

Research on Risk Chain Identification of Business Management in Chinese SMEs Based on ISM-MICMAC Model

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Abstract. Under the background of the new era, enterprise business management faces the threat of various change factors, so it is very important to study the risk of enterprise business management. This paper summarizes the factors that affect the risk of enterprise business management through literature analysis, and constructs the index system of enterprise business management risk chain on this basis. Using the interpretative structural model (ISM), the accessibility matrix is calculated and decomposed; then, the cross-influence matrix (MICMAC) model is used to calculate the driving force and dependence of risk indicators, and finally the deep indicators are obtained. The results show that legal policy, macroeconomic environment, social environment and talent structure have strong driving force and low dependence, which are the deep indexes to control business management risk. Based on the ISM-MICMAC method, the key factors affecting business management risk are identified, which provides theoretical support for the effective construction of business management risk chain and points out the direction for subsequent research on business management risk.

Keywords: ISM-MICMAC, Business Management Risk Chain.

1. Introduction

With the continuous development of economy and society, enterprise business management is also facing new opportunities and challenges. Benefits and risks coexist. In order to obtain benefits, enterprises need to make various risk decisions to avoid or reduce losses. Especially for small and medium-sized enterprises, their ability to resist risks is weak compared with large-scale enterprises, and due to the constraints of their own development stage, scale and other factors, they need to face more complex production environment, volatility factors are more complex and trivial. At this time, it is very important for the decision-making and development of enterprises to find out the risk factors that may affect the business management of enterprises.

In recent years, many scholars have studied in the field of business risk management. Ding et al. ^[1] combined risk management with internal control based on the analysis of major enterprise management risks, and proposed internal control recommendations based on risk management in the cloud computing technology environment. Wu et al. ^[2] reviewed some main work on quantitative analysis of supply chain risk management in business management, and discussed several important research directions in this field. Zhang et al. ^[3] focused on the risk management of BPO partnerships based on the classification of BPO partnerships from the perspectives of service recipients and suppliers. Xu et al. ^[4] analyzed the various potential risks in the process of project implementation, and put forward risk management methods and specific measures to cope with the challenges of WTO. Tang et al ^[5] analyzed different proportions of market-based price difference contracts or government-authorized price difference contracts from the determination of price difference contracts, the equilibrium modeling of electricity market considering risk preference, and the influence of different risk preferences on market equilibrium based on multi-agent deep strong chemistry. Liu et al. ^[6] studied the risk management of business outsourcing of small and medium-sized technology-based enterprises from the perspective of value network. From the perspective of previous interest protection, thinking about risk management issues has changed to effectively avoid outsourcing risks by paying attention to the value realization of all participants and building a risk management system

for business outsourcing. Due to the complexity and diversity of risk factors affecting business management, the degree of volatility is different in different industries and enterprises of different sizes. People still lack a systematic understanding of the volatility of various risks and the relationship between them.

Business management risk is a multi-disciplinary and multi-dimensional cross system. Most of the previous studies focused on specific industries and specific risk factors, but lacked a systematic consideration of the impact of various risks and their relationship from the overall perspective of the enterprise. This paper establishes ISM for risk indicators through expert scoring, and analyzes the interdependence and restriction relationship between the components of the risk indicator system. Then MICMAC is used to analyze the interaction and dependence between the factors, so as to provide some decision-making and management support for enterprise business management. This paper systematically establishes the risk index system of enterprise business management, establishes ISM for risk indicators through expert scoring, and analyzes the interdependence and restriction relationship between the components of the risk indicator system. Then MICMAC is used to analyze the interaction and dependence between the factors in the risk index system, so as to provide some decision-making and management support for enterprise business management.

2. Business management risk chain index system construction

2.1 Macro-environment

This paper selects the macroeconomic environment (S_1), electronic business management (S_2), social environment (S_3), legal policy (S_4) four indicators. The macroeconomic environment (S_1) refers to the economic system in which an enterprise operates, including the economic situation, bank interest rates, and price fluctuations. The bad macroeconomic situation will bring continuous management risks to enterprises. Electronic business management (S_2) has expanded the scope of time and space for business transactions. However, technological innovations may also bring potential risks, such as supplier dishonesty and non-delivery, financial audit risks brought by big data, etc. The social environment (S_3) is related to trust and moral factors. The continuous improvement of the credit ethics system is conducive to reducing the risk of business management and regulating the operation of enterprises in the market. In addition, legal policies (S_4) related to economic activities can play a regulatory role in coordinating the participation of all parties in the social economy and in the event of conflicts of interest, and prevent and eliminate risk factors that threaten economic stability.

2.2 Microscopic environment

In this paper, the micro-environment selected customer loyalty (S_5), supplier costs (S_6), peer competitors pressure (S_7), strategic alliance partners (S_8) four indicators. Customer loyalty (S_5) refers to the degree to which customers have feelings about a company's products or services, form a preference and repeat purchases of the company's products or services for a long time. If customer loyalty is not enough, it is easy to lose, which will bring the risk of fluctuation to the business of the enterprise. In addition, when the supplier's bargaining power (S_6) is weak, the company will correspondingly reduce the supplier's processing costs, making the supplier's cooperative attitude negative. In the long run, this will cause the entire supply chain management level to decline and reduce the supply quality risk. Similarly, the existence of peer competitors pressure (S_7), if the industry product homogeneity degree is serious, the market competitiveness is not prominent, enterprise products to achieve value jump risk will increase. Strategic alliance partnership (S_8) also inevitably has certain risks, such as data flow risk, contract performance risk, credit risk and so on.

2.3 Internal environment of the enterprise

In this paper, the internal environment selected the management team structure (S_9), management team policy (S_{10}), management team communication level (S_{11}), comprehensive financial budget (S_{12}), the number of patents (S_{13}), enterprise development stage (S_{14}), corporate culture (S_{15}) seven indicators. The talent structure (S_9), management policy (S_{10}) and communication level (S_{11}) of the management team all reflect the internal management level of the enterprise. The higher the enterprise management level is, the higher the ability to avoid risks is. In addition, in the current financial integration, the comprehensiveness of the financial budget (S_{12}) is related to the business development of an enterprise. A comprehensive financial budget can better guide enterprises to conduct orderly business activities, and accordingly avoid certain management risks. The patent technology (S_{13}) risk mainly focuses on external factors such as infringement caused by patent counterfeiting and internal factors such as subsequent operational risks of patent acquisition. Different stages of enterprise development (S_{14}) also affect the occurrence of different risks. At the same time, a positive corporate culture (S_{15}) can strengthen employees' confidence in the enterprise and identity, strengthen the cohesion and competitiveness of enterprises. If there is no good risk management culture, employees may be corrupt; enterprises may suffer heavy losses.

Table 1. Enterprise business management risk index system

<i>Primary index</i>	<i>secondary index</i>	<i>Code Reference</i>	<i>Reference</i>
<i>Macro-environment</i>	Macroeconomic environment	S_1	[7]
	Electronic Business Management	S_2	[8]
	Social environment	S_3	[9]
	Legal policy	S_4	[10]
<i>Microscopic environment</i>	<i>Micro-environment</i> Customer loyalty	S_5	[11]
	Supplier costs	S_6	[12]
	Peer competitor pressure	S_7	[13]
	Strategic alliance partners	S_8	[14]
<i>Internal environment of the enterprise</i>	<i>Enterprise internal environment</i> talent structure	S_9	[15]
	Management policy	S_{10}	[16]
	Management team communication level	S_{11}	[17]
	Comprehensiveness of financial budget	S_{12}	[18]
	Patented technology	S_{13}	[19]
	Enterprise development stage	S_{14}	[20]
	Corporate culture	S_{15}	[21]

3. ISM Method

The Interpretative Structural Model (ISM) is an effective method developed by J. N. Warfield to analyze and reveal complex socioeconomic relations. Its characteristic is to clarify the relationship between the elements in the complex system according to the existing practical knowledge, and finally form a clear multi-level hierarchical structure model. ISM can describe the essence of the

system more intuitively, and structure and hierarchically analyze the interdependence and restriction relationship between the components of the system. It is widely used in energy, transportation, risk management, enterprise management and other fields. The steps are as follows^[22]:

STEP1: Determine the adjacency matrix H.

The purpose of determining the adjacency matrix H is to highlight the main influence of factors in complex systems. The adjacency matrix can be calculated by analyzing and judging the relationship between elements and using binary relation $H (H = [h_{ij}]_{n \times n})$.

$$h_{ij} = \begin{cases} 1, & t_{ij} \geq \lambda(i, j=1, 2, \dots, n) \\ 0, & t_{ij} < \lambda(i, j=1, 2, \dots, n) \end{cases} \quad (1)$$

At that time $h_{ij}=1$ the factor C_i will have an impact on the factor C_j .

STEP2: Determine the reachable matrix K.

The reachability matrix K can be calculated from the adjacency matrix H by using the Boolean algebra algorithm

$$\begin{aligned} (A+I) &\neq (A+I)^2 \neq (A+I)^3 \neq \dots \neq \\ (A+I)^m &\neq (A+I)^{m+1} = K (m \leq n-1) \end{aligned} \quad (2)$$

STEP3: Determine the factor set and make a preliminary classification.

To classify the factors $C_i (i=1, 2, \dots, n)$, the reachable set R and the pre-set S need to be determined.

The reachable sets and factor sets are as follows:

$$\begin{aligned} R_i &= \{C_j | C_j \subseteq X, k_{ij} = 1, j=1, 2, \dots, n\} \\ S_j &= \{C_i | C_i \subseteq X, k_{ij} = 1, i=1, 2, \dots, n\} \\ R_i &= R_i \cap S_i \end{aligned} \quad (3)$$

The factors C_i satisfying the above equation are classified as the lowest level of the factor subset. Then, delete the rows and columns corresponding to the factors satisfying the equality in the matrix K, and repeat the above process. After deleting all factors, you get the initial logical diagram.

STEP4: Build a hierarchical network model.

The relationship between factors is determined by the reachability matrix. Based on the hierarchical network model, we can clarify the relationship between the corresponding enterprise business management risk chain index system factors.

4. MICMAC Method

Cross Influence Matrix Multiplication (MICMAC) is an analytical method proposed by Duperrin and Codet^[23] to analyze the interaction and dependence between factors in the system. The principle is to use the reaction path and hierarchical cycle of factors in the system to study the diffusion of the relationship between factors, and classify them based on the driving force and dependence of risk factors. MICMAC can identify highly dynamic and highly dependent variables in the system based on ISM, which is generally suitable for analyzing the importance of factors in the system and proposing corresponding solutions in complex environments^[24]. The steps are as follows^[25] :

STEP1: Calculate the driving force and dependence of each influencing factor. The size of drive and dependency is determined by the number of ' 1 ' in the row and column corresponding to each factor in the reachable matrix.

STEP2: Construct a driving force-dependence matrix. According to the driving and dependence of each factor obtained by analyzing the reachability matrix, the first quadrant of the whole coordinate system is divided into four clusters, which are independent factors, contact factors, autonomous factors and dependent factors.

5. Result

5.1 ISM calculation and analysis

Reference to domestic scholars on business management risk chain index system, using literature research and expert scoring analysis. In order to analyze the influence of the selected 15 risk indicators on the risk of enterprise business management and construct the explanatory structure model, it is necessary to judge the binary relationship between the risk indicators. In order to reduce the error caused by the subjectivity of expert opinions on the results, 13 experts were invited to score the closeness between these 15 risk indicators. If more than half of the experts indicate that the row element S_i has a binary relationship with the column element S_j , it is marked as 1; if less than half, it is marked as 0. The adjacency matrix A is Equation (4).

	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}
S_1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	0
S_2	0	0	0	0	1	1	0	1	0	0	0	1	1	1	0
S_3	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0
S_4	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0
S_5	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1
S_6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
S_7	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
S_8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
S_9	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
S_{10}	0	0	0	1	1	0	1	0	1	0	1	1	0	1	0
S_{11}	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
S_{12}	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
S_{13}	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0
S_{14}	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
S_{15}	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0

(4)

Adjacency matrix represents the direct influence relationship between the two indexes in the risk index system, and reachability matrix represents the transfer relationship between the indexes in the risk index system. For the adjacency matrix A, reachability matrix R can be obtained by Boolean operation, as shown in Equation (5).

	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}
S_1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
S_2	0	1	0	0	1	1	1	1	0	1	1	1	1	1	1
S_3	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
S_4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S_5	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_6	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_7	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_8	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_9	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
S_{10}	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_{11}	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_{12}	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_{13}	0	0	0	0	1	1	1	1	0	1	1	1	1	1	1
S_{14}	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1
S_{15}	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1

(5)

According to the interpretative structural model, the risk indicators are divided into three layers: $S_5, S_6, S_7, S_8, S_{10}, S_{11}, S_{12}, S_{14}, S_{15}$ are in the surface layer, S_{13}, S_2 are in the intermediate layer, S_1, S_3, S_9 are in the fundamental layer, The model results are shown in Figure 1. The risk indicators at the surface layer are mainly derived from the microenvironment and internal environment of enterprise survival, which directly affect the generation of business management risks. The risk indicators in the intermediate layer will mainly affect the surface layer and the fundamental layer indicators through direct or indirect ways. By interpreting the complex connection between the intermediate layer and the fundamental layer, it is the pain point and difficulty to prevent the occurrence of business management risks and reduce the impact of business management risks. The risk indicators at the fundamental layer are mainly derived from the macro environment of the enterprise's survival. The fundamental layer indicators are the fundamental indicators that directly or indirectly affect the other layer indicators. If we want to solve the business management risk from the root, we must start from the fundamental layer indicators, give them enough attention, and use them in daily decision-making after full cognition and interpretation.

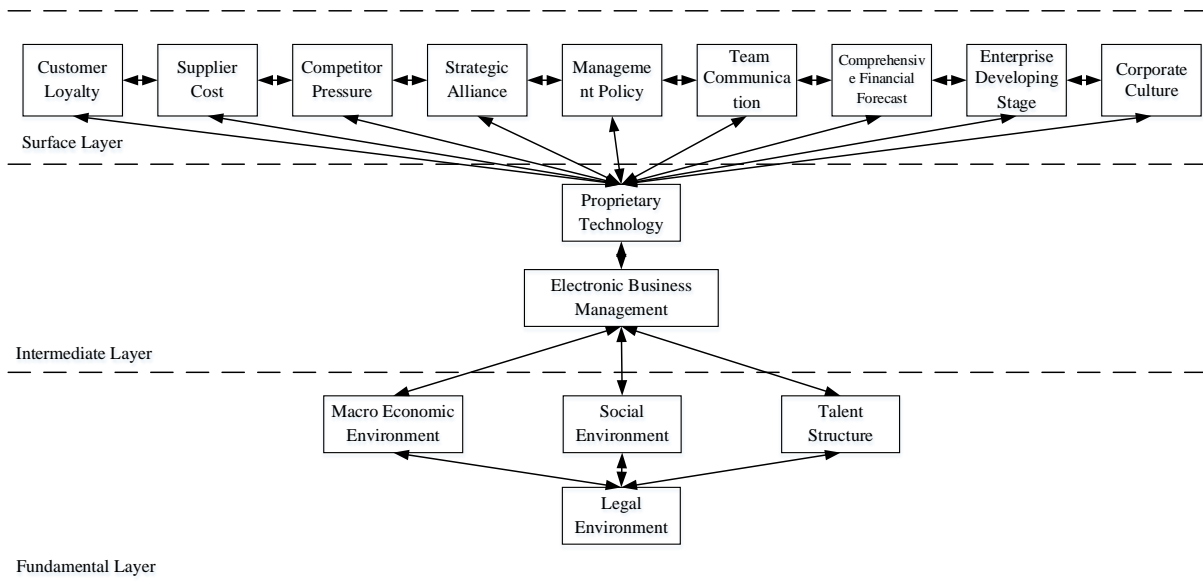


Figure 1. interpretative structural model

In the surface layer, the microenvironment in which the enterprise survives may appear phenomena such as supplier replacement, strong impact of competitors, and decline in customer loyalty, and shaken strategic alliance partnerships. Such phenomena will give the enterprise business management pressure from the outside of the enterprise, which may directly lead to the emergence of business management risks; the various processes of internal operation of enterprises may also increase business risks. For example, imperfect management policies, misjudgment of enterprise development stages, and neglect of corporate culture construction will give business management pressure from within the enterprise and directly promote the occurrence of business management risks.

In the intermediate layer, the proprietary technology has a direct impact on the surface layer, indicating that all the proprietary technology of the enterprise will enhance the competitiveness of the enterprise in the microenvironment of its survival, and have a restraining effect on the events that lead to the occurrence of the risks mentioned above. At the same time, it also has an impact on the internal environment of the enterprise, and can help the management activities of the enterprise through the application of proprietary technology. Carry out smoothly and establish a positive and enterprising corporate culture; electronic business management is directly affected by the fundamental layer and acts on proprietary technology, indicating that the macro environment in which the enterprise is located has a significant guiding role in the survival and development of the enterprise.

The promotion of electronic business management puts forward further requirements for the proprietary technology mastered by the enterprise.

At the fundamental level, the legal policy is the root risk indicator, which provides the legal basis for the business management behavior of the enterprise, and exerts influence and constraints on the macroeconomic environment, social environment and talent structure. For example, the law formulated for the dual carbon target will enable the society to strengthen the supervision of heavy industry and environment-unfriendly manufacturing industry, reduce the flow of funds into this kind of industry, and reduce the cultivation of talents in this direction. This is the way to pass the risk to the intermediate layer and the surface layer.

5.2 MICMAC calculation and analysis

On the basis of the interpretative structural model in the previous section, the driving force and dependence degree of each risk index are obtained by cross-influence matrix multiplication (MICMAC), so as to judge the interaction relationship of risk indicators in the system and confirm the reasonable development direction. Based on the reachable matrix R, the numerical sum of the rows of the risk index is used as the driving force, and the numerical sum of the columns is used as the dependence. The calculation results are shown in Table 2. According to the driving force and dependence value of different risk indicators, four quadrants of the coordinate axis are divided: autonomous factor set, independent factor set, dependent factor set and linkage factor set. In order to solve the risk index with high dependence value, it often relies on priority to solve the remaining indicators in the system. The risk indicators with high driving force value is the pre-implementation object to solve other indicators. The MICMAC analysis results are shown in Figure 2.

Table 2. The driving force-dependence table of enterprise business management risk indicators

Risk indicators	Driving force	Dependence	Risk indicators	Driving force	Dependence
S_1	14	4	S_9	14	4
S_2	11	5	S_{10}	9	15
S_3	14	4	S_{11}	9	15
S_4	15	1	S_{12}	9	15
S_5	9	15	S_{13}	10	6
S_6	9	15	S_{14}	9	15
S_7	9	15	S_{15}	9	15
S_8	9	15	/	/	/

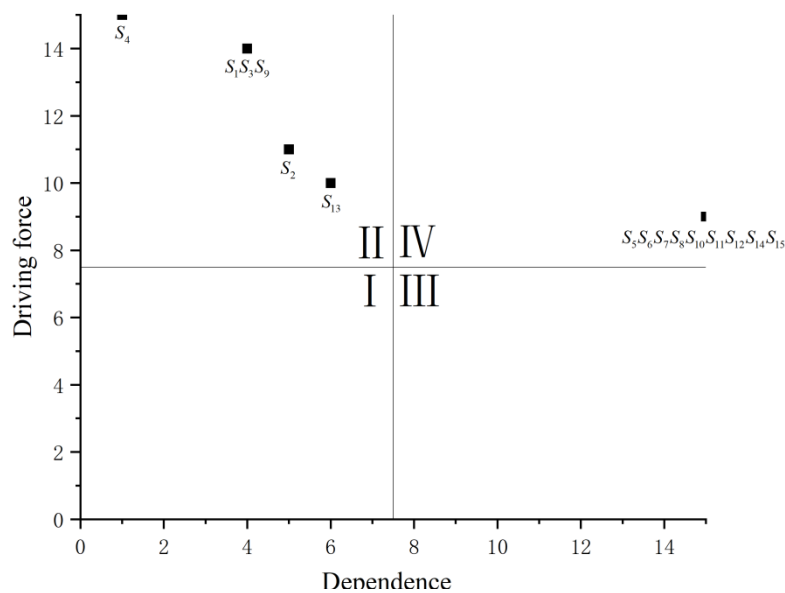


Figure 2. MICMAC analysis results of enterprise business management risk indicators

The driving force and dependence of the indicators in the autonomous factor set I are small, indicating that the correlation between the indicators and the system is weak. The research results show that there are no risk indicators in the autonomous factor set. The indicators in the independent factor set II have the characteristics of strong driving force and weak dependence, and play a leading role in the system. S_1, S_2, S_3, S_7, S_9 and S_{13} belong to the independent factor set. Among them, the driving force value is higher, that is, the legal policy, macroeconomic environment, social environment, and talent structure are the deep indicators to control the risk of enterprise business management. If the environmental changes are recognized and adjusted in time, the risk of enterprise business management can be reduced through the gradual transmission of the remaining indicators. The indicators in the dependent factor set III have the characteristics of strong dependence and weak driving force, indicating that the indicators are greatly affected by other indicators. The research results show that there are no risk indicators in the dependent factor set. The driving force and dependence of the index in the linkage factor set IV are large, which plays a role in transmitting the influence of the lower index to the upper layer in the system. The other indexes in the system belong to this factor set, but the position is also close to the dependent factor set, which is also concentrated in the surface layer in the ISM model, which is consistent with the model results.

5.3 Suggestions

According to the results of ISM-MICMAC analysis, there are different degrees of correlation and influence paths among the risk indicators in the enterprise business management risk chain index system. Therefore, it is necessary to adopt different levels of attention to risk indicators at different levels, and focus on indicators with strong driving forces. Therefore, the following three suggestions are proposed.

(1) Macro environment. In different periods of economic operation, government departments should try to maintain the consistency and coherence of policy regulation in order to stabilize market expectations when formulating policies for the purpose to be achieved, provide a more transparent index construction process, and carry out system reform by improving the business environment and simplifying the approval process to boost the confidence of business owners. In view of the anti-unfair competition law, anti-monopoly law, e-commerce law and other laws and regulations to be improved, timely use of new research results, design more in line with national conditions, more perfect legal system. Business owners actively adapt to changes in the macroeconomic situation, legal

policies, etc., give full play to the influence of subjective understanding on investment and financing decisions, and avoid enterprises from entering a situation contrary to the macro trend.

(2) Micro-environment. Cultivate a good relationship with users, the rational use of user information, protect consumer privacy, integrity management, to prevent the emergence of deceiving consumers or brand crisis, to genuine services and products to improve customer loyalty, actively fulfill their social responsibility and publicity work; we will promote all-round cooperation with strategic partners, innovate the operational mechanism of strategic alliances, do a good job in the qualification review of strategic alliance members, always implement innovative thinking, co-evolve with strategic partners, rationally allocate resources and share tasks, and increase the correlation between alliance members. In the form of a community of interests, we will jointly meet risks and embrace opportunities.

(3) Internal environment. Improve the importance of internal management, such as in the procurement cost control by paying attention to procurement costs, hiring experienced, diligent professional managers, the establishment of professional procurement departments, procurement to achieve full supervision, set up bidding team and legal measures to strengthen internal control; actively promote the communication between various departments in the enterprise, so that each employee has the right to speak in the formulation of enterprise management matters, participate in the company's decision-making, and use effective management communication to enable employees to better invest in their work while clarifying their work tasks, and strive for the realization of enterprise and self-worth. Establish corporate culture, set up risk management objectives, build risk awareness, directors, supervisors and senior management personnel to play an exemplary role, in the subconscious to establish personal goals and corporate goals consistent setting.

6. Conclusion

Firstly, this paper constructs the index system of enterprise business management risk chain through literature reading, and uses ISM-MICMAC model to analyze the correlation of influencing factors of enterprise business management risk. The main conclusions are as follows:

(1) There are many factors that affect the risk of business management. Through the literature review method, the indicators are initially divided into three first-level indicators: macro environment, micro environment and internal environment. Macro environment is divided into four secondary indicators : macroeconomic environment, electronic business management, social environment and legal environment ; the micro environment is divided into four secondary indicators : customer loyalty, supplier cost, peer competitor pressure, strategic alliance partner ; enterprise internal environment is divided into four secondary indicators : talent structure, management policy, management team communication level, comprehensive financial budget, patent technology, enterprise development stage, enterprise culture.

(2) Based on the ISM model, this paper analyzes the relationship between the 15 influencing factors of business management risk. Through the calculation of the reachability matrix, this paper constructs the structural interpretation model of the influencing factors of business management risk, and divides the influencing factors into the " fundamental layer, " " intermediate layer " and " representation layer. "

(3) Based on the MICMAC model, this paper calculates the driving force and dependence degree of each risk indicator. The indicators of legal policy, macroeconomic environment, social environment and talent structure have high driving force and low dependence, so enterprises should first consider these factors when facing business management risks.

The research on business management risk chain can provide business management ideas and solutions for China 's SMEs. At the same time, it can also promote the government to improve the construction of commercial risk management system, improve the supervision ability, and provide scientific basis for the formulation of relevant laws and regulations.

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