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# RESEARCH ON THE COORDINATED DEVELOPMENT OF HIGHER VOCATIONAL EDUCATION AND ECONOMIC INDUSTRY IN MOUNTAINOUS AREAS - TYPICAL CORRELATION ANALYSIS BASED ON THE CASE OF YUNFU CITY

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**Abstract:** Taking Yunfu city, a less developed mountainous area in Guangdong Province, as a case, using typical relevant analysis method, and studying the coordinated development of higher vocational education and economic industry with the data of 2002-2016. Research shows that: (1) the number of students, the number of graduates are the main factors affecting the development of higher vocational education; and the number of students, students than less effect.(2) The GDP and per capita GDP coefficient are relatively large, which is the main factor affecting the development of economic industries, while the proportion coefficient of pillar industries is the smallest.(3) The number of students in higher vocational education is the closest to the economic and industry development; GDP is an important foundation for promoting the development of higher vocational education, and the pillar industries are not very relevant. Finally, to analyze the reasons and put forward suggestions and deficiencies.
**Keywords:** Mountain area; Higher vocational education; Economic industry; Typical related analysis method

## 1. FOREWORD

The 19th National Congress of the Communist Party of China pointed out that the principal contradiction in China is "between unbalanced and inadequate development of the people's ever-growing needs for a better life", and that a better life should include opportunities for education, especially higher education. The imbalance of the current situation focuses on the economic and educational development in the vast underdeveloped areas. A considerable part of the mountainous areas in China are the key areas of "agriculture, rural areas and farmers", and the economic and educational development are underdeveloped. Under the new normal, the poor areas are faced with the dual task of "poverty alleviation" in economy and education. At the same time, higher vocational education is regarded as a way of higher education most closely related to economic development,[1] [2]Under the severe situation of underdeveloped economy in the vast mountainous areas, poverty alleviation not only leads the people to material prosperity, but also requires poverty alleviation through education. Giving regional people the opportunity to accept higher education and realizing national education equity is an important happiness index for the pursuit of a better life.

How to get rid of the "underdeveloped" label and "poverty alleviation" is related to the long-term goals of "common prosperity", "coordinated development" and "a better life". In this sense, the coordinated development of underdeveloped higher vocational education in the vast mountainous areas is not only an economic problem but also a political problem. In theory, the less developed areas may be the western region or central provinces, may also be developed in the province, although with less developed areas, but the east, central and western different areas of the problems and the reason is not the same, this paper focuses on the developed provinces in the less developed areas of higher vocational education and the coordinated development of economic industry research. To this end, this paper to economically developed mountains of Guangdong province Yunfu city for case, due to the Yunfu is a typical economic

underdeveloped areas of Guangdong province, purpose is to study the less developed provinces of higher vocational education development and the coordinated development of economic industry correlation, in order to higher vocational education and economic industry this research category provide beneficial supplement.

## 2. LITERATURE REVIEW AND THEORETICAL ANALYSIS

### (1) (Higher) Vocational Education Development and Related Theories

Vocational education first appeared in the United States. In the provisions of the Morel Act on the development of vocational and technical education in industry and agriculture promulgated in 1862, it developed rapidly from the 1960s to the 1970s. The federal Germany conference in 1987 first proposed the standards for technical and vocational education. Since then, the theoretical and practical research of western vocational education has entered a new stage. John (1993) believes that vocational education and training have a positive economic impact on employment and human resources: through the increase of professional quality and skills, the burden of training resources and the economic benefits of the enterprise personnel, the talents trained by the school are closely related to the market demand, thus promote the ability of employment.[3]Jacibs and Grubb (2003) believes that higher vocational education is not only a part of higher education, but also an educational institution with independent characteristics.[4]

China's higher vocational education began in the late 1970s and early 1980s, after the expansion of a large number of higher vocational colleges. From 1999 to 2005, higher vocational education occupied half of the country, since 2006, focusing on curriculum, professional setting, teaching mode and other aspects. In terms of professional construction, Liu Xia (2012) put forward the view of the construction of higher vocational professional group based on the industrial chain, believing that the construction of higher vocational professional group closely linked higher vocational colleges and regional economy, and emphasized the internal consistency of the two;[5]In terms of talent training in higher vocational education, He Tao (2014) constructs a scientific "talent view" of higher vocational education from three dimensions of social attribute, enterprise attribute and vocational attribute.[6]Zhu Xuemei et al. (2017) put forward from the current social and economic wave that higher vocational education faces challenges and opportunities in talent orientation, teaching content and method, school management, school-running mode and other aspects.[7]

Western theories have laid a solid theoretical foundation for the development of (high) vocational education. The relevant theories summarized by scholars include enterprise resource view theory (representative Barney Barney) and cooperative competition theory (representative is Yale University. Nellbav and Harvard professor Adam. Brandon berg), economies of scale theory (Chamberlain, Marshall, Bain);[8]Three-spiral theory, regional competitiveness theory, human capital theory, new growth theory, late-mover advantage theory;[9]System theory, human capital theory, and gradient transfer theory of regional economic development.[10]

### (2) Research On The Coordination Of Higher Vocational Education And Regional Economic (Industrial) Development

Foreign countries generally study education and economic development, but there are few documents focusing on higher vocational education and regional economic industry. Marius-Cristian Pana et al (2012) believes that education is a key factor to encourage any strategic design of economic development, and the reshaping of the research framework of education connecting labor market must be considered from quantity to quality.[11]P.P. Saviotti et al (2016) by building a model called "TEVECON" to expand education role in economic development, the population into high income and low income two groups, by changing the level of education investment in each group, found that although education can improve high income group population share positive impact on social mobility, but also must weigh between income inequality and income growth.[12]In contrast, some Chinese scholars are involved in this theme. Zhu Dequan et al. (2014) interpreted the linkage relationship between vocational education and regional economy as "circular logic", "inter-subject logic" and "hierarchical coupling logic".[13]Jiang Guoliang (2005) believes that the degree of local development and the speed of economic development determine the scale of higher vocational education and

affect the talent training mode of higher vocational education.[14]Zhang Jian et al. (2012) believe that higher vocational education is the gas station and power source of regional economic development, and regional economic development is the "catalyst" for the development of local higher vocational education.[15]Ding Jinchang (2013) believes that higher vocational education is most closely connected with regional economy, and its vitality is reflected in the connection with regional economy, and puts forward the method of carrying out "local" research and development.[16]Wang Haihua (2013), in his master's thesis "Research on the Coordinated Development of Higher Vocational Education and Regional Economy- -Taking Hunan Province as an example", believed that Hunan higher vocational education and regional economy are coordinated in scale, while the professional structure and quality are uncoordinated, and put forward corresponding countermeasures.[17]The existing literature on the logical relationship between higher vocational education and regional economy (industry) can be summarized into two kinds:

First, to emphasize the restrictive role of economic industry on higher vocational education. Economic foundation determines the superstructure, and how the degree of regional economic development determines the scale of higher vocational education in this region. On the one hand, the development of economic and industry determines the professional talents needed by the industry; on the other hand, economic development can provide the funds needed for educational development.

The second is to pay attention to the reaction of higher vocational education to the economic industry. As a kind of superstructure, the degree of development and perfection of higher vocational education will also react on the economic development of the region. The influence of higher vocational education on local economy is mainly the output after "processing plant": outstanding graduates and technological innovation. In addition, higher vocational education can promote the further diffusion of new technologies through the training of graduates and social talents, thus driving the new development of local economy.

**(3) (Higher) Research Methods For The Coordinated Development Of Vocational Education And Economy (Industry)**

Most of the existing studies on the level of educational development and its social and economic relations focus on the theoretical norms, with few empirical studies.[18]For example, Bai Jie (2014) believes that vocational education and regional economic development are social systems that restrict and influence each other. When the system is in a state of coordinated development, it will promote the development and progress of the two systems, otherwise, in a chaotic state, it will seriously hinder the development of productive forces[19], Also such in [5], [6], [7], [13] and [14]. A small number of empirical studies have been used, such as Xie Peng et al. (2016), to study the relationship between the development level of Jiangsu higher vocational education and the level of social and economic development by factor analysis, correlation analysis and regression analysis methods.[18]Li Zhonghua et al. (2015) derived from the cobb-Douglas production function the formula ($Ce = \beta Re / Y$) and empirically analyzed the contribution rate of higher vocational education to economic growth in western China,[20]This method has certain theoretical significance to study the relationship between higher vocational education and economic development externally, but it lacks the internal substantive connection between them, and the $\beta = 0.73$ and labor simplification rate used are not necessarily suitable for the western region. Some scholars also have both qualitative and quantitative analysis methods. For example, Dai Yong et al. (2003) used the method of combining quantitative analysis and qualitative analysis to study the incoordination between Wuxi higher vocational education and regional economic development and put forward corresponding countermeasures.[21]

To sum up, there are few research documents on the coordinated development of higher vocational colleges and economy and industry, especially in foreign countries, and there is no special analysis on the coordinated development of higher vocational education and economic industry in economically underdeveloped mountainous areas in developed provinces. From the methodological point of view, the research category mainly standard research, a small number of statistical quantitative research method of literature are generally simple related or related, such as literature [18], although first factor analysis of higher vocational education development level into a few variables, but then study the

few variables and social and economic development level group still belong to the related analysis, this method is still inevitable information overlap. The best method to study the correlation of the two groups of multivariates is typical correlation analysis. The existing literature uses typical correlation analysis method, involving science and engineering, economic management and other fields, such as Hu Pingbo (2012)[22], Yu Mingjie, et al. (2012)[23], Su Yufeng (2016)[24], Li Sui, et al. (2017)[25], There are few typical relevant analysis methods in the collaborative research category of higher vocational education and economic and industrial development in mountainous areas.

## 3. EMPIRICAL STUDY

### (1) The Status Quo Of Economic Development And Higher Vocational Education Development In Yunfu City

Yunfu city is located in the northwest of Guangdong. In 1994, it was upgraded from a county-level city to a prefecture-level city in Zhaoqing City. Now it has jurisdiction over one district (Yuncheng District), three counties (Yun'an, Xinxing, Yunan) and one city (entrusted to Luoding City), with a total area of 7,779.1 square kilometers and a population of 2,626,200. Since the establishment of the city, the economic development data of Yunfu, such as GDP and per capita GDP, have increased year by year, especially during the "11th Five-Year Plan" period, the average per capita GDP was 11.8%, the proportion of the primary industry decreased, the proportion of the secondary and tertiary industries increased, from 31.4:36.2:32 in 2005 to 2 5.9.40.40.4:33.7 in 2010 exceeding the proportion of the tertiary industry in 2008. However, in the horizontal comparison of 21 prefecture-level cities in Guangdong Province, Yunfu's per capita GDP ranked the bottom three or fourth. It can be seen from the figure 1: its per capita GDP increased year by year from 2005 to 2016, but it has always lagged behind the provincial average, with a large gap.

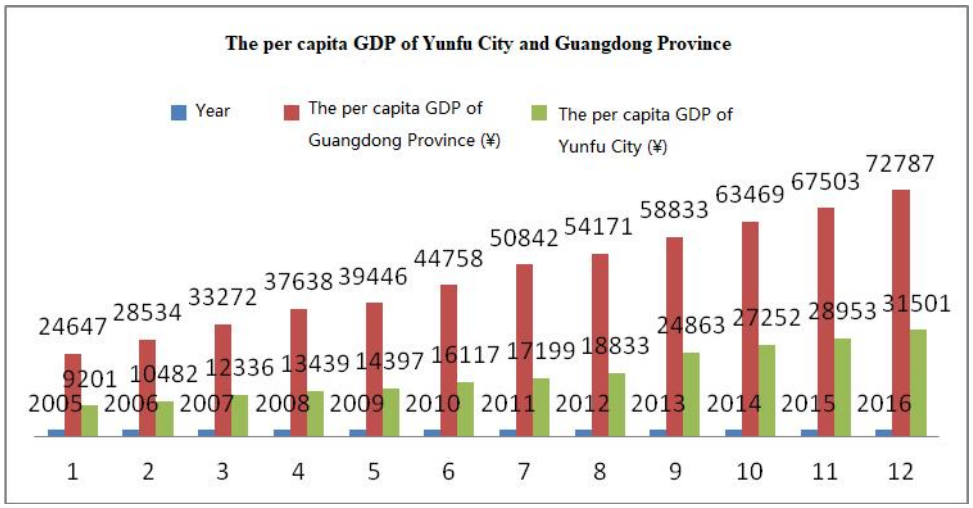


**Figure 1** Comparison Of Per Capita Gdp Between Yunfu City And Guangdong Province
Data source: Annual Statistical Yearbook of Guangdong Province and Yunfu City

Luoding Vocational and Technical College is currently the only public higher vocational college in Yunfu city (Yunfu Branch of Guangdong Pharmaceutical University and Guangdong Health Science and Technology Vocational College are still under preparation). Its predecessor was Guangdong Luoding Normal School, and it was upgraded to higher vocational college in 2001. In the 2016-2017 academic year, the college enrolled 42 majors, with 10,546 full-time students, 584 staff members and 422 full-time teachers. The campus covers an area of 414.81 mu, and has 6 departments and one school. Since its establishment, the college has sent nearly 30,000 graduates to the society. The number and scale are in the middle of the underdeveloped areas, but the indicators of school running scale such as school buildings per student, administrative housing per student and books per student are lower than the provincial average. The proportion of teachers with graduate education, the proportion of teachers with high professional titles, teaching equipment and the total number of paper books are also at the lower level. The number of teachers is insufficient, the quality is not high, the high-level talent drain is serious, and the collaborative innovation mechanism

needs to be improved.

**(2) Research Method: Using The Typical Correlation Analysis Method**

Hotelling In 1936, Canonical Correlation Analysis) was first proposed in 1936. The advantage of typical correlation analysis is that it can better solve the correlation between two groups of multivariates, and its core meaning is:
Suppose two groups of interrelated variables, $X= (X_1,X_2,\ldots X_p)'$， $Y=(Y_1,Y_2\ldots Y_q)$ ', then the covariance matrix of the p + q dimensional vector Z = is: $\begin{pmatrix} X \\ Y \end{pmatrix}$

$\begin{matrix} \sum 11 & \sum 12 \\ \sum 21 & \sum 22 \end{matrix}$ ∑=(), Based on the principal component idea, with two sets of comprehensive variables $U_i$、$V_i$Represents the linear combination of the two groups of original variables, namely, the correlation coefficient of U and V $\begin{cases} U_i = a_{i1}X_1 + a_{i2}X_2 + \ldots + a_{ip}X_p = a'X \\ V_i = b_{i1}Y_1 + b_{i2}Y_2 + \ldots + b_{iq}Y_q = b'Y \end{cases}$

$\frac{Cov(a'X, b'Y)}{\sqrt{Var(a'X)Var(b'Y)}}$ ρ (U, V) = ρ (A ` X, b ` Y) =, seek the appropriate a, b to maximize ρ (a ` X, b ` Y).

The key steps of typical correlation analysis are as follows: 1) correlation analysis between two groups of variables: preliminary analysis of the correlation between two groups of variables, whether there is multicollinearity; 2) Typical correlation coefficient and significance test: X of Bartlett is mainly used$^2$Test; 3) coefficient of typical variables: standardize different dimensions to find different linear equations for typical variables and original variables; 4) load analysis or typical structure analysis: mainly analyze the correlation degree between typical variables and original variables; 5) Typical redundant analysis: mainly analysis the variation and variation between groups.

**(3) Index Selection And Data Collection**

When Li Ping (2006) used the typical correlation analysis method to study the complex correlation between higher education and regional economy, the higher education development indexes include: number of students, number of graduates, number of enrollment, number of college employees, gross enrollment rate of higher education and number of burden students; the regional economic development indexes include GDP, per capita GDP, GDP, fiscal expenditure, urban disposable income, fiscal income, rural net income, proportion of tertiary industry and residential consumption expenditure.[26]Wang Yufei (2010) used the Granger causality model, integration test and error correction model to test the relationship between quantity growth and quality improvement of higher education development and economic growth in Hebei Province. The indicators of higher education development include higher education funding input, number of students and student ratio; regional economic development index: GDP and GDP growth rate.[27]Considering that there is only one university and university staff in Yunfu City that has not changed much in several years, the development index of higher vocational education does not consider the number of higher education, the number of university employees, gross enrollment rate, and consider the economic and industrial particularity of Yunfu city, the development index of the two groups are determined as follows:
Development indicators of higher vocational education: enrollment (X1), students (X2), graduates (X3), student-teacher ratio (X4); economic and industrial indicators: GDP (Y1), per capita GDP (Y2), proportion of secondary industry (Y3), proportion of tertiary industry (Y4), proportion of pillar industry (Y5). Yunfu city pillar industries traditionally including textile and clothing, stainless steel, cement, sulfuric acid, electricity, etc., during the "twelfth five-year" period due to the external environment, environmental protection pressure, many industries such as clothing, cement, sulfuric acid in industrial strategic contraction, in the provincial and municipal government industry transformation and

upgrading strategy concept to foster cloud computing and information services, biological medicine, advanced manufacturing, health care, health tourism and so on four new industries, and modern characteristic agriculture, referred to as "four new". Yunfu Statistical Yearbook did not publish the specific data of pillar industries after 2006, so this paper uses the industrial added value of this year's GDP to calculate the proportion of pillar industries (Y5). Data source: The data of higher vocational education are provided by Yunfu Education Bureau, and the economic and industrial indicators are from the statistical yearbooks of Yunfu Statistics Bureau, among which the economic data lag for one year.

## 4. EMPIRICAL PROCESS: ADOPT STATA SOFTWARE

### (1) Correlation Analysis Between The Two Groups Of Variables:

**Table 1** Related Analysis Of The Development Of Higher Vocational Education And Economic And Industrial Development Group

Correlations for Set-1

| | X1 | X2 | X3 | X4 |
|---|---|---|---|---|
| X1 | 1.0000 | | | |
| X2 | 0.9692 | 1.0000 | | |
| X3 | 0.8814 | 0.9132 | 1.0000 | |
| X4 | 0.6397 | 0.5962 | 0.3533 | 1.0000 |

Correlations for Set-2

| | Y1 | Y2 | Y3 | Y4 | Y5 |
|---|---|---|---|---|---|
| Y1 | 1.0000 | | | | |
| Y2 | 0.9864 | 1.0000 | | | |
| Y3 | 0.6227 | 0.5703 | 1.0000 | | |
| Y4 | 0.8263 | 0.8510 | 0.2552 | 1.0000 | |
| Y5 | -0.0456 | 0.0287 | 0.1260 | -0.0583 | 1.0000 |

Correlations Between Set-1 and Set-2

| | X1 | X2 | X3 | X4 |
|---|---|---|---|---|
| Y1 | 0.9220 | 0.9596 | 0.9303 | 0.4836 |
| Y2 | 0.9084 | 0.9359 | 0.8799 | 0.5077 |
| Y3 | 0.6889 | 0.7132 | 0.7585 | 0.3479 |
| Y4 | 0.8487 | 0.8314 | 0.6798 | 0.6704 |
| Y5 | -0.0539 | -0.0438 | -0.0658 | 0.2750 |

Correlations for Set-1 shows that from the perspective of the internal correlation coefficient of the development index of higher vocational education, the coefficient of graduates (X3) and students (X4), students (X2) and students (X4), there is not much repetition between the indicators; enrollment (X1) and students (X2), students (X2) and graduates (X3) correlation coefficient, there may be multicollinearity, it can be considered to merge (See Table 1).

Correlations for Set-2 shows that from the internal correlation coefficient of the economic industry development index, the proportion of the secondary industry (Y3) and the proportion of the tertiary industry (Y4) and the proportion of the

pillar industry (Y5) and other indicators are relatively small, especially the proportion of the pillar industry (Y5) is negatively correlated with GDP (Y1) and the proportion of the tertiary industry (Y4). GDP (Y1) and per capita GDP (Y2) index have the largest correlation coefficient, reaching 0.9864, which has a large connection.

Correlations Between Set-1 and Set-2 said grouping correlation coefficient after the output is the correlation between higher vocational education development and economic industry development coefficient, from the direct correlation coefficient of the two, GDP (Y1), per capita GDP (Y2) index and the corresponding index of higher vocational education coefficient is larger, and the proportion of pillar industry (Y5) and the corresponding coefficient of the index of higher vocational education are smaller.

**(2) Typical Correlation Coefficient And Significance Test:**

**Table 2** Typical Correlation Coefficient

| Canonical Correlations | |
|---|---|
| 1 | .999 |
| 2 | .783 |
| 3 | .634 |
| 4 | .179 |

The first typical correlation coefficient is 0.999, the largest, which exceeds any correlation coefficient between the development index of higher vocational education and the economic and industrial development index. The second canonical correlation coefficient was 0.783, and the third one was 0.634, which was also relatively large (See Table 2).

**Table 3** Canonical Correlation Coefficient Significance Tests

| Test that remaining correlations are zero: | | | | |
|---|---|---|---|---|
| Wilk's | | Chi-SQ | DF | Sig. |
| 1 | .001 | 43.999 | 20.000 | .002 |
| 2 | .224 | 8.979 | 12.000 | .705 |
| 3 | .579 | 3.279 | 6.000 | .773 |
| 4 | .968 | .196 | 2.000 | .907 |

By the X of the Bartlett$^2$The test shows that the significant probability of the first canonical correlation coefficient (Sig.) Is 0.002, in the case of α =0.05, denying the assumption of zero canonical correlation coefficient, indicating that the correlation between the first pair of canonical correlation variables was significant, while the latter three pairs of canonical variables failed the significance test (α =0.05). Therefore, the correlation between the development of higher vocational education and the industrial development can be transformed into the relationship between the first pair of typical variables (See Table 3).

**(3) Coefficient Of The Typical Variables:**

**Table 4** Coefficients Of The Normalized Variables And The Original Variables

Canonical correlation analysis Number of obs = 15

Standardized Canonical Coefficients for Set-1

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| X1 | 0.0490 | -1.9134 | -2.4682 | -3.0291 |
| X2 | 0.5385 | 0.9173 | -0.5901 | 4.6959 |
| X3 | 0.3796 | 1.2840 | 2.1676 | -1.7329 |

| | | | | |
|---|---|---|---|---|
| X4 | 0.0992 | -0.4697 | 1.5679 | -0.1311 |

Raw Canonical Coefficients for Set-1

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| X1 | 0.0001 | -0.0022 | -0.0029 | -0.0035 |
| X2 | 0.0002 | 0.0004 | -0.0002 | 0.0019 |
| X3 | 0.0005 | 0.0018 | 0.0030 | -0.0024 |
| X4 | 0.0828 | -0.3918 | 1.3080 | -0.1094 |

Standardized Canonical Coefficients for Set-2

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Y1 | 1.0705 | 4.3736 | 5.1200 | 1.2261 |
| Y2 | -0.6886 | -2.2686 | -5.5757 | 0.3174 |
| Y3 | 0.3552 | -0.7733 | -0.1822 | -1.4059 |
| Y4 | 0.4272 | -1.8699 | 0.5321 | -0.5244 |
| Y5 | 0.0247 | 0.0605 | 1.1532 | 0.3921 |

Raw Canonical Coefficients for Set-2

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Y1 | 0.0056 | 0.0228 | 0.0267 | 0.0064 |
| Y2 | -0.0001 | -0.0003 | -0.0007 | 0.0000 |
| Y3 | 0.1024 | -0.2229 | -0.0525 | -0.4053 |
| Y4 | 0.1552 | -0.6791 | 0.1933 | -0.1905 |
| Y5 | 0.0041 | 0.0100 | 0.1910 | 0.0649 |

From the above significance test (See Table 4), the coefficient of the first pair of typical variables can be used to study the correlation between the development of higher vocational education and the development of economic industry. From the results, it can be seen from a special case that the coefficient of the variable Y2 (per capita GDP) is negative, indicating the reverse relationship between per capita GDP and economic and industrial development. According to the output from the above table, the first typical variable from the development index of higher vocational education is:

U1=0.0490X1+0.5385X2+0.3796X3+0.0992X4

The first typical variable that comes from the economic and industrial development index:

V1=1.0705Y1-0.6886Y2+0.3552Y3+0.4272Y4+0.0247Y5

In the first pair of typical variables, the coefficient of most variables is relatively uniform, among which the X2 (number of students) and X3 (number of graduates) in the development index of higher vocational education are large, which are the main factors affecting the development of higher vocational education; while the Y1 (GDP) and Y2 (per capita GDP) in the economic development index are large, which are the main factors affecting economic and industrial development, and the coefficient of Y2 (per capita GDP) is negative, indicating the reverse relationship between per capita GDP and economic and industrial development.

**(4) Typical Structure Analysis (Also Known As Load Analysis):**

**Table 5** Load Analysis Of The Typical Variables

Canonical Loadings for Set-1

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| X1 | 0.9689 | -0.1931 | -0.1266 | -0.0893 |
| X2 | 0.9917 | -0.0446 | -0.0678 | 0.0994 |
| X3 | 0.9495 | 0.2693 | 0.0072 | -0.1606 |
| X4 | 0.5857 | -0.6931 | 0.4030 | 0.1189 |

Cross Loadings for Set-1

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| X1 | 0.9674 | -0.1513 | -0.0803 | -0.0160 |
| X2 | 0.9903 | -0.0349 | -0.0430 | 0.0178 |
| X3 | 0.9482 | 0.2109 | 0.0045 | -0.0288 |
| X4 | 0.5848 | -0.5428 | 0.2555 | 0.0213 |

Canonical Loadings for Set-2

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Y1 | 0.9644 | 0.1066 | -0.1060 | 0.2125 |
| Y2 | 0.9342 | 0.0150 | -0.1434 | 0.2901 |
| Y3 | 0.7413 | 0.1872 | 0.1078 | -0.5457 |
| Y4 | 0.8150 | -0.3874 | -0.0958 | 0.3773 |
| Y5 | -0.0240 | -0.1923 | 0.7060 | 0.1987 |

Cross Loadings for Set-2

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Y1 | 0.9630 | 0.0835 | -0.0672 | 0.0381 |
| Y2 | 0.9328 | 0.0117 | -0.0909 | 0.0520 |
| Y3 | 0.7402 | 0.1466 | 0.0683 | -0.0977 |
| Y4 | 0.8138 | -0.3034 | -0.0607 | 0.0676 |
| Y5 | -0.0239 | -0.1506 | 0.4475 | 0.0356 |

By the previous significance test that only the first pair of typical variables have statistical significance, so only consider the first pair of variable typical structure analysis, namely the main analysis of the correlation between the typical variables and the original variables, including the original variables and the corresponding typical variables (Canonical Loadings) and the relationship between the typical variables (Cross Loadings) (See Table 5).

Canonical Loadings for Set-1 represents the correlation analysis between the original variables of the development index of higher vocational education and its own typical variables U1. All the original variable indicators were positively correlated with U1, and X1, X2 and X3 were strongly correlated with U1, all above 0.9, and the correlation coefficient between X4 and U1 was 0.5857, which also had a strong relationship. These correlation degrees are consistent with the actual situation.

Cross Loadings for Set-1 represents the correlation analysis between the original variable of the higher vocational education development index and the corresponding economic and industrial development variable V1. All the original

variable indicators are positively correlated with V1, and X1, X2 and X3 are strongly correlated with V1, all above 0.9. The correlation coefficient between X4 and U1 is 0.5848, which also has a strong relationship, indicating that there is a strong correlation between the development indicators of higher vocational education and economic industry development, which can be predicted by typical variables of economic industry.

Canonical Loadings for Set-2 represents the correlation analysis between the original variable of the economic industrial development index and its own economic industrial development variable V1. The indicators of pillar industries (Y5) are weakly negatively correlated with V1 (coefficient is-0.0240), while other indicators have a strong positive correlation with a coefficient above 0.7. Among them, GDP (Y1) and per capita GDP (Y2) are the strongest, with 0.9644 and 0.9342 respectively, indicating that the pillar industries have no significant role in driving the economy, and mainly rely on the secondary and tertiary industries to promote economic development.

Cross Loadings for Set-2 represents the correlation analysis between the original variables of economic and industrial development indicators and its corresponding higher vocational education development variable U1. Pillar industry index (Y5) and U1 weak negative correlation (coefficient of 0.0239), other indicators are strong positive correlation, coefficient is above 0.7, including GDP (Y1), per capita GDP (Y2) index strongest, 0.9630,0.9328, shows the original variables of economic industry development index except pillar industry index, have higher vocational education development variables related and can use its prediction.

**(5) Typical Redundancy Analysis**

**Table 6** Typical Redundancy Analysis

| Redundancy Analysis: | |
|---|---|
| Proportion of Variance of Set-1 Explained by Its Own Can.Var. | |
| | Prop Var |
| CV1-1 | .792 |
| CV1-2 | .148 |
| CV1-3 | .046 |
| CV1-4 | .014 |
| Proportion of Variance of Set-1 Explained by Opposite Can.Var. | |
| | Prop Var |
| CV2-1 | .789 |
| CV2-2 | .091 |
| CV2-3 | .018 |
| CV2-4 | .000 |
| Proportion of Variance of Set-2 Explained by Its Own Can.Var. | |
| | Prop Var |
| CV2-1 | .603 |
| CV2-2 | .047 |
| CV2-3 | .110 |
| CV2-4 | .122 |
| Proportion of Variance of Set-2 Explained by Opposite Can.Var. | |
| | Prop Var |
| CV1-1 | .602 |
| CV1-2 | .029 |
| CV1-3 | .044 |
| CV1-4 | .004 |

Proportion of Variance of Set-1 Explained by Its Own Can.Var. The first typical variable U1 from the development

index of higher vocational education can explain 79.2% of the intra-group variation of the corresponding higher vocational education development group, while the other typical variables in this group U2, U3 and U4 are weak (See Table 6).

Proportion of Variance of Set-1 Explained by Opposite Can.Var. The first typical variable V1 from the economic and industrial development index can explain 78.9% of the inter-group variation in the corresponding higher vocational education development group, while other typical variables in this group V2, V3 and V4 are weak.

Proportion of Variance of Set-2 Explained by Its Own Can.Var. The first typical variable V1 from the economic and industrial development index can explain 60.3% of the intragroup variation in the corresponding economic and industrial development group, while the other typical variables in this group V2, V3 and V4 are weak.

Proportion of Variance of Set-2 Explained by Opposite Can.Var. The first typical variable U1 from the development index of higher vocational education can explain 60.2% of the intergroup variation in the corresponding economic and industrial development group, while the other typical variables in this group U2, U3 and U4 are weak.

To sum up the redundancy analysis, it can be seen that the first pair of typical variables (U1, V1) can explain the degree of interpretation between 60% and 80% between the own group and the corresponding group, indicating that the typical correlation model has good results. The first pair of typical variables contains most of the information, which is consistent with the results of significance test and structural analysis above.

## 5. STUDY CONCLUSIONS AND RECOMMENDATIONS

### (1) Research Conclusion

It can be concluded from the above empirical process: ⑴ From the analysis of the index structure of higher vocational education development, X2 (number of students) and X3 (number of graduates) coefficient is the largest, which is the main factor affecting the development of higher vocational education; while X1 (enrollment) and X4 (student-teacher ratio) have little influence on the development of higher vocational education. This is consistent with the actual situation, although the number of students and graduates increased year by year, the scale of education is expanding, but luo ding vocational and technical college annual enrollment and the actual number of different, in recent years, the number of not reported and some dropout nearly thousand, and the rising trend; and the number of students, the faculty is unstable, new employees, and leaving staff rise, especially high education, high title teachers leaving rate is higher, some teachers on vice high or on the doctor to the pearl River Delta and other developed areas.⑵ From the analysis of the index structure of economic and industrial development, Y1 (GDP) and Y2 (per capita GDP) coefficient are large, which are the main factors affecting the economic industry development, while the proportion of pillar industries (Y5) coefficient is the smallest, indicating that the pillar industries has not become the key factor of the economic development of Yunfu region.⑶ From the relevant analysis of the development of higher vocational education and economic industry, in ⑴ and ⑵, the statistical characteristics of U1 and V1 have been described in detail. These statistical characteristics can be simply summarized as: the complex correlation between higher vocational education and regional economic development, which can be comprehensively simplified into the mutual relationship in two aspects. First, the number of students in higher vocational education (X2) is the most closely related to the economic and industrial development; second, the economic and industrial development index GDP (Y1) is still an important basis for promoting the development of higher vocational education, and the pillar industries drive the development of higher vocational education in this region.

### (2) Suggestions

First of all, clarify the administrative subordination and improve financial support to strengthen the hardware construction of the college. Luo Ding vocational and technical college and provincial, city and county government has certain administrative subordinate relations, personnel, finance, dependency relationship fuzzy, also make college for many years in financial, not effective support, for the relevant government must clarify the provincial, city and county

level administration in college all-round development of their respective positioning and role, cohesion focus on college long-term development plan. As the current situation of underdeveloped economy in mountainous areas, the provincial finance should be appropriately inclined to Yunfu area, and the municipal and county administration should also negotiate financial support to update the hardware such as school buildings.

Secondly, a long-term mechanism of tripartite cooperation between "government, enterprises and schools" should be established to improve national cultural identity. In many parts of the country, the mismatch between the higher vocational education and the local economic development is widespread, often because the professional adjustment lacks forward-looking and lags behind the industrial development. This mismatch in developed regions can be quickly solved by the strong local economic and industrial strength and the abundant financial support of the government, and the tripartite cooperation between the government, enterprises and schools is relatively smooth, and the cooperation mode has been institutionalized. On the contrary, in underdeveloped areas, the weak economic strength of enterprises, and the "surplus grain" in the hands of the government is not much. People of different counties and cities lack cultural identity due to historical reasons, and the talents trained by schools are basically "wedding clothes" for other places. With the efforts of provincial, prefectural and county governments, the economy and industry in Yunfu are gradually transformed and upgraded, and the school-enterprise cooperation, national cultural identity, professional and inter-industrial integration emerged.

Finally, revitalize the incentive mechanism of talent stock and allow students to choose the second major. Talent is the key factor in the development of local economy, facing the need of the economic transformation and upgrading of Yunfu city, the municipal government intensify talent introduction, improve talent treatment, to a certain extent, stabilize the higher vocational education teachers, but because of the remote mountainous location and difficult to match adjacent to the pearl river delta talent introduction policy, high degree high title external talent introduction is still lack of enough attraction. Outside talent can not be attracted, the school talent is still lost, the talent policy is only empty but difficult to be implemented. Therefore, the policy of talent introduction should focus on the revitalization of the existing talent stock, and the introduction of external talents should focus on the stability and retention of the existing talents, especially the talents who get the senior title and the doctor can enjoy the same treatment of the introduced talents, which will have a better incentive effect on the existing talents. The competitiveness of a single major structure is not strong in the employment market, which leads to the low employment rate of college graduates. Reasonably allowing students to choose the second major is conducive to improving the technical content of students and then improving the employment rate of graduates, which requires the top-level system design of the education department.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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