

Research on the Growth of Internet SMEs Based on Entropy Theory

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Abstract

With the rapid development of Internet technology, Internet companies rise rapidly in all areas of the society, and have become a major economic way and also a new economic growth point in the modern era. This heralds the coming of network economy era. It is essential for both managers and investors to evaluate the growth of a listed company. Therefore, academics in China have been giving a lot of attention on the study about the growth of those Internet enterprises. First, on the basis of enterprise growth theory and entropy theory, this paper is aimed at recognizing the factors influencing the development of small and medium-sized Internet enterprises by analyzing questionnaires. Then, the concept of entropy is proposed based on the entropy theory. This research provides a new method for growth analysis and also has a far-reaching significance for the development of the Internet SME.

Key words: Internet SME; Enterprise growth; growth entropy; The evaluation model of growth entropy

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INTRODUCTION

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and have become a major economic way and also a new economic growth point in the modern era. This heralds the coming of network economy era. It is essential for both managers and investors to evaluate the growth of a listed company. Therefore, academics in China have been giving a lot of attention on the study about the growth of those Internet enterprises. First, on the basis of enterprise growth theory and entropy theory, this paper is aimed at recognizing the factors influencing the development of small and medium-sized Internet enterprises by analyzing questionnaires (Cerf and Huddle, 2004). Then, the concept of entropy is proposed based on the entropy theory. Moreover, this paper to determine the index weight of the growth entropy system and construct the growth entropy model for the Internet SME (small medium enterprise) by mathematical model and AHP. This research provides a new method for growth analysis and also has a far-reaching significance for the development of the Internet SME.

1. THEORETICAL BASIS

1.1 Enterprise Growth and Its Influencing Factors

1.1.1 The Definition of Business Growth

Many scholars and experts at home and abroad have defined growth: Bright (1931) believes that the key factors for business growth are the size of the company and the industrial structure. Coase (1937) defines corporate growth from the perspective of business functions. On the basis of this, Penrose (1959) considered the scale of enterprises and the ability to acquire resources; Zhang Zhouzhidan (2007), a Chinese scholar, found that the viability of enterprises should also be included; Lu Xiangjun (2011) found that the sustainability of enterprises is an indispensable factor. Through the literature, as shown in Table 1, the development results of the early enterprise growth theory.

Table 1
Early Growth Theory of Enterprises
 (Early foreign research)

Representative	Theoretical school	Research results
Adam Smith, Marshall	Classical economics	Focus on market size and scope economy
Coase, Chandler	Institutional economics	Internal changes in research management and corporate systems
Raymond Vernon	Business growth cycle theory	Divide business growth into different stages of the life cycle
Penrose	Enterprise core competence theory	Pay attention to the optimization of internal resources of the enterprise
Hanan, Freeman	Organizational ecology theory	Focus on the influence of the external environment of the enterprise

Based on the research of the above scholars, this paper defines growth as follows: The

growth trend is sustainable development, and the core goal is to maximize corporate benefits.

The external growth is the continuous expansion of the scale of the enterprise. The connotation is the multiplication of the viability of the enterprise, the improvement of the quality of the enterprise, and the surge of the development potential of the enterprise. This paper refers to the early growth theory, adds the knowledge involved in contemporary scholars' research, and innovates information technology factors to define the growth concept of Internet small and medium-sized enterprises.

1.1.2 Factors Affecting Corporate Growth

The following are the explorations and conclusions of scholars' growth factors from different fields and perspectives in recent years. Uddenberg (2015) explores the impact of stakeholders on business growth. He finds that shareholders' and managers' expectations of returns and risk preferences affect corporate strategy and its growth. Fraser, Bhaumik, Wright (2015) and so on have paid attention to the important role of financial indicators in investment decision-making, and explored the game and interaction between management and technology in the implementation process. Cebula, Agrawal (2015) and other discover the impact of the external environment on the growth of enterprises. They believe that the difference in geographical location and the increase in local employment rate will affect the development of enterprises. Li Xingguo, Ren Yuanzhang, Gu Dongxiao (2014) found that the company's leadership and strategy, business development forms, IT resources, external environment, etc. are the key factors affecting the growth of the company.¹

¹ <http://www.sinoca.com/news/tech/2015-11-29/453999.html>

Table 2
Summary of Scholars' Research on Enterprise Growth Factors

Scholar	Time	Indicator
Shanmugam	2012	Business size, enterprise age
Yao Jun	2012	Cost control capability, capital operation capability, financial capability, flowRatio, asset increase ratio
Delmar	2013	Enterprise establishment time, scale, industry affiliation
Liu Ligang	2014	Marketing ability, product competitiveness, sales net profit rate
Han Xiaojie	2014	Profitability, asset operation efficiency, property safety, main businessSituation, investment situation, cash flow, inventory turnover
Li Qin	2015	Management organization, executive relationship, etc.
Liu xiaoxi	2015	Enterprise expansion speed, capital profitability, development cycle, Technical research and development capabilities
Huang jinxin	2015	Redundant resources, corporate performance
Liu honglai	2016	Corporate financing structure, debt level, debt maturity, etc.
Li xuhong	2016	Corporate tax rate, turnover tax rate and income tax

1.2 The Growth of Internet Small and Medium-Sized Enterprises and Its Influencing Factors

1.2.1 Internet SME Growth Definition

Most of the traditional growth definitions focus on the expansion of traditional enterprise scale, the increase in the number of employees, and the lucrative earnings. I believe that the above is the foundation of business growth. But business growth is a dynamic process, this only emphasizes the results, However, the definition of the problem of growth process is neglected. Of course, the differences in internal resources of enterprises, the rate of development and other factors have caused their growth mode and sustainability to be inconsistent with other traditional enterprises. Therefore, when defining the growth of small and medium-sized enterprises on the Internet, the growth stages and trends should be taken into account. Based on the above summary, this paper defines the growth of small and medium-sized enterprises on the Internet: under the influence of the macro environment, under the influence of various factors within the enterprise, the development momentum and trend of the enterprise. (Tran, 2015)

1.2.2 Internet SME Growth Factors

At present, there are few domestic researches on the growth of small and medium-sized enterprises on the Internet. It is not possible to intuitively summarize the more representative indicators, and can learn from the research of foreign scholars. At present, there are few domestic researches on the growth of small and medium-sized enterprises on the Internet. It is not possible to intuitively summarize the more representative indicators,

and can learn from the research of foreign scholars. Foreign scholars Tran (2015) through a number of case studies, the factors that influence the development of Internet companies should be reflected in government systems, technological improvements, financial indicators, human resources, information and communication technologies. Malkawi, Alraja (2015) found that organizational operational capabilities, competitive resilience, online access to benefits, and managerial

interest sensitivity are key factors in measuring the growth of Internet companies. Sun Junjie (2009) introduced the customer's satisfaction with products and services, the modernization of management methods and the perfection of the corporate system to evaluate the competitiveness of Internet small and medium-sized enterprises. Zhang Yu (2012) studied the growth of Internet companies by studying the marketing and operational capabilities of Internet companies. According to the above summary,

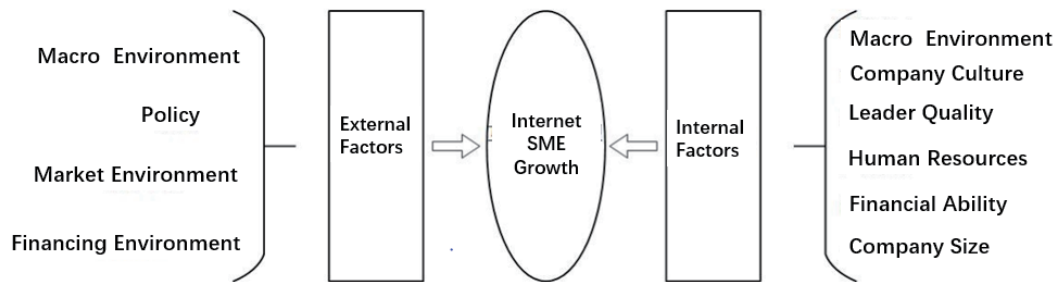


Figure 1
Factors affecting the growth of small and medium-sized enterprises on the Internet

According to the literature summary of the factors affecting the growth of traditional enterprises, 167 questionnaires were distributed to Internet SME employees, and 150 valid questionnaires were collected, with a recovery rate of 89.8%. From the following conclusions (see Appendix I), 20 indicators out of 30 factors are selected as follows:

Table 3
Results of Key Growth Factors for Growth

Customer satisfaction	Technological advancement	Earnings per share	R&D input ratio
Economic level	Financing channel	Competitor quality	Industry growth
Roe	Corporate credit rating	Per capita training	Inventory turnover
Total financial growth rate	Market share	Higher education employees	Senior leadership quality
Policy attention	R&D input-output ratio	Proportion of researchers	Employee turnover rate

1.3 Entropy Theory Definition and Related Research

1.3.1 Entropy Related Concept

Whether entropy evolves from a natural discipline to a social science or other disciplines, it is essentially a function of the state of the system, a measure of the degree of disorder or disorder of the system. The theory will also be unified with certain social science research content (such as systemic) to form new complex disciplines. For example, new discipline nouns such as management entropy were born. However, the application of entropy

theory in management not only includes the order and disorder of entropy theory, but also the efficiency problem of management, and this is an irreversible process. The continuous improvement of entropy theory and the extension of its content illustrate the power and flexibility of entropy theory. Linking it to the new Internet small and medium-sized enterprises is a major practice in the development of entropy theory in enterprise management and even humanities and social sciences.

1.3.2 Related Research on Entropy Theory at Home and Abroad

Kou, Wu (2014) explored the application of entropy in industry. Combining entropy with technology preference theory to measure the functions needed in reconfiguring manufacturing systems, and optimizing the internal combination of the system to a large extent. Tavana, Khalili-Damghani, Rahmatian (2015) used a combination of fuzzy and entropy weight methods to measure the performance of listed companies in the pharmaceutical industry. James (2015) applied the entropy TOPSIS analysis method to supply chain management to further expand the application of entropy theory. In China, Chinese scholar Ren Peiyu (1988) first mentioned management theory to entropy. She believes that management entropy is the law of enterprise movement, and the contradictory movement of enterprise system is that management entropy increases and negative entropy values are very complicated in the system. The result of the unity of opposites that depend on each other's struggles. Ma Xiaowei, Ye Wei (2014) used entropy theory to measure the complexity and evolution of China's energy consumption and industrial structure.

Qiu Shan (2016) constructed an entropy evaluation model of cultural industry, and evaluated the cultural concentration of 30 provincial administrative units in China. Xie Dongmei (2016) introduced the management entropy related to the communication field and proposed the marginal communication for the first time. The concept of solvency and cumulative communication resolution.

2. CONSTRUCTION OF THE GROWTH ENTROPY EVALUATION MODEL FOR INTERNET SMALL AND MEDIUM ENTERPRISES

2.1 The Entropy of the Growth of Small and Medium Enterprises on the Internet

In the enterprise system, the entropy theory refers to the continuous consumption of substances, energy, information, etc. That are applicable within the enterprise as the enterprise continues to develop. The positive effects of various elements within the system will gradually weaken, which will have side effects on the growth of the company and hinder the further development of the company. The so-called growth entropy proposed by the author is to measure whether the various elements within the enterprise system are in an orderly condition, and to present an effective effect on the growth of the enterprise, that is, the amount of invalid energy and effective energy. If new elements and new elements are not introduced, the inefficient energy will gradually increase, and the growth entropy of the enterprise will increase, and the growth of the enterprise will continue to decline.

Based on the research on the factors affecting the growth of small and medium-sized enterprises on the Internet, internal factors are divided into growth ability and growth potential. Growth ability is external explicit performance; growth potential refers to hidden potential power, is the representative of development trend, and the two are the internal motivation of enterprise development. The external influence factor is called the growth environment, which is outside the growth of the enterprise. For reasons of influence. The three are indispensable, so the Internet small and medium-sized enterprise growth entropy evaluation model includes the measurement and analysis of these three dimensions. In summary, due to the interaction of the three, enterprises will show different growth states. The growth environment incorporates the impact of the external environment into growth capabilities and growth potential. Under the influence of the environment, the mutual transformation of the two is affected by it. When the external environment is favorable, as shown in Figure 2, the potential and capabilities within the enterprise will become more favorable, and vice versa.

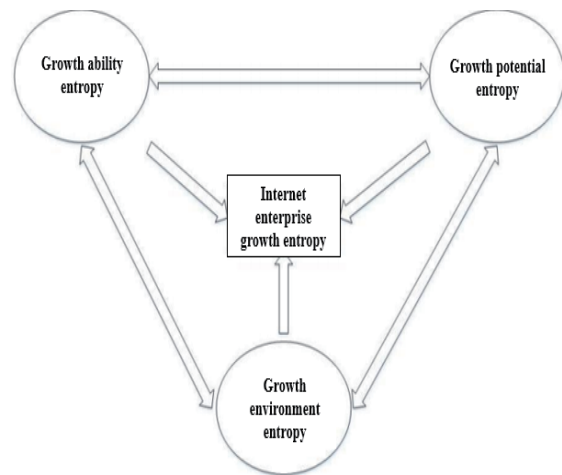


Figure 2
 Evaluation model of growth and entropy of Internet small and medium-sized enterprises

2.2 The Construction of Mathematical Model of Internet Small and Medium Enterprises

Reference entropy theory and related academic papers, the calculation formula of this paper is as follows.

$$ds_n = \sum k_m s_m \quad (1)$$

Among them: k refers to the weight of each indicator, m is the sample data representing the third level indicator, ds_m indicating the entropy value generated by the indicator above the third level indicator.

The calculation formula for the sub-indicators is as follows:

$$ds_m = -K_a \frac{Y_m}{y_m} \ln \frac{Y_m}{y_m} \quad (2)$$

Where K_m is the growth entropy coefficient, because of the relationship between the characteristics of entropy itself, the negative entropy value is often studied. Y_m is the standard deviation of the indicator, and y_m is the average value of the sample selected in this paper.

The overall formula calculation process is as follows:

a. Based on the 17 key factors extracted from 150 questionnaires, build a growth indicator evaluation system;

b. Calculate the growth index matrix of the first-level indicator A.

$$A = (ds_1, \dots, ds_n)$$

c. Calculate the weight of the indicator, construct the weight matrix B

Based on 30 questionnaires and yaaph analytic software, the weights of each factor are calculated:

$$C_n = \begin{pmatrix} C_1 \\ \dots \\ C_n \end{pmatrix}$$

d. The resulting total entropy is calculated as follows:

$$ds_{sum} = A * C_n = (ds_1, \dots, ds_n) * \begin{pmatrix} C_1 \\ \dots \\ C_n \end{pmatrix} \quad (3)$$

The isolated entropy flow of the model refers to the data of the selected three levels of indicators, which are selected and collected by the mathematical model. After weighting with the corresponding weights, a single growth entropy flow value of each index of the research object is calculated. Therefore, the analysis of the corresponding elements one by one can obtain the relevant results. The size of the entropy has a roughly negative correlation with the evaluation of the growth of the enterprise. That is, the smaller the entropy value, the better the growth of the enterprise.

Combine the results of the calculation with the early Raymond enterprise growth cycle theory. According to the total entropy value, analyze the corresponding entropy value at which stage of the enterprise growth long cycle, and analyze the enterprise entropy flow value and enterprise at this stage. Characteristics and development trends of the industry stage.

2.3 Establishment of the Evaluation Index for the Growth of Small and Medium-Sized Enterprises on the Internet

In accordance with the principle of constructing the index system scientifically, minimizing and manipulating, the influencing factors of the hierarchical division are transformed into indicators that can evaluate the growth entropy of small and medium-sized enterprises on the Internet.

Table 4
Internet Small and Medium Enterprises Growth Entropy Evaluation Index System

Growth ability entropy	Profitability	Roe
		Net profit
		Return On Total Assets
	Solvency	Assets and liabilities
		Current ratio
	Operational capability	Inventory turnover
		Accounts receivable turnover
	Technological innovation capability	R&D input-output ratio
		R&D investment ratio
	Growth potential entropy	Financial growth potential
Net asset growth rate		
Human resource potential		Per capita training expenditure
	Proportion of researchers	
Growth environment entropy	Macro environment	Policy support
		The level of economic development
	Financing environment	Financing channel
		Corporate credit rating

The final evaluation index system is shown in Table 4. The indicator system has a total of 28 measurement indicators and is divided into three levels. The growth entropy of Internet SMEs is evaluated from the three dimensions of growth entropy introduced above.

2.4 Establishment of Indicator System Weight

This paper uses expert scoring and analytic hierarchy process to determine the weight of indicators at all levels. In this paper, 40 questionnaires were distributed to middle-level leaders of Internet small and medium-sized enterprises, and 30 questionnaires were collected, with a recovery rate of 75%. The initial scores of the importance of each level of indicators (see Appendix 2 for details), calculate the average score, construct a judgment matrix, and conduct a consistency test. Because the consistency ratio of the judgment matrix is less than 0.1, the consistency test is passed. The pairwise comparison matrix attribute table is shown in Table 5. Using the analytic hierarchy calculation software yaahp to calculate the weight of each factor is shown in Table 6.

Table 5
Judgment Matrix Factor Attribute Table

Score	Interpretation
1	a factor is as important as b factor
3	a factor is slightly more important than b factor
7	a factor is more important than b factor
9	a factor is very more important than b factor
2,4,6,8	Median of the above two comparisons

Table 6
Partial Weights Calculated by Yaahp Software

Internet small and medium enterprises
The judgment matrix CR value is: 0.0516; the total target weight: 1

Internet small and medium enterprises	Business potential	Business environment	Business capability	Wi
Business potential	1	0.5	1	0.2599
Business environment	1	1	1	0.3275
Business capability	2	1	1	0.4126

Business potential
The judgment matrix CR value is: 0.000; the total target weight: 0.2599

Business potential	Financial growth	Human resource growth	Wi
Financial growth	1	0.5	0.3333
Human resource growth	2	1	0.6667

3. SUMMARY AND OUTLOOK

3.1 Conclusion

3.1.1 Establish an Open System Mechanism Based on Entropy

As a system, an enterprise can only maximize profits by operating in an orderly manner. According to the analysis of the total entropy value in this paper, the effective combination of the system will continue to be consumed continuously. Internet companies themselves are characterized by rapid development and rapid

replacement. Therefore, it is necessary to establish an open system mechanism to introduce external resources in an appropriate and orderly manner to offset the ineffective energy generated during the operation of the enterprise.

Secondly, it is best to use the changes in the external environment to avoid risks and coordinate internal and external. At the same time, after improving their internal systems, the company pays close attention to changes in the external environment and information, and actively introduces new knowledge from the outside world. Reduce all the costs that can be circumvented and provide good conditions for open system mechanisms.

3.1.2 Create an Innovative Atmosphere Based on Ability Entropy

For Internet companies, innovation and technology are a pair of “connected infants” hidden on the road of corporate growth. For a new type of industry, technology blessing is an indispensable factor, and it can seize the opportunity when entering the market.; The emphasis on innovation allows companies to introduce negative entropy flows at all times throughout the growth cycle, maintaining the company’s low entropy growth. According to the survey results of the questionnaire, management pays great attention to technology research and development and innovation. In innovation, it pays attention to efficiency, saves innovation costs, and effectively stimulates innovative personnel. In the whole system of the enterprise, the whole staff is guided to participate and actively innovate; the innovative concept is injected, the existing system is rigid and self-styled, and the negative entropy flow is introduced to hedge the dissipation generated by the internal system.

3.1.3 Build a Talent Selection System Based on Potential Entropy

The core competitiveness of an enterprise is talent, although the cultivation of personnel does not directly create benefits like sales. However, the attention to talents is indeed the foundation of the future development and development of the company. According to the model’s potential for the company, it is essential for the cultivation of future personnel. First of all, corporate employees can learn from the outside world while paying attention to internal training and learning, including customers, competitors, etc., so that the learning atmosphere can bring vitality to the whole enterprise.

In addition, in the selection of personnel, it is not limited to one, focusing on the development capabilities of the current enterprise while paying attention to its potential for development. Because capacity and potential are part of the development of the enterprise, the continuous infusion of vitality affects the development of other subsystems. Only when all subsystems work toward one goal can the synergy of the entire system be enhanced. Strengthen the operation and governance dimension based on subsystem entropy.

3.1.4 The State of the Enterprise Is Determined by the Operation of the Enterprise Machine

Mature theoretical conditions and skilled execution can exert the greatest value. It can be dialectic in the analysis of subsystems. Since most of the small and medium-sized companies in China have developed from the original high-tech enterprises, the previous business model has not Suitable for Internet small and medium-sized enterprises with high development status. In a short period of time, it is necessary to make timely adjustments, increase the company’s governance, introduce new management talents, and find ways to manage the company itself. Only in this way will the enterprise not be completely defeated by the original state control when the threshold of the system instability is critical.

3.2 Research Limitations

The research on the growth of small and medium-sized enterprises on the Internet is a complicated project. It is true that Internet small and medium-sized enterprises belong to emerging enterprises, and the number of relative research is small. Due to limitations in time and ability, this study still has the following shortcomings:

- Growth evaluation indicators are relatively subjective. The key influencing factors of this paper’s growth are the extraction of questionnaires based on the literature summary, with great limitations.
- In the process of model analysis, the impact of three dimensions on the growth of small and medium-sized enterprises on the Internet was analyzed, but the interaction between internal factors of dimensions was not taken into account.

3.3 Future Prospects

Although entropy theory is derived from the theory of thermodynamics, entropy theory is universally applicable to systems. In recent years, more and more management studies have introduced theories of natural sciences and have proven to be viable. The growth research of small and medium-sized enterprises on the Internet has a profound impact on the management of small and medium-sized enterprises on the Internet, investors, and even employment.

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