Investigating the relationships between components of social responsibility and life cycle stages Fuzzy Analytic Hierarchy Process (FAHP) and Multi-Criteria Fuzzy Analytical Network Process (FANP) In companies listed on the Tehran Stock Exchange

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ABSTRACT

Firms at different stages of development face different goals of social responsibility and show different capabilities in performing social responsibility. They experience the effects of their social responsibility differently in different life cycles. The purpose of this study is to review, rank and analyze the level of responsibility of firms during different stages of the life cycle. Based on this, Fuzzy Analytic Hierarchy Process (FAHP) Multi-Criteria Fuzzy Analytical Network Process (FANP) which includes the company's attention to environmental issues, products, human resources, attention to customers, social issues and optimal energy consumption was used. The criteria were converted into fuzzy numbers through the questionnaire, and after collecting the results of experts' opinions, grades were assigned in the fuzzy spectrum from 1-9. Also the results showed that effective measures of life cycle measurement and social responsibility based on the mentioned approaches in the field of refinement and their importance are of different importance. Also, the score assigned to the newly established stage for emerging companies has the highest weight among other stages of the life cycle. Sensitivity analysis also revealed that for one percent change in environmental, product, human resource, customer, social and energy sub-criteria, the probability of choosing the stage of company establishment as the first priority is the highest percentage.

Keywords:

social responsibility, life cycle, multi-criteria decision making of fuzzy network

1. Introduction

Corporate Social Responsibility (CSR) includes a set of corporate activities and actions aimed at "doing a good job" for the company's in-house stakeholders such as employees or external stakeholders, including: suppliers, consumers, legal entities. , People and non-profit organizations. A review of the research literature based on empirical evidence obtained from previous research shows that many factors may affect the performance of corporate social responsibility (CSR). In this regard, we can mention such things as: financial constraints (Zhao and Xiao X , 2019), the level of competition in the product market and the life cycle, especially the level of maturity of the company, as determining or effective factors (Huo et al., 2018)

The role of business in our society has been debated since the middle of the last century. The growing pressures of trade on humanity and the natural environment have significantly raised concerns among people around the world. Nowadays, more responsible use of increasing business power by different stakeholders is anticipated for businesses. The term "**corporate social responsibility**" (CSR) may provide a general framework for describing a business's responsible behavior and social participation. However, it is still problematic to find an accepted definition of CSR, not to mention CSR evaluation. However, CSR evaluation is not only important for researchers to examine the relationship between different organizational variables and CSR, but also for stakeholders to use social responsibility information during the decision-making process (Lee and Choi, 2018).

In this paper, to identify, categorize and refine the measures of corporate responsibility and the factors affecting it through a combination of knowledge analysis methods, content analysis approach of fuzzy analytical hierarchical processes (FAHP), multi-criteria fuzzy network process (FANP), is done. Finally, the relationship between corporate social responsibility (CSR) and the factors that affect it will be determined by emphasizing the company life cycle. The contribution of the present study in the development of the nascent corporate social responsibility (CSR) literature, in other words, innovation and novelty of the present study can be considered in terms of endogenous aspect of corporate social responsibility (CSR) and Measurement of this

variable based on the use of management willingness score in this field.

Such a method allows the use of a quasi-experimental research plan based on which companies are divided into experimental and control groups. In addition, in comparison with other related studies such as Danieli et al. (2022), each of which merely examines the effect of lack of investment on one of the stakeholders or one of the dimensions of corporate social responsibility (CSR), Effects of Lack of Investment on Different Dimensions of Corporate Social Responsibility (CSR) such as: Society, Environment, Human Rights and Employee Relations, deals with the nuances of lack of investment and its relationship with corporate social responsibility (CSR) (Danieli et al., 2022).

The results of the study will show that the lack of investment reduces the overall performance of the company in this area by increasing concerns about corporate social responsibility (CSR). All aspects of corporate social responsibility (CSR), with the exception of human rights aspects, are significantly affected by the lack of investment. Lack of investment considers the strengths and concerns of the community, diversity, product quality and safety, and increases attention to the strengths of corporate governance, good relationships with employees and the environment.

Finally, in comparison with studies such as Zhao and Zhang (2018), Quan, Wu and Yin (2015), which is only one of the measures of corporate social responsibility (CSR) or lack of investment and part of the factors affecting In this study, the quantitative fuzzy network analysis (FANP) approach will refine and assess the importance of effective factors and measures , and the question of whether the criteria for measuring responsibility at different stages of the life cycle have the same or different priority; Will be answered.

2. Theoretical foundations and research background

Although the importance of the relationship between corporate social responsibility (CSR) and its financial performance has been acknowledged in the management literature, the research literature shows that the results obtained in this field are limited and incomplete and even have contradictory results. Some

studies have concluded that investing in corporate social responsibility (CSR) activities enhances a firm's financial performance. In this regard, as an example, we can refer to the research conducted by Lee and Choi (2018). The literature on corporate social responsibility begins with an analysis of the potential role of measuring corporate social responsibility performance and control systems to strengthen corporate social, ethical, and environmental motivations.

The main feature of social responsibility is the desire of the organization to be responsible and accountable for the consequences of its activities and decisions on society and the environment. Social responsibility first introduces a framework of ethical governance according to which organizations adopt strategies that improve the condition of society and avoid activities that worsen the state of society. In general, the term corporate social responsibility refers to the emergence of a movement that seeks to incorporate environmental and social factors into business decisions, business strategy and corporate accounting to enhance social and environmental performance alongside the economy for the business, community and environment. (Lee and Choi, 2018).

The result of corporate social responsibility motivations in management has been better performance of the company in terms of better allocation of organizational resources and reform of organizational structures in line with the company's value-oriented goals (Zhao and Zhang, 2018). It is also stated that measuring the performance of corporate social responsibility and accountability systems in dimensions such as: identifying basic behaviors and opportunities, facilitating environmental decisions and coordination, promoting the interaction between individual interests and organizational goals, and facilitating training in this area. , has become objective. Dimensions of accountability in developing countries impose significant costs on the company from outside or have a significant impact on the company's profitability. Given that pharmaceutical and food companies are one of the most strategic industries in the country, expansion and capability in this field can significantly improve the country's position in the region and internationally. Companies operating in this field deal with the most basic levels of human needs, namely physiological needs and security, while a wide range of shareholders benefit from their diverse products and services (Danieli et al., 2022).

A review of the research literature based on existing theories or empirical evidence obtained from previous research shows that it is widely believed that the performance and disclosure of corporate social responsibility is a kind of ethical action that should be done by the company. Previous research on corporate social responsibility provides a theoretical basis for integrating a company's ethical expectations into a rational economic and legal framework (Kim and Park, 2015).

While the results of some other researches have shown that corporate social responsibility (CSR) measures in the field of natural resource sustainability and attention to social benefits have a Neutral effect on the financial performance of the company. Over the past few decades, corporate social responsibility (CSR) disclosure has become a powerful stimulus for the overall development of stakeholders, while the relationship between CSR and its performance has yielded conflicting results due to the use of the most cross-sectional CSR evaluation display. This study fills an important gap by analyzing the framework of CSR evaluation methods in identifying five criteria and 17 indicators that include CSR accountability, transparency and adaptation strategies. To achieve the CSR goal, strategies related to various literature and Quaternary studies have been defined for selecting criteria in which the criteria are expressed in a fuzzy horizon.

This multi-criteria decision making model (MCDM) has been solved using fuzzy analytical networking process and Balanced Scorecard (BSC) method to develop the selection strategy and CSR implementation criteria. The results of this paper will help corporate executives, especially in developing countries, to pursue sustainable action effectively as CSR providers and gain a significant reasonable advantage. The findings show the structure of CSR evaluation and the interrelationships between BSC perspectives / criteria and indicators that managers must emphasize in order to achieve optimal CSR performance. In this study, the most important strategy and criteria for implementing the optimal level of CSR are as follows: "CSR project responsiveness" is the best strategy. Project teamwork, incentives, environmental resources, communication for motivation, stakeholder initiative report, CSR project

with stakeholder capital, strategic governance, mission sustainability, political role, human resources are the criteria in order (Debans et al., 2018).

Based on the above statements, Debans et al. (2018) stated that their study is based on the assumptions of shareholder theory and aims to develop a CSR framework for the mining sector and provide a difference in understanding the CSR and the interests of major shareholders in the mine. Sector, which is defined as the government, mining companies, and other social stakeholders as a result of a literature review. In defining CSR activity metrics, in addition to interviews with key stakeholders, metrics that stand for the economic, legal, ethical, humanitarian, and environmental dimensions of CSR are used. Also, the Analytical Networking (ANP) process, which is a multi-criteria decision-making technique, is used to measure criteria to show how stakeholders perceive the CSR activities of mining companies and which activities they give more importance and priority. In this regard, they stated that examples that have been studied in detail in the literature show that conflicts in the mining sector, both in Turkey and in other countries, stem mainly from differences in the views and interests of major stakeholders on social responsibility (Debans et al., 2018).

Other studies, such as Danieli et al. (2022), suggest that CSR perceptions vary by region and culture. They argue that different cultures present different values, and that these values mutually shape society's expectations of companies and the role of companies in society. Accordingly, from the point of view of stakeholder theory, understanding the priorities and interests of stakeholders in the mining sector is very important for mining companies in order to understand the expectations of other stakeholders they face. In addition, it is important to understand the social movements and conflicts that have arisen among mining activists (Danieli et al., 2022).

Despite previous studies in CSR research on stakeholder differences and stakeholder expectations; The views of managers have contributed greatly to this issue, It is noteworthy that in case studies, interview methods and content analysis are generally used internally . No qualitative methodology has been found in any study in the reviewed literature that weighs the perceptions and expectations of stakeholders in different parts of the industry using an analytical method such as ANP. (Debans et al., 2018).

In some studies conducted by Naziroo et al. (2018), the results obtained from the research indicate a negative or inverse relationship between corporate social responsibility (CSR) measures and corporate financial performance. Based on these different and sometimes contradictory findings, it can be concluded that the results of this research in the field between the environmental performance of the company and financial performance are due to errors in sampling and They are an incentive to research about important modifiers that have been overlooked in the subject literature (Hu et al., 2018).

Hassan and Habib (2017) studied the relationship between lack of investment and the level of corporate social responsibility (CSR). Based on the analysis of empirical evidence obtained from their research, the researchers showed that firms that have more transparent corporate social responsibility (CSR) reporting have less investment shortages. Cheng et al. (2014) in a similar study based on the analysis of the findings of their research have identified companies that have better corporate social responsibility (CSR) performance, compared to similar companies , face fewer restrictions on financing and capital. On the other hand, lack of investment may force companies to limit and even avoid investing in corporate social responsibility (CSR). Because corporate social responsibility (CSR) efforts are only costly in the short term and companies that have invested in this area can only benefit from the benefits of such investments in the long run, such as gaining trust or social credibility. (Hassan and Habib, 2017).

According to the life cycle theory, the problems and issues of companies are mostly affected by different stages of the company life cycle. Recent empirical studies in accounting and finance have examined the impact of corporate life cycle on issues such as corporate investment, financing, dividend decisions, and corporate financial performance (Hassan and Habib, 2017).

A review of the research literature also shows that based on empirical evidence from previous research, companies are likely to make relatively larger, growth-based investments in the early stages of their business life cycle. While in maturity, their investments are likely to be towards maintaining existing assets. Depending on the financial resources, small and young businesses often turn to private equity and debt markets. While large and mature companies rely

heavily on public markets. The financial structure of companies changes throughout their life cycle (Debans et al., 2018). In addition, Dota and Nezlobin (2017) based on the results of their research concluded that the company's growth path plays an important role in determining the balance between information disclosure and risk.

3. Research background

Bobaker et al. (2018) reviewed empirical studies in the field of accountability in a meta-analytic study. The researchers divided the research into three categories according to the criteria used to measure financial performance:

1) In studies where the criterion of market value to book value has been used to measure financial performance, shows that in all five studies that have used these criteria to measure financial performance, the existence of A positive and significant relationship between social responsibility and financial performance has been confirmed.

2) In the studies that used the criterion of "return on assets" to measure financial performance, none of them reached a negative and significant relationship.

3) In some studies, stock market metrics have been used to measure financial performance and have been divided into two categories: comparative information and event studies. Among comparative studies, the results vary considerably, and the majority report a mixed or ineffective relationship. Event studies provide a better picture of this relationship because they compare a company's revenue with that of the company itself.

In a study conducted by Hu et al. (2018), based on the results of the study, there is a positive and significant relationship between environmental performance and financial performance of organizations. In addition, the results of this study indicate a positive and significant relationship between social performance and corporate ownership of organizations.

Hast et al. (2018) examined the causal relationship between corporate social performance and financial performance in Canadian companies between 2004 and 2015. Using the "Granger causality" approach, no significant relationship has been seen between the two

variables of social performance and financial performance of companies.

Hu et al. (2018) examined the corporate social responsibility and financial performance of 50 Malaysian companies in a study entitled Corporate Social Responsibility and Financial Performance. Their analysis showed that there is a positive and almost weak relationship between corporate social responsibility and financial performance. Therefore, they claimed that reporting corporate social activities improves financial performance.

Lane et al. (2015) examined the relationship between concentration of ownership and bank performance in 423 banks in 29 countries. His studies show that there is a direct relationship between relative concentration and bank performance in China, but the shareholding ratio for state-owned companies is inversely related to bank performance. However, there is less evidence on the relationship between concentration of ownership and performance in South Asian countries. Previous studies show that in developed and developing countries, the relationship between ownership structure and performance has been an important and ongoing topic of discussion in financial studies.

Doaei and Rouhani (2016) stated in their research that due to the increasing spread of environmental problems, companies incur heavy costs in terms of social responsibility. The results of logistic regression of their research model show that there is a negative and significant relationship between social responsibility and financial constraints in the growth stage of the company and there is a negative and significant relationship between social responsibility and financial constraints in the maturity and decline of the company. Also, their results show that state-owned companies have no significant effect on the relationship between social responsibility and financial constraints.

Rezazadeh and Yar Ahmadi (2009) stated in their research that the results show that there is a positive relationship between the life cycle maturity stage and corporate social responsibility. Contrary to expectations, financial resources do not play a moderating role in the relationship between the life cycle and corporate social responsibility. Conclusion: Mature companies invest in corporate social responsibility more than other companies in order to gain competitive advantages.

4. Methodology

Hypothesis and fuzzy network model of research

In this research, which is part of survey research; The aim is to investigate the hypothesis of effective measures of measuring financial constraints and life cycle and social responsibility by relying on fuzzy approaches in the field of refining and evaluating their importance is different.

For this purpose, the fuzzy network process model is formed as described in Figure (1). Figure 3-4 shows the fuzzy hierarchical analysis of the research. Fuzzy hierarchical analysis method will be used to select the options of the company's life cycle stages according to the sub-criteria of the company's social responsibility. Sub-criteria include company attention to environmental issues (zistmohiti), product (Mahsul), human resources (manabe ensani), customer attention (customers), social issues (Ejtemaei) and energy efficiency (Energy) Converted to fuzzy numbers and the results of expert opinions are collected and scores in the fuzzy range from 1 to 9 are assigned. These scores are prepared by experts for the superiority of each of the above criteria.

In this type of hierarchical analysis, the research aims to meet the criteria mentioned; Rank the level of responsibility of companies during the life cycle stages and examine the research hypothesis in order to announce the result.

The ANP method is also one of the multi-criteria decision-making methods of fuzzy network, which is similar to the FAHP method. But in that criteria or sub-criteria or options have a dependency or relationship. In fact, the AHP method can be considered as a special case of FANP fuzzy networking technique. If there is an issue in which the criteria are related or the sub-criteria are internally related; this type of problem can no longer be done through the AHP method because the problem no longer goes out of the hierarchical state and creates a network state. In this case, the problem must be solved through the ANP method. Thus the AHP method is a special case of the ANP method. The network analysis process provides a comprehensive and powerful method for making accurate decisions using the empirical information or personal judgments of each decision maker and by providing a structure for organizing different criteria and evaluating the importance and preference of each of them over options. , Simplifies the decision process.
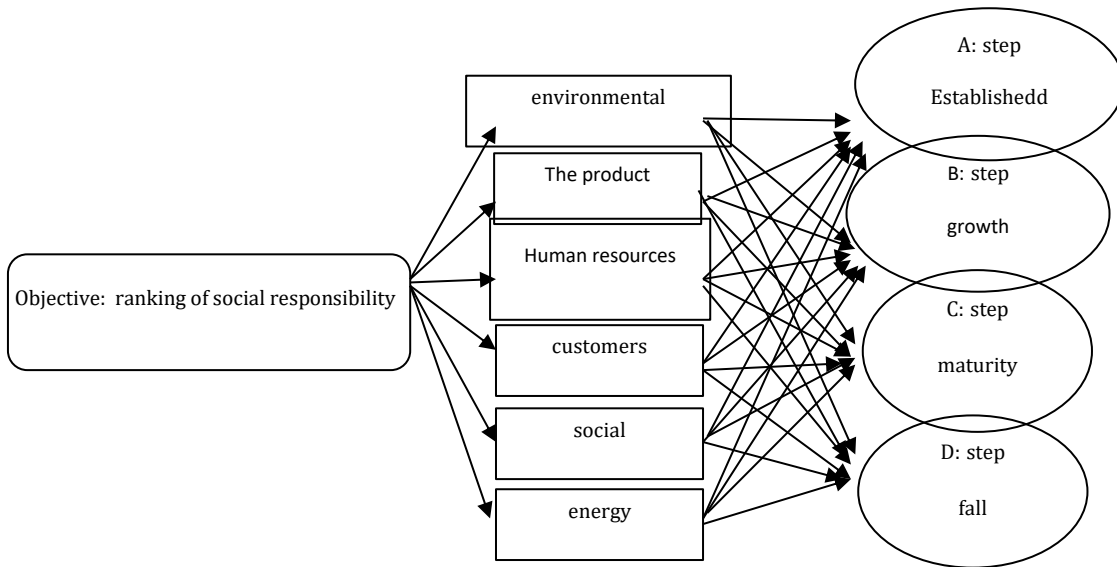

Figure (1) Fuzzy network analysis with criteria and selection of options

The main difference between network and hierarchical analysis is in the structure of model definition and the relationship between its elements. In hierarchical analysis, this relationship is only independent, while in ANP, this relationship can be both independent and dependent. . It can be said that the hierarchical method shows a special case of network analysis method because the network analysis method can be used in the independent state within a cluster and between several clusters. The network analysis method has a non-linear structure while in the hierarchical analysis method it is linear and has a high level goal and low level factors. When comparing pairs in the hierarchical analysis method, the question arises which of the two options is more important? While in network analysis method, the purpose of pairwise comparisons is to examine the extent to which the parameters affect each other.

In the previous section, hypotheses from the research related to the FAHP method were analyzed. In this section, the aim is to investigate the hypothesis of effective measures of measuring financial constraints and life cycle and social responsibility based on the multi-criteria fuzzy network (FANP) approach in the field of refinement and evaluation, which is of different importance.

To implement and perform fuzzy ANP, the following steps must be performed in order:

1) Creating a research network diagram: In this step, the problem should be divided into standard levels and if there are sub-criteria and options, and the relations between them should be determined A very important point in this step is the existence of Inter-criteria relations. These relationships can be identified in several ways. These questions can be found by asking experts about inter- criteria relationships, or by using methods such as the Dimtel method or the ISM method.

2) Formation of paired comparison matrices: In this stage, the elements of each level are compared in pairs at a higher level than other related elements, and matrices of paired comparisons are formed. Also, at the end, a pairwise comparison of internal relations should be formed. These pairwise comparisons should be answered by Mr. Saati's 9-item range as follows .

Table (1) Fuzzy reversal preference values for even comparisons preference values for even comparisons

Numerical value	preferences
9	Completely preferred or quite more important or quite desirable
7	Preference or importance very strong desirability
5	Preference or importance or strong desirability
3	A little preferred or a little more important or a little more desirable
1	Equal preference or importance or desirability
2,4,6,8	Preferences between the above distances

3) Calculating the incompatibility rate: In this step, we calculate the ANP incompatibility rate. If this rate is less than 0.1, it indicates matrix compatibility.

4) Formation of the initial super-matrix: Using the weight of the obtained pairwise comparisons, we form the initial super-matrix. The initial supermatrix is the same weights obtained in step 2 of the pairwise comparisons.

5) Creating a rhythmic supermatrix: After creating an initial supermatrix, a rhythmic super matrix must be created.

6) Creating a Limit Supercatrix: The rhythmic super-matrix must be infinitely multiplied so that each row converges to a number. And that number is the weight of that criterion or sub-criterion or option.

5.Analysis and findings
5.1. Results of FAHP weight ranking calculations

Tables 2 to 8 show the results of weight calculations of the fuzzy hierarchical method with different criteria for the life cycle. What is clear in the fuzzy hierarchical research method with the opinion of experts in terms of most criteria, the initial stages and growth for companies are important steps in terms of ranking with the aim of corporate social responsibility. As shown in the table above, according to the goal, the environment is the first priority. Next priorities according to the weights gained are customers, energy, social and human resources.

Table (2) Weight calculation results of fuzzy hierarchical method of criteria

Rank	Standard name	Standard weight
1	Environmental	٠/27
5	Human resources	٠/149
2	Customers	٠/238
4	Social	٠/164
3	Energy	٠/18

Table (3) Weight calculation results of fuzzy hierarchical method of life cycle stages with environmental criteria

Rank	Standard name	Standard weight
2	Initial growth	٠/339
1	mature	٠/347
3	decline	٠/314

As shown in the table above, in terms of environmental, the mature stage is the first priority. The next priorities are assigned to the growth stage, the initial stage and the decline stage according to the obtained weights.

As shown in the table above, in terms of energy, the mature stage is the first priority. The next priorities are assigned to the growth stage, the initial stage and the decline stage according to the obtained weights.

Table (4) Weight calculation results of fuzzy hierarchical method of life cycle stages with energy criteria

Rank	Standard name	Standard weight
2	initial&growth	٠/331
1	mature	٠/336
3	decline	٠/325

Table (5) Weight calculation results of fuzzy hierarchical method of life cycle stages with customer criteria

Rank	Standard name	Standard weight
1	Initial growth	٠/341
2	mature	٠/336
3	decline	٠/322

As shown in the table above, in terms of customer benchmarks, initial stage and growth is the first priority. Subsequent priorities are assigned to the maturity and decline stages according to the weights obtained.

As shown in the table above, according to the HR criteria, the adult stage is the first priority. Subsequent priorities are assigned to the growth and early stages and the decline stage according to the weights obtained.

As shown in the table above, according to the social statement, the adult is in the first priority. Subsequent priorities are assigned to the growth and early stages and the decline stage according to the weights obtained.

As shown in the table above, according to the main criterion of goal (social responsibility) in a fuzzy hierarchical method, the mature stage of companies is the first priority. Subsequent priorities are assigned to the growth and early stages and the decline stage according to the weights obtained.

Table (6) Results of weight calculations of fuzzy hierarchical method of life cycle stages with human resources criteria

Rank	Standard name	Standard weight
2	Initial growth	٠/338
1	mature	٠/339
3	decline	٠/323

Table (7) Results of weight calculations of fuzzy hierarchical method of life cycle stages with social criteria

Rank	Standard name	Standard weight
2	Initial growth	٠/338
1	mature	٠/344
3	decline	٠/319

Table (8) Results of weight calculations of fuzzy hierarchical method of life cycle stages with the main objective criterion

Rank	Standard name	Standard weight
2	Initial growth	٠/34
1	mature	٠/342
3	decline	٠/32

Hypothesis test results by FAHP method

The hypothesis that was related to hierarchical analysis stated that effective measures of measuring financial constraints and life cycle and social responsibility by relying on fuzzy hierarchical approach in the field of refining and evaluating their importance are of different importance. Since the scores obtained for life cycle stages according to environmental, product, human resources, customer, social and energy metrics are different numbers according to Table 2, it can be concluded that the level of importance to it is clearly

different and accordingly the hypothesis of the research is acceptable.

5.2 Fuzzy Network Pattern Analysis (FANP)

5.2.1 Graphical structure of research model by FANP method

In this stage, which is the first stage of problem solving, the structural diagram of fuzzy network including target and clusters were defined as criteria and cores as sub-criteria. In this method, the purpose was to examine the level of responsibility with the five criteria mentioned in the previous section on each

stage of the life cycle of companies, which is finally shown in the FANP structural diagram of the research.

As shown in diagram 2, environmental, product, human resource, customer, social, and energy metrics are related to both the target coreie responsibility, and the four cores of the life cycle stage and according to questionnaire from experts will measure the importance of each criterion on the four cores of early stages, growth, maturity and decline:

According to a questionnaire from experts, the importance of each criterion will be measured on the four cores of early stages, growth, maturity and decline.
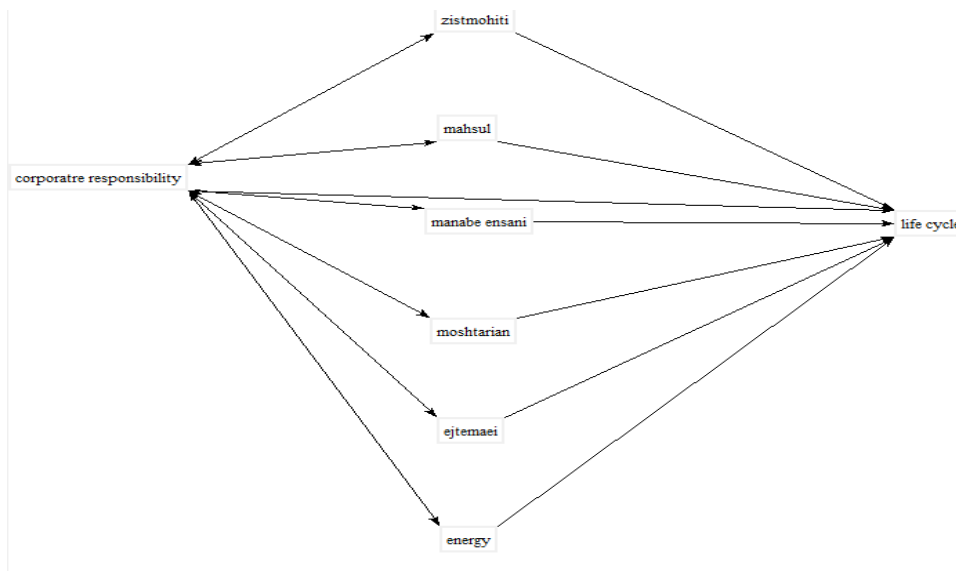

Diagram (2) Diagram of the structure of a multi-criteria fuzzy network model

5.2.2 Formation of pairwise comparisons and inconsistency rate calculations

Due to the internal relationships between the criteria for weighting and ranking, ANP network analysis method is used. First, pairwise comparisons are created and provided to 10 experts. After collecting pairwise comparisons, their incompatibility rate was calculated, which is all less than 0.1, and indicates the compatibility of the pairwise comparison matrix, then we integrate them with the geometric mean method and enter them in the superdesign software for weighting and ranking. The ANP model is created in the superdesign software and the pairwise comparisons

integrated in the software are entered. The results are as follows.

Table 9 shows the incompatibility rates of the pairwise comparison matrix relative to the environmental criterion. According to the pairwise comparisons, the most impact of environmental criteria is in the initial stage of company establishment, which should be considered as one of the sub-criteria of corporate responsibility in this stage of the life cycle.

Table 10 shows the rate of incompatibility of the pairwise comparison matrix relative to the product criterion. Since the incompatibility rate is less than 0.1;

According to the pairwise comparisons, the most impact of the product criterion is in the initial stage of establishing companies, which should be considered as one of the sub-criteria of corporate responsibility in this stage of the life cycle.

Table 11 shows the incompatibility rates of the pairwise comparison matrix relative to the HR criterion. Since the incompatibility rate is less than 0.1; According to pairwise comparisons, the most impact of human resources criteria is in the initial stage of company establishment that this component should be considered as one of the sub-criteria of corporate responsibility in this stage of the life cycle.

Table 12 shows the incompatibility rates of the pairwise comparison matrix relative to the customer criteria. Since the incompatibility rate is less than 0.1; according to the pairwise comparisons, the most impact of customers 'criteria in the initial stage of

companies is that this component should be considered as one of the sub-criteria of companies' responsibility in this stage of the life cycle.

Table 13 shows the incompatibility rates of the pairwise comparison matrix relative to the social criterion. Since the incompatibility rate is less than 0.1; according to pairwise comparisons, the most impact of social criteria is in the decline of companies, which should be considered as one of the sub-criteria of corporate responsibility in this stage of the life cycle.

Table 14 shows the rate of incompatibility of the matrix of pairwise comparisons with the energy criterion. Since the incompatibility rate is less than 0.1; According to the pairwise comparisons, the most impact of the energy criterion is in the initial stage of establishing companies, which should be considered as one of the sub-criteria of corporate responsibility in this stage of the life cycle.

Table (9) Matrix of pairwise comparisons of life cycle stages with environmental criteria

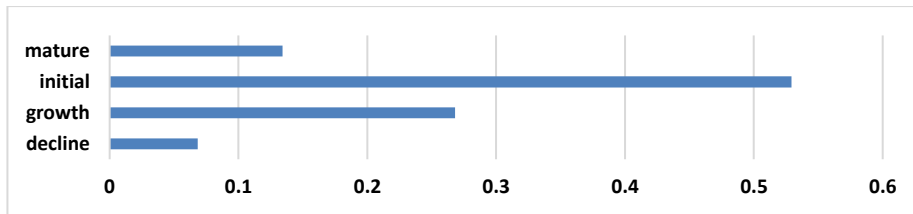|	decline	growth	initial	mature
decline	1	0/25	0/2	0/333333
growth	4	1	0/333333	3
initial	5	3	1	4
mature	3	0/333333	0/25	1
Incompatibility rate	0/06767			

Figure 2 Results of weight chart of Pairwise comparisons of life cycle stages with environmental criteria

Table (10) Matrix of pairwise comparisons of life cycle stages with product criteria

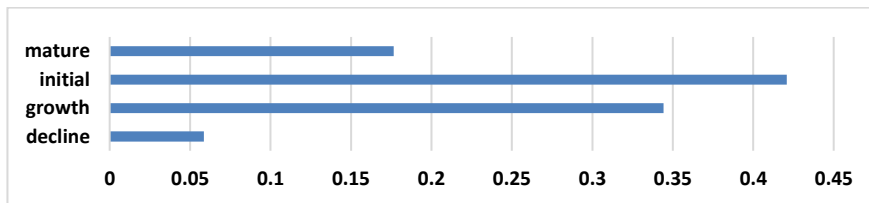|	decline	growth	initial	mature
decline	1	0/166667	0/2	0/25
growth	6	1	0/5	3
initial	5	2	1	2
mature	4	0.333333	0/5	1
Incompatibility rate	0/06373			

Figure 3 Weight chart results of pairwise comparisons of life cycle stages with product criteria

Table (11) Matrix of pairwise comparisons of life cycle stages with human resources criteria

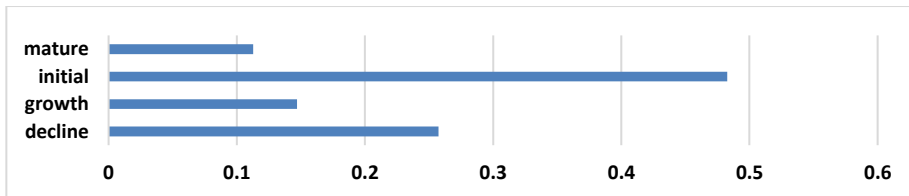|	decline	growth	initial	mature
decline	1	3	0/333333	2
growth	0/333333	1	0/333333	2
initial	3	3	1	3
mature	0/5	0/5	0/333333	1
Incompatibility rate	0/08062			

Figure 4 Weight chart results of pairwise comparisons of life cycle stages with human resources criteria

Table (12) Matrix of pairwise comparisons of life cycle stages with customer criteria

	decline	growth	initial	mature
decline	1	0/25	0/2	0/333333
growth	4	1	0.5	3
initial	5	2	1	3
mature	3	0/333333	0/333333	1
Incompatibility rate	0/0403			

Figure 5 Weight chart results of pairwise comparisons of life cycle stages with customer criteria
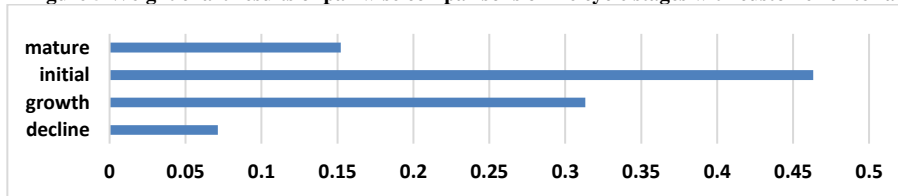
Table (13) Matrix of pairwise comparisons of life cycle stages with social criteria

	decline	growth	initial	mature
decline	1	5	4	3
growth	0/2	1	3	0/5
initial	0/25	0/333333	1	0/333333
mature	0/333333	2	3	1
Incompatibility rate	0/07009			

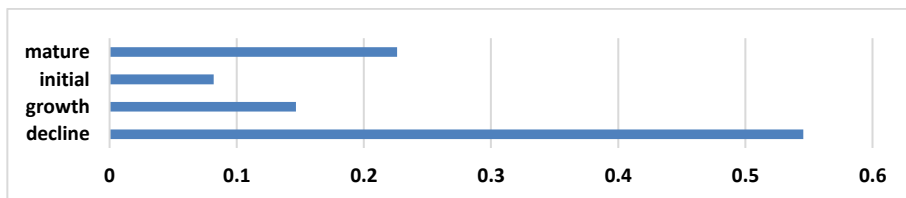**Figure 6 Weight chart results of pairwise comparisons of life cycle stages with social criteria**

Table (14) Matrix of pairwise comparisons of life cycle stages with energy criteria

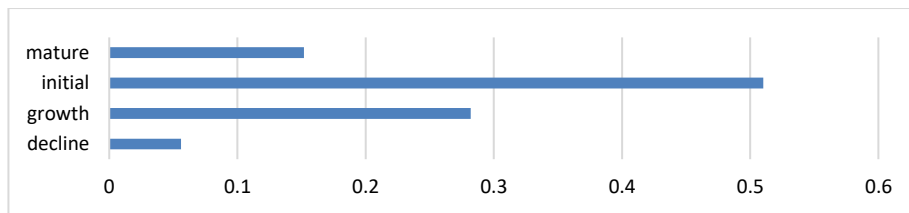|	decline	growth	initial	mature
decline	1	0/2	0/166667	0/25
growth	5	1	0/333333	3
initial	6	3	1	3
mature	4	0/333333	0/333333	1
Incompatibility rate	0/07854			

Figure 7 Results of weight chart of Pair comparisons of life cycle stages with energy criteria

5.2.3 Formation of non-weighted and weighted supermatrix

In this section, the consensus of all the weights calculated in the non-weighted supermatrix is called the non-weighted supermatrix other than this supermatrix. Matrix M weight is a model of corporate social responsibility assessment. In this super matrix, since it is possible to add less than one by adding some values of rows, with the help of Decision Supper software, the total weight of all columns can be equalized, in this case, the weight matrix is obtained. The restricted supramatrix can then be obtained from the weighted supermatrix shown in Table 15.

In the above 15 table the final weights of FANP model criteria are shown. The first priority for newly established companies among environmental criteria is product, human resources, customers, social aspect and energy according to this analytical method of environmental issues and according to the coefficients of the non-weighted super matrix of product quality in the initial period of establishment; Companies at this stage should prioritize social responsibility. According to the above supermatrix, companies in the growth stage should put optimal energy consumption on the agenda and in the maturity stage, companies are obliged to prioritize a range of social issues related to products.

In the weighted super matrix, the final weights of the research fuzzy network model were

calculated by the Super Decision software and reported in Table 16. In terms of social criteria, the most weight is assigned to the decline stage of companies. Also, the highest weight of the energy

criterion as an important criterion from the sub-core of the social responsibility network is related to the company's growth stage. In terms of human resources criteria, the most important attention and priority for companies is in the initial stage. Another important criterion of social responsibility is paying attention to the aspects of product production, which was found to have the greatest weight in this criterion related to the initial stage of establishment.

Also, two other criteria, including customer satisfaction and environmental factors, have the greatest impact on the initial stage of establishment.

Table 15 is reported to be the limited supermatrix. By calculating this matrix, FANP analysis is completed and according to the fuzzy network computing literature; After calculating the weight supermatrix in the limit matrix ; the values of the weights are given as limit calculations when observations tend to be infinite.

The results of Table 15 show that, in general, social responsibility, according to experts, is the first priority when the weight values of the criteria tend to be infinite . Then, according to the weight values of the criteria, in general, the highest weight as the second priority of the fuzzy network is related to the growth stage, and the company's social responsibility in the maturity stage is the last priority. On the other hand, in terms of social criteria, the most weight is allocated to the decline of companies and the next priorities in terms of social criteria are related to the stages of maturity, growth and establishment.

Also, the highest weight of energy criteria as an important criterion of the sub-core of social

responsibility network is related to the growth stage of the company and the next priorities in terms of energy criteria are related to the stages of establishment and maturity. In terms of human resources criteria, the most important attention and priority for companies is in the initial stage, and the next priorities in terms of human resources criteria are related to the stages of decline and growth. Another important criterion of social responsibility is paying attention to the aspects of product production, which it was found that the greatest weight of this criterion is related to the initial stage and then the stages of growth and maturity. Also, the other two criteria, including customer satisfaction and environmental factors, have the greatest impact on the initial stage and then the stages of growth and maturity.

At the end of topics this section, it should be noted that the research hypothesis that was related to fuzzy network analysis; He stated that effective measures of measuring financial constraints and life cycle and social responsibility, relying on the fuzzy network approach in the field of refinement and evaluation, are of different importance. Since the scores obtained for life cycle stages according to environmental, product, human resources, customer, social and energy metrics are different numbers according to Table 15, it can be concluded that the level of importance is clear. It is different and accordingly the third sub-hypothesis is acceptable with the analysis of the research fuzzy network.

Table (15) FANP method supermatrix

	gole	Social	energy	human	decline	growth	initial	mature	product	customer	Environment
gole	0	0	0	0	0	0	0	0	0	0	0
social	1	0	0	0	0	0	0	0	0	0	0
energy	1	0	0	0	0	0	0	0	0	0	0
human	1	0	0	0	0	0	0	0	0	0	0
decline	0/09362	0/5455	0/2062	0/25742	0	0	0	0	0/05856	0/07134	0/06842
growth	0/27969	0/14667	0/3538	0/14697	0	0	0	0	0/34418	0/31325	0/26811
initial	0/6267	0/08177	0/2267	0/48268	0	0	0	0	0/42081	0/46326	0/52924
mature	0	0/22606	0/2143	0/11293	0	0	0	0	0/17645	0/15216	0/13423
product	1	0	0	0	0	0	0	0	0	0	0
customer	1	0	0	0	0	0	0	0	0	0	0
Environment	1	0	0	0	0	0	0	0	0	0	0

Table (16) FANP method weighted supermatrix

	gole	Social	energy	human	decline	growth	initial	mature	product	customer	Environment
gole	0	0	0	0	0	0	0	0	0	0	0
social	0/14286	0	0	0	0	0	0	0	0	0	0
energy	0/14286	0	0	0	0	0	0	0	0	0	0
human	0/14286	0	0	0	0	0	0	0	0	0	0
decline	0/01337	0/5455	0/2062	0/25742	0	0	0	0	0/05856	0/07134	0/06842
growth	0/3995	0/14667	0/3538	0/14697	0	0	0	0	0/34418	0/31325	0/26811
initial	0/8953	0/08177	0/2267	0/48268	0	0	0	0	0/42081	0/46326	0/52924
mature	0	0/22606	0/2143	0/11293	0	0	0	0	0/17645	0/15216	0/13423
product	0/14286	0	0	0	0	0	0	0	0	0	0
customer	0/14286	0	0	0	0	0	0	0	0	0	0
Environment	0/14286	0	0	0	0	0	0	0	0	0	0

Table (17) FANP method limited supermatrix

	gole	Social	energy	human	decline	growth	initial	mature	product	customer	Environment
gole	0	0	0	0	0	0	0	0	0	0	0
Social	0/07692	0	0	0	0	0	0	0	0	0	0
energy	0/07692	0	0	0	0	0	0	0	0	0	0
human	0/07692	0	0	0	0	0	0	0	0	0	0
decline	0/10345	0/5455	0/2062	0/25742	0	0	0	0	0/05856	0/07134	0/06842
growth	0/13453	0/14667	0/3538	0/14697	0	0	0	0	0/34418	0/31325	0/26811
initial	0/21957	0/08177	0/2267	0/48268	0	0	0	0	0/42081	0/46326	0/52924
mature	0/08091	0/22606	0/2143	0/11293	0	0	0	0	0/17645	0/15216	0/13423
product	0/07692	0	0	0	0	0	0	0	0	0	0
customer	0/07692	0	0	0	0	0	0	0	0	0	0
Environment	0/07692	0	0	0	0	0	0	0	0	0	0

6.Conclusion

In this study, the effective factors in ranking the level of responsibility of companies based on six criteria of environmental, product, human resources, customers, social and energy for different stages of the life cycle of companies were studied. The research claimed that the effective measures in measuring the importance of the level of responsibility during the life cycle stages are clearly different from each other.

Whereas during the implementation of the fuzzy network multi-criteria ranking method, it was found that the score assigned to the newly established stage for emerging companies has the highest weight among other stages of the life cycle; In both the fuzzy hierarchical process (FAHP) and the Fuzzy Analytical Network Process (FANP), it obtains the first rank for selection in comparisons by paired method and a difference in rankings according to the graphs and results of the fuzzy network ranking table was revealed.

From the obtained results, it can be concluded that among the indicators, the most important factor for ranking is the attention to environmental issues, which has had the largest share in the implementation of accountability goals. Something that is also clear in the diagrams.

After that, the next most important factor was to pay attention to customer demands, which is one of the most important pillars of attention to external stakeholders, and according to the results, companies usually pay more attention to this component of social responsibility at the beginning. Also, the human resources sub-criterion was ranked third for selecting alternatives to the hierarchical research model. In this study, the alternatives meant the same different stages of the life cycle. Finally, in the sensitivity analysis, it was revealed that for a one percent change in the environmental, product, human resources, customer, social and energy sub-criteria, The probability of choosing the stage of establishing the company as the first priority has the highest percentage.

Based on the results, it can be suggested that the start-up phase is very important for the long-term development of the company. Hence, companies are advised to adopt an appropriate corporate environmental strategy to help the company successfully overcome the difficult stage. Our results can help corporate development policy makers to adopt more sensible and reliable social responsibility disclosure policies, as well as prioritize customer satisfaction in the early stages of development and growth. This can be more relevant for companies at different stages of the life cycle. Also, companies should not blindly pursue social responsibility goals. Also, energy management and attention to social issues along with the next priorities for mature companies should be considered as an appropriate social responsibility strategy based on the characteristics of the company.

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