

Research on Agility Development of Energy Enterprises under the Background of Carbon Emission Trading

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Abstract. In recent years, environmental problems caused by greenhouse gas emissions have attracted more and more attention. Under increasing cost pressure, energy enterprises have become one of the targets to control carbon emissions. Taking China Guodian Corporation as an example, it is of great significance to study the agility development of China's energy enterprises under the carbon emission trading system. This paper uses content coding analysis method to explore the influencing factors of agility of energy-based enterprises in China and the specific degree of influence. Through research, it is found that corporate culture, leadership awareness and internal competition have a positive effect on the agility of energy-based enterprises. This study develops the relevant theories of energy-based enterprises from the perspective of agility and finds a key breakthrough for energy-based enterprises to cope with the pressure of carbon emission reduction and optimize their operations.

1 Introduction

Since 2005, European and American countries have launched carbon trading markets one after another. Foreign related research started earlier, which can provide inspiration and reference for studying China's carbon emission trading quota allocation and agility of energy-based enterprises. In 2017, China proposed to launch a national carbon emissions trading system^[1]. The construction and development of a carbon trading market will have a huge impact on high-carbon risk industries such as energy-based enterprises (mainly referring to non-green power enterprises and high-carbon and high-emission energy-related enterprises). Therefore, it is very necessary and urgent to use the methods and theories introduced in this chapter to carry out research on agility development of energy-based enterprises under the background of carbon emission trading in China^[2].

The term "agility manufacturing" was first coined by General Motors of the United States and Iacocca Institute and evolved. In recent years, literatures mainly study enterprise agility from the perspective of management and information science. The academic community has yet to reach a consensus on the definition and extension of agility^[3]. In the domestic research literature, a concept highly related to enterprise agility is response. Goldman^[4] pointed out that an enterprise with flexibility and agility can make profits under unpredictable circumstances according to changes in internal and external environment. Ganguly^[5] took Apple Company as an example to analyze the relevant indicators of enterprise agility, and selected three

indicators of market share, market response time and cost effect to analyze. Conforto^[6] proposed a complete definition of agility based on frame semantic analysis. Follow-up research as business leaders and human resources professionals realize the importance of agility, they propose the concept of strategic agility and begin to explore the in-depth relationship between strategic agility and human resources management^[7], entrepreneurial teams^[8] and corporate performance^[9]. Combined with the research purpose of this study and the previous domestic and foreign literature, this paper defines the agility of energy-based enterprises as the measures taken by enterprises to adapt to their survival and development under the influence of one or more influencing factors.

The agility evaluation index system of energy-based enterprises under the background of carbon emission trading constructed in this paper is helpful for managers of energy-based enterprises to evaluate the comprehensive coping ability of enterprises and find out the problems of energy-based enterprises' growth then take targeted measures. This is also the innovation of this article.

2 Research method

2.1. Method Selection

This paper aims to explore the key factors and influencing mechanism of agility of energy-based enterprises under the background of carbon emission trading. Case study is a good choice^[10], Because "the

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factors affecting agility of energy-based enterprises" and "the ways in which these factors affect agility" are complex phenomena in energy and management.

2.2. Case description

The object of the case study selected in this paper is China Guodian Group Company (hereinafter referred to as the Company), which is mainly based on the following considerations: First, China Guodian Group Company, established in 2002, is a comprehensive large-scale power group mainly focused on power generation and a large-scale central enterprise at the deputy ministerial level. Its development speed is fast and its benefits are good. The world's top 500 enterprises, which have undergone many rounds of restructuring, are typical energy-based enterprises. Second, China Guodian Corporation can provide abundant data. The researchers of this case and the senior management of China Guodian Corporation have maintained a long-term friendly relationship to facilitate interviews and the acquisition of case data.

2.3. Data collection and coding

The main sources of the data in this paper are as follows: our research team sorted out nearly 300,000 words of written records and learned a large amount of first-hand information through comprehensive interviews and exchanges with the grass-roots and middle-and high-level employees of the National Energy Investment Group Co., Ltd. (formerly China Guodian Corporation) in 2019. This paper adopts content coding analysis to gradually code the collected interview data, the process is as follows: first, classify and summarize the screened effective data and sort out 7 items, namely: corporate culture (C), leadership awareness (L), internal competition (P), corporate agility (Q), corporate culture and corporate agility (C-Q), leadership awareness and corporate agility (L-Q), internal competition and corporate agility (P-Q). After preliminary screening, comparison before and after, literature search and other methods, 36 items with problems were eliminated from 267 data items, and the distribution of the number of items in the remaining valid items is shown in Table 1:

Considering that too few items mean that this dimension is not significant, this study excludes dimensions with items less than 1% of the total number of items in the category. The following is the case analysis process:

3 Content coding analysis

For ease of presentation, this article numbered 10 interviewees of China Guodian Group Company, and they were respectively named R1, R2R10.

3.1 Corporate culture

Table 1. List of Categories and Number of Entries Distribution

Category	Number of entries
Corporate culture	41
Leadership consciousness	52
Internal competition	27
Enterprise agility	39
The relationship between Corporate culture and enterprise agility	26
The relationship between leadership consciousness and enterprise agility	27
The relationship between internal competition and enterprise agility	19

Enterprise culture is a non-material soft constraint accompanying the enterprise^[11], which regulates the behavior and thoughts of employees in the enterprise management process. After encoding valid data, this paper finds that there are three main indicators of corporate culture: values(C1), humanistic care(C2) and management style(C3). Value concept is a belief system about value formed by people in the long-term practice process, which determines the pursuit and value orientation of life. Humanistic care^[12] emphasizes attention to people's spiritual life and rich and varied individual needs. The enthusiasm, initiative and creativity of people in enterprises full of humanistic care are fully stimulated. The management atmosphere is the default order and working atmosphere among the workers involved in management functions.

3.2 Leadership consciousness

Leadership consciousness is the direction of an enterprise's development and is also the core and soul of the enterprise. Through comparison and selection of effective items, it is found that leadership consciousness can be divided into three dimensions: carbon trading consciousness (L1), organization of carbon trading activities (L2) and improvement of carbon trading system (L3). The awareness of carbon trading will affect the decision-making of high-level enterprises in the carbon trading market, thus affecting the response countermeasures of energy-based enterprises. The organization of carbon trading activities is a key factor to measure the strength of leadership awareness. These activities will promote the promotion of carbon trading and the agility of enterprises of various units and subsidiaries in a carbon constrained environment. Perfecting the carbon trading system will provide firm institutional guarantee for the normal conduct of carbon trading activities of enterprises and give them flexibility to adapt to macro conditions.

3.3 Internal competition

Internal competition is a game between green energy and black energy companies facing the market and the future under energy-based enterprises. It can be found that there are two dimensions of internal competition: carbon

emission reduction competition^[13] (P1) and carbon investment competition (P2). The competition for carbon emission reduction is a game in which green energy companies gain benefits and policy support because of carbon emission reduction and black energy companies face rising costs because of carbon emission. Carbon investment competition is a competition within energy-based enterprises in the investment and financing market under the condition of preferential supporting policies.

3.4 Enterprise agility

Enterprise agility is a measure taken by an enterprise to adapt to its survival and development under the influence of one or more influencing factors. Through the analysis of valid data, it is found that enterprise agility is mainly divided into three dimensions: agility of policy regulation (Q1), operational agility(Q2) and cooperative enterprise agility(Q3). Agility of policy regulation is the internal notification and response to the call for carbon emission reduction instructions and regulations in the context of carbon emission trading. Operational agility is a practical measure taken by an enterprise at the operational level in response to constraints. Agility of cooperative enterprises is the degree to which upstream and downstream companies respond to external variables. Figure 5 details the dimensions and typical entries of Enterprise agility.

3.5 The relationship between Corporate culture and enterprise agility

According to the calculation of three dimensions of enterprise culture and three dimensions of enterprise agility, theoretically there are nine dimensions of relationship between enterprise culture and enterprise agility. However, through screening and coding, it is found that there are actually three main dimensions of the relationship between corporate culture and corporate agility in this study: the relationship between values and operational agility, the relationship between management culture and operational agility, and the relationship between humanistic care and cooperative enterprise agility. Table 2 lists the dimensions and typical items of the relationship between enterprise culture and enterprise agility:

Based on the principle of easy understanding, this study determines the strength of the dimension relationship according to the following principle: when the number of items in a dimension of a relationship is not less than 40% of the total number of items in the category, it is determined that the relationship between the two is stronger and vice versa. Under such analysis rules, the total number of items collected for the relationship between enterprise culture and enterprise agility is 36. Under this category, if the number of items is greater than 14, the dimension relationship is stronger. Therefore, the following analysis results can be obtained: there is a strong correlation between management culture and operational agility. In addition, the total number of

items related to corporate culture and corporate agility, leadership awareness and corporate agility, internal competition and corporate agility is 72, of which 36 items are valid, and each variable accounts for 50% of the total number of items related to corporate agility. It can be determined that there is a strong correlation between corporate culture and corporate agility.

From this, the following analysis results can be obtained: A1: There is a weak correlation between values and operational agility. A2: There is a strong correlation between management culture and operational agility. A3: There is a weak correlation between humanistic care and agility of cooperative enterprises. A4: There is a strong correlation between enterprise culture and enterprise agility.

Table 2. Dimensions and Typical Items of the relationship between Corporate culture and enterprise agility

Dimensions(entries)	Typical entry
C1-Q2: Relationship between Value Concept and Operational Ability (10)	How do you know without trying? We have invested a great deal of manpower and material resources. Even if we fail to reach the expected emission reduction target in the end, we will still be living happily.
C3-Q2: Relationship between Management Style and Operational Agility (17)	Although we are the president, we usually don't reduce the staff. At this critical juncture, how can we give up lightly because of the repeated trial and error of our employees?
C2-Q3: The Relationship between humanistic concern and Agility of Cooperative Enterprises (9)	We will also send researchers to assist the coal industry in developing clean energy when needed by upstream enterprises, so as to achieve the goals of reducing costs, increasing efficiency and achieving win-win results.

3.6 The relationship between leadership consciousness and enterprise agility

Using the same analytical method and standard, we can obtain the following analytical results^[14]: A5: there is a weak correlation between organizational carbon trading activities and the agility of policy norms. A6: there is a strong correlation between improving carbon trading system and operation agility. A7: there is a strong correlation between leadership awareness and enterprise agility.

3.7 The relationship between internal competition and enterprise agility

Using the same analytical method and standard, we can obtain the following analytical results: A8: There is a weak correlation between carbon investment competition and the agility of policy regulation. A9: There is a strong correlation between carbon emission reduction competition and operational agility. A10: There is a

weak correlation between carbon emission reduction competition and agility of cooperative enterprises. A11: There is a strong correlation between internal competition and enterprise agility.

3.8 Enterprise Culture, Leadership Consciousness and Internal Competition Affect Enterprise Agility Model

Taking Guodian Corporation of China as an example for case analysis, this paper puts forward a model of corporate culture, leadership awareness and internal competition affecting corporate agility, as shown in Figure 1:

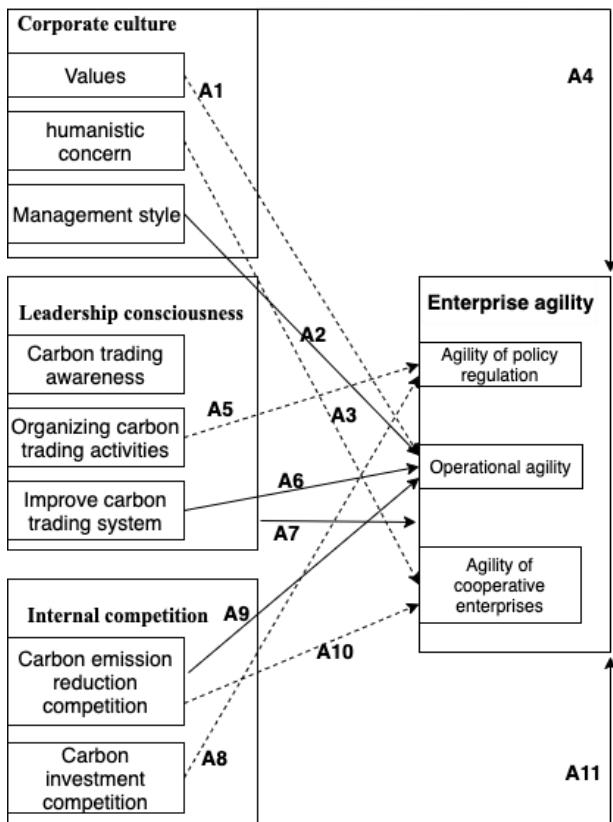


Fig.1. Model of Enterprise Culture, Leadership Consciousness and Internal Competition Affecting Enterprise Agility

Note:

Solid lines indicate strong dimensional relationships;
 Dashed lines indicate weak dimensional relationships.

4 Conclusion

Through interviews with senior and middle-level personnel of China Guodian Corporation and coding analysis based on the collected documents and data, the following conclusions are drawn in this study:

First, the enterprise culture of energy-based enterprises can promote the development of enterprise agility. From A1, A2 and A3, it can be seen that management culture plays the greatest role in promoting enterprise agility. A good management style can make the company run more efficiently, thus accepting new

things better and faster. This kind of atmosphere will drive the company's personnel to adapt to environmental changes quickly and make timely adjustments, thus promoting the development of enterprise agility. As for values and humanistic care, their promotion to enterprise agility is not obvious, which can also be explained. Values are a person's pursuit of life. It is difficult for everyone to achieve a consistent pursuit of life. Some people can respond quickly to changes in the environment, while others have been pursuing and maintaining the old environment. If it were not for pressure and policies, values would be difficult to change. Humanistic care is the product of management culture. Only a healthy management style can breed humanistic care. Humanistic care can mobilize the initiative of individual employees, but it cannot play a role alone.

Second, the leadership consciousness of energy-based enterprises can promote the development of enterprise agility. As can be seen from A5 and A6, improving the carbon trading system has the strongest promoting effect on enterprise agility. The company's internal carbon trading system has been improved, and there will be rules and laws to follow when registering and trading. In fact, these energy companies do. On the one hand, it protects the legitimate and legitimate interests of these energy-based enterprises; on the other hand, it also sets up barriers for individual companies seeking benefits under the background of carbon emission trading. It seems that organizing carbon trading activities can promote the development of enterprise agility. However, through interviews, we know that most of these carbon trading activities are to cope with inspection and publicity, making the response to carbon emissions trading superficial, paying attention to forms, and not giving full play to its due working effect. If you want to promote the development of agility of energy-based enterprises, seriously organize carbon trading activities and pay attention to quality rather than quantity will be a good starting point.

Third, Internal competition of energy-based enterprises can promote the development of enterprise agility. As can be seen from A8, A9 and A10, the competition for carbon emission reduction has the strongest promotion effect on enterprise agility. We can infer that green energy companies have gained benefits and policy support because of carbon emission reduction. On the contrary, black energy companies are facing challenges in terms of rising costs and financial constraints because of carbon emissions. Under such circumstances, black energy companies either choose to withdraw from the market and close down, or transform and upgrade to take the road of ultra-low emission. Under the pressure of survival, these companies that chose the latter naturally took the road of coping with environmental changes and keeping pace with the times, and this choice also promoted the development of enterprise agility, enabling these enterprises to better meet the requirements of the times and the environment. Relatively speaking, carbon investment competition is relatively weak to promote the development of enterprise agility. Although traditional thermal power and coal

power companies are difficult to gain favor and attention in the capital market, this does not mean that their profitability and living space have been squeezed. Thermal power is still the most important energy source in our country. Bankruptcy of small and medium-sized micro-enterprises can only show the survival difficulties of small energy companies.

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References

1. L.w.Liu , H.j.Zong, E.d.Zhao. Appl. Energy. **124**.199-212(2014)
2. L.w.Liu, X.r.Sun, C.x.Chen. Appl. Energy. **168**. 594-609(2016)
3. Y. Zhou, W. j. Zhong and S. Mei.Science of Science And Management Of S. & T.**36**.70-83(2015)
4. S. L. Goldman, R. N. Nagel and K. Preiss(1995)
5. A. Ganguly, R. Nilchiani and J. V. Farr.Int J Prod Econ.**118**.410-423(2009)
6. E. C. Conforto, D. C. Amaral, S. L. D. Silva, A. D. Felippo and D. S. L. Kamikawachi.Int. J. Proj. Manag.**34**.660-674(2016)
7. M. F. Ahammada, K. W. Glaistera and E. Gomesb.Human Resource Management Review.**30**.100700(2020)
8. Y. j. Xing, Y. p. Liu, D. K. Booijhawon and S. Tarbac.Human Resource Management Review.**30**.100696(2020)
9. T. Clauss , M. Abebe , C. Tangpong and M. Hock.IEEE Trans Eng Manag.(2019)
10. K. M. Eisenhardt.Acad Manage Rev.**14**.532-550(1989)
11. P. Richard.Sociologus.**66**.183-202(2016)
12. B. N. Raveesh, G. S. Gowda and M. Gowda.Indian J Psychiatry.**61**.S693-S697(2019)
13. L. Zhang, H. Zhou, Y. Liu and R. Lu.Inter J Env Res Pub Heal.**15**(2018)
14. Z. X. dong.J. Bus. Econ.**46**-56(2019)