Research on Financial Information Quality Evaluation System of Listed Companies in Low-carbon Environment

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Abstract. The era of low-carbon puts forward higher requirements for information transparency of listed companies. This paper analyzes the quality of financial information disclosure of listed companies as the content, and determines the quality evaluation system of financial information of Chinese listed companies under the background of low-carbon. The system has three first-level indicators of "timeliness", "authenticity" and "integrity", ten second-level indicators and nineteen third-level indicators. Then combined with the analytic hierarchy process and the entropy weight method to calculate its weight, a listed company financial information quality evaluation index model was constructed, which provided a reliable basis for listed companies to improve their competitiveness in the low-carbon wave.

1. Introduction

The era of low carbon has come, and the reduction of energy consumption in the development process of enterprises will have a positive impact on economic development. From the macro level, listed companies have a strong impetus to the economy and a strong influence on the society. Only by promoting the transformation and upgrading of listed companies can we achieve the ultimate goal of green ecological civilization. From the micro level, it is of great practical significance for listed companies to pay attention to energy saving while developing their companies. An objective and accurate evaluation system will guide the company to develop with high quality. Therefore, it is extremely urgent to establish the financial information quality evaluation system of listed companies under the low-carbon environment.

2. Construction of Financial Information Quality Evaluation System of Listed Companies in Low-carbon Environment

This article intends to build a quality evaluation system for financial information of Chinese listed companies under the low-carbon environment, which will assist listed companies in making accurate decisions, and also lay the foundation for listed companies to improve their service levels and enhance their platform competitiveness.
2.1. Design Principles of the Index System

(1) Scientific principles. When conducting research, the evaluator should maintain a scientific and rigorous attitude, based on relevant theories, consider the specific operating conditions of listed companies, combine theoretical models with actual operations, and establish a scientific index system. Only a scientific evaluation system can provide correct guidance for corporate behavior.

(2) Comprehensiveness Principle. The evaluation index system should be able to evaluate the overall overall strength of the platform and not lose any important attributes of financial information disclosure. Therefore, the selection of evaluation indicators should cover the service content of each stage of financial information disclosure.

(3) Operational Principles. The purpose of constructing the financial information quality evaluation index system of listed companies is to obtain countermeasures and suggestions for improving management through the practical application of the index system. Therefore, the indicator system must have good operability, and the data required for evaluating the indicators must have a reasonable and reliable source channel.

2.2. Determination of the evaluation index

Based on comprehensive research at home and abroad, this system has identified three levels of indicator systems, including three first-level indicators of "timeliness", "authenticity" and "integrity", ten secondary indicators, and ten Nine three-level indicators. The specific process is as follows:

(1) Timeliness. Listed companies should collect new internal control systems, accounting systems, and the operation of the company's internal controls in a timely manner in accordance with nationally prescribed standards, collate the collected information, form reports, and disclose to information users in a timely manner, not in advance or Lag, meet the quality requirements of information timeliness.

(2) Authenticity. Listed companies shall objectively and truthfully disclose the content of each part of internal control, and shall not omit or reduce the financial information that should be disclosed but not disclosed; relevant regulatory authorities shall conduct fair, just and open supervision to ensure the authenticity and reliability of the disclosed information.

(3) Completeness. According to regulations, when an enterprise establishes and implements effective internal control, the content of financial information disclosed to the outside should include the five major elements of internal environment, risk assessment, control activities, information and communication, and internal supervision to ensure the quality of information.

2.3. Establishing a hierarchy

The establishment of the index system and the implications of each index are as Table 1 shows.
Table 1. Financial information quality evaluation index

| First-level | Secondary and tertiary indicators | Assignment |
|-------------|-----------------------------------|------------|
| A Timeliness | A1 Publication Date of Annual Report | January-March = 5; April = 3; after April = 1 |
| B Authenticity | B1 Whether to disclose CPA annual financial statements | Yes = 5; No = 3 |
| | B2 Type of audit report issued by CPA | Standard = 5; With emphasis section = 4; Reserved opinion = 3; Unable to express opinion = 2; Negative opinion = 1 |
| | B3 Change the accounting firm | Yes = 5; No = 3 |
| | B4 Be investigated or punished (criticized) by regulatory authorities or exchanges or not. | Yes = 5; No = 3 |
| C Integrity | C1 The internal environment | Yes = 5; No = 3 |
| | C12 Whether the (Vice)chairman and general manager are "two jobs in one" | No = 5; Yes = 3 |
| | C13 Whether to disclose the establishment of an audit committee | Yes = 5; No = 3 |
| | C14 Disclosure of information regarding hr policies | |
| | C15 Disclosure of corporate culture | |
| | C2 The risk assessment | Yes = 5; No = 3 |
| | C21 Discuss whether to disclose internal and external risks | |
| | C22 Disclosure of adjustment risk response measures | |
| C3 Control activities | C31 Disclosure of sales and collection controls | Disclosure and detailed content = 5; Disclosure but brief content = 3; Failure to disclose = 1 |
| | C32 Disclosure of purchase and payment controls | |
| | C33 Disclosure of financing and investment controls | |
| | C34 Disclosure of inventory controls | Yes = 5; No = 3 |
| | C35 Disclosure of monetary and capital controls | |
| | C36 Disclosure of control over related party transactions | |
| | C37 Whether the control of fixed assets is disclosed | |
| C4 Information and Communication | C41 The number of board meetings held | 1-4 times = 1; 5-9 times = 3; 10 or more times = 5 |
| | C42 Whether the investor relationship management mechanism is disclosed | Yes = 5; No = 3 |
| C5 Internal supervision | C51 Whether the internal control self-evaluation report is disclosed | |
| | C52 Disclosure of material defects in internal control | |
| | C53 Whether the establishment of internal control organizations and audit departments | 5 for all Settings; Let's just say that one is equal to 3; 1 for not set |

3. Determine indicator weights
This article uses a combination of subjective weighting method and objective weighting method to determine the index weight. For the weight of the first-level indicators, subjective empowerment is adopted by the expert survey method. The author specifically interviewed more than 40 experts from academia and industry to conduct a questionnaire survey, and gave experts on the timeliness, authenticity and integrity of financial information disclosure as weights that they considered reasonable.
In this paper, the timeliness weight of 19.40%, the authenticity weight is 33.42%, and the integrity weight is 47.64%.

Regarding the determination of the weights of the second and third level indicators, this article will use the entropy weight method to measure the weights. According to the degree of variation of each index, the information entropy of each index is obtained. The entropy weight of each index is calculated using the entropy, and then each the weight of the item index finally determines the relatively objective weight, which reduces the impact of the subjective factors of empowerment. Because the entropy weight assignment requires that the values are all non-zero positive integers, we assign the above indicators to intervals ranging from 1-5. The specific calculation steps of the entropy weight method are as follows (with N samples and M evaluation indexes).

(1) Add the scores of all the j-th indicators of the N samples and record them as:

$$\sum_{i=1}^{N} X_{ij}$$  \hspace{1cm} (1)

(2) Calculate the proportion of the j-th index value of the i-th sample:

$$P_{ij} = \frac{X_{ij}}{\sum_{i=1}^{N} X_{ij}}$$  \hspace{1cm} (2)

(3) Calculate the entropy of the j-th index:

$$E_j = -K \sum_{i=1}^{N} P_{ij} \ln(P_{ij})$$, among them \( K = \frac{1}{\ln(N)} \)  \hspace{1cm} (3)

(4) Calculate information entropy redundancy:

$$D_j = 1 - E_j$$  \hspace{1cm} (4)

(5) Calculate index weight:

$$W_j = \frac{D_j}{\sum_{j=1}^{M} D_j}$$  \hspace{1cm} (5)

(6) Calculate the internal control disclosure quality evaluation score of real estate listed company i:

$$S = \sum_{i=1}^{M} W_j \times X_{iN}$$  \hspace{1cm} (6)

(1) Calculation of quality evaluation model for financial information disclosure

(1) Calculation of timeliness A:

$$A = A_i \times W_{ai}$$  \hspace{1cm} (7)
② Calculation of authenticity B. According to the entropy weight method, the weights of the secondary indicators of authenticity are, respectively, \( j = 1,2,3,4 \).

\[
B = \sum_{j=1}^{4} B_j \times W_{Bj} \tag{8}
\]

③ Calculation of completeness C

According to the entropy weight method, the weights of the second-level indicators of completeness are \( W_{C1}, W_{C2}, W_{C3}, W_{C4}, W_{C5} \), and the weights of the third-level indicators are, respectively, \( W_{C1j}, j=1,2,3,4,5 \), \( W_{C2j}, j=1,2 \), \( W_{C3j}, j=12,3,4,5,6,7 \), \( W_{C4j}, j=1,2 \), \( W_{C5j}, j=1,2,3 \).

\[
C = W_{C1} \times \sum_{j=4}^{4} C_{1j} \times W_{C1j} + W_{C2} \times \sum_{j=1}^{2} C_{2j} \times W_{C2j} + W_{C3} \times \sum_{j=1}^{2} C_{3j} \times W_{C3j} + W_{C4} \times \sum_{j=1}^{2} C_{4j} \times W_{C4j} + W_{C5} \times \sum_{j=1}^{3} C_{5j} \times W_{C5j} \tag{9}
\]

④ ICIDQI calculation:

\[
ICIDQI = A \times W_A + B \times W_B + C \times W_C \tag{10}
\]

(2) Weights of the second and third level indicators of the financial information disclosure quality evaluation model.

Through Excel software, combined with (1) to (10) entropy weight method to calculate the weight calculation formulas. The weights of all the indicators are shown in Tables 2:

| Table 2. Index weight table of all levels |
|------------------------------------------|
| First-level | Secondary and tertiary indicators | Secondary and tertiary indicators |
| A (0.1940)  | A1 (0.1474)                       | C31 (0.2454) |
| B (0.3342)  | B1 (0.1074)                       | C32 (0.2588) |
|            | B2 (0.0025)                       | C33 (0.2182) |
|            | B3 (0.0320)                       | C34 (0.0202) |
|            | B4 (0.0964)                       | C35 (0.0344) |
| C (0.4764)  | C11 (0.0019)                      | C36 (0.0356) |
|            | C12 (0.0122)                      | C37 (0.0331) |
|            | C13 (0)                           | C41 (0.0315) |
|            | C14 (0.0089)                      | C42 (0.0348) |
|            | C15 (0.0154)                      | C51 (0)      |
|            | C21 (0.0089)                      | C52 (0)      |
|            | C22 (0.0198)                      | C53 (0.0211) |

4. Conclusion

The research results of this paper have certain reference value for the evaluation of the quality of financial information of enterprises in the context of low-carbon. However, in actual application, the scale and industry of enterprises are very different, and the evaluation indicators of quality of financial information will also be different. In addition, for the financial information of enterprises in the low-carbon environment, the impact of subjective factors cannot be eliminated in the process of assigning entropy weights to the evaluation model in the evaluation model, which may have a certain impact on the accuracy of the conclusion. Further improvement and development in later research.
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