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Developing and presentation of appropriate tools to measure the level of compliance with the criteria affecting the environmental performance of industries using the fuzzy DANP approach

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Abstract

The main purpose of this study is to provide appropriate tools for measuring the level of compliance with environmental criteria. In order to achieve this importance, the research process has been carried out in two separate stages. First, after studying the theoretical foundations of the research, in order to identify environmental criteria, a qualitative research method with a descriptive phenomenological approach was used. By conducting purposive sampling until reaching the saturation stage, complete interviews were conducted with 15 people and the validity of the results was obtained by using the research background, referring to the participants and obtaining their agreement. In the second stage, in order to determine the weight and importance of the identified criteria, this issue was addressed by designing a questionnaire and consulting environmental experts with the help of the fuzzy DANP (DEMATEL based ANP) technique. According to the identified criteria and determining the weight and importance of each of them by designing and introducing a standard questionnaire as a tool to measure the degree of compliance, the main purpose of the study was achieved. The result of the research in the first stage is identifying 20 criteria and classifying them into 4 general categories and in the second stage determining the weight and prioritization of each of the above criteria and introducing appropriate tools for observing environmental criteria. Findings of the research are effective in better knowledge and understanding of environmental criteria and the extent of their observance, development of environmental accounting standards by industry and encouraging organizations to implement green accounting and will have desirable consequences.

Keywords: Environmental Performance, Green Accounting, Phenomenological Approach, Fuzzy DANP Technique
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1 Introduction

Excessive use of natural resources and wealth and unbalanced economic and industrial development of countries have increased concerns about environmental issues and also increased public awareness of the environmental respon-

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sibilities of various companies and industries. Accordingly, the environmental dimension of corporate sustainability is the main factor of corporate success and reliability and social responsibility increases the competitive competitiveness of companies [28]. There is official scientific evidence that the emission of greenhouse gases from economic activities, and in particular the burning of fossil fuels for energy production, has caused climate change. In the meantime, industry has been recognized as a major partner in sustainable development and global experience has proven that improving the standard of living in the environment and environmental performance is not possible without the cooperation of industry [10]. Currently, many companies are using the environmental accounting system to find appropriate ways to report and disclose information to the public. Evidence shows that the information provided by the green accounting system is useful for users and plays an important role in their decisions [5]. Environmental and social information reporting deals with the disclosure by the organization of product information, consumer benefits, employee benefits, social activities, and environmental impacts. This disclosure is part of the organization's responsibility to its stakeholders and responds to their expectations [3]. Also, corporate social responsibility based on environmental responsibility in the company has a positive and significant effect on the quality of profits in the company [18] and corporate social responsibility measures may accelerate the process of ensuring environmental sustainability [22]. Accordingly, the main sources of environmental pollution are the industrial sector, in other words, companies and production and industrial units, refineries and power plants. These economic actors, their investors, and on a larger scale, society as a whole, will never succeed unless they are indifferent to the threats to human and environmental well-being in the long run. In such circumstances, governments, stock exchanges, markets, investors, professional legislators, academics, and other community activists call on companies to be transparent about their goals, performance, and impact on sustainability and to promote corporate social and environmental responsibility Becomes environmental sustainability [22]. Of course, the observance of environmental components in companies is not only provided through the performance of domestic firms, but also through transnational pressure from export sales, which enhances environmental performance [8]. The results of the study of the impact of industry on the presentation of environmental reports show a significant difference in the type of disclosure in different industries [15]. Given that each industry has its own pollution related to its own operations, so it will have concerns related to the same type of pollution. Therefore, environmental performance requirements should be considered according to the pollution of each industry. One of the most important performance measurement indicators in companies is evaluating the environmental performance of companies. In this regard, leading companies around the world provocatively use their environmental performance as a strategy for business development in the environment [9]. Because in most free economies, corporate environmental responsibility is a basic principle and is related to the size of government and the volume of economic liberalization [14]. Some Criteria are very key for some industries, while others are not relevant to the industry. As a result, reporting on important Criteria for the industry can provide more relevant information for users. Firms and companies are considered as one of the important environmental stakeholders in the long run as a factor of environmental sustainability. Environmental protection is an integral part of sustainable development, the environment and development are linked through a complex system of cause and effect [22]. Considering the above-mentioned issues and the fact that no purposeful research has been conducted to provide a suitable tool for measuring the level of compliance with environmental criteria at the company level, the purpose of this study is to Accounting, while identifying the variables affecting environmental performance, to introduce appropriate tools to measure their compliance in companies and industries. Therefore, in order to conduct research, it is necessary to identify environmental criteria and introduce appropriate tools in each industry separately. Therefore, by choosing an industry from among the polluting industries, this issue will be addressed.

Therefore, in this study, the cement, lime and gypsum industry in the Tehran Stock Exchange was selected as the statistical population. Therefore, in this study, environmental experts of the industry have been selected as the statistical population in question. In the first part of the research, by studying the theoretical foundations and consulting environmental experts in the cement, lime and gypsum industries, the desired criteria were determined. In studies that aim to determine the status of a phenomenon, hypothesis determination is less important; in other words, in descriptive research that aims to discover existing facts and the researcher cannot predict how events occur, the hypothesis is less important. Therefore, the main research question was posed as follows:

What are the environmental criteria?

After answering the question of the first stage and determining the criteria, in the second stage, in order to determine the weight and importance of the criteria, the following question was answered by designing a questionnaire and receiving the opinions of environmental experts:

Do the identified environmental criteria have different priorities and weights?

Finally, in order to introduce a tool to measure environmental compliance, the following question has been developed:

What is the appropriate tool to measure the level of compliance with environmental criteria?

2 Literature review

Corporate sustainability encompasses all activities and strategies that meet the needs of stakeholders while maintaining the human and natural resources needed by the future. Corporate sustainability encompasses concepts such as social responsibility, corporate governance, and environmental issues. Sustainability issues include financial information and non-financial information, and one of its non-financial dimensions is its environmental dimension [23]. This dimension is related to the set of factors that company managers and investors usually need the most attention when making decisions [4]. The set of environmental factors cannot be the same in all companies. But the most common environmental issues for companies include climate change risk, water and energy management, air pollution [12]. In this regard, following the emergence of environmental issues and the company's responsibility for environmental performance, guidelines, principles, rules and regulations for companies are developed, based on which companies publish their reports on the environmental criteria [17]. It is important to note that environmental issues have become important in recent decades with the increasing growth of industrial development on the one hand and the limitation of environmental resources on the other hand and are expected to attract much attention in the future [20]. It is predicted that environmental criteria will become the factors of success and survival of companies in the future [4]. Environmental performance is a set of operations of the company that is synchronized and compatible with the environment and this performance is mainly measured through criteria and scales [24]. Acceptance of the concept of sustainability and the threat of sustainability is the starting point of all environmental issues. The manufacturing industry and business sectors are the main culprits of the threat to sustainability and have a major impact on the environment. Production, industry and business rely on social legitimacy [19]. Several theories, including the theory of stakeholders, the theory of legitimacy, the agency theory, and the theory of voluntary disclosure, support the future of environmental information. Stakeholder theory states that stakeholders are entitled to the activities of an organization. Accordingly, management must manage the organization in order to maximize the interests of all stakeholders. Managers, based on their commitments to the whole society in order to reduce environmental pollution, effective use of natural resources in the production and operation process and adapt products and services to the environment, engage in their management activities and try to avoid environmental hazards [6]. This theory raises the level of environmental awareness and encourages companies to develop their programs in response to changes in societal demand [13]. On the other hand, according to agency theory, managers emphasize social and environmental performance more than owners, because they spend from the company's resources and not their personal resources. In addition, according to the theory of legitimacy, corporate executives increase their public credibility with society by achieving non-profit goals such as environmental measures. The theory of legitimacy implies that environmental disclosure is a function of the intensity of political and social pressures that companies face with respect to their environmental performance. As a response to this pressure, companies will try to provide more environmental information [7]. According to the theory of voluntary disclosure, companies disclose information in order to eliminate information asymmetry, and companies with better environmental performance disclose more information [27]. Undoubtedly, the point of agreement between these four theories is that companies ultimately tend to provide environmental information to users of financial statements. Therefore, based on the mentioned theories, determining environmental criteria and indicators and providing appropriate tools to measure compliance with them in companies is very important.

The literature on environmental and social reports and information includes studies that have examined various environmental factors. Some of them deal with existing theories such as environmental issues, environmental disclosure, environmental reporting, environmental performance and others. companies use different procedures due to non-mandatory and voluntary submission of environmental issues and do not provide detailed information on environmental performance to the public and only report information in explanatory notes and board reports [11]. This makes it impossible to extract relevant and useful information about the environmental performance of companies from the financial statements. Therefore, in order to measure environmental performance and provide a tool to measure the level of compliance with the criteria, this should be achieved through a qualitative approach and interviews with people involved in the industry.

Companies have only voluntarily presented their environmental performance in explanatory notes and board reports

and have not been quantified [11]. Accounting procedures are limited to the measurement and reporting of economic activities and do not have the ability to report environmental status in the form of accounting figures [25].

Based on the results of previous research, no company wants to provide the public with detailed information on the performance of environmental costs in the annual reports (optional and reluctant). In another study, as long as the disclosure of environmental performance information is non-mandatory and voluntary, companies use different procedures for reporting and the rate of corporate environmental performance fluctuates. This makes it impossible to extract appropriate and useful information regarding the environmental performance of companies from the text of financial statements [1]. Therefore, in order to measure environmental performance, it is necessary to achieve a quality approach and interview with people involved in the industry. Since there is no specific index for ranking the environmental performance of companies [2]. So far, no purposeful research has been conducted using a qualitative approach and the use of local criteria to identify environmental examples at the company level. Therefore, in this study, the criteria and examples of environmental compliance of companies have been identified.

3 Methodology

Considering that the subject of the research is to provide appropriate tools for measuring the degree of observance of environmental criteria in companies, first to determine environmental criteria through a qualitative approach, by interviewing environmental experts in the cement, lime and gypsum industries, this issue was addressed. Therefore, the best research method that can answer the research question in the first stage is a qualitative and phenomenological research method. Researchers consider phenomenology to be the practice that aims to describe specific phenomena or the appearance of things and the experience of individuals. At this stage, the research method is descriptive and sampling is done with maximum variety of purposive sampling. The sample size in this study was determined by reaching the data saturation limit. A total of 15 people, including 1 woman and 14 men in the age range of 35 to 50 years, formed the statistical sample of the study. The duration of each interview varied from 50 to 100 minutes. In order to analyze the data, the seven-step collage method has been used. After determining the main criteria of the research in the first part, in the second part, the weight and priority of the criteria were determined through the fuzzy DANP technique. In order to collect the desired data, a questionnaire was designed to compare the criteria and was judged by environmental experts. Then the data were analyzed by fuzzy DANP technique. The mentioned research is of survey and descriptive type. It is also practical in terms of purpose. After determining the weight and importance of each of the criteria identified by the fuzzy DANP technique, a standard questionnaire was introduced to determine the degree of environmental compliance with the criteria.

4 Analysis and results

In the first stage, the research question was posed as follows: What are the environmental criteria? To answer this question, based on the descriptive phenomenology method and through interviews with environmental experts, the following steps have been performed:

Step 1: After each interview, all the material expressed by the interviewees was entered in text form in a Word file. While doing this, the researcher bracketed any thoughts or ideas he had based on previous studies, which helped identify environmental criteria and criteria.

Step 2: At this stage, meaningful sentences and phrases related to the criteria were extracted from each interview text. These phrases were recorded in a separate file and coded based on the interview number and paragraph number. 120 significant phrases were identified from 15 texts of the interview.

Step 3: Meaningful expressions were extracted and formulated and each of the meanings was coded into a category. All the expressions and their meanings were checked several times to ensure the correctness of the process and the consistency of the meanings.

Step 4: The formulated meanings were categorized and grouped. These categories represent the unique structure of the clusters. Each cluster was coded to include all formulated meanings for the meaning group. The cluster groups, which reflect a particular point of view, were then merged to form a distinct structure of theme or criterion. In fact, all criteria are convergent internally and externally divergent, meaning that each of the "formulated meanings" falls

into only one theme cluster that is semantically distinct from other structures. The 8 clusters were classified into 4 criteria. The final criteria are shown in Table 1.

Step 5: At this stage of the analysis, all criteria were defined in a comprehensive manner. After integrating all the study criteria, the general process of "recognition, compensation, motivation and education" was extracted as a general structure.

Step 6: This step is somewhat similar to the previous, the reduction step was performed and redundant and erroneous descriptions were removed from the overall structure. Some corrections were made to make a clear connection between the clusters and the extracted criteria, and some ambiguous expressions that undermined the overall description were removed.

Step 7: In this step, the research findings were validated. Trustworthiness in research, validity of the findings among the basic principles of qualitative research that are also very important in phenomenological research method. Colaizzi method points to the final validity of each informed person and considers the most important criterion for evaluating the findings of phenomenological research to be the validation of comprehensive descriptions of the phenomenon under study by the participants themselves [26]. This validation was performed by referring to the interviewees again, showing the findings of the results and discussing with them. Finally, all participants expressed their satisfaction with the results, which reflected their experiences.

In managerial and social issues, the interactions of a large number of factors affecting a particular issue can be categorized and organized using the DEMATEL method. This method has been developed through the study of structural relationships in complex systems. Due to the fact that most decisions are made in the absence of certainty, the fuzzy DEMATEL method was proposed. This method uses fuzzy linguistic variables to facilitate decision making in the absence of environmental reliability. In the analytical network process (ANP), feedback and interaction between clusters and criteria are possible [16]. The main reason for combining the DEMATEL method and the ANP and introducing the DANP (DEMATEL based ANP) technique is that to calculate the relationships between elements and components, the ANP forms pairwise comparison matrices and calculates the eigenvectors corresponding to each of the pairwise matrices and then It is placed in a suitable position in the super matrix. This method requires a large number of pairwise comparison matrices to calculate the internal relationship between the elements, which is complicated and takes a lot of time to solve the problem. To deal with this limitation, the DEMATEL method can be used. Compared to the ANP, DEMATEL requires fewer pairwise comparison matrices to calculate the internal relationship between elements and components, which will reduce the computational volume and the level of complexity of the operation. Despite this advantage, DEMATEL is not able to form a super matrix and in contrast to the ANP has this ability. Therefore, to solve this problem, ANP based on the DEMATEL technique, which is called DANP, is used. The DANP method is one of the multidisciplinary decision-making methods that uses the DEMATEL communication matrix, the super matrix forms the ANP and calculates the weight of criteria and sub-criteria. In fact, this method is a combination of DEMATEL method and ANP.

The second question of the research was posed as follows: Do the identified environmental criteria have different priorities and weights? In order to answer the above question, after determining the symbol for the criteria according to Table 1, the fuzzy DANP technique was used and during the following steps, the weight and importance of environmental criteria were determined:

Step 1- Calculate the direct connection matrix (D)

Step 2- Normalize the direct communication matrix

Step 3- Calculate the Complete Criteria Matrix (TC)

Step 4- Calculate the Complete Dimensional Relation Matrix (TD)

Step 5- Calculate the intensity and direction of the effect

Step 6- Normalize the Full Dimension Relationship Matrix ($T_D^{\propto}$)

Step 7- Normalize the Complete Correlation Matrix ($T_C^{\propto}$)

Step 8- Form an unbalanced super matrix

Step 9- Limit the rhythmic super matrix

Step 10- Extract the weight and prioritize the criteria

In the first step, respondents were asked to demonstrate the effectiveness of criterion i over criterion j (preference of criterion i over criterion j in relation to the relevance of environmental criteria) using Table 2. In these matrices $\tilde{x}_{ij} = (l_{ij}, m_{ij}, u_{ij})$ are triangular fuzzy numbers. To take into account the opinion of all experts according to Formula (4.1), an arithmetic mean is taken from them.

$$\tilde{z} = \frac{\tilde{x}^1 \oplus \tilde{x}^2 \oplus \tilde{x}^3 \oplus ...\tilde{x}^p \oplus}{p} \tag{4.1}$$

In this formula, p is the number of experts and $\tilde{x}^1, \tilde{x}^2, \tilde{x}^3$ are the matrix comparison of expert 1, expert 2 and expert p, respectively, and $\tilde{z}$ Is a triangular fuzzy number in the form $\tilde{z}_{ij} = (l'_{ij}, m'_{ij}, u'_{ij})$.

In the second step, the matrix normalizes the mean of direct communication and is called the H matrix. Formulas (4.2) and (4.3) are used to normalize the obtained matrix.

$$\tilde{H}_{ij} = \frac{\tilde{z}_{ij}}{r} = \left(\frac{l'_{ij}}{r}, \frac{m'_{ij}}{r}, \frac{u'_{ij}}{r}\right) = (l''_{ij}, m''_{ij}, u''_{ij}) \tag{4.2}$$

$$r = \max_{1 \le i \le n} \left(\sum_{j=1}^{n} u'_{ij}\right) \tag{4.3}$$

The value of r is equal to the maximum value of the line sum of the upper limit of the merged matrix of comments, which is the highest value in this research is equal to 14.825.

In the third step, after calculating the normal matrices, the matrix of fuzzy total relations is obtained according to formulas 4 to 7

$$T = \lim_{k \to +\infty} (\tilde{H}^1 \oplus \tilde{H}^2 \oplus ...\tilde{H}^k \oplus) \tag{4.4}$$

$$[l_{ij}^t] = H_l \times (I - H_1)^{-1} \tag{4.5}$$

$$[m_{ij}^t] = H_m \times (I - H_m)^{-1} \tag{4.6}$$

$$[u_{ij}^t] = H_u \times (I - H_u)^{-1} \tag{4.7}$$

In these formulas, I is a single matrix and H_l, H_m, H_u each is a $n \times n$ matrix whose constituents are the low number, the middle number, and the high number of the triangular fuzzy numbers of the H matrix, respectively.

In the fourth step, the matrix (T_D) must be extracted from the Criteria Complete Matrix (T_C). Therefore, each element of the T_D matrix is obtained from the average of its sub-criteria in the T_C matrix. If we know each T_D matrix element t_{ij} (Table 3), each t''_{ij} is obtained from the average of each T_C^{ij}.

In the fifth step, to calculate the intensity and the direction of the effect, we calculate the r_i and d_i indices according to equations 8 and 9. The D_i index represents the sum of the ith row and the R_j index represents the sum of the jth column of the T_C matrix with respect to the corresponding dimension. For each $i = j$ we will have:

$$\tilde{D} = (\tilde{D}_i)_{n\times 1} = \left[\sum_{j=1}^{n} \tilde{T}_{ij}\right]_{n\times 1} \tag{4.8}$$

$$\tilde{R} = (\tilde{R}_i)_{1\times n} = \left[\sum_{j=1}^{n} \tilde{T}_{ij}\right]_{1\times n} \tag{4.9}$$

Which $\tilde{R}$ and $\tilde{D}$ are $n \times 1$ and $1 \times n$ matrices, respectively.

The next step is to determine the importance of the indicators $(\tilde{D}_i + \tilde{R}_i)$ and the relationship between the criteria $(\tilde{D}_i - \tilde{R}_i)$. If $(\tilde{D}_i + \tilde{R}_i) > 0$, the relevant criterion is effective and if $(\tilde{D}_i + \tilde{R}_i) < 0$ is, the relevant criterion is Impressive.

It is then de-fuzzy using the following formula:

$$\text{defuzzy} = \frac{((u-l)+(m-l))}{3} + l \tag{4.10}$$

The results are presented in Tables 4 and 5.

In the sixth step to normalize the matrix of full relation of dimensions $(T_D^{\propto})$ First, each boundary of this matrix is separated so that three tables of lower, middle and upper boundaries are obtained, then each boundary is divided by the sum of the rows in that boundary and resulting matrix is transposed (replaces rows and columns).

In the seventh step, to normalize the complete correlation matrix of criteria $(T_C^{\propto})$ and to form an unbalanced super matrix, the sum of each row T_C^{ij} is calculated according to the relevant dimension, and then in each T_C^{ij}, each element is divided by the sum of the corresponding row elements.

In the eighth step to form a weighted super matrix, the matrix $(T_D^{\propto})$ is multiplied by the matrix W. In this way, each $t_D^{\propto ij}$ in W_{ij} equal is multiplied. The resulting matrix is called a balanced super matrix.

In the ninth step to limit the weighted super matrix, according to formula (4.11), bring it to power (consecutive odd numbers) so that all the numbers in each row converge. The weighted super matrix in this study reached convergence at power 5.

$$\lim_{z\to\infty} (W^{\propto l})^Z,\ \lim_{z\to\infty} (W^{\propto m})^Z,\ \lim_{z\to\infty} (W^{\propto u})^Z \tag{4.11}$$

In the tenth step, in order to extract the weights and prioritize the criteria, using the relation of 10 weights extracted from the limit super matrix, it becomes a definite number, and the weight of the main criterion is obtained from the sum of the weights of its sub-criteria. The results are given in Table 6.

The next question of the research is as follows: What is the appropriate tool to measure the level of observance of environmental criteria? In order to answer this question, the output of the results related to the previous steps can be used. Using the criteria identified in the first stage (phenomenological stage), a standard questionnaire was designed to assess the degree of environmental compliance. This questionnaire is designed to audit environmental cases. In the mentioned questionnaire, it was requested that the degree of observance of environmental criteria be specified as a 5-point range. Also, considering that the weight and importance of the criteria were determined through the results obtained from the fuzzy DANP technique, so it is possible to determine the observance of environmental criteria through the following formula [21].

$$S = \sum_{i=1}^{k} (W_i * N_i)$$

S: Overall rating of environmental compliance

W: The weight of each criterion

N: Total score obtained from the environmental questionnaire

K: Number of criteria

In explaining the above, it can be said that W is the weight of each criterion, which has been obtained through the DANP technique and with the analysis and opinion of experts. In calculating N it can be said that, considering that the standard questionnaire is used in the environmental, in this questionnaire the degree of observance of environmental criteria is asked qualitatively (range of 5 options). And each instance receives a point according to the observance. Then the scores of the instances are added together and N is the sum of the scores of observing all the instances in the questionnaire.

Table 1: Environmental criteria

Criterion	symbol	sub-criteria	symbol
Recognition and prevention of environmental pollution	1C	Application of environmentally friendly consumables	11C
		Optimizing the consumption of energy carriers, raw materials and consumables	12C
		Equipment repair and upgrading	13C
		Identify pollution sites and measure emissions	14C
		Online monitoring and seasonal monitoring	15C
Compensation for environmental damage	2C	Waste recycling	21C
		Collection of household waste in employees' dormitories	22C
		Prevention of air pollution and development of filtration system and installation of electro filter	23C
		Prevention of water pollution and implementation of wastewater treatment systems	24C
		Reduction and management of factory waste	25C
Motivation and development of environmental activities	3C	Self-declaration in pollution monitoring	31C
		Participate in conferences and seminars on environmental issues	32C
		Joint cooperation with the Environment Organization	33C
		Received and encouraged as the green industry of choice	34C
		ISO 14001 Environmental Management System	35C
Environmental education and culture	4C	Holding environmental training workshops	41C
		Cooperation with organizations in order to develop environmental standards	42C
		Design, publication and brochure installation	43C
		Landscaping, painting and allocating space for hazardous waste	44C
		Maintaining a green environment	45C

Table 2: The range of five points of the DNAP technique and the definitive equivalent for verbal expressions

Variable	Definitive equivalent	Fuzzy equivalent
Effect less	0	(0,0,0)
Low impact	1	(0,0.25,0.5)
Medium impact	2	(0.25,0.5,0.75)
high impact	3	(0.5,0.75,1)
Too much impact	4	(0.75,1,1)

Table 3: Full dimensional communication matrix

	1C	2C	3C	4C
1C	(0.038,0.093,0.357)	(0.022,0.067,0.289)	(0.021,0.066,0.287)	(0.018,0.06,0.275)
2C	(0.032,0.084,0.333)	(0.011,0.05,0.252)	(0.015,0.055,0.259)	(0.011,0.05,0.248)
3C	(0.035,0.089,0.34)	(0.013,0.054,0.261)	(0.01,0.049,0.252)	(0.012,0.051,0.251)
4C	(0.016,0.055,0.264)	(0.01,0.041,0.211)	(0.007,0.033,0.203)	(0.003,0.029,0.191)

5 Conclusions and future research directions

In order to advance the research in the first stage, by interviewing environmental experts in the cement, lime and gypsum industries and using descriptive phenomenology (Colaizzi method) in 7 stages, environmental criteria and

Table 4: Full dimensional communication matrix

	D_i	R_i	$(D_i)^{defuzzy}$	$(R_i)^{defuzzy}$	$D_i + R_i$	$D_i - R_i$
11C	(0.195m0.482,1.83)	(0.198,0.497,1.916)	0.835	0.870	1.706	-0.035
12C	(0.124,0.333,1.51)	(0.22,0.513,1.894)	0.655	0.876	1.531	-0.220
13C	(0.224,0.508,1.828)	(0.234,0.52,1.854)	0.853	0.869	1.722	-0.016
14C	(0.185,0.477,1.889)	(0.137,0.371,1.582)	0.850	0.696	1.547	0.154
15C	(0.226,0.516,1.865)	(0.165,0.414,1.676)	0.869	0.752	1.621	0.117
21C	(0.036,0.202,1.15)	(0.062,0.243,1.185)	0.463	0.497	0.960	-0.034
22C	(0.028,0.184,1.014)	(0.02,0.165,0.952)	0.409	0.379	0.788	0.030
23C	(0.067,0.298,1.442)	(0.134,0.419,1.783)	0.602	0.779	1.381	-0.176
24C	(0.062,0.273,1.337)	(0.017,0.188,1.161)	0.558	0.455	1.013	0.102
25C	(0.089,0.298,1.365)	(0.049,0.241,1.228)	0.584	0.506	1.090	0.078
31C	(0.02,0.198,1.099)	(0.044,0.242,1.255)	0.439	0.514	0.953	-0.074
32C	(0.037,0.217,1.157)	(0.019,0.154,0.908)	0.470	0.360	0.830	0.110
33C	(0.078,0.293,1.396)	(0.046,0.251,1.292)	0.589	0.530	1.118	0.059
34C	(0.059,0.264,1.333)	(0.08,0.298,1.418)	0.552	0.599	1.151	-0.047
35C	(0.057,0.261,1.32)	(0.064,0.288,1.432)	0.546	0.594	1.141	-0.048
41C	(0.014,0.154,1.005)	(0.018,0.151,1.042)	0.391	0.403	0.795	-0.012
42C	(0.017,0.186,1.152)	(0.014,0.158,1.022)	0.452	0.398	0.849	0.054
43C	(0.008,0.117,0.83)	(0.003,0.141,0.874)	0.318	0.339	0.657	-0.021
44C	(0.022,0.121,0.85)	(0,0.101,0.742)	0.331	0.281	0.612	0.050
45C	(0.007,0.156,0.935)	(0.034,0.183,1.092)	0.366	0.436	0.802	-0.071

Table 5: Pattern of causal relationships of the complete dimension relationship matrix

	D_i	R_i	$(D_i)^{defuzzy}$	$(R_i)^{defuzzy}$	$D_i + R_i$	$D_i - R_i$
1C	(0.099,0.286,1.207)	(0.12,0.321,1.294)	0.531	0.578	1.109	-0.048
2C	(0.155,0.548,4.565)	(0.056,0.212,1.013)	1.756	0.427	2.183	1.329
3C	(0.069,0.243,1.104)	(0.053,0.203,1.001)	0.472	0.419	0.891	0.053
4C	(0.036,0.159,0.869)	(0.044,0.19,0.964)	0.355	0.399	0.754	-0.045

Table 6: Relative and final weight of criteria

Factors	**Relative weight**	**Final weight**	**Priority**
C1	0.432		
C11	0.211	0.0909	2
C12	0.206	0.0889	3
C13	0.24	0.1038	1
C14	0.15	0.0647	5
C15	0.193	0.0833	4
C2	0.212		
C21	0.139	0.0295	3
C22	0.029	0.0062	5
C23	0.551	0.1168	1
C24	0.136	0.0288	4
C25	0.145	0.0307	2
C3	0.198		
C31	0.192	0.0381	4
C32	0.02	0.0039	5
C33	0.217	0.0431	3

criteria were identified. The results show 20 criteria that were classified into 4 main categories. The main criteria of environmental observance are recognition and prevention of environmental pollution, compensation for environmental damage, motivation and development of environmental activities, education and environmental culture. Examination

C34	0.287	0.057	1
C35	0.283	0.0562	2
C4	0.158		
C41	0.363	0.0573	1
C42	0.258	0.0408	3
C43	0.051	0.0081	4
C44	0.014	0.0022	5
C45	0.314	0.0496	2

of the research results with its background indicates that in some studies, the criteria identified in this research are mentioned and are consistent with each other.

In the next step and after determining the environmental criteria, with the help of fuzzy DANP technique and in 10 steps, the weight and importance of each of the environmental criteria and criteria were determined.

According to the research results, the main criterion of "recognition and prevention of environmental pollution" has the highest weight and importance compared to other criteria from the perspective of experts (Table 6). This issue refers to the importance of recognizing and preventing pollution. Among the sub-criteria of this main group, in order of importance, we can mention the repair and improvement of equipment, the use of environmentally friendly consumables, the optimization of energy carriers, online monitoring and the identification of pollution sites. The main criterion of "environmental damage compensation" has a second degree of weight and importance compared to other criteria from the perspective of experts (Table 6). This issue points to the importance of compensating for environmental damage from the perspective of experts. Among the sub-criteria of this main group, in order of weight and importance, we can mention preventing air pollution, reducing and managing waste, recycling waste, preventing water pollution and collecting garbage in employees' dormitories. The main criterion of "motivation and development of environmental activities" has a third degree of weight and importance compared to other criteria from the perspective of experts (Table VI). Among the sub-criteria of this main group, in order of weight and importance, we can mention receiving and encouragement as green industry, ISO environmental management system, joint cooperation with the environmental organization, self-declaration in monitoring and participation in conferences and seminars. The main criterion of "environmental education and culture" has a fourth degree of weight and importance compared to other criteria from the perspective of experts (Table 6). Among the sub-criteria of this main group, in order of weight and importance, we can hold environmental training workshops, conservation of green space, cooperation with organizations in order to develop environmental standards, design and publication of brochures, landscaping, painting and allocating space for waste. cited. In order to introduce the tool for measuring the degree of environmental observance, the information related to the output of the phenomenological method and fuzzy DANP method were used to design a standard questionnaire. According to the identified and approved criteria, questions were designed in the form of a questionnaire and qualitatively with a range of 5 options that are used as a tool to assess environmental compliance. Also, by considering the weight of the criteria (output of the fuzzy DANP technique) and the score obtained from the questionnaire, the overall score of environmental observance can be calculated. According to experts, it is suggested that all industries involved in environmental issues, given the importance of criteria, have the necessary programs to prevent pollution related to environmental issues on their agenda so that their burden of as much as possible can be the basis for a healthy environment. One of the identified criteria is joint cooperation with the Environment Organization. Environmental protection requires mutual cooperation of different organizations, so it is better to establish the necessary interaction between the Environmental Protection Organization and the developers of accounting and auditing standards as well as the stock exchange organization according to the environmental criteria presented in the present study. Also, institutionalizing participation in social activities is derived from the criteria of the present research model, which can play an important role in achieving a favorable environment. Given the importance of environmental issues, it is suggested that the subject of environmental accounting be included in the course of accounting courses and the content of such research be used to raise the level of knowledge and knowledge of accountants.

Among the limitations of the present study are the unavailability of experts and specialists as in other studies that use the opinions of experts and the limitations in the implementation of the questionnaire in terms of unwillingness to respond by some members of the statistical sample. According to the results of the present study, the following topics can be presented for future research:

1. Investigating and Determining the Relationship between Financial Performance and the Environmental Compliance of Industries in Polluting Companies

2. Providing a model for determining and introducing the industry index in order to determine the environmental audit of polluting companies

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