported according to Table1.

Table1. six inputs and one output of eigh Production manager of dairy factory

	Inputs						Outputs
	X1	X2	X3	X4	X5	X6	Y1
DMU1	25071	236840	25	0.245	67	12	875,145
DMU2	23387	139389	18	0.128	32	23	979,891
DMU3	22481	19429	15	0.298	60	15	1,030,504
DMU4	12270	219531	10	0.512	45	11	153,166
DMU5	15530	215624	14	0.359	82	17	5 ,734,772
DMU6	3892	26405	8	0.220	53	16	142,982
DMU7	3941	52135	8	0.188	18	22	188,125
DMU8	34902	142237	28	0.331	23	27	785,285

In table2, eight production managers are evaluated using BCC Model. As you see, DMU3, DMU5 are efficient and other units are inefficient. According to Table (1) Note that these two efficient units have smaller amounts of other units input and also have greater output. Inefficient managers to increase their efficiency must put efficient managers as a target. For this purpose, by using CRA-BCC (central resource allocation model) for each unit, the unit obtains a target. The results of the model of resource allocation in Table 2 are. It can be seen, unit3 is a target for unit1, 7, 8 and unit5 is a target for unit2, 6. For unit4 has not been real target, but an efficient target is obtained for it.

Table2; Results of CRA-BCC

	Results of CRA-BCC								
Efficiency	X1	X2	X3	X4	X5	X6	Y1	target	
DMU1	0.72	22481	19429	15	0.298	60	33	1,030,504	DMU3
DMU2	0.43	15530	215624	14	0.359	82	40	5 ,734,772	DMU5
DMU3	1	22481	19429	15	0.298	60	33	1,030,504	DMU3
DMU4	0.87	21123	219531	11	0.612	45	11	153,166	DMU*
DMU5	1	15530	215624	14	0.359	82	40	5 ,734,772	DMU5
DMU6	0.92	15530	215624	14	0.359	82	40	5 ,734,772	DMU5
DMU7	0.81	22481	19429	15	0.298	60	33	1,030,504	DMU3
DMU8	0.66	22481	19429	15	0.298	60	33	1,030,504	DMU3

4. Result

According to the results of the study noted that the two units are managed efficiently, have fewer raw materials, use cleaner Devices, their number of workers per shift are more suitable. By solving one model instead of n models, the projection is obtained for all DMUs. More targets are real DMU; inefficient managers to increase their efficiency must put efficient managers as a target. Because managers' focus is on inputs, it is recommended to improve the status they are using skilled manpower, modern industrial devices (for accelerating and improving production), reducing the shifts (dependent on market conditions and the facilities are), reducing the cost of raw materials (so that no adverse effect on product quality. This is achieved through supplier evaluation), rewarding to efficient managers in each period, mentioning inefficient production managers to make better use of inputs, Correct marketing in order to assess market needs and promote the image of their organization.

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