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Performance Evaluation on Entrepreneurial University Construction Based on Dominance Rough Set Theory

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Abstract: Scientific and reasonable evaluation on entrepreneurial university can effectively promote the construction of entrepreneurial university. The index for the performance evaluation on entrepreneurial university construction is set up and a preference decision table is formed by gathering data about entrepreneurial university construction of Zhejiang province within resent 3 years. Then the dominance rough set approach is applied to the performance evaluation of entrepreneurial university construction. The preference decision rules formed is of ability to reasonably classify and evaluate different level of performance of entrepreneurial university construction, realizing the purpose of summarization and evaluation. Knowledge abstracted can provide decision suggestion to the entrepreneurial university construction of higher education institutions.

Key words: Entrepreneurial university construction, dominance rough set theory, performance evaluation, preference decision

INTRODUCTION

Since the late 20th, practice and research about entrepreneurial University is becoming a hot issue in the area of higher education in the world gradually. Foreign scholars in higher education or related fields such as Borden, Clark and Henry, Aizikeweici and others, has conducted an in-depth study of the the Entrepreneurial University and achieved important results, Current domestic academia on Entrepreneurial University studies is divided into two main categories: One is the summary and analysis to the theory of entrepreneurial universities abroad; the other is the path of our entrepreneurial University construction research (Gao *et al*., 2010). Study on the performance of Entrepreneurial University Construction is rare, Therefore, how entrepreneurial University construction objectives to establish scientific index system and evaluation method is an important significance. This article is based on dominance rough set theory, applied to construction performance evaluation of entrepreneurial University, explores a scientific and standardized method of evaluation.

CREATING ENTREPRENEURIAL UNIVERSITIES CONSTRUCTION PERFORMANCE EVALUATION INDEX SYSTEM AND DATA ACQUISITION

Entrepreneurial universities construction performance evaluation index system: In the research and analysis about the entrepreneurial university construction at home and abroad on the basis of the performance evaluation results data, combined construction, initially set the performance evaluation system for with the actual situation of the entrepreneurial university the entrepreneurial university construction. After three rounds of Delphi enquiry, on the basis of the opinions from many experts scholars, to further adjust integrate and perfect assessment index system, eventually to build the entrepreneurial university construction performance evaluation index system (Table 1). The index system includes five first-level indicators, 22 secondary indicators, the index weight determined by analytic hierarchy process (ahp) (Greco *et al*., 2001).

Data acquisition and processing: According to the study of index system, analysis of collected 7 entrepreneurial universities pilot school in zhejiang province nearly three years of data (Greco *et al*., 2002a), calculate the secondary indicators and level indicators score combined with the expert assessment. Creating entrepreneurial universities performance evaluation and decision tables, as shown in Table 2.

DOMINANCE ROUGH SET THEORY

Dominance relation: Suppose knowledge representation system S = {US, Vf} preference for multiple attribute decision table (Greco *et al*., 2002b), A = C∪CL, x∈U, y∈U for P⊆C, ∀q∈C. If the preference attribute value f (y, q)≥f (x, q), remember to yD_rx, that is Dn = {{x, y}∈U×U,

Table 1: Entreremeurial universities construction evaluation index system

First-level indicators	Weight	Secondary indicators	Weight
Management capacity	0.22	Projected capacity	0.19
		Organizing ability	0.16
		Coordinate ability	0.26
		Coaching ability	0.26
		Strain capacity	0.26
Entrepreneurial education	0.28	Entrepeneurial faculity	0.24
		Entrepreneurial personnel training	0.24
		Entrepreneurial curriculum provision	0.18
		Entrepreneurial base construction	0.18
		Entrepreneurial start-up sunding	0.16
External environment	0.15	Govermment contacts	0.19
		Business linkages	0.26
		Peer contact	0.25
		Alumni contact	0.16
		Run a school	0.14
Entrepreneurial culture	0.16	School system of emtrepremeurship	0.28
		Students entrepreneurial groups	0.37
		Campus entrepreneurial activity	0.35
Fund channel	0.19	Govemment funding	0.30
		Enterprise financing	0.25
		Fund support	0.21
		School revenues	0.24

Table 2: Entrepreneurial universities performance evaluation and decision tables

School	Management capacity	Entrepreneurial education	External environment	Entrepreneurial culture	Fund channe	Comprehensive assessment
One	95.1	96.2	92.3	90.2	94.1	94.0
Two	86.2	88.6	90.4	84.4	90.3	87.9
Three	93.2	97.0	90.0	94.1	88.3	93.1
Four	80.7	85.2	84.3	86.4	83.1	83.8
Five	84.3	86.2	86.4	90.2	86.6	86.5
Six	86.4	85.1	84.4	85.6	83.5	85.1
Seven	78.2	83.3	80.1	82.2	79.3	80.8

$f(y, q) \geq f(y, q) \geq f(x, q) \geq f(x, q), \forall q \in P\}$, this reationship is referred to as the dominance relation. P-advantage set and P-disadvantage set about x, respectively is $D^{+}_{p}(x) = \{y: yD_{p}x\}$ and $D_{P}^{-}(x) = \{y: yD_{p}x\}$.

Rough approximation based on dominance relation: The preference attributes of decision Table $S = \{U, A, V, f\}$, $U = \{U_1, U_2, \ldots, U_{|U|}\}$ is known as the theory of space domain objects, $A = C \cup CL$, C is conditions preference property set (Jian *et al*., 2007), CL is decision-making preference property set and $C \cap CL = \phi$, $V = \cup V_a$, $a \in A$ V_a, is the attribute of a domain; $f: U \times A$ is the information function, for $\forall a \in A$, $\forall x \in U$, $f(x,a) \in V_a$ specifies the preference for each object attribute value in the U. If the condition attribute set of $P \subseteq C$, $x \in U$, $Cl_T \subseteq CL$ given preference information, according to the theory of Greco etc, the upper and lower approximation and boundary of $Cl_t^{\geq}$ area respectively def ined as:

$$\overline{apr_p}(Cl_t^{\geq}) = \{x \in U : D_p^{-}(x) \cap Cl_t^{\geq} \neq \}\emptyset$$

$$\underline{apr_p}(Cl_t^{\geq}) = \{x \in U : D_P^{+} \subseteq Cl_t^{\geq}\}$$

$$bnd\ (Cl_t^{\geq}) = \overline{apr_p}(Cl_t^{\geq}) - \underline{apr_p} = (Cl_t^{\geq})$$

where, $\overline{apr_p}(Cl_t^{\geq})$ is composed of all objects set may belong to the $Cl_t^{\geq}$, $\underline{apr_p}(Cl_t^{\geq})$ is composed of all objects set surely belongs to $Cl_t^{\geq}$, not sure to set of objects belonging to constitute $Cl_t^{\geq}$ of the border area.

Classification quality and reduction: To define the classification of the CL quality:

$$Y_P(CL) = \frac{|U - ((\cup bnd\ (Cl_t^{\geq})) \cup (\cup bnd\ (Cl_t^{\geq}))|}{|U|}$$

where, Y_P (CL) said correct classification of the number of objects with the ratio of the total number of objects in the preference for multiple attribute decision Table 1 (Xiao and Wu, 2001).

Reduction: A minimal subset of $P \subseteq C$ meeting the contion of $Y_P(CL) = Y_C(CL)$ is called a Reduction on CL, recorded as red_p (C, CL). A decision table may be more than one Reduction, the intersection of all Reduction called the

decision table of nuclear. The nucleus is the most important attribute in the preference attributes decision Table set, it also may be an empty set.

Preference decision rules: Preference decision rules is a form of dependence between preference property set conditions and decision-making preferences property set. After getting rough Reduction based on dominance relation, it can derive by preference of decision rules (Yang *et al*., 2009).

PERFORMANCE EVALUATION OF ENTREPRENEURIAL UNIVERSITY CONSTRUCTION ON DOMINANCE ROUGH SET THEORY

Discrete data: Table 2, management capacity, entrepreneurial education, external environmen, Entrepreneurial culture, fund channe is the condition attribute, comprehensive assessment is the decision attribute. The application of frequency method to discrete the data in Table 2 into three disjoint preference interval "excellent", "qualified", "bad", discrete the preference of decision table, shown in Table 3.

Generation of attribute reduction and preference of decision rules: Each of the attributes in the Table 3, there are clearly "excellent" "qualified" "bad", According to decision attribute comprehensive evaluation can be divided into three classes preference order: Cl_1 = {bad}, Cl_2 = {qualified}, Cl_3 = {excellent}, according to the preference of decision class division theory field, available:

$Cl_1^{\geq} = Cl_1$ = Comprehensive evaluation is bad

$Cl_2^{\geq} = Cl_1 \cup Cl_2$ = Comprehensive evaluation at most is qualified

$Cl_2^{\geq} = Cl_3 \cup Cl_2$ = Comprehensive evaluation at least is qualified

$Cl_3^{\geq} = Cl_1 \cup Cl_2 \cup Cl_3$ = Comprehensive evaluation are excellent at most

$Cl_3^{\geq} = Cl_2$ = Comprehensive evaluation at least is excellent

To Reduction of object classification, genetic algorithm can find five Reduction, as shown in Table 4-8.

By Table 4-8, according to the preference rules of any Reduction, seven objects for evaluation can be classified correctly, the quality of classification is 100%. Reduction contains two condition attributes at most, all objects can be classified only need a minimum of 3 preference rules and a maximum of 4 preference rules, it is simple and easy to understand. The intersection of five Reduction set is obviously an empty set, that is, the Reduction is without nuclear. From the Table 4, we can see whatever other indicators evaluation, management ability evaluation is good, so comprehensive evaluation is good; as long as management ability is poor, the comprehensive evaluation is bad. So management ability is the key element of the construction of entrepreneurial university, strong control core is the fundamental assurance for the construction of entrepreneurial university. From Table 5-8, the frequency of entrepreneurial education "external environment" entrepreneurial culture'fund channe is same. If it appeared twice in four reductions, it shows the same important

Table 3: Performance evaluation of construction of entrepreneurial university preference of decision table

School	Management capacity	Entrepreneurial education	External environment	Entrepreneurial culture	Fund channe	Comprehensive assessment
One	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Two	Qualified	Qualified	Excellent	Bad	Excellent	Qualified
Three	Excellent	Excellent	Qualified	Excellent	Qualified	Excellent
Four	Bad	Qualified	Bad	Qualified	Bad	Bad
Five	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified
Six	Qualified	Bad	Qualified	Qualified	Qualified	Qualified
Seven	Bad	Bad	Bad	Bad	Bad	Bad

Table 4: D≤ generated by the reduction (management capacity) preference of decision rules

Preference of decision rules	Satisfy the rules of the school	Supporting No.
Management capacity = Excellent⇒Comprehensive assessment = Excellent	One, three	2
Management capacity = Qualified⇒Comprehensive assessment = Qualified	Two, five, six	3
Management capacity = Bad⇒Comprehensive assessment = Bad	Four, seven	2

Table 5: D≤ generated by the reduction {entrepreneurial culture, fund channe} preference of decision rules

Preference of decision rules	Satisfy the rules of the school	Supporting No.
Entrepreneurial culture = Excellent and fund channe≥Qualified⇒Comprehensive assessment = Excellent	One, three	2
Entrepreneurial culture = Bad and fund channe≤Excellent⇒Comprehensive assessment≥ Qualified	Two	1
Entrepreneurial culture≤Excellent and fund channe≤Qualified⇒Comprehensive assessment≤Excellent	One, three	2
Entrepreneurial culture≤Qualified and fund channe≤Qualified⇒Comprehensive assessment≤Qualified	Five, six	2
Entrepreneurial culture≤Qualified Fund channe = Bad⇒Comprehensive assessment = Bad	Four, seven	2

Table 6: D≤ generated by the reduction {external environment, entrepreneurial education} preference of decision rules

Preference of decision rules	Satisfy the rules of the school	Supporting No.
Entrepreneurial education = Excellent and external environment ≥ Qualified⇒Comprehensive assessment = Excellent	One, three	2
Environment≤Excellent⇒Comprehensive assessment≤Qualified entrepreneurial education ≤Qualified and external	Two, five, six	3
Environment = Bad⇒Comprehensive assessment = Bad	Four, seven	2

Table 7: D≤ generated by the reduction {external environment, fund channe} preference of decision rules

Preference of decision rules	Satisfy the rules of the school	Supporting No.
Entrepreneurial education = Excellent and fund channe≥Qualified⇒ Comprehensive assessment = Excellent	One, three	2
Entrepreneurial education≤Qualified and fund channe≤Excellent⇒ Comprehensive assessment≤Qualified	Two, five, six	3
Entrepreneurial education≤Qualified and fund channe = Bad⇒ Comprehensive assessment = Bad	Four seven	2

Table 8: D≤ generated by the reduction {entrepreneurial education, entrepreneurial culture} preference of decision rules

Preference of decision rules	Satisfy the rules of the school	Supporting No.
Entrepreneurial education≥Qualified and entrepreneurial culture = Excellent⇒ Comprehensive assessment = Excellent	One, three	2
Entrepreneurial education≤Excellent and entrepreneurial culture = Bad⇒ Comprehensive assessment≤Qualified	Two	1
Entrepreneurial education≤Qualified and entrepreneurial culture⇒Qualified ⇒Comprehensive assessment≤Qualified	Five, six	2
Entrepreneurial education = Bad and entrepreneurial culture≤Qualified⇒ Comprehensive assessment = Bad	Four, seven	2

degree of the four properties, these are all important factors of constructing entrepreneurial university. This is consistent with the five core elements theory of entrepreneurial university which was said by burton clark.

From Table 5-8, we can be see that as long as the evaluation of entrepreneurship education or entrepreneurial culture is excellent, the evaluation of peripheral environment or capital channel is more than qualified, comprehensive evaluation is good; but when the evaluation of peripheral environment or channels is poor, the evaluation of entrepreneurship education or entrepreneurial culture is qualified, comprehensive evaluation are poor. This suggests that, at the beginning of the construction of entrepreneurial university, must develop peripheral environment, broaden the financing channels, open the construction of entrepreneurial university, build the foundations (Xiao and Wu 2001); When at a certain stage of the construction of entrepreneurial university, must improve the level of school entrepreneurship education and cultivate entrepreneurial culture atmosphere, in order to improve the level of entrepreneurial university construction and realize the sustainable development of entrepreneurial university.

CONCLUSION

In this study, advantages of rough set theory was applied to evaluation of the construction of entrepreneurial university and obtained some beneficial knowledge, decision preference can handle incompatibility that is caused by preference attributes in the attribute decision making, preference rules is closer to the natural reasoning rules of decision makers, it's easy understanding. The method can be classification and performance evaluation for the construction of entrepreneurial university and the regular quantity are few, easy to understand and operate. In addition, the Reduction can also explain the role of different factors in the construction of entrepreneurial university and provide some guidance.

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