Association for Information Systems
AIS Electronic Library (AISeL)

Eleventh Wuhan International Conference on e-Business

Wuhan International Conference on e-Business

5-26-2012

Research on Innovation Ability of Industrial Clusters Based On the Fuzzy Comprehensive Evaluation Method ——In Case Of Si Chuan Software Industry Cluster

Xi Ming Sun
School of Management, Wu Han Institute of Technology, China

Xia Liu
School of Management, Wu Han Institute of Technology, China

Research on Innovation Ability of Industrial Clusters Based On the Fuzzy Comprehensive Evaluation Method ——In Case Of Si Chuan Software Industry Cluster

Sun Xi Ming[1], *Liu Xia*[2]
[1] School of Management, Wu Han Institute of Technology, China
[2]School of Management, Wu Han Institute of Technology, China

Abstract: This paper was first based on the introduction of the fuzzy comprehensive evaluation method and the index system of innovation ability of industrial clusters, and apply the fuzzy comprehensive evaluation method to the cluster's innovation capability for the scientific evaluation, then do the practical situation on the Sichuan Cheng du software industry cluster, obtaining the result is consistent with the practical situation. Therefore, using the fuzzy analytic hierarchy process can not only be on different clusters for horizontal comparison analysis, but also on different periods of the same cluster of longitudinal analysis, so as to clear the superiority and the insufficiency of clusters in the innovation, this method are meaningful for the evaluation of cluster's innovation capability .

Keywords: fuzzy comprehensive evaluation; cluster innovation capability; evaluation

1. INTRODUCTION

As an important component of the regional development "industrial cluster" has become the beautiful landscape on the territory of China's economic development, and is increasingly becoming the focus of public attention. It is the aggregation of all kinds of factors of production and factors of innovation, a collection of production system, the public management system and innovation system; it is also the important carrier of being directed by various policies and measures, relying on industrial group to implement regional development policy; it is the important point of industrial structure adjustment and upgrade of our current country ,Then Innovation is the essential attribute of industry cluster and the important source of power of competitiveness, therefore, the increase of industrial cluster development research is very important, it is not only as the exploration for " bottom-up" road of adjustment of industrial structure and upgrade, but also as a key link to speed up the transformation of economic development mode of China.

2. THE CONSTRUCTION OF INDUSTRIAL CLUSTER INNOVATION ABILITY INDEX SYSTEM

In the same macroeconomic environment, conditions of the same or similar clusters, their ability of the innovate effect can be quite different, even in the same country, the same industry also is such different. Cluster innovation capability evaluation index are innovation environment, innovation resources, innovation consciousness, innovation activity, cooperation network [1].Where in, environment of industrial cluster is exogenous factors, clusters structure comprises a cluster of innovation resources and the subjects, consciousness of innovation in industrial clusters is the cognitive subject , innovation activities include both individual innovation activities, and the interaction between innovation main body[2]. This article refers to the" Chinese industry cluster innovation development report" which is published by the Economic Management Publishing House and the relevant papers and other writings, combing with the actual situation of regional innovation, at the same time ,according to the principle of objectivity, convenience principle, principle of operation and the

comprehensive principle of the construct the index system, it has established the cluster innovation capability evaluation index system, its hierarchical structure as shown in table 1.

Table 1: Cluster innovation capability evaluation index system

	First grade indicator	Second grade indicator
Industrial cluster innovation capability evaluation index system	Innovation environment (U1)	cluster group policy (U11)
		Venture capital development level (U12)
		The level of competition in the market (U13)
		Industry level (U14)
		The high-end customer structure (U15)
	Innovation resources (U2)	Enterprise research and development infrastructure (U21)
		Strength of enterprise investment in research and development (U22)
		The average strength of enterprise technical staff (U23)
		The intensity of skilled workers of the enterprise (U24)
		The average intensity of R & D (U25)
	Innovative consciousness (U3)	Innovation value of the region where the enterprise is(U31)
		Market opportunity technology recognition of the enterprises (U32)
		Recognition of using external resources. Of the enterprises (U33)
		Entrepreneurship values of the region where the enterprise was (U34)
		Regional culture of the Enterprises (U35)
	Innovation activities (U4)	Innovation capabilities of enterprise research and development (U41)
		The average development level of enterprise research and development (U42)
		Enterprise product development capacity (U43)
		The average level of enterprise product development (U44)
		The average level of commercialization of (U45)
	Cooperation network (U5)	Cooperation network infrastructure of the region where enterprise is (U51)
		Enterprise Cooperative Innovation participation (U52)
		Enterprise cooperative innovation depth (U53)
		Enterprises cooperation network recognition (U54)
		Enterprise cooperation activities (U55)

3. FUZZY COMPREHENSIVE EVALUATION MODEL

Industrial cluster innovation ability evaluation index is multiple, complex, and is difficult to be précised, with obvious fuzzy and comprehensive, therefore, its innovation ability evaluation by its nature is a kind of fuzzy comprehensive evaluation. Fuzzy comprehensive evaluation method is comprehensive assessment method based on fuzzy mathematics, making the factors quantitative whose boundary is not clear,[3]- [8] and which is not easy to be quantitative, fuzzy comprehensive evaluation method has the advantages of concise analytic hierarchy system, at the same time, putting qualitative description and quantitative analysis together, and better solve the difficulties that qualitative evaluation indexes are difficult to quantify, therefore, this can be said to be a relatively reasonable, scientific evaluation method[4]. In this paper, with the expert evaluation method to determine the index weight of each level, and on the basis of this, it applies the two stage fuzzy comprehensive evaluation to cluster innovation capability. The specific steps are as follows:

3.1 Comment set

The evaluation set is a set which judge object may make various evaluation to evaluation target .Therefore, the evaluation set V can be created as; V = {V1, V2, V3, …. V_M}, Vj (j= 1, 2,……. n) expressing specifically " excellent, good, poor," reviews.

3.2 Determine the comprehensive evaluation factor set

Factor set is a set of the various factors which influence the innovation ability of industrial clusters. According to some properties into s sub factor set: U_1 ,U_2 , …, U_s , U= { U_1 , U_2 , …, U_n }. Every sub factor U_I was by the number of second indicators. Sub factor, credited as Ui = { U_{i1} , U_{i2} , …, U_{ij}} , i= 1, 2, …, s, meeting the following:

(1) $n_1 + n_2 + \ldots + ns = n$;

(2) $U_1 \cup U_2 \cup \ldots \cup Us = U$;

(3) for any i ≠ j ， Ui ∩U j = Φ ;

3.3 Weight set A

A = ($a_1 \ldots a_2 \ldots a_S$) first grade level indicator weight set, in which: a_i is first indicator weight

A_1 = (a_{i1} , a_{i2} ,…,a_{in}) second grade index the weight set, in which: a_{i1} is second index weight

3.4 First grade fuzzy comprehensive evaluation

For each set of factors U_i, respectively, makes comprehensive evaluation. Let V ={ V_1 , V_2 , …,V_M} for the evaluation set, the weight distribution for U_i : Ai = (a$i1$, a$i2$,…,ain),i= 1, 2, …,s ,in which, if Ri is the single factor evaluation matrix, then the first grade evaluation vector: B_i= A_i • R_i= (b_{i1} , b_{i2} , …, $b_{in)}$,i= 1,2,..,s

3.5 Second grade fuzzy comprehensive evaluation

Then regret the above any Ui as a factor, denoted as U= { U1 , U2 , …, Us }, U is also a factor set, single factor evaluation matrix of the U for

$$R = \begin{bmatrix} B_1 \\ B_2 \\ \ldots \\ B_4 \end{bmatrix}$$

According to their importance weights allocation; A = { $a_1 \ldots a_2 \ldots a$$i$ },i= 1, 2, …, s, the two stage evaluation vector; B= A • R= (b1 , b2 , …, bn),do Normalized treatment for B,B= （b1 , b2 , …,bn ） , According to the maximum subordination principle, namely takes b j (j = 1, 2,…, n) the maximum value corresponds to the V j element as the results of comprehensive evaluation.

4 .EMPRICAL ANALYSIS

This paper uses the fuzzy comprehensive evaluation method, according to the design index system of industry cluster innovation ability evaluation above ,and apply to Sichuan Province, Cheng du City software, the steps are as follows:

4.1 Determine the evaluation set

The evaluation set V= {V1, V2, V3, V4, V5} = { stronger, strong, general, weak, weaker }

4.2 Determine the membership vector

In order to guarantee the objectivity of the evaluation, in terms of innovation ability of expert evaluation, it should consist of extensive research from different post and levels of work. Through sending evaluation forms to 100 experts from different management personnel and scientific research institutions personnel in different fields, please them do the review, analysis, and score according to the cluster level of cognition and evaluation,

and then by computer do statistical indicators for percentage of votes of each grade, the cluster index the degree of membership vector are as follows:

A=(0.20,0.26,0.17,0.19,0.18)，

A1=(0.18,0.23,0.22,0.16,0.21)，

A2=(0.19,0.16,0.24,0.21,0.20)，

A3=（0.26,0.20,0.14,0.15,0.25)，

A4=(0.16,0.24,0.14,0.25,0.21)，

A5=(0.23,0.21,0.19,0.13,0.24)

4.3 Please expert group on evaluation objects do evaluation, fuzzy matrix are as follows :

$$R_1=\begin{bmatrix}0.48 & 0.29 & 0.11 & 0.10 & 0.08\\ 0.41 & 0.31 & 0.18 & 0.09 & 0.01\\ 0.32 & 0.22 & 0.25 & 0.11 & 0.10\\ 0.19 & 0.29 & 0.20 & 0.20 & 012\\ 0.44 & 0.24 & 0.12 & 0.10 & 0.10\end{bmatrix}$$

$$R_2=\begin{bmatrix}0.18 & 0.28 & 0.21 & 0.16 & 0.17\\ 0.23 & 0.24 & 0.19 & 0.18 & 0.16\\ 0.19 & 0.29 & 0.17 & 0.15 & 0.20\\ 0.26 & 0.14 & 0.21 & 0.11 & 0.10\\ 0.29 & 0.29 & 0.21 & 0.11 & 0.10\end{bmatrix}$$

$$R_3=\begin{bmatrix}0.28 & 0.29 & 0.19 & 0.19 & 0.05\\ 0.39 & 0.30 & 0.20 & 0.10 & 0.01\\ 0.21 & 0.22 & 0.22 & 0.23 & 0.12\\ 0.20 & 0.19 & 0.18 & 0.22 & 0.21\\ 0.20 & 0.19 & 0.18 & 0.22 & 0.21\end{bmatrix}$$

$$R_4=\begin{bmatrix}0.26 & 0.24 & 0.22 & 0.18 & 0.10\\ 0.33 & 0.29 & 0.26 & 0.11 & 0.01\\ 0.31 & 0.21 & 0.19 & 0.19 & 0.10\\ 0.11 & 0.22 & 0.29 & 0.20 & 0.18\\ 0.38 & 0.24 & 0.16 & 0.16 & 0.05\end{bmatrix}$$

$$R_5=\begin{bmatrix}0.30 & 0.25 & 0.10 & 0.24 & 0.11\\ 0.47 & 0.23 & 0.11 & 0.11 & 0.08\\ 0.37 & 0.22 & 0.11 & 0.15 & 0.15\\ 0.26 & 0.26 & 0.19 & 0.19 & 0.10\\ 0.28 & 0.28 & 0.13 & 0.18 & 0.13\end{bmatrix}$$

4.4 First level fuzzy comprehensive evaluation

B1=A1 $\bullet$ R1= (0.37，0.27, 0.17，0.12，0.07)

B2=A2 $\bullet$ R2= (0.23，0.25，0.20，0.15，0.17)

B3=A3 $\bullet$ R3= (0.31，0.26，0.17，0.16，0.10)

B4=A4 $\bullet$ R4= (0.27，0.24，0.23，0.17，0.09)

B5=A5 $\bullet$ R5= (0.34，0.25，0.12，0.18，0.11)

4.5 Second stage fuzzy comprehensive evaluation

$$B=A\bullet R=(0.20,\ 0.26,\ 0.17,\ 0.19,\ 0.18)\bullet\begin{bmatrix}0.37 & 0.27 & 0.17 & 0.12 & 0.07\\ 0.23 & 0.25 & 0.20 & 0.15 & 0.17\\ 0.31 & 0.26 & 0.17 & 0.16 & 0.10\\ 0.27 & 0.24 & 0.23 & 0.17 & 0.09\\ 0.34 & 0.25 & 0.12 & 0.18 & 0.11\end{bmatrix}$$

$$=(0.15，\ 0.30,0.18,0.26,0.11)$$

4.6 Conclusion

From the maximum membership principle of the fuzzy comprehensive evaluation, determine that the innovation ability of industrial clusters belongs to V2 , It is that Cheng du software industry cluster capacity is strong, and it is consistent with findings. Due to the dependence of the rich innovation resources, the improving public environment and a good human environment, Cheng du industrial clusters showed strong competition ability, innovation ability and growth potential.

In conclusion, the fuzzy comprehensive evaluation method is a kind of methods of combining qualitative and quantitative evaluation. The method can be more scientific, objective evaluation on the innovation ability of industrial clusters.[9]- [10]Based on the evaluation results, the government can generally have a knowledge of the state of cluster innovation capability, thus they can adopt the corresponding enhancement of innovation to improve the regional innovative capacity and further improve regional core competitiveness. At the same time, in establishing single factor evaluation matrix, it mainly used method of expert grading which belongs to qualitative survey, and it have certain subjectivity. In the future, if each evaluation index ,in constructing the corresponding membership function, are based on a variety of statistical data and the certain method, then was calculated the judgment matrix R_i （i＝1，2，3，4，5）, the scientific of quantitative levels of this approach will further improve.

REFERENCES

[1] HUANG SU JIAN.(2010) .Chinese industrial cluster development report. Economic management.

[2] GUAN J. (2009—09). Innovative capability and export performance of Chinese firm . Technovation, : 737 - 747.

[3] DU DONG, PANG QINGHUA and so on. (2008). Modern comprehensive evaluation method and case (the Second Edition). Beijing: Tsinghua University press.

[4] LUO ZHAO JUE .(2010) .Fuzzy comprehensive evaluation method in scientific research project evaluation . Science and Technology Innovation Herald.

[5] HOU LIN LIN, Li HANG. (2010). Based on fuzzy comprehensive evaluation for national defense science and technology management performance evaluation. China Forum of science and technology.

[6] XU YUE. (2010).Application of fuzzy comprehensive Evaluation Method in the Environment Quality Evaluation of Public Park. Friend of Science Amateurs.

[7] LUO Gang. (2010-05). The application of fuzzy judgment in evaluation of teaching quality. Journal of Chongqing University of Arts and Sciences(Natural Science Edition)

[8] WANG XU MING. (2009-02). The Assessment Model of the Employment Quality of College Students Based on Fuzzy Comprehensive Evaluation Method. Journal of Zhejiang Ocean University(Humanities Sciences)

[9] ZHANG ZHUO. (2009-05) On the Application of Fuzzy Comprehensive Judgment in the Evaluation of Students' Usual Performance.

[10] FANG YONG HENG.. (2011). Studies of the Evolution of Industrial Clusters System. Xi'an University of Architecture and Technology