

THE PROPORTION OF SPORTS PUBLIC SERVICE FACILITIES BASED ON THE DEA MODEL IN COLLEGES AND UNIVERSITIES



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A PROPORÇÃO DE INSTALAÇÕES DE SERVIÇOS PÚBLICOS DESPORTIVOS UNIVERSITÁRIOS COM BASE NO MODELO DEA

INVESTIGACIÓN SOBRE LA PROPORCIÓN DE ASIGNACIÓN DE INSTALACIONES DE SERVICIO PÚBLICO DE DEPORTES UNIVERSITARIOS BASADA EN EL MODELO DE LA DEA

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ABSTRACT

In order to strengthen the physical education of college students, it is necessary to reasonably allocate university sports public service resources. In order to improve the allocation of university sports resources, this study constructs the Data Envelopment Analysis (DEA) model by analyzing the proportion of public sports service facilities in colleges and universities. Through the selection of input index and output index of sports public service facilities in colleges and universities, as well as selecting 20 colleges and universities as decision-making units, this paper constructs a DEA model, and studies the use of the DEA Tobit two-stage method to evaluate the matching efficiency of public sports service facilities in colleges and universities. The results show that the pure technical efficiency of sports public service facilities in colleges and universities is effective, and the scale efficiency of most colleges and universities is relatively high, and the proportion of sports facilities is relatively reasonable. However, there are still large problems in the proportion of public sports service facilities in colleges and universities, so it is necessary to adjust the proportion and scale of sports facilities allocation reasonably. This study verified the effectiveness of the DEA model in evaluating the proportion of public sports service facilities in colleges and universities, hoping to provide certain reference for improving the proportion of public sports service facilities in colleges and universities.

Keywords: DEA model; college sports; sports service; sports facilities; facilities ratio.

RESUMO

A fim de reforçar a educação física dos estudantes universitários, é necessário alocar de forma razoável os recursos públicos de serviços desportivos universitários. A fim de melhorar a alocação de recursos desportivos universitários, este estudo constrói o modelo de Análise por Envoltória de Dados (Data Envelopment Analysis — DEA) ao analisar a proporção de instalações de serviço esportivo público em faculdades e universidades. Através da seleção do índice de entrada e índice de saída de instalações de serviços públicos esportivos universitários, bem como da seleção de vinte faculdades e universidades como unidades de tomada de decisão, este estudo constrói um modelo DEA e estuda o uso do método DEA Tobit em duas fases para avaliar a respectiva eficiência das instalações de serviços públicos desportivos em faculdades e universidades. Os resultados mostram que a eficiência técnica das instalações de serviços públicos desportivos em faculdades e universidades é eficaz, e a eficiência em escala da maioria das faculdades e universidades é relativamente alta, e a proporção de instalações esportivas é relativamente razoável. No entanto, ainda há grandes problemas na proporção de instalações públicas de serviço desportivo em faculdades e universidades, pelo que é necessário ajustar razoavelmente a proporção e a escala das instalações desportivas atribuídas. Este estudo verificou a eficácia do modelo DEA na avaliação da proporção de instalações públicas de serviço desportivo em faculdades e universidades na esperança de fornecer certa referência para melhorar a proporção de instalações públicas de serviço desportivo nesses locais.

Descritores: modelo DEA; esporte universitário; serviço desportivo; instalações desportivas; proporção de instalações.

RESUMEN

Para fortalecer la educación física de los estudiantes universitarios, es necesario asignar razonablemente los recursos del servicio público deportivo universitario. Con el fin de mejorar la asignación de recursos deportivos universitarios, este estudio construye el modelo Análisis Envoltorio de Datos (Data Envelopment Analysis DEA) analizando la proporción de instalaciones de servicios públicos deportivos en colegios y universidades. Mediante la selección del índice de entrada y de salida de las instalaciones de servicio público deportivo en colegios y universidades, así como la selección de 20 colegios y universidades como unidades de toma de decisiones, este documento construye un modelo DEA y estudia el uso del método DEA Tobit de dos etapas para evaluar la eficiencia de emparejamiento de las instalaciones de servicios deportivos públicos en colegios y universidades. Los resultados muestran que la eficiencia técnica pura de las instalaciones de servicio público deportivo en los colegios



y universidades es efectiva, y la eficiencia de escala de la mayoría de los colegios y universidades es relativamente alta y la proporción de instalaciones deportivas es relativamente razonable. Sin embargo, todavía existen grandes problemas en la proporción de instalaciones de servicios deportivos públicos en colegios y universidades, por lo que es necesario ajustar la proporción y la escala de la asignación de instalaciones deportivas de manera razonable. Este estudio verificó la efectividad del modelo DEA al evaluar la proporción de instalaciones de servicios deportivos públicos en colegios y universidades, con la esperanza de proporcionar cierta referencia para mejorar la proporción de instalaciones de servicios deportivos públicos en colegios y universidades.

Descriptor: modelo de la DEA; deporte universitario; servicios deportivos; instalaciones deportivas; proporción de instalaciones.

INTRODUCTION

With the development of social economy, social public service is also developing and improving, and sports public service is an important part of it. As an important part of public service, the ultimate goal of public sports service is to realize public interest, that is, all social members can fully enjoy the right of sports service, feel the happiness brought by sports and exercise, and promote public health. As the builders and successors of socialism in the new era, college students must have a strong physique.¹ The physical education of college students has also received extensive attention from all walks of life. In order to strengthen the physical education of college students, more and more colleges and universities pay more attention to the public service level of sports in schools. The public sports service resources and facilities in Colleges and universities are the premise and foundation of public sports service work.²

In the study of strategic agility of manufacturing companies, hemmati et al. Used the method of questionnaire survey and used fuzzy Two-stage DEA model to analyze the collected questionnaire data.³ The results show that there is a close internal relationship among enterprise resources, strategic agility and competitive advantage, and this relationship makes the company's return to scale close to 1 al.2016. used DEA model to study the coverage efficiency of rural health centers in southern Greece.⁴ The output of the model and the selection of its weight were mainly based on consulting relevant experts, taking medical staff, nursing staff and

technical equipment as input indicators, and patient care and disease treatment as output indicators. The results showed that the conditions of different health centers were significantly different.⁵

It can be seen that the relevant research at home and abroad mainly designs the application of DEA model in many fields, as well as the related problems of sports facilities.⁶ The DEA analysis method is mainly used in the production efficiency of tax department, water use efficiency of provinces and bank operation efficiency, and so on.⁷ The research seldom involves the research on the matching of sports public service facilities in Colleges and universities by using DEA model. Therefore, this study studies the matching efficiency of sports facilities in colleges and universities by constructing DEA model.

Analysis on the matching efficiency of public sports service facilities in Colleges and Universities

Through field research, questionnaire survey and telephone interview, this study conducted a survey on 20 universities in a province, and evaluated the ratio of public sports service facilities in Colleges and universities by using DEA model index. The survey objects mainly include college physical education teachers, college students' Sports Management Center and college students. At the same time, the relevant sports literature is also consulted. The number of 20 decision-making units is 1,2,3,4,...., 18,19,20. The specific proportion of public sports facilities in Colleges and universities is obtained, as shown in Table 1.

Table 1. Input and output data of sports public services in colleges and universities.

School	Amount of funding for college sports facilities (Ten thousand yuan x1)	University sports system staff (People x2)	College sports professional instructors (People x3)	Stadium area per capita (Square meter x4)	Number of sports equipment (Station x5)	Frequency of students participating in sports activities (Times y1)	Student fitness pass rate (y2)	Number of participants in college sports activities (Person-time y3)
1	32	8	12	0.005	41	300	92.60%	251
2	33.2	10	14	0.012	38	298	89.80%	265
3	31.5	7	15	0.011	32	288	93.40%	278
4	34	11	13	0.009	35	291	92.10%	264
5	35	9	12	0.01	40	305	88.90%	248
6	32.8	8	15	0.023	39	308	90.50%	252
7	36.1	10	16	0.028	34	311	91.80%	263
8	34.2	13	11	0.018	38	316	93.80%	249
9	35.8	9	10	0.011	36	325	94.20%	267
10	36.9	7	13	0.014	29	342	92.90%	250
11	37.4	8	15	0.025	31	351	93.50%	247
12	32	12	14	0.018	30	299	92.60%	243
13	35.1	10	12	0.024	34	332	93.10%	252
14	34.8	11	16	0.014	32	326	92.50%	246
15	33.6	8	11	0.016	38	328	90.20%	248
16	38	9	13	0.021	36	341	93.50%	229
17	39.2	13	15	0.024	32	331	92.80%	238
18	37.5	7	17	0.023	38	340	90.50%	245
19	38.9	8	14	0.018	36	328	92.60%	238
20	35.6	10	12	0.015	32	335	92.40%	253

Table 1 shows the input and output of public sports service facilities in 20 colleges and universities. It can be seen from the table that 20 schools have different outputs under different input conditions. The input indicators mainly include the investment of school sports facilities, the number of college sports system staff, the number of college sports professional guidance personnel, per capita sports area and the number of sports equipment equipped, etc. the output indicators mainly include the frequency of students participating in sports activities, the qualified rate of students' physical fitness and the number of people participating in school sports activities. In terms of investment indicators, the sports facilities funds of 20 universities are about 200000-300000 yuan, of which the 17th university has the largest investment, close to 400000 yuan, 392000 yuan. Compared with the third university, the investment of sports facilities in the third university is the least, which is 315000 yuan; the staff of the sports system of 20 colleges and universities are between 10-20 people, including the staff of the 18th University compared with the ninth University, the staff of the sports system of the ninth university is the least, which is 10, which is related to the scale of the university sports system. Similarly, the per capita sports ground area of 20 universities is about 0.02 square kilometers, and the number of sports equipment is between 30 and 40 sets. In terms of output index, the average number of students who participate in sports activities three times or more per week, the number of students who exercise for more than half an hour is about 300, the qualified rate of students' physique is mostly above 90%, and the number of students participating in sports activities organized by schools is between 200 and 300.

Table 2 shows the matching efficiency of public sports service facilities in Colleges and universities. The indicators of matching efficiency include pure technical efficiency, scale efficiency and comprehensive efficiency. It can be seen from the table that the pure technical efficiency, scale efficiency and comprehensive efficiency of four universities are

Table 2. Matching efficiency of sports public service facilities in colleges and universities.

School	Pure technical efficiency	Scale efficiency	Comprehensive efficiency
1	1	1	1
2	1	1	1
3	0.76	0.735	0.559
4	1	0.759	0.759
5	1	0.895	0.895
6	0.755	0.78	0.589
7	0.604	0.998	0.603
8	0.535	0.996	0.533
9	0.52	0.868	0.451
10	0.623	0.659	0.41
11	0.794	0.774	0.614
12	1	1	1
13	1	1	1
14	0.76	0.735	0.559
15	1	0.759	0.759
16	1	0.895	0.895
17	0.755	0.78	0.589
18	0.604	0.998	0.603
19	0.535	0.996	0.533
20	0.52	0.868	0.451

all 1, which are the first, the second, the 12th and the 13th universities respectively. For other universities, the three kinds of efficiency are mostly above 0.5, while the comprehensive efficiency of the ninth, 10th and 20th universities is less than 0.5, which are 0.451, 0.41 and 0.451 respectively. Comprehensive efficiency is used to express the comprehensive ratio of sports public service facilities in colleges and universities. The comprehensive ratio efficiency of sports public service facilities in colleges and universities is 0.69, and 12 colleges and universities have not reached the average value, more than half. It shows that there are still big problems in the proportion of public sports service facilities in colleges and universities, and it is necessary to adjust the proportion and scale of sports facilities allocation reasonably. Pure technical efficiency is used to express the output efficiency of input elements of decision-making units. The pure technical efficiency of 20 universities is above 0.5, which indicates that the pure technical efficiency of sports public service facilities in Colleges and universities is effective; scale efficiency is mainly used to measure whether the scale of public sports service facilities in Colleges and universities is optimal. According to the results of Table 1, the scale efficiency of most colleges and universities is relatively high, Basically, it is above 0.7, indicating that the ratio of sports facilities in Colleges and universities is relatively reasonable. In order to more intuitively see the differences between pure technical efficiency, scale efficiency and comprehensive efficiency among 20 universities, the different efficiency of each university is shown in the form of a bar chart, as shown in Figure 1.

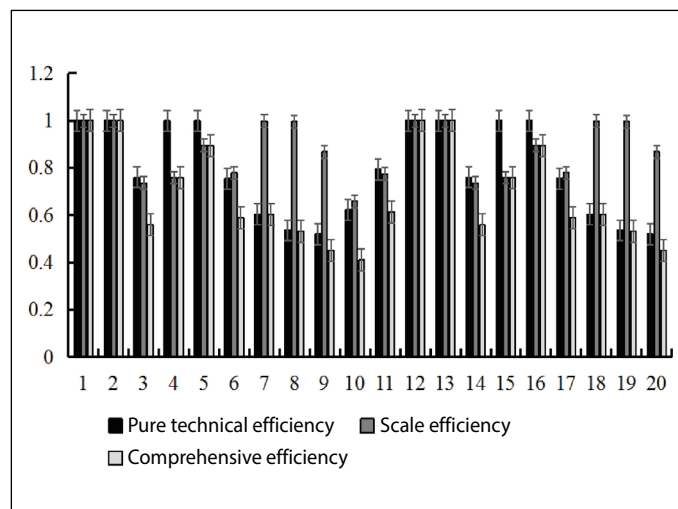


Figure 1. Comparison of sports public service facilities in colleges and universities.

CONCLUSIONS

The research on the ratio of public service resources and facilities in colleges and universities is helpful to adjust the allocation of resources reasonably and create conditions for college students to exercise. This study constructs the DEA model when analyzing the proportion of sports public service facilities in colleges and universities. Through the selection of input index and output index of sports public service facilities in colleges and universities, and selecting 20 colleges and universities as decision-making units, this paper constructs DEA model. At the same time, DEA Tobit two-stage method is used to evaluate the matching efficiency of sports public service facilities in colleges and universities, and the pure technical efficiency, scale efficiency and comprehensive efficiency of the allocation of sports public service facilities in colleges and universities are finally obtained. The results show that the comprehensive matching efficiency of sports public service facilities in 20 colleges and

universities is 0.69, and 12 colleges and universities have not reached the average value, which indicates that there are still large problems in the proportion of public sports service facilities in colleges and universities, and it is necessary to adjust the proportion and scale of sports facilities allocation reasonably. At the same time, the pure technical efficiency of most colleges and universities is higher than

that of the pure technical facilities of colleges and universities. This study uses EDA model to evaluate the efficiency of public sports service facilities in colleges and universities.

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