Resource Allocation Efficiency of Provincial Tourism Higher Vocational Education – The Case in China

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Abstract – *Taking 32 Higher Vocational Colleges in Jiangxi Province in Central China as the research object, this paper analyzes the current situation of their allocation, and measures the resource allocation efficiency of tourism higher vocational education by using the CCR model of data envelopment analysis (DEA), and then explores the characteristics of the allocation efficiency. The results show that the investment elements of Tourism Higher Vocational Education in Jiangxi Province are reasonable, but there are still some problems, such as the big difference between colleges and universities, the imbalance of regional tourism education resources allocation efficiency and the insufficient resource utilization efficiency. Based on this, this paper puts forward some suggestions to improve the resource allocation efficiency of Tourism Higher Vocational Education in Jiangxi Province, such as establishing a tourism education resource allocation mechanism suitable for the tourism market, improving the utilization efficiency of tourism vocational education resources, implementing joint school running, realizing the sharing of educational resources in the whole Province, reforming the enrollment system, obtaining more and better student resources and strengthening the introduction of tourism education technology Teaching performance.*

Key words – *tourism higher vocational education, resource allocation efficiency, DEA*

INTRODUCTION

At present, China's tourism industry is entering a new stage of mass tourism to improve the management service level and improve the quality of tourism. In order to promote the high-quality development of tourism, the Ministry of culture and tourism issued *The Guidance on the Implementation of the Tourism Service Quality Improvement Plan* in January 2019, pointing out that it is necessary to give full play to the advantages of teachers and facilities in colleges, tourism vocational colleges and research institutions, and improve the professional quality of tourism practitioners. China's tourism education has been running for more than 30 years [1]. Practice shows that tourism higher vocational education, as the cradle of a large number of tourism professionals, has an obvious effect on improving the quality of tourism service. The resource allocation of tourism higher vocational education is the key to the relationship between the cultivation of tourism higher vocational talents and the demand of tourism market talents. The research on this problem can provide reference ideas and methods for promoting the overall coordinated development of tourism higher vocational talents training objectives and tourism market talent demand structure, and at the same time, it is of great significance to improve the quality of tourism higher vocational education personnel training.

In recent years, Jiangxi Province has vigorously implemented the strategy of strengthening tourism province [2]. In July 2019, the general office of Jiangxi Provincial People's government issued *The Three-year Action Plan for High-quality Development of Tourism Industry in Jiangxi Province (2019-2021)*, which also proposed to "strengthen the development of tourism by talents", relying on universities and tourism enterprises, implement the tourism talent training plan, and focus on the development of high-quality tourism. This makes the training of tourism talents become the key point to promote the future development of tourism in Jiangxi Province. There are many tourism vocational colleges in Jiangxi Province. In the good period of vigorously developing vocational education in China and deepening the reform of vocational education system in Jiangxi Province, the rational allocation and utilization of tourism higher vocational education resources and the training of tourism professionals are both internal and external, which is of great significance to promote the optimization and upgrading of tourism service quality in Jiangxi Province.

OBJECTIVES OF THE STUDY

On the basis of mastering the data related to the resource allocation of Tourism Higher Vocational Education in Jiangxi Province, this study will construct an index system to measure the resource allocation efficiency of tourism higher vocational education, and use Data Envelopment Analysis (DEA), This paper measures and analyzes the resource allocation efficiency of Tourism Higher Vocational Education in Jiangxi Province, and puts forward a series of suggestions to improve the resource allocation efficiency of Tourism Higher Vocational Education in Jiangxi Province.

METHODS

Participants of the Study

According to the division of General Higher Vocational Education (junior college) by the department of vocational education and adult education of the Ministry of education of People's Republic of China in 2019, the major categories of tourism major include tourism (Tourism Management, tour guide, travel agency management, scenic spot development and management, hotel management, leisure service and management, research travel management and service, wine marketing and service), catering (catering management Cooking technology and nutrition, nutrition catering, Chinese and Western pastry technology, Western food technology, and Exhibition (exhibition planning and management) three professional categories [3]. By the end of 2018, among the 55 Higher Vocational Colleges in Jiangxi Province, 32 have opened major tourism majors (including similar majors), accounting for 58.18% of the province's higher vocational colleges. Among 32 Tourism Vocational Colleges in Jiangxi Province, there are 8 private colleges, accounting for 33.33%, and 24 public colleges, accounting for 66.67%. There are 13 and 5 universities in Nanchang and Jiujiang, accounting for 40.5% and 15.6% respectively, while there are 2 universities in Xinyu, Ganzhou, Pingxiang, Yichun and Yingtan, accounting for 6.3% and 1 in Fuzhou, Ji'an, Jingdezhen and Shangrao respectively, accounting for 3.1%.

Research Instrument

Measurement Model

Data Envelopment Analysis (DEA) is a quantitative analysis method for evaluating the relative effectiveness of comparable decision making units (DMUs) for the problems of multiple inputs and outputs by using linear programming method. The process of resource allocation of tourism higher vocational education is a multi input and multi output system. In addition, in the evaluation of resource allocation efficiency, DEA only needs to determine specific input-output variables, so as to avoid theoretical traps and subjective factors interference, and ensure that the efficiency evaluation results are based on objective data. Therefore, this study uses DEA to construct the evaluation model of resource allocation efficiency of Tourism Higher Vocational Education in Jiangxi Province, in order to get more objective results.

This paper mainly uses the CCR model of DEA, which is a CCR model with non Archimedean infinitesimal by introducing non Archimedean infinitesimal ε on the basis of "relative efficiency evaluation" by American operational research experts Charnes, Cooper and Rhodes. The CCR model with non Archimedean infinitesimal is established by introducing the non Archimedean infinitesimal ε, which mainly uses cross-section data and is based on a set of input-output data To estimate the effective production frontier, so as to evaluate technology efficiency and scale efficiency. In the model, decision making unit (DMU) is the object of efficiency evaluation. Technical efficiency (crste) refers to the ratio of actual output to ideal output under the condition of keeping the input of DMU unchanged, which is used to measure the efficiency of resource allocation. The calculation formula of CCR model is as follows:

$$\min\left[\theta-\varepsilon\left(\sum_{j=1}^{m}s^{-}\right)+\left(\sum_{j=r}^{r}s^{+}\right)\right]$$

$$s.t.\begin{cases}\sum_{j=1}^{n}x_j\lambda_j+s^{-}=\theta x_0\\ \sum_{j=1}^{n}y_j\lambda_j-s^{+}=y_0\\ \lambda_j\geq 0,\ j=1,2\cdots,n\\ s^{+}\geq 0, s^{-}\geq 0\end{cases}$$

In the formula, θ is the efficiency evaluation index of DMU_{j0}, x_j is the set of input elements of DMU_j, y_j is the set of output factors of DMU_j, λ is the combination proportion of DMU_j, s^-,s^+ are the slack variables, x_0,y_0 are the input vector and output vector of DMU_j [4].

Measurement System

Educational resources refer to the general term of human resources, material resources, financial

resources and other resources (such as information and system) resources provided for education. Any education process is a process of using and consuming certain human, material and financial resources [5]. The allocation of educational resources refers to the allocation and utilization of human, material, financial, institutional and other educational resources invested in the cause of education, with a view to optimizing the allocation and utilization of educational resources [6]. Efficiency is one of the goals that must be pursued in the process of allocating educational resources. Efficiency in the allocation of educational resources mainly refers to the ratio of input and output of educational resources [7].

Although efficiency is a concept in the field of economics, tourism higher vocational education is a part of social public utilities, which is different from commercial enterprises. Therefore, the index system in economics cannot be copied in the analysis process [8]. Based on the existing research results, combined with the current situation of Tourism Higher Vocational Education in Jiangxi Province, and considering the availability of data, this paper determines the input and output three-level index system of resource allocation efficiency of Tourism Higher Vocational Education in Jiangxi Province, which is shown in Table 1.

Table 1. Evaluation Index System of Educational Resources Allocation Efficiency in Tourism Higher Vocational Colleges

Primary level index	Secondary level index	Third level index
input	Faculty allocation	X_1 – Total number of full-time teachers X_2 – Number of teachers with master's degree or above X_3 – Number of teachers with the title of deputy senior title or above
	School running resources	X_4 – Equipment value of teaching assets X_5 – Number of books in collection
output	Talent training output	Y_1 – Number of graduates Y_2 – Employment of graduating students

Data Gathering Procedure

Taking 32 higher vocational colleges with tourism related majors in Jiangxi Province as the research object, the evaluation index data of educational resource allocation efficiency are mainly from *The Annual Report on the Quality of Higher Vocational Education in Jiangxi Province (2019)* and the official websites of Higher Vocational Colleges in Jiangxi Province. In addition, in order to make the data more objective and authentic, the relevant personnel of colleges and universities were investigated and consulted.

RESULTS

Input and output index data of educational resources of 32 Tourism Higher Vocational Colleges in Jiangxi Province are imported into DEAP2.1 software and calculated by CCR model. Finally, the efficiency evaluation index θ of 32 decision-making units is obtained. See Table 3 for details. When $\theta = 1$ and $s^- = s^+ = 0$, then DMU_{j0} is DEA efficient, that is, in the system composed of n decision-making units, the output y_0 obtained on the basis of original input x_0 has reached the optimal; when $\theta = 1$ and $s^- \neq s^+ \neq 0$, DMU_{j0} is weak DEA efficient, that is, in the system composed of n decision-making units, the original output of y_0 obtained on the basis of reducing s^- for input x_0 is unchanged, or when input x_0 is not, or the output can be increased by s^+ when the input x_0 is unchanged; when $\theta < 1$, DMU_{j0} is non DEA efficient. It can be seen from the table that there are 13 decision-making units which are effective in DEA ($\theta = 1$), accounting for 40.62% of the total number of decision-making units. The inputs of these decision-making units have achieved good output effect, and the input elements of decision-making units have reached the optimal combination; while for the remaining 19 decision-making units, the value of θ is less than 1, indicating that these decision-making units are not DEA efficient.

On the whole, the average technical efficiency of educational resources allocation of 32 Tourism Higher Vocational Colleges in Jiangxi Province is relatively ideal, but there are still some problems such as low utilization efficiency and resource input redundancy. The average value of efficiency evaluation index of CCR model of 32 decision-making units is 0.835, and the value of θ of decision-making units with the lowest efficiency is 0.319. From the distribution of efficiency, 40.62% of the value of θ is 1, which is the best; the distribution of θ value of 10 decision-making

units is between 0.7-1, accounting for 31.25% of all decision-making units. See Table 2 for details.

Table 2. Technical Efficiency Frequency Distribution of CCR Model of Tourism Education Resources in Higher Vocational Colleges

Range	Frequency	Percentage	Cumulative percentage
$0.300\leq\theta<0.400$	1	3.13%	3.13%
$0.400\leq\theta<0.500$	0	0%	3.13%
$0.500\leq\theta<0.600$	1	3.13%	6.26%
$0.600\leq\theta<0.700$	7	21.86%	28.13%
$0.700\leq\theta<0.800$	5	15.63%	43.75%
$0.800\leq\theta<0.900$	4	12.50%	56.25%
$0.900\leq\theta<1.000$	1	3.13%	59.38%
$\theta=1.000$	13	40.62%	100.00%
total	32	100.00%	-

DISCUSSION

(1) The differences between schools are obvious

From the perspective of educational resources allocation, there are obvious differences in the conditions of running schools, the status of teachers and the investment of funds among 32 Tourism Vocational Colleges in Jiangxi Province. For example, the smallest covers an area of about 200 mu, while the largest is 1400 mu; in terms of book collection, two colleges only have more than 100000 books, while six universities have more than one million books; in terms of teaching assets and equipment, the colleges and universities with assets value less than 30 million Yuan account for a large proportion, while two colleges and universities have reached more than 120 million yuan. From the efficiency measurement results, the standard deviation of technical efficiency of Tourism Vocational Colleges in Jiangxi Province is 0.18, and the dispersion degree of the difference is relatively large. The maximum value of θ is 1, while the minimum value is only 0.319.

(2) The combination of input elements is reasonable

Tourism higher vocational education is a huge network system. Teaching equipment, teacher allocation, talent exchange and teaching management are all important nodes in the network system, forming a unified education system of distribution, flow and cooperation of tourism education resources in the whole province. The powerful group aggregation effect of the system enables the teaching information flow, capital flow and human resources of colleges and universities to move independently and have certain overall relevance [9]. The tourism higher vocational education resources in Jiangxi Province has a high average allocation efficiency, and the average value of CCR model θ is 0.835; among the 11 prefecture level cities, the average technical efficiency of nine prefecture level cities is above 0.8. Among the 32 colleges, 13 are effective in DEA, accounting for 40.62%. The input factors of these colleges and universities have achieved good output effect, and the input factors have reached the optimal combination.

(3) The attributes of running schools are different

In the allocation of educational resources in Colleges and universities, the supporting factors are basic factors, which directly affect the fairness and efficiency of resource allocation, including the support of the state, the support of higher authorities and the support of local governments [10]. In terms of the school running system, there are 24 public colleges and 8 private colleges among 32 Tourism Vocational Colleges in Jiangxi Province. It can be seen from Table 3 that the average technical efficiency θ of CCR model of public colleges and universities in Jiangxi Province is slightly higher than that of private colleges, but from the redundancy of five input indicators, the average redundancy of public institutions is greater than that of private colleges. It can be seen that the school running system has a great impact on the resource allocation efficiency of Tourism Higher Vocational Education in Jiangxi Province. Although public colleges and universities can get more policy support from the government and input factors are more than private colleges, they are prone to redundancy of input elements, the utilization efficiency of various resources is lower than that of private colleges, and the waste degree of resources is greater than that of private colleges.

(4) Utilization of input resources is insufficient

The results of efficiency measurement show that there are redundancies in the five indicators of tourism higher vocational education resources investment in Jiangxi Province. Among them, the relaxation variable values of the total number of full-time teachers are -27.649, the number of teachers with master's degree or above is -13.677, the number of teachers with associate senior high or above is -8.702, the value of teaching assets and equipment is -598.768, and the number of books in library is -4.297. This shows that the tourism higher vocational education resources in Jiangxi Province have not been fully utilized, there are still low utilization efficiency and redundant resources input, which will cause a certain waste of educational resources.

Table 3. Efficiency Analysis of Higher Vocational Colleges of Tourism in Jiangxi Province

School running system	Quantity	Θ mean value	Average redundancy of each input index				
			X_1	X_2	X_3	X_4	X_5
Public school	24	0.858	-33.118	-11.439	-9.692	-610.553	-4.705
Private school	8	0.767	-19.115	-7.646	-5.731	-563.008	-3.074

(5) Regional allocation of resources is uneven

In general, northern Jiangxi includes eight prefecture level cities, namely Nanchang, Jiujiang, Xinyu, Jingdezhen, Pingxiang, Shangrao, Yingtan and Yichun; central Jiangxi includes two prefecture level cities, Fuzhou and Ji'an; and southern Jiangxi refers to Ganzhou. From the efficiency measurement results, the highest value of θ in southern Jiangxi is 0.924, followed by northern Jiangxi with 0.881 and central Jiangxi with 0.793. The resource allocation efficiency of tourism higher vocational education among different regions in Jiangxi Province is not balanced, showing a state of "high in the north and low in the middle". From the regional perspective, the standard deviation of θ value of 8 cities in northern Jiangxi is only 0.1, while that of two cities in central Jiangxi is 0.3, which shows that the resource allocation efficiency of Tourism Higher Vocational Education in central Jiangxi is more obvious.

RECOMMENDATION

(1) Establish the resource allocation mechanism of Tourism Higher Vocational Education in line with the market

As a tertiary industry, education, like other industrial sectors, has the problem of how to allocate educational resources reasonably. The demand of tourism market has a decisive impact on tourism higher vocational education. If the allocation of tourism education resources is divorced from the demand of the tourism market, tourism education is difficult to develop and continue. In the face of the current tourism market environment, we should change the existing tourism vocational education system. We should not blindly emphasize the educational function of tourism vocational education and ignore its economic value. In order to establish a tourism resource allocation mechanism suitable for the tourism market, Jiangxi higher vocational colleges should pay attention to the proportion of investment in tourism education, and take the investment of national finance and local government on tourism vocational education as the cost of promoting the development of tourism market.

(2) Improve the utilization efficiency of tourism higher vocational education resources

Tourism vocational education resources are various human, material and financial resources that can be used in tourism vocational education. At present, the supply and demand of educational resources in Higher Vocational Colleges of tourism in Jiangxi Province is not balanced. The reasons are as follows: first, the scale of each college is different; second, the allocation of educational resources is not on demand. Therefore, colleges and universities should vigorously develop a variety of tourism vocational education resources, such as full-time teachers, the surrounding environment of colleges and universities, intangible social culture and so on, which can be used as rich educational resources, so that all kinds of resources can be fully developed and utilized in tourism higher vocational education; at the same time, the utilization efficiency of education resources should be improved to make all kinds of investment in tourism vocational education Resources should be used as much as possible, so as to break the imbalance between supply and demand of tourism higher vocational education resources [11], and alleviate the current situation of resource redundancy. This not only meets the needs of Tourism Higher Vocational Colleges' own development, but also makes innovative use of resources.

(3) Implementation of a joint school-running model of tourism higher vocational education resource sharing

In view of the problems of the large inter school differences and unbalanced regional allocation of educational resources of Tourism Higher Vocational Colleges in Jiangxi Province, we can implement the joint mode of educational resources sharing of Tourism Higher Vocational Colleges in Jiangxi Province, especially to share the redundant tourism education resources of colleges and universities with other colleges and universities. This can not only reduce the lack of resource utilization efficiency, but also make up for the lack of tourism education resources in some colleges and universities, so as to promote the balanced allocation of tourism education resources in Colleges and regions, and improve the resource allocation efficiency of Tourism Higher Vocational Education in the whole province. For example, there are 13 Tourism Higher Vocational Colleges in Nanchang City, and the allocation of educational resources in some colleges and

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universities is redundant. Too many teaching equipment, equipment and training rooms are not fully utilized, resulting in the idle of tourism education resources; while the scale of colleges and universities in other cities is small, the allocation of education and teaching equipment, equipment and training sites are not complete. In this way, the Tourism Higher Vocational Colleges in Jiangxi Province can share resources and jointly run schools, strengthen the cooperation and even "merge" among them [11]. Specifically, we can realize the sharing of curriculum resources and the mutual recognition of students' credits through the teachers' Union of higher vocational colleges, so as to achieve the complementary advantages of teaching resources; we can also strengthen the sharing of teaching management and reform mode among colleges and universities, improve the teaching service of tourism education, and improve the overall quality of tourism major in Jiangxi Province.

(4) Reform the enrollment system of related majors in Tourism Higher Vocational Colleges

The enrollment system mainly includes enrollment plans and enrollment examination forms. With the development of tourism economy, the enrollment scale of tourism major in Jiangxi tourism vocational colleges is gradually expanding. However, tourism majors in some colleges and universities are still new majors, such as hotel management major of Jiangxi Industry and Commerce Professional Technology Tnstitute and Tourism Management Major of Ganzhou Teachers College, which were recruited for the first time in 2018, and their enrollment system is not mature. These colleges should make reasonable enrollment plans according to the allocation of tourism education resources. However, some higher vocational colleges which have established tourism major earlier should innovate the enrollment system, adjust the enrollment plan and change the old enrollment examination form according to the background of the current market environment and the needs of tourism professional education in Colleges and universities.

(5) Strengthen the introduction of tourism education technology in Tourism Vocational Colleges

Educational technology is the technology of educational technology and its innovation integration, the core of which is teaching design technology and curriculum development technology [12]. Through the analysis of curriculum construction of 32 Tourism Vocational Colleges in Jiangxi Province, it is found that there are not many excellent courses above the provincial level in most of the colleges and universities. It is necessary to further introduce advanced tourism education technology, optimize teaching design and develop high-quality courses. In the face of various educational resources, colleges and tourism teachers should make use of advanced education technology to make students change from passive knowledge receivers to active learning explorers, so as to achieve the dual purpose of promoting students' learning and improving teaching performance by using tourism education resources [13].

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