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Optimized Allocation of Vocational Education Resources in Fujian and Taiwan and the Development Path of E-commerce English Curriculum System Based on Principal Component Analysis Approach

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Abstract Carrying out a comprehensive evaluation of the resource allocation capacity of higher vocational education can play a guiding, diagnostic and motivational role in the development path of resource allocation and curriculum system of higher vocational education. Based on the public product theory and resource allocation theory, this paper adopts the principal component analysis method to establish the configuration optimization model and evaluation index system to quantitatively analyze the resource allocation capacity of higher vocational education in Fujian and Taiwan, and to promote the high-quality development of vocational education of e-commerce English. It is known from the study that this paper uses 6 secondary indicators and 22 tertiary indicators to represent the input and output efficiency. Taking the data of Fujian Province as the research object, the cumulative variance contribution rate of physical resource factor and digital resource factor is 83.35%, and the talent cultivation factor and regional service factor is 82.945%, which are the main components of input and output indicators. The average value of the allocation efficiency of vocational education resources in each region of Fujian Province: Minbei>Minnan>Minzhong>Mindong> Minwest. Based on this, this paper gives six paths for the development of e-commerce English curriculum system. Therefore, the findings of this paper can promote the balanced development of higher vocational education system.

Index Terms principal component analysis, configuration optimization model, index system, higher vocational education

I. Introduction

Under the continuous innovation and progress of electronic communication and network technology, and the vigorous support and guidance of national policies, cross-border e-commerce in China has been developing rapidly. Data from the Ministry of Commerce show that since 2010, cross-border e-commerce has maintained a high growth rate of 20% per year, and the scale has reached 10.5 trillion yuan by 2019 [1]. The two sides of the Taiwan Straits, Fujian and Taiwan, are close to each other and have similar “five margins”, and the demand for economic and trade cooperation is becoming more and more extensive and strong. According to the data of the Statistical Yearbook of Fujian Province, the total cross-border trade between Fujian and Taiwan in 2019 amounted to about 74.9 billion yuan, but the value of cross-border e-commerce contribution was less than 1 billion yuan. Therefore, cross-strait cross-border e-commerce cooperation has huge development space and potential [2]-[4]. Fujian Province is not only the starting point and birthplace of the "Maritime Silk Road", but also a key node of the "Land Silk Road", and plays a pivotal role in the strategic construction of the "Belt and Road" [5]. The Taiwan Strait is located in the “Sea Silk” choke point, is an inseparable part of China's national territory, will inevitably become the motherland's continent of the Maritime Silk Road fortress and bridgehead [6]. The unique location advantages of both sides of the Taiwan Strait are the natural conditions for cross-border e-commerce exchanges and cooperation between Fujian and Taiwan.

The unique geographic location and historical origin of Fujian Province have the advantage of integration with Taiwan, and realizing the development of vocational education in Fujian and Taiwan is of great significance for cultivating high-quality scientific and technological innovation talents, and it helps to improve the level of vocational education cooperation between Fujian and Taiwan, and to promote the high-quality development of education in Fujian in the new era [7], [8]. At present, the global economy is affected by a variety of factors such as epidemics,

wars and trade protectionism, and regional political and economic friction is increasing, and the integration process of vocational education in Fujian and Taiwan is facing an unprecedented test. Specifically, it can be divided into two points. On the one hand, there is an imbalance in the matching of educational resources such as teacher resources and e-commerce training bases with the number of students in Taiwan, and there is a negative growth in the ratio of investment and benefit income. On the other hand, Taiwan's cross-border e-commerce enterprises have fewer English-speaking talents, and the design of e-commerce English courses is unreasonable, focusing only on the English level of the students, and not taking into account the business negotiation in the e-commerce industry and cross-cultural barriers in cross-border business [9], [10]. For this reason, there is an urgent need to explore the optimization of vocational education resource allocation and the design of e-commerce English curriculum system between Fujian and Taiwan, in order to promote cooperation and exchange between Fujian and Taiwan, and to inject new impetus and vitality into the education, economic and social development of the two places. And when dealing with multivariate problems such as resource allocation and curriculum system design, which have correlation between variables, traditional statistical analysis methods are difficult to effectively solve such complex events, while principal component analysis methods provide excellent solution routes for such problems [11], [12].

Based on the theory of public goods and the theory of resource allocation, this paper combines the development status of vocational education in Fujian and Taiwan and the implementation of vocational education cooperation projects to establish a system of evaluation indexes for the allocation of resources for higher education, to measure, monitor, evaluate and comprehensively analyze the allocation of resources for higher education in the region. The data of Fujian Province is selected as the research object, and data processing is carried out through interpolation fitting and other methods. Principal component analysis was used for principal component extraction to obtain the eigenvalues and corresponding contribution rates of the factor loading matrices calculated using the maximum variance method, and a number of principal factors were determined for the input system and the output system. The variability of the development level of the six regions of Fujian, Minbei, Minnan, Minzhong, Mindong and Minxi, was measured. From the evaluation results, the development path of e-commerce English curriculum system for higher vocational education is proposed.

II. Underlying concepts and theories

II. A. Underlying concepts

II. A. 1) Vocational education

Vocational education is education that gives students the knowledge and skills needed to engage in a certain occupation or productive labor, and is implemented after the completion of junior high school education, through both vocational school education and vocational training. Vocational school education is divided into three levels: primary, secondary and higher. Vocational training includes pre-employment training, vocational training, apprenticeship training, on-the-job training, job-transfer training and other vocational training, which can also be categorized into three levels: primary, intermediate and advanced. Vocational training is mainly carried out through appropriate vocational training institutions and vocational schools. This study deals with vocational school education [13].

II. A. 2) E-commerce English course

“E-commerce English” is a professional development course for cross-border e-commerce, e-commerce, business English, international trade majors, mainly for e-commerce commonly used English listening, speaking, reading, writing, translation and other application skills related to cross-border e-commerce in the field of terminology, communication and professional skills and techniques, with both theoretical and practical, and it ranks as a professional core course in the curriculum system of business English, international trade and e-commerce majors. It is theoretical and practical, and is a core course in the curriculum system of Business English, International Trade and E-commerce majors. The predecessor courses of this course are University English, cross-border e-commerce practice, international trade practice, and the subsequent courses are business negotiation and exhibition English [14].

The first course was offered in Huizhou City Vocational College in 2017, and the course standard, lecture plan, and question bank have been designed. The course has been operated on Super Star platform for 4 years, with all kinds of resources. In March 2023, it was awarded as an online open boutique course, and was set as a model teaching package by Super Star platform for promotion, which can be used by practitioners of foreign trade industry and cross-border e-commerce in the countries along the Belt and Road, students of cross-border e-commerce, e-commerce, business English, international trade, and some foreign students of e-commerce majors. Students of cross-border e-commerce, e-commerce, business English, international trade, and some foreign students majoring in e-commerce can study.

II. B.Grounded Theory

II. B. 1) Public Goods Theory

Western scholars have introduced the marginal utility theory of value into the field of finance, forming the theory of public goods [15]. In order to achieve an equilibrium between the supply and demand of public goods, the sum of each person's needs must be equal to the total supply of public goods in the market, and the price in this equilibrium state is the price of public goods. The Pure Theory of Public Expenditure published in 1954 and the Schematic Discussion of Public Expenditure Theory published in 1955 gave a classic definition of pure public goods, that is, an individual's consumption of a certain product does not require the consumption of such a product by others. In 1956, he published "A Pure Theory of Local Expenditure", which sparked a wave of discussion among Western scholars about local public goods, and many literature on local public goods appeared at this time. In the theory of "club economy", the concept of public goods is further expanded, and the concept of quasi-public goods is proposed. Later, in 1969, he criticized the theory of "Lindahl equilibrium", arguing that the equilibrium level of public goods supply brought about by Lindahl's equilibrium was not optimal, and the optimal level was higher than the level at the time of this equilibrium. In 1973, the theory of public goods was further expanded and the theory of mixed products was proposed. Since then, the research of public goods theory has mainly focused on ensuring the efficiency of public goods supply.

II. B. 2) Resource allocation theory

Resource allocation theory refers to the scarcity of resources, making the use of resources in the process must choose an optimal method to maximize the advantages of resources. Educational resource allocation is mainly about how to rationally allocate scarce educational resources, so that educational resources can serve everyone and cultivate high-level talents. In the continuous development of social and economic development today, educational resources have been a great development, but the quality of educational resources relative to the needs of people, or seems very scarce, but people for the quality of the scarce resources of the thirst, forcing us to the existing scarce resources for a reasonable and fair configuration to meet people's needs. The main ways of allocating educational resources in China are: the planned allocation method (according to national standards to determine the amount of each person to enjoy, through administrative means to manage the allocation of resources) and the market allocation method (mainly in accordance with the supply and demand relationship in the market to determine the optimal allocation of resources).

III. Constructing the model of optimal allocation of vocational education resources between Fujian and Taiwan

III. A. Current Development of Vocational Education in Fujian and Taiwan

(1) Comparison of the current situation of vocational education development between Fujian and Taiwan

At present, the gap between the development of vocational education in Fujian and Taiwan is still relatively obvious. Taiwan has a long history and rich experience in vocational education, and the level of vocational education is high, but it is facing problems such as brain drain and population aging. Vocational education in Fujian Province started late, but has made remarkable progress in recent years, with the implementation of the Fujian-Taiwan Vocational Education Cooperation Program being the most important.

(2) Implementation of Fujian-Taiwan Vocational Education Cooperation Programs

Since 2009, Fujian Province and Taiwan have implemented a total of 12 Fujian-Taiwan vocational education cooperation projects, covering a variety of fields such as machinery, electronics, chemical industry, tourism, etc., and there is no lack of projects with strong innovativeness and obvious driving effect. Among them, Fuzhou Institute of Vocational Technology and Taiwan's Hwa Hsia University of Science and Technology cooperation “mechanical automation maintenance and management” project, through the organization of teacher training, student exchanges and practical teaching, etc., to promote exchanges and cooperation between teachers and students of the two schools, broaden the student's horizons, improve the students' vocational literacy and practical ability.

In addition, Xiamen Institute of Technology and Taiwan Nankai University of Science and Technology cooperation “chemical laboratory skills training” program, through the introduction of Taiwan's chemical laboratory skills training system and advanced chemical laboratory equipment, improve the students' experimental skills and practical ability, for the region's chemical industry to send more high-quality technical personnel. In addition, the Fujian-Taiwan Vocational Education Cooperation Program also focuses on the integration of industry and education, actively introduces enterprise resources, strengthens the combination of teaching and practice, and improves the vocational quality and employment competitiveness of students.

III. B. Resource optimization allocation process

The model of optimal allocation of vocational education resources in Fujian and Taiwan is divided into two parts: the part of analysis model of vocational education resources in Fujian and Taiwan and the part of optimal allocation model of resources.

The resource analysis model part is divided into 2 steps, and the flow chart is shown in Figure 1.

(1) Analyze the characteristics of the data, when the data is obviously multi-dimensional, and there is a certain correlation, easy to use the principal component analysis method of downscaling and obtaining indicator weights; when the number of dimensions of the data is less, and the correlation is not very strong, easy to use the method of maximization of the deviation to obtain the indicator weights; when you need to compare the two methods of obtaining the weights of the indicators, you can successively use the two methods of obtaining the weights of the indicators.

(2) The weights of the indicators obtained by the principal component analysis method or (and) the deviation maximization method will be weighted by the mean value to obtain a comprehensive indicator, i.e., a comprehensive score, which can be used to carry out a variety of analyses of resources.

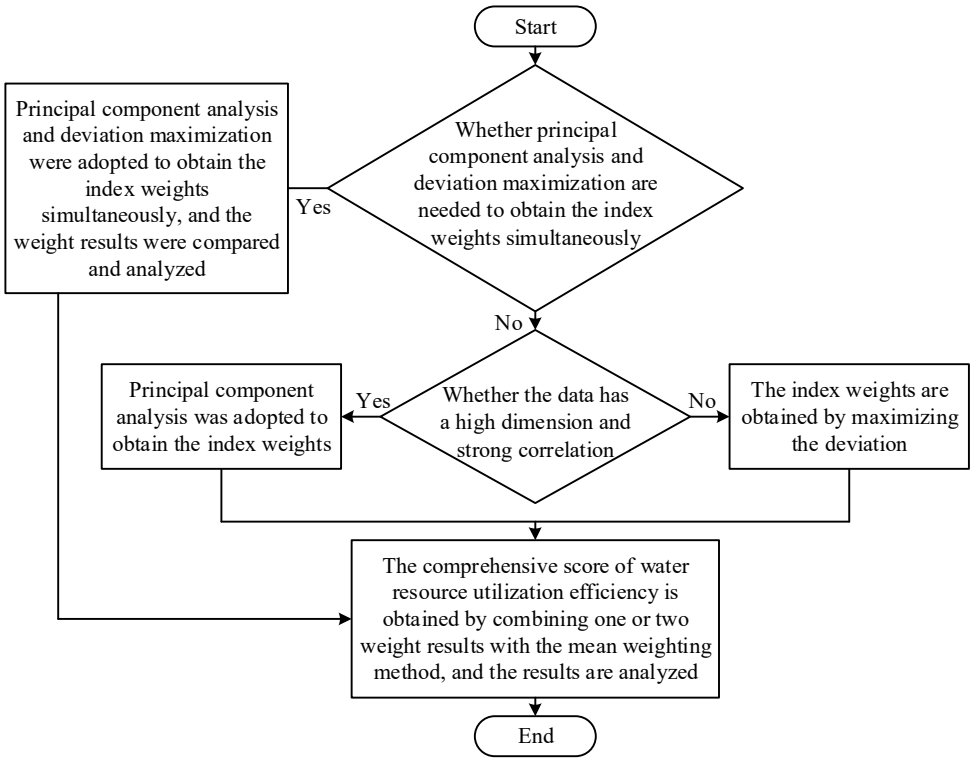


Figure 1: Flowchart of the water resources analysis model

III. C. Optimized configuration model construction

III. C. 1) Principal Component Analysis

Principal component analysis is a statistical method of dimensionality reduction, which transforms the original n correlated indicator vectors into p new uncorrelated random vectors with the help of orthogonal transformation principle, which is algebraically manifested by transforming the covariance matrix of the original random vectors into diagonal matrices, and geometrically manifested by transforming the original coordinate system into a new orthogonal coordinate system pointing to the p orthogonal directions in which the sample points are dispersed. The multidimensional variables are then downscaled so that an originally high-dimensional set of variables is converted into a low-dimensional system of variables. The low-dimensional system is further transformed into a one-dimensional system by constructing an appropriate value function, thus removing redundant indicators and simplifying the complexity of the problem [16]. The specific algorithm is as follows:

Assume m indicators (variables) for each of the n test items: $X_1, X_2, ..., X_m$, list the original data matrix:

$$X=\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix}=(X_1,X_2,...,X_m) \tag{1}$$

In the formula:

$$X_i=\begin{pmatrix} x_{1i} \\ x_{2i} \\ \vdots \\ x_{ni} \end{pmatrix} i=I,2,...,m \tag{2}$$

The following linear combination is made with the m indicators (variables) $X_1,X_2,...,X_m$ of the data matrix X:

$$\begin{cases} F_1=a_{11}X_1+a_{21}X_2+...+a_{p1}X_m \\ F_2=a_{12}X_1+a_{22}X_2+...+a_{p2}X_m \\ ..... \\ F_m=a_{1p}X_1+a_{2p}X_2+...+a_{pp}X_m \end{cases} \tag{3}$$

Simply written as $F_i=a_{1i}X_1+a_{2i}X_2+...+a_{pi}X_m, i=l,2,...,m$.

To narrow the scope, the following constraints are imposed on the combination coefficients $A_i=(a_{1i},a_{2i},\ldots,a_{pi})$:

$$a_{1i}^2+a_{2i}^2+\cdots+a_{mi}^2=1, i=1,2,...,m \tag{4}$$

where a_{1i} is a unit vector ($|a_{1i}|=1$, i.e., a_{1i} is modulo 1) and meets the following requirements

F_i and F_j $(1\le i,j\le m, i\ne j)$ are independent of each other, i.e., the correlation coefficient of F_i and F_j is 0; 2) F_i is the highest variance among all linear combinations (see above) of X_1 to X_m.) of the combinations with the largest variance. To wit:

$$Var(F_1)=\max_{c'c=1} Var\left[\sum_{i=1}^{m} C_iX_i\right] \tag{5}$$

where $c'=(c_1,c_2,...,c_m)$.

F_2 is the combination with the largest variance among all linear combinations from X_1 to X_m that are uncorrelated with F_1, and F_m is the combination with the largest variance among all linear combinations from X_1 to F_{m-1} that are uncorrelated with X_1 to X_m of all linear combinations with the largest variance.

III. C. 2) Principal component analysis to construct the indicator system

Principal component analysis is to multiply each value by the corresponding weights, and then sum up to get the overall value. Using this method, multiple single indicators can be synthesized into a composite indicator, i.e., a composite score, and the specific formula is shown in equation (6):

$$Y=\sum_{i}^{n} y_iw_i=\sum_{i=1}^{n}\frac{x_i}{\overline{x}_l}w_i \tag{6}$$

where: Y is the comprehensive index calculated for comprehensive evaluation.

y_i is the individual index of the i evaluation index, which is actually a kind of dimensionless evaluation value obtained by comparing the actual value of the i index with the evaluation standard.

Expanding y_i, we can see its meaning and calculation method, where x_i is the actual value of the i th evaluation index, $\overline{x}_l$ is the evaluation standard value of the i th evaluation index (the average value of the indexes selected in this paper is used as the evaluation standard), and w_i is the i th weight of the evaluation index in the comprehensive evaluation.

IV. Empirical studies

IV. A. Indicators and data

IV. A. 1) Indicator system

This paper constructs the input index system of higher vocational education resources from the input situation of 3 aspects, such as talents, financial resources and material resources, and regarding the construction method of the index system for measuring the output efficiency of educational inputs, as well as taking into account the specificity of the demand for higher vocational education resources, this paper uses 3 indicators, including basic resources, practical teaching resources and informatization resources, to indicate the input resources, and 3 indicators, namely, social service, international cooperation and talent cultivation, to measure the output efficiency of vocational education resources input. Based on the availability, scientificity and applicability of data, the evaluation index system of input efficiency of higher vocational education resources constructed in this paper is shown in Table 1.

Table 1: Resource allocation efficiency evaluation index system

Primary indicator	Secondary indicator	Tertiary index
Input index	Investment in basic resources	The value of the teaching and scientific instruments and equipment of the raw(X1)
		The students are equipped with the number of the number of machines(X2)
		The quality of the two divisions(X3)
		Master ratio(X4)
	Practice teaching resource input	The area of the construction of an internship base in the school(X5)
		The total number of internship bases in the school is prepared(X6)
		The value of the teaching equipment provided by enterprises(X7)
	Information resources investment	Total number of resources(X8)
		Network number(X9)
		The total amount of bandwidth of the campus network(X10)
		Online courses(X11)
Output indicator	Social services	Horizontal technical services to the amount(Y1)
		Vocational training(Y2)
		Non-education training to account funds(Y3)
	International cooperation	The number of courses adopted outside the country(Y4)
		Training for non-full-time countries(Y5)
	Talent culture	Graduate employment(Y6)
		Employment in the province(Y7)
		Independent start-up ratio(Y8)
		Employer satisfaction(Y9)
		Initial employment of graduates(Y10)
		Monthly income of new graduates(Y11)

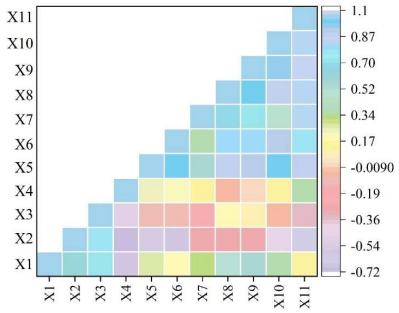
IV. A. 2) Data sources

This study takes the data of Fujian Province as an example, and the data are divided into two categories: the first category is the macro data to measure the overall efficiency of the resource input of higher vocational education in Fujian Province, and the data come from the Annual Report on the Quality of Higher Vocational Education. The second category is the institutional data for assessing the resource input performance of higher vocational institutions under the “Double-High Program” in Fujian Province, which comes from the annual quality reports of the institutions and their campus websites. Some of the data were not available, and were supplemented by interpolation and fitting in this paper.

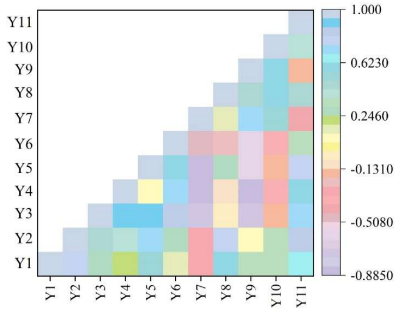
IV. B. Analysis of resource allocation efficiency of vocational education in Fujian and Taiwan

IV. B. 1) Study on the overall efficiency of resource inputs

In order to determine whether there is information overlap between the indicators, SPSS 19.0 software was used to carry out the analysis, and Pearson correlation coefficients were calculated for the input and output indicators, and the results are shown in Figure 2. As can be seen from the figure, there is a certain degree of information overlap between the input and output indicators. Therefore, this paper adopts the principal component analysis method to extract the principal components of input and output indicators respectively.



(a) Pearson correlation coefficient of input index



(b) Pearson correlation coefficient of output index

Figure 2: The Pearson correlation coefficient of input and output index indicators

The principal component analysis was calculated using the statistical software IBMSPSS 22.0, and the resulting matrix of component score coefficients is shown in Table 2. The calculation shows that the cumulative variance contribution ratio of the first 2 principal components of the input indicator is 83.35%, so these 2 principal components can be taken as input factors (named physical resources factor and digital resources factor, respectively). The cumulative variance contribution rate of the first two principal components of the output indicator is 82.945%, so these two principal components can be taken as the output factors (named as the factor of human resources training and the factor of regional services, respectively).

Table 2: The score coefficient matrix of the input and output index

Order	Input index score coefficient			Output index score coefficient		
	Index	Component 1	Component 2	Index	Component 1	Component 2
1	X1	0.052	0.302	Y1	-0.005	0.232
2	X2	-0.091	0.272	Y2	0.036	0.245
3	X3	-0.026	0.292	Y3	0.174	0.034
4	X4	0.038	-0.252	Y4	0.186	-0.008
5	X5	0.162	0.003	Y5	0.152	0.098
6	X6	0.147	-0.012	Y6	0.154	-0.030
7	X7	0.116	0.016	Y7	-0.173	0.018
8	X8	0.152	0.112	Y8	-0.082	0.245
9	X9	0..164	0.098	Y9	-0.184	0.145
10	X10	0.158	0.033	Y10	-0.120	0.203
11	X11	0.157	-0.062	Y11	0.068	0.199

In order to calculate the relative differences between the resource inputs and outputs of higher vocational education in Fujian Province in different years, this paper has carried out the dimensionless processing of the original input and output indicators, and calculated the linear combination of them with the matrix of the coefficients of the principal component scores, and the resulting changes in the total scores of inputs and outputs of higher vocational education are shown in Figure 3. As can be seen from the figure, there is an overall trend of isotropic change between the resource input scores and output scores of higher vocational education in Fujian Province from 2018 to 2024, with the output scores showing signs of slowing down to a certain extent after 2022. As can be seen from the figure, the output scores are significantly lower than the input scores within most years. In order to analyze the reason, this paper decomposes the input-output efficiency, i.e., the comprehensive efficiency is expressed as the product of pure technical efficiency and scale efficiency. A value of 1 for each efficiency indicates that the efficiency of resource use is optimized.

The results obtained by applying the BCC model to analyze the efficiency of input scores and output scores of higher vocational education in Fujian Province from 2018 to 2024 are shown in Table 3. As can be seen from the table:The efficiency value of each in 2018, 2021 and 2024 is 1, indicating that the efficiency of the use of vocational education resources in Fujian Province is optimized in these three years. Each of the efficiency values for 2020-2023 is less than 1 (except for pure technical efficiency in 2019), which indicates that the efficiency of vocational education resource use in Fujian Province fails to grow in equal proportion to the level of resource inputs during these four years, and thus the returns to scale show diminishing returns.

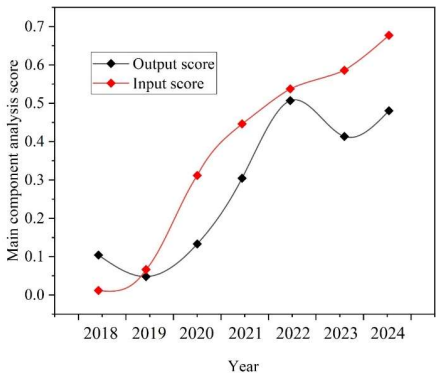


Figure 3: Higher vocational education input and output

Table 3: Overall efficiency of higher vocational education

Year	Overall efficiency			Scale benefit
	Integrated efficiency	Pure technical effect	Scale efficiency	
2018	1	1	1	Invariant
2019	1	1	1	Invariant
2020	0.263	1	0.816	Diminishing
2021	0.511	0.325	0.727	Diminishing
2022	0.824	1	1	Diminishing
2023	0.917	0.728	0.828	Diminishing
2024	1	1	1	Invariant
Mean	0.788	0.861	0.902	-

IV. B. 2) Interregional variability studies

The allocation of resources for higher vocational education in each region of Fujian Province is shown in Table 4, which divides Fujian Province into five regions: east, west, center, south and north. The geometric mean of the efficiency value of each city in the region is obtained as the average value of the efficiency of each region, which is 0.999, 0.998, 0.952, 0.942, 0.843, respectively, from the high to the low of Minbei, Minnan, Minzhong, Mindong, and Minxibei.Comparison reveals that the average value of the efficiency of the average inter-regional differences in the size of the differences between the two regions, but there is not much difference in the region. Specifically, the comprehensive technical efficiency of higher vocational education resource allocation in northern Fujian is the highest, and the intra-regional difference in efficiency is small (the variance is 2.51E-06), and the efficiency of 2 regions has reached the optimum, and only the average value of the efficiency of the Jianyang region is 0.992, and it is found that 3 out of 4 institutions in the Jianyang region have reached the DEA effective.

The efficiency of higher vocational education resource allocation in southern Fujian is higher than the provincial average, and the difference in efficiency within the region is small, and the higher vocational institutions in Quanzhou, Zhangzhou and Xiamen have reached DEA effective.

The allocation efficiency of higher vocational education resources in central Fujian is slightly lower than the provincial average, and the difference in efficiency within the region is more obvious, except for Sanming, the allocation efficiency of education in other regions fails to reach the optimum, among which Putian has relatively more higher vocational colleges and universities, and the efficiency of allocation of education resources is 0.998, which is higher than the average value of central Fujian and the provincial average, and the efficiency of allocation of higher vocational education resources in Fuzhou is relatively low, which is lower than the average value of central Fujian.

East Fujian comprehensive technical efficiency is lower than the provincial average and there are some differences within the region, Ningde regional efficiency average is 0.902, the lowest in the region, and 2 higher vocational colleges and universities in the region did not achieve the optimal allocation of educational resources, Fuzhou occupies 2.

The comprehensive technical efficiency of western Fujian is the lowest in the province, and there are large differences within the region, the efficiency of the Sanming region is far below the average level of Fujian Province, restricting the overall configuration of the region and even Fujian Province to improve the efficiency of the overall configuration of the region, in which the scale efficiency of 1 of the 3 institutions in the Sanming region is low, and

the scale efficiency is incremental, which means that there are insufficient elements of the input of educational resources, resulting in the output of educational resources is also low.

Overall, the mean value of the allocation efficiency of higher vocational education resources in Fujian Province in 2024 is 0.965, and the variance is 0.0114, with some differences between regions. The reason for the large gap may be the geographical location, the level of economic development, the degree of perfection of the industrial structure, the level of education and the degree of concentration of colleges and universities, which will have a certain degree of influence on the effect of input and output of higher vocational colleges and universities in terms of the inputs and outputs of factors such as manpower, material resources and financial resources. In the process of promoting the stable development of higher vocational education in Fujian Province, the western region of Fujian can be given an appropriate tilt in resource input, and the use of point to lead the way to promote the development of higher vocational colleges and universities in all regions of Fujian, to realize the sharing of educational resources in all regions, to narrow the gap in the allocation of resources between the regions, and to promote the common development of higher vocational education in Fujian Province.

Table 4: Education resource allocation efficiency in higher vocational colleges

Geographic partition(mean,SD)	Geographic	Number of higher vocational colleges	Mean	Min	Configured valid number	Configuration invalid
Mindong (0.942,0.083)	Fuzhou	12	0.962	0.892	10	2
	Lingde	4	0.902	0.751	2	2
Minxi (0.843,0.0371)	Longyan	2	1	1	1	1
	Sanming	3	0.784	0.663	2	1
Minzhong (0.952,0.0122)	Putian	4	0.998	0.954	2	2
	Sanming(partial area)	1	0.973	0.892	1	0
	Fuzhou(partial area)	3	0.952	0.845	2	1
Minnan (0.998,0.00724)	Xiamen	5	0.861	0.578	4	1
	Quanzhou	4	1	1	1	3
	Zhangzhou	3	0.999	0.982	2	1
Minbei (0.999,0.000251)	Nanping	5	0.984	0.973	3	2
	Jianyang	4	0.992	0.981	3	1
Fujian (0.965,0.0114)	12 city	50	0.965	0.574	33	17

V. Development Path of E-commerce English Course System

(1) Adopting a suitable cross-border e-commerce English textbook

Cross-border e-commerce English is a highly specialized course, and it is necessary to adopt a textbook that is suitable for senior teachers' teaching and students' learning.

(2) To be supplemented by other supporting courses

The teaching of cross-border e-commerce has now basically formed a set of relatively scientific discipline system.

(3) Utilize cross-border e-commerce platform for practical training

Cross-border e-commerce English tutorial materials have SKILLPRACTICE training after each subsection. For example, in the PRODUCT DESCRIPTION of this subsection, there is an exercise for the “please consult the relevant website information, according to the following picture information, for the product to do a detailed product description”, this practice questions are more practical.

(4) Utilizing WeChat Public Platform as a Second Classroom for Auxiliary Teaching

The WeChat public number of Science and Trade Business English is welcomed by cross-border e-commerce practitioners, business English enthusiasts and learners all over the country, so that students can utilize odd hours to study at any time and any place in their spare time.

(5) Business English Vocational Skills Competition of “Cross-border E-commerce Masters

In addition to participating in e-commerce competitions and various e-commerce entrepreneurship competitions, students specializing in cross-border e-commerce can also participate in business English competitions.

(6) Provide volunteer services for the “Cross-border E-commerce Conference”.

We utilize such a good resource and opportunity for students to participate in the whole conference as volunteers. Students can have zero distance contact with successful people in the cross-border e-commerce ecosystem, listen to the wonderful speeches of a large number of executives from AliExpress, Dunhuang.com, Amazon.com, Ebay, DaLong.com and so on, so that the importance of cross-border e-commerce English is internalized into the interest in learning, and finally passive learning is turned into active learning.

VI. Conclusion

This paper firstly combines the current situation of vocational education development in Fujian and Taiwan to construct a reasonable evaluation index system for the input efficiency of higher vocational education resources. The input and output indicators were downscaled using principal component analysis to obtain a number of principal factors for a comprehensive evaluation of the resource allocation capacity of higher vocational education. The results show that:

(1) The evaluation index system of higher vocational education resource input efficiency constructed in this paper mainly includes 6 secondary indicators and 22 tertiary indicators.

(2) This study takes the data of Fujian Province as an example, and the 2 principal components of its input factors are physical resources and digital resources respectively. The 2 principal components of the output indicators are talent cultivation and regional services, respectively.

(3) The resource inputs and outputs of higher vocational education in Fujian Province as a whole show an increasing trend from 2018 to 2024, and show the same trend of change. The allocation of resources for education in each region of Fujian Province is, in descending order, Minbei, Minnan, Minzhong, Mindong and Minxi.

(4) The development path of e-commerce English curriculum system: adopting suitable cross-border e-commerce English teaching materials, utilizing the WeChat public platform as the second classroom for supplementary teaching, etc.

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