Surveying the efficiency of judo sports committees of Iran provinces through data envelopment analysis (DEA)

Mozaffari Seyed Amir Ahmad, Amirtash Ali Mohammad and Hami Mohammad[*]

Department of Physical Education, Science and Research Branch, Islamic Azad University, Tehran, Iran
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ABSTRACT

The purpose of this research is to study the efficiency of judo sports committees of Iran provinces from 2008 to 2012. For this purpose, the non-parametric DEA was used. The inputs and outputs used for determining the efficiency of the committees were designated through the use of experts' comments and five-scale range of the phase. Inputs include staff, budget and the judo sports capital of each province. Activities of the judo committees of each province related to the public sports, champion sports, sports training, sports research, sports events and active judo committees were determined as the outputs of the research. Then a check list related to the inputs and outputs of the research was prepared and sent to the judo committees of provinces. All the 30 provinces sent their related data. Data were analyzed by the use of two models of CCR and BCC output shaft in the DEA. The results showed that in year 2008, 14 committees (46.67%) and in year 2009, 15 committees (50%), in year 2010, 12 committees (40%), in year 2011, 13 committees (43.33%) and in year 2012, 18 committees (60%) were acquired the full efficiency.

Keywords: Efficiency, DEA, Sports Committees, Judo.
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INTRODUCTION

Nowadays, through diminishing the economic boundaries, competition in the production and global business have entered new dimensions and efforts for promoting and improving the efficiency based on economic rationality should always be at the center of emphasis and attention [19]. According to the fact that living in the complex dynamic today's world is accompanied by two main features (limited resources and facilities, limited needs and demands), so the increasing attention toward productivity is one of the necessities of the current era [1]. Efficiency, effectiveness and productivity have different meanings and sometimes they are mistakenly used interchangeably. Generally, we can consider that the productivity is a combination of efficiency and effectiveness [3]. Efficiency shows that to what extent an organization could use the optimal inputs for generating outputs and in other words, it shows the right way to do something [20]. Evaluating the efficiency in the public services sector is not as easy as the one in a productive, business organization and it is far more complex. Because, the services have a nature which is different from commodity, plus the services do not have the capability to be stored [23]. The important matter in measuring the efficiency of the public services sector is that usually the outputs resulted from service activities cannot be easily changed to numbers and figures. In addition to that, because this sector is financed with public budget, its outputs should be responsible in front of the society and audience [15]. The same as other organizations, sports organizations showed more attention toward the better use of their resources and facilities. With societies

become industrialized and spread of the mechanism phenomenon, the social performances of sports have increased and it is expressed as one of the essential needs of the current societies, and it has a valuable contribution in the development and promotion programs of the countries [24]. All the sports activities of different sports fields in Iran are under the supervision of the ministry of youth and sports and they are conducted by the sports federations. Since the judo federation is one of the main institutions in custody of judo in our country, so it is essential that the managers of the judo federation use the maximum resources and facilities for achieving efficiency in their activities and achieving optimal performance and they should asses how to use such resources, because allocating optimal resources need evaluating the efficiency of the organization units [9]. All of the activities of the judo sports in each province are conducted under the supervision of judo committees of provinces. In other words, judo committees of provinces are the executive arms of the judo federation all around the country. According to the important role of the judo committees of the provinces in developing and spreading the judo sports throughout the country and according to this point that activity and investment in judo sports are for this generation and future generations, different resources and facilities are distributed among the judo committees of provinces, but for evaluating and measuring how to use such resources and facilities, traditional and empirical methods have been used so far and there is no established system for evaluating and measuring the efficiency and performance of the judo committees of provinces. Thus, according to the mission and goals of the judo committees of provinces, first the measuring indices of efficiency of the judo committees of provinces are determined in this research and then efficiency of the judo committees of provinces are studied by the use of DEA. The DEA was initiated by PhD thesis of Edward Roads under the supervision of Cooper and Charnes and it evaluated the academic achievements of the USA students in 1978. The results of this study resulted in publication of the first article about publically introducing of DEA in year 1978 [5]. In the mentioned article named as CCR, they used mathematical programming methods for generalizing Farrell's method of optimizing in order to measure the systems efficiency with multiple inputs and outputs. According to the provided definition by Charnes, Cooper and Rhodes, DEA consists of a mathematical programming pattern that empirically estimates the heavy proportions such as production function or efficiency boundary for the observed data. By the use of DEA method, the efficiency of the similar decision making units are calculated and compared [6]. The reason for wider acceptance of DEA than other methods is its ability to study the complex and almost unknown relations between several inputs and outputs which exist in these activities [13]. Banker and Charnes (1984) developed the concepts and patterns of DEA with new concepts and the result was BCC pattern [2]. This pattern is used for measuring and determining the efficiency of units and also for revising the inputs and outputs for raising the efficiency rate with regard to return to variable scale [7-18-22]. In this method, after defining the efficiency of the organization with several input and output by ratio of total weight of the outputs to the total weight of the inputs, it determines these weights in a way that the organization is exposed to the evaluation in its best possible status in comparison with other similar organizations, also we can consider the efficiency of different units of an organization.

Efficiency= $\dfrac{\text{Total weight of outputs}}{\text{Total weight of inputs}}$

According to the nature of this research which is about the judo committees of provinces, and these committees are considered as service organizations, and their main purpose is to increase the sports services to the society (which means that their purpose is to increase outputs, and not inputs) the output shaft model in DEA is used [16].

Nowadays DEA is used in different fields related to the sports and physical education which include: 1- In the first method, efficiency is measured at a play level which its input data consists of shooting, corner and ball possession, and the output is the result of the play [4]. 2- In the second method, the efficiency of the coaching or management is measured and different skills of management in professional sports are studied and measured [21]. 3- In the third method, the efficiency of a team in a league is studied and analyzed and deviations from the team potential abilities are obtained [11-12]. 4- In the fourth method, the efficiency of a sports organization is studied and measured and the weak points and strength points of the organization used in the allocated resources are determined [1]. Now we point to some of the researches about measuring the efficiency through the use of DEA. Halkos and Tzeremers (2011) studied the efficiency of 25 wealthy European clubs in year 2009. Their research goal was to analyze the effect of current value and debts of the clubs on their performance efficiency and the research output was the club's revenue. The research output includes total sum of the championship cups of these teams in Europe, intercontinental, club world cup and domestic cup. In the standard pattern of DEA, the research results showed that the club current value levels had a negative effect on the performance. This fact shows that clubs with high value did not manage to have higher performance. Also, the results showed that the clubs debts did not have an effect on their performance level.

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The research results showed that only the money cannot be a guarantee for success [14]. In a study named measuring the efficiency of the champions' league soccer teams, Escuer and et al., (2010) studied the efficiency of the teams in the Euefa champions' league. In this study, the soccer teams participating in Euefa champions' league from 2003 to 2007 were studied by the use of DEA. The research results showed that in CRS model in season 2003-2004, 11 teams were efficient, in season 2004-2005, 7 teams out of 32 teams were efficient. In season 2005-2006 also 11 teams were efficient and in season 2006-2007, 8 teams participating in Euefa champions' league were efficient. Also the results of the efficiency scale showed that in the studied seasons, the rate of efficiency scale of the teams were high (0.95) [8]. In Winand's research (2009) about the efficiency of the soccer clubs of France and their dynamism between years of 2004 to 2007, the DEA was used for surveying the rate of efficiency of teams, and two total variables of payable wages of the club and population of the city were club is located in were used as the research inputs and two variables of team scores at the end of the season and the team turnover were used as the outputs. The average pure technical efficiency of the teams was 0.93 and the scale efficiency average was 0.85. Non-efficiency of the scale was the most important reason for the non-efficiency of the France league [25]. Guzman (2006) surveyed the efficiency of the Spanish soccer league in three seasons through the input shaft of DEA. The research results showed that pure technical efficiency of the teams were 0.8. The total efficiency average of the teams was 0.6, which means that the teams needed 0.4 reductions in their used resources. The results of the scale efficiency also showed that the Spanish teams had averagely 30% non-efficiency scale, which means that they do not have the desired amount [10]. Haas (2004) studied the efficiency of the teams participating in BundesLiga in season 1999-2000, and used the input shaft method of DEA. Research inputs include the players' and coach's income and the outputs include the team scores at the end of the season, absolute number of viewers and the team's revenue. 4 teams out of the 18 teams of Bundesliga were efficient, which means that according to scale and according to the performance and management they were efficient. 7 teams had the efficiency scale equal to one and 11 teams had non-efficiency scale. The research results showed that most of the Bundesliga teams performed at the desired level based on the scale and the most important reason for non-efficiency of the German teams was due to the performance no-efficiency [12]. Also in surveying the league of America, Haas (2003) came to this conclusion that most important reason for non-efficiency of the teams was due to the non-efficiency of the scale of the teams, and according to the pure technical efficiency they were at a high level [11]. Based on the aforesaid contents about the efficiency of the organizations and based on the important and constructive role of judo committees of provinces in developing and spreading the judo throughout the provinces, the current research is seeking the answer to this question that whether the judo committees in provinces of our country are efficient or not?

MATERIALS AND METHODS

 The current research is a descriptive-correlative research and its information is gathered through field data. From the time perspective, due to the fact that this research is about the efficiency of the judo committees in provinces of our country, the time period is between the years of 2008 to 2012, and it is a retrospective study. In order to determine the efficiency of the judo committees in provinces through the DEA method, the first step is to determine the committees' inputs and outputs. The input data had the nature of cost and the output data had the nature of production. Based on the duties of the judo committees of provinces, the inputs and outputs of these committees were designed in a questionnaire with five scale range of the phase (figure 1) and 30 judo experts were asked to give their comments about the importance of each of these input and output indices and to express their components. 28 questionnaires were returned and the findings were analyzed by the Bojadziev fuzzy logic [17].
In table 1, the linguistic variables and fuzzy numbers related to them are mentioned.

Table 1. Linguistic variables and fuzzy numbers related to them

Linguistic Variable	Fuzzy Numbers
Totally appropriate	(1 ، 1 ، 0.8)
Appropriate	(1 ، 0.8 ، 0.6)
Average	(0.7 ، 0.5 ، 0.3)
Inappropriate	(0.4 ، 0.2 ، 0)
Totally inappropriate	(0.2 ، 0 ، 0)

Below you can see the fuzzy average and the de-fuzzy from the Bojadziev's average.

$$A_{ave} = \frac{A_1 + \cdots + A_n}{n} = \frac{\left(a_1^{(1)}, a_M^{(1)}, a_2^{(1)}\right) + \cdots + \left(a_1^{(n)}, a_M^{(n)}, a_2^{(n)}\right)}{n}$$

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$$A_{ave} = (m_1, m_M, m_2) = (\frac{1}{n}\sum_{i=1}^{n} a_1^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_M^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_2^{(i)})$$

$$X_{max} = \frac{m_1 + m_M + m_2}{3}$$

The reliability coefficient of questionnaires was 0.87. After analyzing the questionnaires through the use of fuzzy method, the appropriate inputs and outputs (with higher rate of importance 0.7) were obtained for determining the rate of efficiency of judo committees of provinces. After determining the research inputs and outputs, the check list related was prepared for collecting the data of the province judo committees, and it was sent through the official letter of the judo federation to the respective province committees (30 provinces). In the descriptive statistics part, the central tendency indices such as mean and standard deviation and SPSS software were used. For determining the efficiency of the province judo committees, two methods of CCR and BCC output shaft in DEA were used, and the DEA Solver software was used for analyzing the efficiency of the judo committees. The population of this research includes the judo sports committees of 30 provinces and the data related to the years 2008 to 2012 of these committees were considered. The research data were collected through the heads of the committees and the sample was equal to the population.

RESULTS

In table 2, the information related to the inputs and outputs of the research and their related components are mentioned.

Table 2, inputs and outputs of the judo committees of the provinces of the country

	Research Variables	Components expressing for inputs and outputs
Inputs	1) Staff	Total Staff of the judo committee of the province and committees of the respective provinces
	2) Budget	Total current budget, Belt test revenues, Orders sale, Educational classes, Right to participate in the tournament
	3) Sports capitation	Total per capita of province indoor sports (belonged to the committees) and total per capita of province indoor sports belonged to the office of youth and sports of the province which is used by the committees.
Outputs	1) Public sports	Total men and women participating in the public judo sports programs
	2) Champions sports	1-Province judo athletes, participating in the national team camps. 2-Province athletes who are members of the national team. 3-Medals won by the province athletes in the local competitions 4- Medals won by the province athletes in the international competitions
	3) Sports education	1-Coaching training 2-Referee training
	4) Sports research	1- Special sports courses 2- No. of participants in the special courses
	5) Sports events	1-No. of held province competitions, 2-Hosting national and international judo competition, 3-Dispatching province sports teams to the domestic judo competitions and international judo tournaments
	6) Active sports committees	Ratio of no. of active judo sports committees in province to the no. of cities of the province at the end of the previous year

At this stage, after collecting the data related to the provinces judo committees, the adequate weights were given to the input and output variables, and then their efficiency were calculated by the use of DEA. The analysis of related results is shown in the table 4. The efficiency of 1 for each model (100%) means that these committees had desirable outputs regarding their input resources, thus they are recognized as the reference collection, and the rest of the committees should be compared to reach their full efficiency. CCR column indicates the total technical efficiency. BCC column indicates the performance efficiency rate. SE column in this table indicates the efficiency scale rate which is acquired by dividing the CCR on BCC. Efficiency scale indicates that whether the organization size in its used resources was desirable or not.

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Table 3. Results of the efficiency of the provinces judo committees during years 2008-2012

Provinces	2008			2009			2010			2011			2012		
	CCR	BCC	SE	CCR	BCC	SE	CCR	BCC	SE	CCR	BCC	SE	CCR	BCC	SE
Azerbayjan.E	0.716	0.751	0.953	0.662	0.702	0.943	0.872	0.952	0.916	0.743	0.792	0.937	0.809	0.845	0.957
Azerbayjan.W	0.989	1	0.989	0.956	0.99	0.965	1	1	1	0.858	0.901	0.952	1	1	1
Ardebil	0.510	0.601	0.848	0.553	0.571	0.968	0.668	0.672	0.995	0.643	0.671	0.958	0.603	0.697	0.864
Esfahan	1	1	1	1	1	1	1	1	1	0.950	0.973	0.976	1	1	1
Ilam	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bushehr	0.614	0.627	0.979	0.661	0.671	0.985	0.710	0.729	0.974	0.692	0.754	0.917	0.509	0.573	0.889
Tehran	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bakhtiari	0.523	0.558	0.937	0.625	0.701	0.891	0.664	0.669	0.993	0.497	0.511	0.974	0.573	0.627	0.914
Khorasan.S	0.491	0.503	0.975	0.466	0.467	0.999	0.515	0.522	0.986	0.521	0.548	0.949	0.481	0.491	0.979
Khorasan.R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Khorasan.N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Khozestan	1	1	1	1	1	1	1	1	1	0.856	1	0.856	1	1	1
Zanjan	0.919	0.941	0.976	1	1	1	0.753	0.777	0.968	1	1	1	0.812	0.841	0.966
Semnan	0.809	0.857	0.943	0.870	0.895	0.972	0.629	0.686	0.916	0.692	0.693	0.997	0.804	0.825	0.974
Sistan	0.441	0.453	0.972	0.405	0.421	0.962	0.476	0.513	0.927	0.427	0.430	0.993	0.504	0.509	0.991
Fars	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Qazvin	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Qom	0.818	0.854	0.958	0.796	0.797	0.998	0.706	0.769	0.917	1	1	1	1	1	1
Kordestan	0.904	0.982	0.920	0.929	0.936	0.992	1	1	1	0.751	0.781	0.961	1	1	1
Kerman	0.801	0.903	0.886	0.876	0.894	0.980	0.819	0.837	0.979	1	1	1	1	1	1
Kermanshah	0.942	0.970	0.971	1	1	1	1	1	1	1	1	1	1	1	1
Kohkiloye	0.413	0.454	0.909	0.438	0.470	0.931	0.451	0.461	0.979	0.490	0.518	0.945	0.552	0.620	0.890
Golestan	1	1	1	1	1	1	1	1	1	0.815	0.831	0.981	1	1	1
Gilan	1	1	1	1	1	1	0.687	0.713	0.963	0.952	0.981	0.970	1	1	1
Lorestan	1	1	1	1	1	1	0.864	0.889	0.972	1	1	1	1	1	1
Mazandaran	1	1	1	1	1	1	0.822	0.854	0.962	1	1	1	1	1	1
Markazi	0.938	0.972	0.964	0.983	1	0.983	0.916	0.942	0.972	1	1	1	0.895	0.919	0.973
Hormozgan	0.507	0.510	0.995	0.538	0.554	0.970	0.467	0.493	0.946	0.459	0.478	0.959	0.482	0.515	0.934
Hamedan	1	1	1	0.759	1	0.759	0.937	0.954	0.981	0.818	0.833	0.981	0.862	1	0.862
Yazd	1	1	1	1	1	1	0.911	0.985	0.925	0.961	0.975	0.986	1	1	1
Mean	0.844	0.864	0.972	0.850	0.869	0.976	0.829	0.847	0.975	0.837	0.855	0.976	0.863	0.882	0.973
Std. Deviation	0.208	0.198	0.038	0.203	0.196	0.048	0.187	0.181	0.029	0.197	0.191	0.032	0.198	0.182	0.044

In 2008, from total 30 judo committees, 14 committees (46.67%), in year 2009, 15 committees (50%), in 2010, 12 committees (40%), in 2011, 13 committees (43.33%) and in year 2012, 18 committees (60%) were efficient in both models of CCR and BCC.

DISCUSSION AND CONCLUSION

Provinces judo committees are considered as the most important judo sports organizations in the provinces of the country, and they have the main responsibility for spreading and developing the judo all around the provinces. The judo committees should act according to the plans and duties delivered to them by the judo federation along with the development of judo in provinces. In this research, the efficiency of the performance of the committees was studied during years 2008 to 2012. The purpose of this research was to survey the efficiency of the judo committees of provinces through the use of input resources of these committees and providing several judo sports services in provinces. For this purpose, based on the comments of the judo experts, three variables of staff, budget and apace per capita in sports were chosen as the used inputs. Variables of the judo public sports, champions' sports, sports education, sports research, sports event and active judo committees were chosen as the committees' outputs (result of these committees' activities). In this research, by analyzing the total efficiency (TE) of the administrations in to two resources of pure technical efficiency (PTE) and scale efficiency (SE) the effort was on determining the non-efficiency resources of the committees. The research findings showed that in 2008, from total amount of 30 province judo committees, 14 committees (46.67%) had full efficiency, which means that they had efficiency in both PTE and SE. 15 committees (50%) were efficient regarding the performance. Although west Azerbaijan province was efficient regarding the performance, due to the non-efficiency in scale, it was not efficient regarding TE. In 2009, from total amount of 30 province judo committees, 15 committees (50%) had full efficiency, which means that they had efficiency in both PTE and SE. 17 committees (56.67%) were efficient regarding performance. Although Markazi and Hamedan provinces were efficient regarding the performance, due to the non-efficiency in scale they were not efficient regarding total efficiency (TE). In 2010, from total amount of 30 province judo committees, 12 committees (40%) had full efficiency. In 2011, from total amount of 30 province judo committees, 13 committees (43.33%) had full efficiency, which means that they had efficiency in both PTE and SE. 14 committees (46.67%) were efficient regarding the performance. Although Khuzestan province was efficient regarding the performance,

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due to the non-efficiency in scale, it was not efficient regarding TE. In 2012 from total amount of 30 province judo committees, 18 committees (60%) had full efficiency, which means that they had efficiency in both PTE and SE. 19 committees (63.33%) were efficient regarding the performance. Although Hamedan province was efficient regarding the performance, due to the non-efficiency in scale, it was not efficient regarding TE. Haas (2003), Guzman (2006) and Winand (2009) came to this conclusion that non-efficiency in scale is one of the important reasons of non-efficiency in the current leagues of America, Spain and France [11-10-25]. In this research it was also shown that non-efficiency of scale (undesirable size of the organization) has an important role in total non-efficiency of the provinces judo committees during years of 2008 to 2012. Regarding the performance, some of the committees were at the efficient level but due to the lack of desirable and optimal size of the used input resources in that year, they were not efficient regarding the total efficiency. The current research results are inconsistent with the results of Haas (2003), Guzman (2006) and Winand (2009) and it shows that there are two main solutions for increasing the total efficiency of the judo committees [11-10-25]. One of the solutions is to increase the rate of efficiency of committees in transferring the used inputs to desirable outputs (PTE), which means that by improving the management programs and performance guidelines, provide the maximum outputs for spreading the public sports of judo, champions' sports, sports education, sports research, sports events and active judo committees in province through the use of input resources such as staff, budget and available sports capitation. The second solution is to allocate resources to these committees. The resources allocated to each province should be proper for the needs of the province judo committee, and the amount of budget is really important in this field.

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