

Analysis of the Influence Factors of College Students Employment Based on the Interpretative Structural Model

Ziyu Liu^{1, a}, Xiaomin Shen^{2, b}

¹ School of Economics and Management, Hebei University of Science and Technology, ShiJiaZhuang HeBei 050018, China.

² School of Economics and Management, Hebei University of Science and Technology, ShiJiaZhuang HeBei 050018, China.

^a43174609@qq.com, ^b1508009068@qq.com

Keywords: Interpretative structural model; Employment factors; Evaluation index; Index system.

Abstract. Aimed at the problem of low employment rate of college students, we establish the evaluation index system of university students' employment in this paper. Then we use the practical method of interpretative structural model to analyze the influence factors of university students' employment, and explain the factors that affect college students' employment model. According to the hierarchical results of interpretative structural model, we analyze the connection between the various factors, and divide the influence factors of university students' employment into four levels. Finally, we clear the hierarchical structure relationship of factors that affect college students' employment, and find out the most direct factors and the most fundamental factors which cause the low employment rate of college students.

1 Introduction

In recent years, a large number of graduates face severe employment situation due to our country university enrollment expansion, so whether the college students can successful employment become a big issue of social. This paper present an evaluation index system of university students' employment to find out the key factors that affect the employment of college students. The paper use the method of interpretative structural model to analyze the influence factors of college students' employment [1-4], and then further analyze the contact among the factors to find out the most direct factors and the most fundamental factors which influence college students' employment, and finally confirm the key factors that affect college students' employment.

The rest of the paper is organized as follows: The second part gives the basic theory and work procedures of interpretative structural model; the third part constructs the evaluation index system of College Students' employment according to the factors which influence College Students' employment rate; the fourth part gives the flow chart of the interpretative structure model and construct the interpretative structural model which influence factors of the College Students' employment, and further analyze the relationship among the factors; the fifth part gives the conclusion of this paper, and prospected the research work in the future.

2 Interpretative structural model

Professor Warfield of the United States for the first time to put forward explanation structure model used to analyze the complex social and economic system structure in 1973. The basic idea of interpretative structural model is: through a variety of methods and techniques to find out the composition or influence factors of system, and analyze the links among the factors, and draw the directed graph; by using matrix model to classify the disorder and complex relationship among the various factors, and finally make the relationship become clear hierarchical structure model, which raise awareness and understanding of the problems [6].

Interpretative structural model method is a structural and modeled technique which is widely used in modern systems engineer [7]. Interpretative structural model is a static and qualitative model, we get the accessible matrix through logical calculus which expressed directed graph of the adjacent

matrix, and then resolve the accessible matrix, and finally make the complex system into a clear multilevel hierarchical form, and then we can analyze the relationship among the influence factors [8].

The work program of ISM (Interpretative structural model) is divided into seven steps as follows: (1) the implementation team of ISM: it was composed by the technical experts, facilitators, participants;(2) setting the key issues;(3) Selection of key factors affecting the composition of the system; (4) Including the correlation of each factor; (5) We established adjacency matrix and accessible matrix based on the correlation among the various elements;(6) Resolving the accessible matrix, and making the accessible matrix hierarchy;(7) We established the interpretative structural model based on hierarchical accessible matrix.

3 Establishing Evaluation Index System of College Students' Employment

In order to understand the factors that influence students' employment, the paper use the method that combine literature research and expert query to get the influence factors of college students' employment[9-10]. We select minimize the "primary" indicators to use for actual evaluation, and then establish employment evaluation system according to the influence factor.

The index was divided into two levels, in which the first level has 4 indicators, the second level has 14 indicators. Employment influence factors of the first level include: social factor, economic factor, school factor, personal factor. The impact of social environment on employment can not be ignored, social factors include: social hierarchy, business innovation, regional development, enterprise employment system and family influence [11]; the speed of economic development have directly impact on the demand for business, economic factors mainly include the economic structure and economic growth; schools are institutions to train personnel, school factors include: College career guidance efforts, Personnel training mode, Professional settings, school influence [12-13]; however, personal factors are important factors that affect the employment rate personal factors include: self-awareness, moral character and basic ability. Establishing the evaluation system of college students' employment according to the existing index is shown in Fig. 1.:

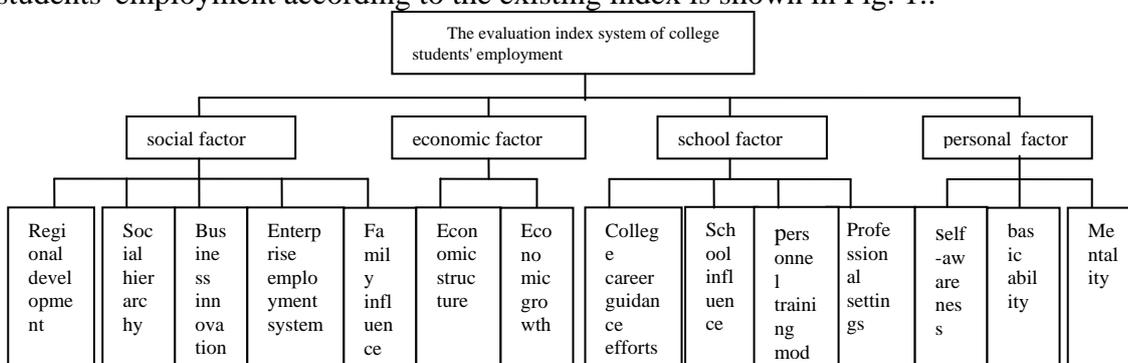


Fig. 1. The evaluation index system of college students' employment

4 Interpretative structural model of College Students' Employment

There are many factors that affect college students' employment, and many factors are difficult to directly quantify; there are influence among the factors each other, so we study the influence factors through the interpretative structural model of the College Students' Employment [7]. The build process of Interpretative structural model of College Students' Employment is shown in Fig. 2.:

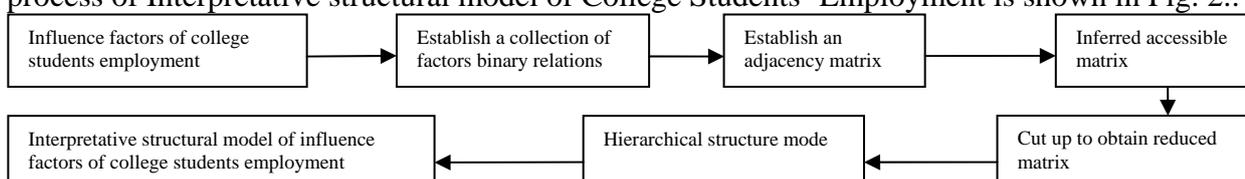


Fig. 2. Interpretative structural model build process of college students' employment factors

In order to establish the interpretative structural model that affect college students' employment factors, we number the evaluation index according to the established evaluation index system of employment, which is shown in table 1. it is interconnected between any two elements of the Employment of Students can create a collection $S = \{S_1, S_2, S_3, \dots, S_{14}\}$.

Table 1 The Interpretative Factors of College Students' Employment

variable	factor	variable	factor
S ₁	Regional Development	S ₈	Economic growth
S ₂	Social hierarchy	S ₉	Self-awareness
S ₃	Enterprise Innovation Capacity	S ₁₀	Mentality
S ₄	Enterprises Employment System	S ₁₁	Basic ability
S ₅	Family Influence	S ₁₂	College career guidance efforts
S ₆	Schools influence	S ₁₃	Talent training mode
S ₇	Economic industry structure mode	S ₁₄	professional settings

4.1 Establishing the collection of binary relations. According to the provisions of the research purpose, binary relation is need to discuss the relationship between any two influence factors(S_i, S_j), denoted: R_{ij} abbreviated as R). the relationships in general can be divided into two categories: R and \bar{R} ; R include reachable relationship; \bar{R} include unreachable relationships[14].for any a ordered pair(S_i, S_j),if its reachable ,which belongs to R , otherwise belongs \bar{R} .

According to the analysis and guidance of experts and investigation, we establish A collection of binary relation about 14 influence factors:

$$R = \left\{ \begin{array}{ccccc} (S_1, S_2) & (S_1, S_7) & (S_1, S_8) & (S_1, S_{14}) & (S_2, S_5) \\ (S_3, S_4) & (S_3, S_7) & (S_3, S_8) & (S_4, S_{13}) & (S_4, S_{14}) \\ (S_5, S_{10}) & (S_5, S_{11}) & (S_6, S_{10}) & (S_6, S_{13}) & (S_7, S_1) \\ (S_7, S_8) & (S_8, S_1) & (S_9, S_{12}) & (S_{12}, S_{11}) & (S_{14}, S_9) \end{array} \right\} \quad (1)$$

4.2 Generating Adjacency Matrix. According to the relationship among the relevant factors, we establish the relationship among the influence factors under the rules of follows, and then generate adjacency matrix(A).

- (1) there are affect between S_i and S_j , then a_{ij} equals 1, otherwise equals 0;
- (2) there are affect between S_j and S_i , the a_{ji} equals 1, otherwise equals 0;
- (3)if there are strong mutual influence between S_i and S_j , then a_{ij} and a_{ji} equals 1, if the degree of mutual influence are different between them, then the larger equals 1, the smaller equals 0.

$$A = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

4.3 Accessible Matrix Aⁿ. After the obtained adjacency matrix A, sum of matrix(A) and the unit matrix(E), and we got $A + E$, then do power operation of matrix $(A + E)$, until (1) the establishment of the formula to give a positive integer n.

$$M = (A + E)^{n+1} = (A + E)^n \neq (A + E)^{n-1} \neq \dots (A + E)^2 \neq (A + E) \quad (2)$$

The Power operation is conducted based on Boolean algebra operations. Wherein the exponential operation is carried out based on Boolean algebra. $M = (A + E)^n$ is called accessible matrix, if the element m_{ij} equal 1, then represent the two elements from S_i to S_j exists the accessible path. Accessible matrix shows the direct and indirect relationships among the elements. We operate Matrix $A + E$ base on the

Power operation of Boolean algebra, and get $A' = (A + E)^7 = (A + E)^6 \neq (A + E)^5$, then accessible matrix $A' = (A + E)^6$

$$A' = \begin{bmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \end{bmatrix}$$

We can see from the accessible matrix A' , the row and column of the influence factors (S_1, S_2, S_7 , and S_8) are the same. There are strong correlation among them. So we can put the factors (S_1, S_2, S_7 , and S_8) see as a factor, then reserve S_1 , and delete another factors (S_2, S_7 , and S_8), finally we get the reduced accessible matrix A'' .

$$A'' = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

4.4 hierarchical processing Accessible matrix. The basic step of hierarchical process as follows: (1) According to the number of "1", we order the factors from less to more, and got the reduced matrix through reduced the rows and columns of the matrix; (2) In this matrix table, from upper left to lower right corner, we decompose out the unit matrix of the most order, and fill the dotted border, and each dotted box represents a level [15-16], finally, we obtain the hierarchical accessible matrix table of college students' employment factor. The table of hierarchical accessible matrix, which is shown in table 2.

Table 2 The table of hierarchical accessible matrix

	S_{10}	S_{11}	S_{13}	S_{12}	S_5	S_6	S_9	S_{14}	S_1	S_3	S_4
S_{10}	1	0	0	0	0	0	0	0	0	0	0
S_{11}	0	1	0	0	0	0	0	0	0	0	0
S_{13}	0	0	1	0	0	0	0	0	0	0	0
S_{12}	0	1	0	1	0	0	0	0	0	0	0
S_5	1	1	0	0	1	0	0	0	0	0	0
S_6	1	1	1	0	0	1	0	0	0	0	0
S_9	0	1	0	1	0	0	1	0	0	0	0
S_{14}	0	0	0	1	0	0	0	1	0	0	0
S_1	1	1	1	1	1	0	1	1	1	0	0
S_3	1	1	1	1	1	0	1	1	0	1	0
S_4	0	0	1	1	0	0	1	1	0	0	1

From the dashed line in Table 2, we can see that each the unit matrix corresponding to a hierarchical structure level, so we divide the influence factors of college students' employment into four levels, the first level have three factors (S_{10}, S_{11} , and S_{13}), the second level have three factors (S_{12}, S_5 and S_6), the third level have two factors (S_9 and S_{14}), the fourth level have three factors (S_1, S_3 and S_4).

4.5 Establishing the Interpretative Structural Model of influence factors of College Students' Employment.

The four factors (S_1, S_2, S_7, S_8) had a strong correlation, we removed the rows and columns of the corresponding elements (S_2, S_7, S_8) when hierarchical processing. When we established the interpretative structural model of the influence factors of college students' employment, and the factors that had strong correlation with regional development (S_1) should be added. We divide the influence factors of university students' employment into four levels. The first level is direct factors

that affect college students' employment, and the fourth level is the fundamental factors that affect college students' employment. The interpretative structural model of influence factors of college students' employment as shown in Fig. 3.:

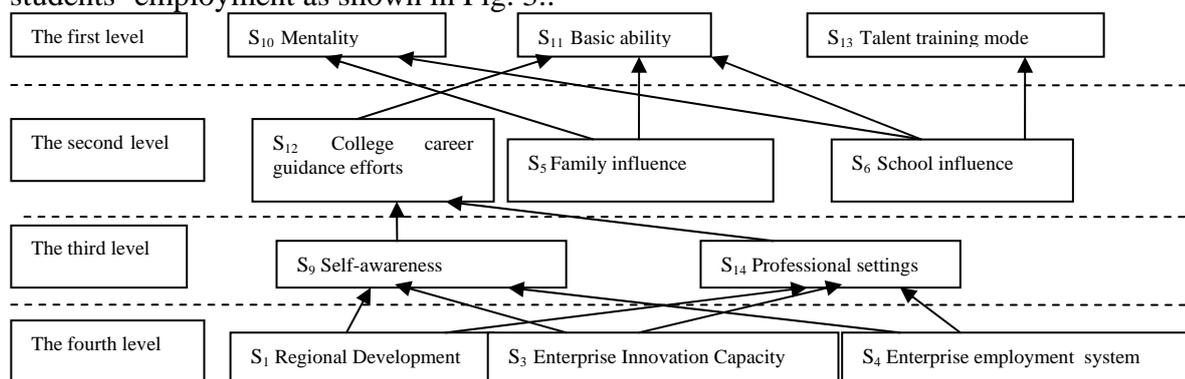


Fig. 3. Interpretative structural model of influencing factors of College Students' Employment

4.6 Analysis of the structural model of influencing factors of College Students' Employment. From the interpretive structural model about the factors that influence the college students' employment we can see that by using interpretive structural model to analyze these factors can make the complex relationship among these factors become more methodical and hierarchical. The factors that influence college students' employment are as follows:

(1) The factors in the first level directly affect the employment of college students, including attitude, basic ability and talents training mode. These factors would be affected by the factors at the next level, and other factors can affect college students' employment through these factors.

(2) The second and third level are in the middle level. These factors affect the employment of university students through the change of factors in the first level. The second level factors include college career guidance efforts, school influence and family influence; the third level factors are self-awareness and professional settings. These factors are affected by factors in the fourth level.

(3) The factors in the fourth level including regional development, innovation and enterprise employment mechanism. Because the Rows and Columns which Corresponds with regional development, social class, industrial structure and economic growth economic is identical, and there was a strong connection relationship among the four factors, so the fundamental factors included regional development, innovation and enterprise employment system, social class, economic structure and the speed of economic development. These factors are the most essential factors that affect the employment of university students, that is, they are the root of all the factors that affect the employment of university students.

The main purpose by Using the interpretive structural model to analyze the factors which affect students' employment was to find out the key factors and the hierarchical relationship and interaction among them. Its practical significance is that by finding out the most fundamental and the most direct factors to increase the rate of university students' employment. Above analysis showed that the key factors include: Attitude, Basic skills, Talent training model, Regional development, Social hierarchy, Economic structure, Economic growth, Innovation and Enterprise employment system.

5 Conclusions

In present, because the influence factors of College Students' employment are not yet clear hierarchy, this paper explore the factors that affect college students' employment, and we establish the interpretative structural model that affect college students' employment factors by using the method of interpretative structural model, and further analyze the links among the factors. According to the results of hierarchical processing, the influence factors of students' employment are divided into four levels. Finally, we clear the hierarchical structure relationship of factors that affect college students' employment, and find out the most direct factors and the most fundamental factors which cause the low employment rate of college students. How to rapidly improve the employment rate of college students will be the main content that we study in the future.

Acknowledgments

This paper was financially supported by the project of Educational Research of Polytechnic college of Hebei University of Science and Technology (2013Z07) under which the present work was possible.

References

- [1] Aiying Jiao, Xinxia Guo. Analysis of influencing factors of rural science and technology entrepreneurship based on interpretative structural model[J]. *Technology Management Research*, 2016(4):212-217. In Chinese
- [2] Juan Huang. Research on the influence of family background on the employment of College Students[D]. Changsha: Hunan Normal University master's thesis, 2010. In Chinese
- [3] Zhaodong Zhu, Qin Wang, Shengchao Zhang. Investigation and analysis of College Students' science and Technology Entrepreneurship [J] *Contemporary Educational Theory and Practice*, 2014 (3): 50-52. In Chinese
- [4] K. Mathiyazhagan, Kannan Govindan, A.Noorul Haq, Yong Geng. An ISM approach for the barrier analysis in implementing green supply chain management *Journal of Cleaner Production*, 2013, 47: 283-297.
- [5] Wei Huang, Liming Zhang, Junlong Lu, Chenghua Zhang. Analysis of the influence factors of the rammed earth wall quality based on interpretative structural model[J]. *Xi'an University of Architecture & Technology (Natural Science)*, 2014, 46 (3): 333-341. In Chinese
- [6] Chandramowli S, Transue M, Felder F A. Analysis of barriers to development in landfill communities using interpretive structural modeling[J]. *Habitat International*, 2011, 35(2): 246-253.
- [7] Govindan K, Palaniappan M, Zhu Q, et al. Analysis of third party reverse logistics provider using interpretive structural modeling[M]. Netherlands: Elsevier, 2012.
- [8] Wei Huang, Zongke Li, Yuefeng Li. An empirical study on the influence factors of APP extension based on interpretative structural model[J / OL]. *Knowledge Management Forum*, 2016, 1 (1): 61-73. <http://www.kmf.ac.cn/paperview?id=12>. In Chinese
- [9] Jingfeng Liu. Exploration and practice of employment quality evaluation index system of graduates of Higher Vocational Colleges[J]. *China Electric Power Education*, 2010, (21): 165-167. In Chinese
- [10] Qiaoqiao Li. Research on evaluation index system of university graduates' Employment Quality [D]. Northeast Normal University, 2012. In Chinese
- [11] Daxin Ren. Analysis of the influencing factors of College Students' employment ability[J] *Liaoning Technical University*, 2010 (9): 555-557. In Chinese
- [12] KEMPEN GI, BALLEMANS J, RANCHOR AV, et al. The impact of low vision on activities of daily living, symptoms of depression, feelings of anxiety and support in community-living older adults seeking vision rehabilitation services[J]. *Care Rehabilitat*, 2012, 21(8): 1405-1411.
- [13] Pingyi Li, Julian Zhao, Yu Zeng. The research summarize of the competitiveness of university graduates' Employment[J]. *Inheritance*, 2011(32): 66-67. In Chinese
- [14] Xiaoyan Yang, Jie Chen. The explanation structure model of knowledge flow in Supply chain coordination[J]. *Soft Science*, 2013, 27 (05): 140-144. In Chinese

- [15]Borade A B, Bansod S V. Interpretive structural modeling-based framework for VMI adoption in Indian industries[J]. International Journal of Advanced Manufacturing Technology, 2011,58(9-12): 1227-1242.
- [16]Govindan , Palaniappan M, Zhu Q, et al. Analysis of third party reverse logistics provider using interpretive structural modeling[M]. Netherlands: Elsevier, 2012.