Assessment on Merger and Acquisition Risk of Agricultural Manufacturing Enterprises in China

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Abstract Composition of merger and acquisition risk of agricultural manufacturing enterprises in China is analyzed, which is mainly strategic risk, external risk, transaction risk and integrated risk. And there are a total of 16 specific sources of risk. Concrete assessment methods for merger and acquisition risk of agricultural manufacturing enterprises are introduced. Firstly, set up the risk factor sets at first and second layers and divide merger and acquisition risk into 5 layers; establish risk assessment matrix according to the score by expert group. Secondly, determine the weights of the various risk factors by the ideology of information entropy. Finally, find out the subordinated vector of risk factor, construct risk assessment matrix, calculate the second grade risk assessment vector and conduct risk assessment. Taking a given agricultural manufacturing enterprise as an example, fuzzy mathematics method is used to conduct risk assessment on its merger and acquisition project. Result shows that the overall risk of merger and acquisition project is relatively low, and merger and acquisition can be implemented. Merger and acquisition risk assessment based on fuzzy mathematics has made the assessment result more objective and reliable, so as to provide a reasonable reference for the scientific decision-making of agricultural manufacturing enterprises in China.

Key words Merger and acquisition risk; Information entropy; Risk control; China

With the establishment and improvement of market economy, the management mechanism, management body and financing system agriculture, which are the basis of the national economy, must adapt to the needs of the new situation in China. It is an effective way for agricultural manufacturing enterprises in China to conduct horizontal integration, vertical extension, merger and reorganization and diversified economy. In recent years, mergers and acquisitions (M & A) tide among agricultural manufacturing enterprises come into existence in China, represented by emulsion, soybean crushing industry, and meat processing industry. And M & A tide is spreading to other industries, which puts forward higher requirements for assessment and control of M & A risks in agricultural manufacturing enterprises in China[1]. Fuzzy mathematics method is used to evaluate the M & A risk of agricultural manufacturing enterprise, offering references for the decision making of merger of agricultural manufacturing enterprises in China.

1 Source of M & A risk

M & A risk of agricultural manufacturing enterprises is affected by many factors. According to the process of M & A, we conclude that merger risk is mainly composed of strategic risk, external risk, transaction risk and integrated risk. Fig. 1 illustrates the sources of M & A risk[2-4].

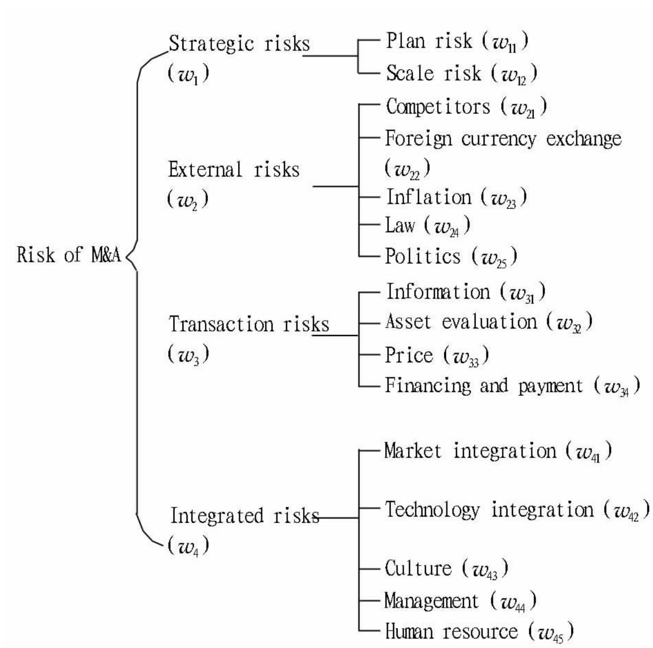

Fig. 1 The source of M & A risk

2 Introduction of methods

2.1 Establishment of a risk assessment matrix Firstly, risk factor set at first layer is established, which is $w=\{w_1, w_2, w_3, w_4\}$, and that at second layer is also set up: $w_1=\{w_{11}, w_{12}\}$, $w_2=\{w_{21}, w_{22}, w_{23}, w_{24}, w_{25}\}$, $w_3=\{w_{31}, w_{32}, w_{33}, w_{34}\}$, $w_4=\{w_{41}, w_{42}, w_{43}, w_{44}, w_{45}\}$. Then, according to the M & A risk degree, the assessment is classified into levels of low, relatively low, moderate, relatively high and high, denoted by v_1, v_2, v_3, v_4, and v_5. Finally, a panel of judges, including professional finance staff, financial experts, management experts and professional legal staff, try to evaluate the risk factors and to establish an assessment matrix of M & A risk[5]:

$$r_i=\begin{pmatrix} r_{i11} & \cdots & r_{i1n} \\ \vdots & \vdots & \vdots \\ r_{im1} & \cdots & r_{imn} \end{pmatrix} (i=1,2,3,4) \qquad (1)$$

where r_{ijk} is membership degree of the j^{th} risk factor in the i^{th} risk subordinated to the k^{th} assessment in M & A risk assessment.

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$r_{ijk} = \frac{Q_{ijk}}{Q}$, where Q is the total population of judges, Q_{ijk} is the number of judges using the k^{th} assessment on the j^{th} factor in the i^{th} risk, m is the number of risk factors in the i^{th} risk, and n is the assessment grade.

2.2 Weight determination If there are great differences among judges on certain risk factor, in other words, the membership degree of risk factor is highly dispersed, we consider that assessment on this risk factor is controversial and this factor has uncertainty. Therefore, information entropy is used to determine the weights of the various risk factors[6]. Equation of weight determined by information entropy is $H(i,j) = -\sum_{k=1}^{n} r_{ijk}\log(r_{ijk})$. Let $s_{i,j} = 1 - \frac{H(i,j)}{\log(n)}$, the weight is $\lambda_{i,j} = \frac{s_{i,j}}{\sum_{j=1}^{m} s_{i,j}}$, where $0 \leqslant s_{i,j} \leqslant 1$. If $r_{ijk} = \frac{1}{n}$, $s_{i,j} = 0$; and if one of the r_{ijk} is 1 and the rest are 0, we have $s_{i,j} = 1$. The more dispersed the r_{ijk} is, the smaller the $s_{i,j}$ becomes, and *vise versa*. And $\sum_{j=1}^{m} \lambda_{i,j} = 1$.

Analytic hierarchy process (AHP) is adopted to determine the weight of risk factor at first layer. Precedence matrix C is obtained by using 1 – 9 Scale Method. According to the characteristic equation $C\eta = \lambda\eta$, eigenvector η' is calculated when characteristic root is the maximum. And η' is the weight vector[7–8]. Here, we introduce a simple method to calculate the eigenvector η' and the maximum eigenvalue $\lambda_{\max}$. Let $\eta_i = (\prod_{j=1}^{n} c_{ij})^{\frac{1}{n}}$, we have $\bar{\eta}_i = \frac{\eta_i}{\sum_{i=1}^{n} \eta_i}$ after normalization processing of η_i. Hence, $\eta' = (\bar{\eta}_1, \bar{\eta}_2, \cdots, \bar{\eta}_n)^T$ and $\lambda_{\max} = \sum_{i=1}^{n} \frac{(C\eta')_i}{n\bar{\eta}_i}$ are the eigenvector and eigenvalue, respectively. Consistency index $CI = \frac{\lambda_{\max} - n}{n-1}$ is obtained through maximum eigenvalue. According to the consistency index table (RI), consistency ratio $CR = \frac{CI}{RI}$ is calculated. If $CR < 0.1$, the precedence matrix has the consistency.

2.3 Risk assessment r_{ijk} is the membership degree of w_{ij} in the k^{th} assessment. Hence, vector of risk membership degree of w_{ij} is $(r_{ij1}, r_{ij2}, r_{ij3}, r_{ij4}, r_{ij5})$. Similarly, we have the risk membership degree vectors of other risk factors in w_i. Based on this, the risk assessment matrix r_i is formed. Then, use vector of weight λ_i determined by information entropy to calculate the risk measurement vector at first grade, which is $u_i = \lambda_i \cdot r_i$. Let $u^T = [u_1, u_2, u_3, u_4]$ be the risk assessment matrix at second grade, risk measurement vector at second grade is $f = \eta' \cdot u = [f_1, f_2, f_3, f_4, f_5]$ by using the weight of risk factor at first layer η'. Finally, M & A risk assessment is conducted by vector f[8].

3 Case analysis

A given agricultural manufacturing enterprise is going to buy another agricultural enterprise. Therefore, 20 experts in management, finance and law are invited to evaluate its M & A risk. Table 1 reports the result of scores.

Weight and assessment result at first grade are obtained through assessment matrix (Table 2).

Table 1 The scores by experts

Grade	v_1		v_2		v_3		v_4		v_5	
	Population	Proportion %	Population	Proportion %	Population	Proportion %	Population	Proportion %	Population	Proportion %
w_{11}	2	10	2	10	5	25	5	25	6	30
w_{12}	3	15	3	15	6	30	6	30	2	10
w_{21}	8	40	8	40	3	15	1	5	0	0
w_{22}	6	30	6	30	7	35	1	5	0	0
w_{23}	2	10	5	25	6	30	6	30	1	5
w_{24}	10	50	5	25	5	25	0	0	0	0
w_{25}	17	85	1	5	2	10	0	0	0	0
w_{31}	2	10	4	20	5	25	5	25	4	20
w_{32}	14	70	4	20	2	10	0	0	0	0
w_{33}	12	60	8	40	0	0	0	0	0	0
w_{34}	12	60	7	35	1	5	0	0	0	0
w_{41}	9	45	7	35	4	20	0	0	0	0
w_{42}	7	35	7	35	3	15	3	15	0	0
w_{43}	0	0	3	15	5	25	10	50	2	10
w_{44}	0	0	0	0	15	75	4	20	1	5
w_{45}	0	0	4	20	6	30	8	40	2	10

Table 2 The result of assessment at first grade

Factor set	Weight distribution	Assessment result
w_1	$\lambda_1 = (0.52, 0.48)$	$u_1 = \lambda_1 \cdot r_1 = (0.124, 0.124, 0.274, 0.274, 0.204)$
w_2	$\lambda_2 = (0.21, 0.14, 0.06, 0.21, 0.38)$	$u_2 = \lambda_2 \cdot r_2 = (0.560, 0.212, 0.189, 0.036, 0.003)$
w_3	$\lambda_3 = (0.02, 0.31, 0.36, 0.31)$	$u_3 = \lambda_3 \cdot r_3 = (0.621, 0.318, 0.052, 0.005, 0.004)$
w_4	$\lambda_4 = (0.22, 0.12, 0.16, 0.37, 0.13)$	$u_4 = \lambda_4 \cdot r_4 = (0.141, 0.169, 0.418, 0.224, 0.048)$

Since analytic hierarchy process is commonly used in research, weight obtained from analytic hierarchy process is directly given out, as well as the result of consistency check:

$$\eta' = (0.24, 0.14, 0.28, 0.34), CR = \frac{CI}{RI} = 0.08 < 0.1.$$

Hence, the result of final risk assessment is

$f = \eta' \cdot u = (0.33, 0.23, 0.24, 0.14, 0.06)$.

The final results show that 33%, 23% and 24% experts believe that the risk of this M & A project is low, relatively low and moderate, respectively. Only 20% experts argue that this project has great risk. Therefore, the overall risk of this M & A project is at a relatively low level; and mergers and acquisitions can be implemented.

4 Conclusion

M & A risk is an issue must be taken seriously in China during the process of mergers and acquisitions of agricultural manufacturing enterprises. M & A risk itself is inseparable from the complexity of M & A enterprises and the external environment. Objective assessment of M & A risk not only provides a reference for the merger, but also offers guidance to the further control of risk. In this paper, M & A risk is evaluated through the fuzzy mathematical method; and entropy method is introduced when determining the weight of risk factor, so as to make the risk assessment more objective and to provide a reliable basis for the decision making of agricultural manufacturing enterprises in China.

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中国农业生产企业并购风险评价

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摘要 分析了中国农业生产企业并购风险的组成,它主要由战略风险、外部环境风险、交易风险和整合风险4类风险组成,其具体的风险来源有16个。介绍了农业生产企业并购风险评价的具体方法:首先,建立首层和第2层风险因素集,并将并购风险划分为5个级别,根据专家小组的评分建立风险评价矩阵;其次,利用信息熵的思想确定各风险因素的权重;最后,求出风险因素的隶属度向量,构建风险度量矩阵,计算出第2级风险度量向量,并作出风险评价。以中国某农产品加工企业为案例,运用模糊数学方法对该企业的并购项目进行了风险评价,结果表明,该并购项目的总体风险较低,可以实施并购。基于模糊数学的并购风险评价方法使评价结果更加客观、可靠,从而能为中国农业生产企业的科学决策提供合理参考。

关键词 并购风险;信息熵;风险控制

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绿色农产品封闭供应链优化模型研究

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摘要 界定了绿色农产品封闭供应链的定义,它由供应商、生产商、分销商、零售商和消费者(顾客)5方构成。分析了分销商的成本构成,主要包括面向上下游企业的农产品订单作业成本、库存成本和供应运输成本3种,并据此建立了绿色农产品封闭供应链的概念模型。通过动态规划的思想构建了绿色农产品封闭供应链的4阶段优化模型,即在农产品供应链具有约束条件、销售量存在不确定性的情况下,考虑具有动态系统和约束条件的供应、生产、分销、零售4阶段的库存成本、供应运输成本和订单作业成本之和的优化问题,从而为供应链管理中的各项分析和决策活动提供参考。

关键词 封闭供应链;运作优化;绿色农产品