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## An Evaluation Model for Financial Reporting Supply Chain Using DEMATEL-ANP

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### Abstract

The quality of corporate financial reporting is not only related to the internal accounting process of the company, but also with a variety of external factors. Therefore, it is necessary for scholars to alter the methods to research problems from the internal to the external, and to propose the concept of "financial reporting supply chain" which will gradually become an important subject in the accounting research and accounting practice. The evaluation results show that: the auditing process plays the biggest role in the optimization process of financial reporting supply chain, which is the base for the effectiveness of the system of financial reporting supply chain.

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### 1. Introduction

At present, researches related with financial reporting supply chain have attracted wide attention from scholars [1, 2]. But the researches of the existing articles on financial reporting supply chain is still in the primary stage that because they mainly focus on the definition, function and aim and formation of implementation [3, 4]. Thus, it lacks of researches on the optimization of financial reporting supply chain.

While as early as in 2003, hosted by Norman Lyle, International Accountant Federation (IFAC) had designed a set of global questionnaire strengthening the process of financial reporting and in August 2005 [5]. It launched a global study on "how to improve the quality of financial reporting supply chain". Therefore, optimizing financial reporting supply chain has become an important issue in financial reporting supply chain research [6]. Based on the establishment of the index system of financial reporting supply chain optimization, this research identifies the key

factors which influence the optimization of financial reporting supply chain by adopting the method of Decision Making Trial and Evaluation Laboratory and Analytic Network Process (DEMATEL-ANP). It therefore provides scientific basis for making the financial reporting supply chain optimization strategy, strengthening the management and control over the financial reporting process, and improving the quality of financial reporting.

DEMATEL-ANP is a model integrates the advantages of analytic network and trial & evaluation to solve the issues of complexity and dependency among different criteria [7]. It has been widely used in finance and banking strategies making, R&D projects, E-learning evaluations, management systems, IT systems and control systems, production scheduling, supply chain management, and so on [8].

Such serious economic cases as Enron Event (Scandal) which are related to accounting issues show that the quality a company's financial report (the accounting information quality) is not only related to the process of the company's internal accounting, but also to many external factors [9]. For

instance, accounting standards, external audit, etc. all exert a direct or indirect influence on the quality of financial reports. In line with this situation, many scholars change their research perspective from the inside of the corporation to the outside impacts to evaluate the quality of financial reporting from a wider scope [9, 10]. And they recommend corporations to take practical measures to implement integrated management over financial accounting reports whose information is false or of low quality. Against this backdrop, financial reporting supply chain emerges as the time requires and gradually become an important topic of accounting research and practice [11].

Table 1. The Evaluation Index System.

FCI	SCI	Evaluation
U1	Sufficiency of information disclosure U11	Board of directors to establish a system to clarify the responsibility and consequences of information disclosure, and to ensure sufficient information disclosure
	Effectiveness of regulation establishment U12	To ensure that corporate governance has a practical effect through rules and regulations
	Balance between governance and strategy U13	Using the CIMA strategy score card, to reach a balance between the obligations and the strategic issues
	Completeness of salary report U14	To disclose the relation between salary reporting and management status
	Completeness of salary report U21	To ensure the simplicity and legibility based on the authenticity and importance of the financial reporting
U2	Guarantee of IT service U22	Companies to provide richer and more convenient accounting information with more extensive usage, such as chart and data which can be converted at will and materials with video data which can be quickly operated.
	Attention to small accounting subjects U23	To make a simple standard for small accounting subjects
	Clearness of statement reporting U24	The company to provide the reader with clear and concise information which will help users to improve their performance
U3	Selection of FRC auditing project U31	To welcome the FRC proposal to increase the range of choice in the UK auditing market
	Equality of identified responsibility U32	To ensure the equality of responsibility and the cooperation principle between auditors and their clients
	Richness of the auditing reporting content U33	To increase the information content of audit opinion
	Convenience of auditing process U34	To successfully coordinate the external reporting and internal management reports to make the accounting process more relevant and convenient, and to reduce the complexity of the audit process
U4	Coordination of financial reporting U41	To closely coordinate the external financial reporting and management reports to provide more relevant and convenient information for the users
	Efficiency of departmental reporting U42	To adopt the newly issued standards by IASB (IRS8 for departmental reporting)
	Completeness of online financial reporting U43	To use XBRL to increase the usage of online financial reporting
	Utilization of statement reporting U44	To attach penetrating statement in the financial data to improve the utilization of financial reporting
	Clarity of fair value U45	To establish a mixed measurement model of fair value

According to the situation of financial reporting supply chain and CIMA’s perspectives, this research selects the evaluation index from corporate governance (U1), financial reporting process (U2), auditing process (U3) and financial reporting utilization (U4) as shown in Table 1 to demonstrate the usage of DEMATEL-ANP model to evaluate the financial supply chain. The most remarkable characteristic of this index system is that the indexes in the same class are not relatively independent but mutually influenced and logically related [12]. Thus, the evaluation of the financial reporting supply chain could be more precise and reasonable. Based on the evaluation results, decision-makings on improving the financial reporting supply chain like operations, behaviours, and executions will be optimized.

The rest of this paper is organized as follows. Section 2 presents the proposed evaluation model based on DEMATEL-ANP. This section describes the key principle of the model in terms of DEMATEL and ANP. Analysis of the evaluation results are also demonstrated in this section. Section 3 summarizes this paper by giving our key findings.

**2. Evaluation Model based on DEMATEL-ANP**

In the process to establish the model of financial reporting supply chain optimization, the logic relations among each index should be given full consideration [12]. Using DEMATEL method to determine the relationship and intensity among the first class indexes, ANP Method is used to calculate the relative weight of second class indexes, thereby to increase the objectiveness and preciseness of the results.

*2.1. DEMATEL Model*

The first step is to judge the direct interrelationship among first class indexes. We should establish a direct relation matrix *A* using Delphymethod [13]. Among them, 0-4 means having no influence, low influence, medium influence, high influence, and very high influence respectively.

$$A = \begin{matrix} & \begin{matrix} U_1 & U_2 & U_3 & U_4 \end{matrix} \\ \begin{matrix} U_1 \\ U_2 \\ U_3 \\ U_4 \end{matrix} & \begin{vmatrix} 0 & 2 & 2 & 2 \\ 2 & 0 & 3 & 3 \\ 3 & 4 & 0 & 2 \\ 2 & 1 & 1 & 0 \end{vmatrix} \end{matrix}$$

$$X = \begin{matrix} & \begin{matrix} U_1 & U_2 & U_3 & U_4 \end{matrix} \\ \begin{matrix} U_1 \\ U_2 \\ U_3 \\ U_4 \end{matrix} & \begin{vmatrix} 0 & 0.222 & 0.222 & 0.222 \\ 0.222 & 0 & 0.333 & 0.333 \\ 0.333 & 0.444 & 0 & 0.222 \\ 0.222 & 0.111 & 0.111 & 0 \end{vmatrix} \end{matrix} \quad T = \begin{matrix} & \begin{matrix} U_1 & U_2 & U_3 & U_4 \end{matrix} \\ \begin{matrix} U_1 \\ U_2 \\ U_3 \\ U_4 \end{matrix} & \begin{vmatrix} 0.543 & 0.719 & 0.664 & 0.730 \\ 0.868 & 0.679 & 0.857 & 0.943 \\ 1.023 & 1.090 & 0.698 & 0.968 \\ 0.553 & 0.467 & 0.431 & 0.375 \end{vmatrix} \end{matrix}$$

The second step is to calculate the standardized direct relation matrix *X\T* through (1) (2) and (3).

$$X = K \times A \tag{1}$$

$$k = \min \left( \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n |a_{ij}|}, \frac{1}{\max_{1 \leq j \leq n} \sum_{i=1}^n |a_{ij}|} \right) \tag{2}$$

$$T = X^1 + X^2 + X^3 + \dots \tag{3}$$

$$= \sum_{i=1}^{\infty} X^i = X(1-X)^{-1}$$

The influencing degree D, the influenced degree R, the center degree D+R and the reason degree D-R of the first class index can be calculated, where D represents the sum of the T matrix elements and R represents the sum of T matrix element. D+R shows the position of certain index in all indicators and the role it plays. If D-R is positive, that means the index has bigger influence than other indicators. It is called reason element [14]. If D-R is negative, that means the index is more affected by other indicators; it is called result element. According to D-R and D+R, we can draw the consequences graph as shown in Fig. 1.

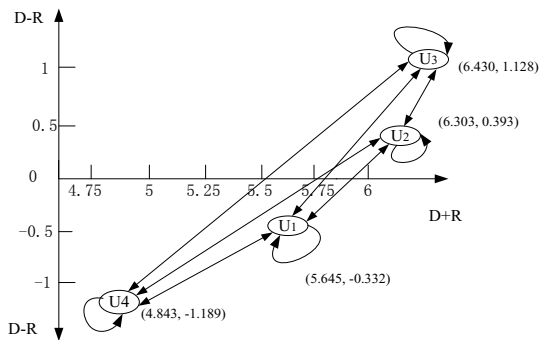


Fig. 1. Consequences of First Class Index.

2.2. ANP Model

According to the consequences graph of first class index drawn by DEMATEL and combined with the actual situation in the financial reporting supply chain optimization process, we can draw ANP network which only has the target layer among the control layer.

This research randomly selected 6 experts and judged the interrelationship between element groups and between single elements respectively to establish a judgment matrix, according to 1-9 judgment scale proposed by the Saaty [15, 16]. With the aid of DECISION SUPER, the judgment matrix of the pair's comparison is entered into the software by using questionnaires to be calculated, and the consistency of the judgment matrix is checked during this process.

When the input of all the data is completed, DECISION SUPER will automatically produce the limit super matrix. According to the result of the limit super matrix, the weight of each evaluation index is determined (as shown in Table 2).

2.3. Evaluation Results

As shown in Table 2, the descending order of importance in optimizing financial reporting supply chain is as follows: the auditing process (0.501), the financial reporting process (0.201) and the use of corporate governance (0.179) and financial reporting (0.111). In addition to the weight of the

element groups, we can also get the weight of the single elements.

Table 2. The weight of each index in financial reporting supply chain optimization.

FCI	SCI	A	B	C	D	E	F	Avg	
U <sub>1</sub> 0.179	U <sub>11</sub>	0.087	0.092	0.101	0.069	0.050	0.101	0.083	
	U <sub>12</sub>	0.050	0.047	0.019	0.052	0.017	0.027	0.035	
	U <sub>13</sub>	0.034	0.035	0.051	0.034	0.014	0.023	0.032	
	U <sub>14</sub>	0.034	0.016	0.025	0.046	0.025	0.022	0.028	
	U <sub>21</sub>	0.086	0.084	0.070	0.092	0.085	0.099	0.086	
U <sub>2</sub> 0.201	U <sub>22</sub>	0.029	0.021	0.026	0.036	0.003	0.018	0.022	
	U <sub>23</sub>	0.034	0.012	0.025	0.016	0.017	0.014	0.020	
	U <sub>24</sub>	0.079	0.073	0.063	0.079	0.064	0.079	0.073	
	U <sub>31</sub>	0.087	0.166	0.153	0.123	0.214	0.126	0.145	
	U <sub>3</sub>	U <sub>32</sub>	0.082	0.044	0.068	0.064	0.095	0.038	0.065
U <sub>3</sub> 0.501	U <sub>33</sub>	0.112	0.106	0.225	0.126	0.205	0.187	0.160	
	U <sub>34</sub>	0.107	0.197	0.102	0.090	0.148	0.194	0.140	
	U <sub>41</sub>	0.018	0.006	0.005	0.030	0.003	0.004	0.011	
	U <sub>4</sub>	U <sub>42</sub>	0.044	0.025	0.016	0.051	0.009	0.014	0.027
	U <sub>43</sub>	0.055	0.043	0.032	0.046	0.038	0.026	0.040	
U <sub>4</sub> 0.111	U <sub>44</sub>	0.041	0.022	0.012	0.032	0.005	0.026	0.023	
	U <sub>45</sub>	0.021	0.011	0.008	0.012	0.006	0.003	0.010	

Among them, the descending order of importance in optimizing the financial reporting supply chain is as follows: Richness of the auditing reporting content (0.160), Selection of FRC auditing project (0.145), Convenience of auditing process (0.140), Conciseness of financial reporting (0.086), Sufficiency of information disclosure (0.083), Clearness of statement reporting (0.073), Equality of identified responsibility (0.065), Completeness of online financial reporting (0.040), Effectiveness of regulation construction (0.035), Balance between governance and strategy (0.032), Completeness of salary report (0.028), Efficiency of departmental reporting (0.027), Utilization of statement reporting (0.023), Guarantee of IT service (0.022), Attention to small accounting subjects(0.020), Coordination of financial reporting(0.011) and Clarity of fair value(0.010).

3. Summary

This research evaluated the index in the optimization of financial reporting supply chain using the evaluation model based on DEMATEL-ANP. The evaluation results show that: the auditing process plays the biggest role in the optimization process of financial reporting supply chain, which is the base for the effectiveness of the system of financial reporting supply chain. The second important factor is financial reporting process which is the central step of financial reporting supply chain interrelated with other internal factors. Corporate governance is the next factor which is the main environmental factor to achieve the optimization of financial reporting supply chain. Finally, it is the utilization of financial reports which determines the oriented goal of financial reporting supply chain.

This paper argues that, in order to effectively achieve the optimization of financial reporting supply chain, it is essential to strengthen auditing supervision and ensure that the audit process is scientific and orderly, in which the auditing function of inspection and supervision is fully played. The financial reporting process should be optimized to ensure steady improvement of the quality of accounting information. Corporate governance should be strengthened to make the company logistics, cash flow and economic activity information flow highly unified. In the meantime, we should emphasize the utilization of accounting information decisions, so that financial reporting supply chain can serve the users of financial information to make decisions. In addition, we should also pay attention to IT service guarantee for accounting information and issues such as small accounting subjects and financial reporting coordination, so that the financial reporting supply chain system can play an even greater role.

Admittedly, there are several drawbacks in this study. Firstly, it did not comprehensively analyze the optimization indicators of the financial reporting supply chain. In future studies, third class indicators can be established to complement and improve the evaluation system. Secondly, the data in this research are mainly subjective ones. Future studies can take the approach of combining subjective data with objective ones to increase the objectiveness of the evaluation. Thirdly, this analysis did not take into consideration important factors such as the actual practice of running the optimization of the supply chain. In this sense, the author can research the topic from these perspectives.

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