ORIGINAL PAPER

A MODEL FOR CORPORATE SOCIAL RESPONSIBILITY RANKING ON IRON ORE MINE COMPANIES BY FUZZY COGNITIVE MAPPING METHOD

Mohsen Askari, Alireza Naser Sadrabadi, Seyed Heydar Mirfakhredini, Ali Morovati Sharifabadi

Yazd University, Yazd, **Iran**

ABSTRACT. **Background:** Due to the rising importance of our global interdependence, some concepts like corporate social responsibility (CSR) have a significant role in this dynamic and flourishing industry composed of lodging, transportation and so on. Accordingly; any small decisions or actions occurring in one of these centers, regardless of their direct effects on the desired sectors, can gradually have direct and indirect, hidden and obvious, as well as tangible and intangible impacts on all sectors in society and consequently lead to a series of actions and reactions in all levels and layers. Thus, the purpose of this study was to explain and rank factors affecting corporate social responsibility (CSR) of iron ore mining companies in Yazd Province, Iran. In addition, for the first time, the fuzzy FCM method has been used to rank corporate social responsibility

Methods: CSR indicators and dimensions were extracted using Content Analysis of interviews with expert groups from a total number of 9 iron ore mining companies in Yazd Province, Iran. Then, relations between the indicators were determined via Fuzzy Cognitive Map, and subsequently, they were ranked through FC Mapper. In the end, the intensity of the impact of the indicators on each other was calculated through Mic Mac.

Results: The obtained dimensions by Content Analasys, included safety and health as well as legal, ethical, environmental, philanthropic, and economical. Indicators of "striving to reduce harm to the environment", "striving to reduce toxic and greenhouse gases", "increasing employee satisfaction and motivation", "developing and promoting community knowledge and culture" and "providing real-time information about The work and the disadvantages resulting from it" were ranked the highest in the ranking model. In the end, the intensity of the impact of the indicators on each other was calculated through Mic Mac that influential indicators were included "voluntary support of employees in social activities", "efforts to reduce toxic and greenhouse gases" and "transparency in contracts with contractors".

Conclusions: This research can be beneficial to government, researchers and organizations in helping them to understand indicators based corporate social responsibility in order to persuade them to do their commitment about society.

Key words: Corporate Social Responsibility, Content Analysis, Fuzzy Cognitive Mapping, Mic Mac.

INTRODUCTION

Being socially responsible means that individuals and organizations need to treat social, cultural, and environmental issues by way of ethics and sensitivity. Efforts to establish social responsibility can thus help individuals, organizations, and governments have a positive impact on progress, working conditions, and society. Therefore, individual social responsibility extends beyond its scope by creating an active position to have a positive impact on others and the surrounding environment. Thus, individual social responsibility is considered as the basis of corporate social responsibility (CSR); since society is a community of individuals which

can consequently shape the culture of social responsibility. The concept of CSR includes subjects related to an organization's behavior within a social environment, and it is also beyond merely traditional economic territories. Since the field of activity is not merely economic, businesses encounter a collection of rights and responsibilities within society that does not allow them only focus on economic management to achieve their goals. Organizations also deal with social, economic, legal, ethical, and environmental challenges in their everyday activities that can affect their behaviors. These organizations may aim at maximizing profitability or earning maximum shareholders' equity, while social obligations should be correspondingly taken into account. In fact, companies do not just meet the needs of their owners, but those of a set of social actors that are dependent on the company and its field of activity. Indeed, CSR is a greater responsibility assumed by the company considering its impacts on society and the natural environment.

STATMENT OF THE PROBLEM & SIGNIFICANCE OF THE STUDY

Growth and development of various industrial and commercial institutions and organizations as well as increased competitions among them has led these entities to think only of their organizational interests and accomplish their goals in any possible way. Currently, managers need to abandon particularism and mere preoccupation with organizational goals and set those of their community and country as a guide for their efforts [Seyyedjavadain et al., 2016]. Unquestionably, no sense of responsibility towards people is a barrier to the provision of effective services by managers and their success. Managers should not just think of concepts such as control, supervision, order, and guidance; but they are required to reflect on services to the public as a duty and a good thing to achieve organizational excellence [Norman, MacDonald, 2009].

CSR, as a guideline for businesses, has been growing over the recent years. The extent of this concept and its expansion can be thus realized through numerous publications,

conferences, and active organizations working in this domain [Gao, 2011]. In other words, sustainable development can result when the role of CSR becomes bolder. Based on the concept of CSR, since organizations are members of a community like individuals and have responsibilities for their surrounding environment; they are required to improve their economic and social performance and also put the promotion of social life standards of individuals in the society into their agenda [Aluchna, 2010].

Studies have shown that social responsibility is one of the best tools for gaining public legitimacy and competitive advantage [Rhou et al., 2016]. According to Mattra et al. [2012], social responsibility means the responsibility or commitment of a person or organization to social concepts such as individuals or the physical environment around them.

The concept of CSR means how wealth is responsibly created through businesses. Thus, it includes the behavior of an organization in terms of employees, customers, contractors, the environment, and society. A win-win relationship and shared value creation for society and an organization is accordingly a conceptual infrastructure for CSR. This also emphasizes responsibility and responsiveness as the bases of behavior in an organization within a society and responsibly monitors businesses along with the production of wealth. While most companies currently believe that social and environmental responsibilities using a sustainable development approach needs to be stressed, the domains and boundaries of reporting and disclosure of CSR for Iranian companies are not clear enough, since there is no proper understanding of dimensions of CSR and no comprehensive studies explaining the operationalized concept of CSR and recognizing its nature, type, and content. Therefore, it is necessary to contribute to perception and development of disclosure of CSR in companies in Iran, as a developing country, based on an experimental study and its results in the light of a sustainable development approach, the Constitution of the Islamic Republic of Iran, the general policies

of the perspective of the Islamic Republic of Iran on the horizon of 1404, the Fifth Development Plan, and privatization process [Asayesh, Feizpour, 2014]. Additionally, CSR has been defined within two intellectual schools. One group believes that businesses are only required to increase their profitability within legal boundaries and to observe ethical standards and limitations [Freeman 1998, Levitt 1958] and another group assumes that companies need to comply with a wide range of obligations in society [Carrol 1979]. Reviewing the related literature on CSR, the following models were identified as the main ones explaining this type of self-regulation (Table 1).

Table 1. CSR models

Model	Dimensions/Indicators	References
ISO260000 Model	Responsiveness	Castka & Balzarova
	Transparency	
	Ethical behavior	
	Respect for shareholders' equity	
	Respect for rule of law	
	Respect for international behavioral norms	
	Respect for human rights	
Stakeholder Theory	Society	Harrison & Freeman
	Environmental groups	
	Employees	
	Customers	
	Investors	
	Suppliers	
Global Reporting Initiative	Economy	Sustainable Reporting Guide
	Environment	
	Human rights	
	Working activities and proper working conditions	
	Product liability	
	Society	
Davis Model	Profitability	Davis (1975)
	Improved social welfare	
Lantos Model	Ethical	Lantos (2001)
	Philanthropic	
	Strategic	
Carrol Model	Philanthropic	Carrol (1979)
	Economic	
	Legal	
	Ethical	
Three-Level Model	Principles of CSR	Wood (1991)
	Policy-making and responsive processes	
	Tangible results relevant to organizational social issues	
CSR European Style	CSR in government	Albareda et al. (2007)
	CSR in government-business relationship	
	CSR in government-society relationship	
	CSR in government-business-society relationship	

RESEARCH LITERATURE

Zakaria SF., Ahmad AR. [2019] in a study entitled "AHP Ranking of CSR Human Resource Theme of Takaful Operators" by content analysis of the annual reports of 11 takaful operators in Malaysia for the year 2014 was undertaken to examine the CSR initiatives disclosed. The highest priority vector for each group—human-self, intellect, posterity and wealth—are provision of healthy & safe workplace (0.317), the existence of employee training and development programs (0.404), providing staff home ownership scheme (0.473) and policies on the company's remuneration schemes (0.493), respectively. Results of research of Erin H.Kao et al [2018] in title "The relationship between CSR and performance: Evidence in China" show variations in market response to CSR

engagement by firm ownership type. That is, the market responds favorably to CSR by market-oriented non-SOEs but neutrally to CSR by SOEs with substantial agency costs. The Chinese firms are able to link their CSR activities to firm performance over time, likely recognizing the long-term benefits of CSR. Our study demonstrates the important role of ownership in the dynamic CSR-performance relationship. In a study entitled "Applications of analytical methods of gray relation entropy in ranking corporate social responsibility: Evidence of Iranian pharmaceutical companies," Senowbar and Baz-Mohammadi (2017) introduced the analysis of gray relation entropy weighting to find solutions to analyze and rank companies in this perspective. Karabašević, D et al [2016] in a study entitled "Ranking of companies according to the indicators of corporate social responsibility based on SWARA and ARAS methods" proposed framework for evaluation and ranking is based on the SWARA and the ARAS methods. The usability and efficiency of the proposed framework is shown on an illustrative example. As well, Ghasemi-Hosseinabadi [2016] in a study entitled "Corporate social responsibility and how to measure it" examined motives and reasons for disclosure of CSR following a review of literature on this concept, and conclusively proposed a framework for a comprehensive report. According to this framework, the comprehensiveness rate of the CSR reports could be measured. Abd-RazakAhmad et al [2015] in title "i-CSR Ranking in the Workplace" showed that the activities that are highly ranked in each sub-areas are 'fardhu ain tazkirah session', 'medical benefit for immediate family members', 'fringe benefit, like entitlement to comprehensive medical benefit or takaful protection', 'entitlement to special leave to visit the elderly, parents or attending own children's school activities' and 'free biannual medical check-ups'. The rankings of these activities will serve as a reference point for Islamic organizations to prioritize their CSR initiatives according to Islamic teachings. Ahmad et al. [2015] in an article entitled "Ranking Islamic corporate social responsibility" using analytical hierarchy process (AHP). Besides, Ardalan et al. [2015] fulfilled a project entitled

"Investigation of the relationship between social capital, social responsibility, and organizational commitment: A case study on employees at Razi University of Kermanshah" using structural equation modeling (SEM) and found that only economic dimension, among the four CSR dimensions, had a positive and significant effect on it. Moreover, only ethical and philanthropic dimensions had positively and significantly influenced job satisfaction. Examining the impact of quality of relationships on consequences arising from it, the relationship between all variables (except for organizational trust on the intention to quit jobs) indicated a significant effect. Hirigoyen, and Poulain-Rehm [2014] measured the relationship between CSR and financial performance of 329 listed companies of three geographic regions, i.e., the United States, Europe, and Asia via SEM. The results of their study showed that not only CSR had failed to have a positive effect on corporate financial performance, but also corporate financial performance had no positive impact on CSR. Also, Nowrouzi et al. [2014] in an article entitled "Theoretical processing of corporate social responsibility based on the grounded theory" conducted an unstructured interview with CSR administrators and executives and collected a series of initial themes during the coding process and then extracted the desired categories. Valmohammadi [2014] also examined the relationship between CSR and organizational performance using SEM and reported that CSR had an impact on performance, and also participation and development could play an important role in increasing organizational performance. Hasas-Yeganeh and Arzegar [2013] in a study entitled "Developing components and indicators of corporate social responsibility and its current status in Iran" shed light on this issue. This study suggested and analyzed components and indicators of disclosing CSR via a sustainable development approach and using questionnaires and path analysis within a comprehensive framework. Also, the existing situation and the level of disclosure of the social dimension of the companies were determined through the content analysis of reports provided by the board of directors. Kitzmueller and Shimshack, [2012] in a project entitled "Investigating relationship

between corporate social responsibility and limitations of supplying financial resources in companies listed in Tehran Stock Exchange" examined the relationship between CSR and financial performance using financial data of 100 companies through correlation and regression and showed a positive and significant relationship between CSR and financial performance; i.e. increase in one of the variables could be accompanied by a rise in another one. Moreover, Salehi-Omran et al. [2012] in a study entitled "Examining the importance of corporate social responsibility indicators in industrial centers and universities"; investigated the amount of attention to CSR indicators in industrial centers and universities. Given the importance of CSR in universities and higher education institutes; five indicators of proper working conditions, training programs, non-discrimination at work and attention to vulnerable groups, as well as concepts of environmental protection and society were highlighted.

RESEARCH METHOD

A combination of qualitative and quantitative methods was employed in this study. The research procedure started with studying theoretical foundations to identify factors affecting CSR ranking of iron ore mining companies in Yazd Province, Iran. Accordingly, there were attempts to review the most important factors and indicators affecting the explanation of SCR ranking for selected experts through studying and reviewing the resources available in this area, including existing models and theories in this field. About the review of the models and theories in the previous section and their explanation for the selected experts and given that the existing models had been generally prescribed for organizations, expert opinions about the CSR dimensions were also investigated via a series of interviews. In this study, content analysis was used to organize the collected data within a systematic framework. After extracting the dimensions and components of CSR for iron ore mining companies in Yazd Province, the indicators were rated via FCM.

At the first step of the study, a qualitative research methodology containing meetings and interviews with selected experts of iron ore mining companies of Yazd Province was used; the concepts associated with CSR were explained, key statements based on the identifiers (codes) were registered, and they were consequently introduced as open codes. Within the content analysis; after reviewing open codes, statements with overlapping concepts and meanings were merged, and then the dimensions were identified as axial codes. Afterward, FCM was used to better understand the relations between the indicators and their significance of coefficients.

A total number of 21 iron ore mining companies (with active status) licensed by the end of November 2013 had been listed in the system of the Ministry of Industry, Mine, and Trade in Yazd Province at the time of the study. Of these companies, only nine cases had a well-defined organizational chart. Therefore, following talks with relevant authorities in these nine companies, each one accepted to create and introduce a group consisting of experts in the field of human resources, industrial psychology, or safety and health in order to collaborate in this study. Accordingly, 9 groups were selected to advance the research objectives.

Content Analysis

Content analysis is known as an appropriate research technique to respond to questions about the content of a message. Although there were claims in preliminary approaches that content analysis can also encompass characteristics of authors along with effects on the audience; today, these two functions are only possible in field methods and documentary integration ones [Bakhshi, Jalaeian, 2016]. In qualitative content analysis, there are also attempts to identify and extract categories in communicative massages through selective, open, and axial coding. Considering the use of qualitative content analysis in this study, the following steps were followed:

Step 1: Explain the concepts and foundations of CSR for selected experts

Step 2: Implement open coding via identifying statements from interviews and assigning them with identifiers (codes)

Step 3: Divide up codes by examining statements and paying attention to their overlapping and then their aggregation and integration

Step 4: Perform axial coding for identifying groups in which the concepts are located on the axis of the main category.

FUZZY COGNITIVE MAPPING

Building an FCM model requires inputs resulting from experiences and knowledge of experts in a subject matter. Accordingly, in such models, accumulated experiences of individuals and existing knowledge of the domain in which the model is drafted are integrated, and then causal relations are created between the constituent elements of the system (Kosko, 1988). The methodology developed by Rodriguez-Repiso [2005] also used the initial matrix of success (IMS), the fuzzified matrix of success (FZMS), the strength of relationships matrix of success (SRMS), and final matrix of success (FMS) for FCM. So, calculating the four matrices for FCM was as follows:

IMS

IMS is a $[m \times n]$ matrix in which *n* refers to the number of key success factors and *m* is the number of people interviewed for data collection. Each O_{ij} element in the matrix indicates the importance given by person *j* to specific concept *i*; which can be different in various projects and even for various success factors.

FZMS

Numeric vector V_i can be moved to fuzzy sets in which each element of fuzzy set means the element O_{ij} of vector V_i with vector V_i. Numeric vectors with 0 and 1 values can be thus converted into fuzzy sets as follows:

Find the maximum value in V_i and consider $X_i = 1$ for it:

$$Max\,(O_{iq}) \rightarrow X_i(O_{iq}) = 1 \qquad (1)$$

Find the minimum value in V_i and consider $X_i = 0$ for it:

$$Max\,(O_{iq}) \rightarrow X_i(O_{iq}) = 0 \qquad (2)$$

Specify the ratio of all the other elements of vector V_i within [0,1]; i.e.

$$X_i(O_{ij}) = \frac{O_{ij} - Min\,(O_{ip})}{Max\,(O_{iq}) - Min\,(O_{ip})} \qquad (3)$$

In which, $X_i(O_{ij})$ is the degree of membership for the element O_{iq} in vector V_i.

SRMS

SRMS is a $[n,n]$ matrix. In this respect, rows and columns are associated with the matrix of the key success factors and each element in the matrix indicates the relation between factor *i* and factor j. As well, S_{ij} can accept values within [0,1] .

Proximity of the relation between V_1 and V_2 with regard to computing similarity between the two vectors confirms the strength of the relation between concepts *1* and *2* which is associated with these two vectors represented by the element S_{12} in SRMS. Proximity of relation between these two vectors is based on the distance between both vectors according to the concept of distance between vectors [Kosko, 1985].

If d_j is the distance between element *j* of vectors V_1 and V_2,

$$d_j = \left|X_1(V_j) - X_2(V_j)\right| \qquad (4)$$

And *AD* is the average distance between vectors V_1 and V_2,

$$AD = \frac{\sum_{j=1}^{m}|d_j|}{m} \qquad (5)$$

Proximity or similarity of *S* between two vectors is presented based on the following equation:

$$S = 1 - AD \tag{6}$$

S=1 verifies the similarity of the whole and *S=0* is a marker of the maximum degree of non-similarity.

If vectors V_1 and V_2 have an inverse relation, the method to compute the similarity between them is like the former one with the exception that the equation of the distance between the given elements is inversely related with vectors V_1 and V_2.

$$d_j = \left| X_1(V_j) - (1 - X_2(V_j)) \right| \tag{7}$$

FMS

Once SRMS is completed, some data inserted in this matrix can be misleading. All the key success factors are not related, and there is not always a causal relation between them. To analyze the data and to convert SRMS into FMS, there is a need to use expertise, which includes only the set of fuzzy numeric elements that represent causal relations between key success factors. During data analysis in SRMS matrix, both vectors can be assumed relatedly adjoining. Vectors can also indicate close mathematical relations, while two indicators or concepts can be logically and completely non-related. These unconventional relations can be easily analyzed through expertise [Rodriguez-Repiso, 2005].

MIC MAC

MicMac forms up based on driving power (effect) and dependence power (being influenced) of each variable and makes it possible to further study the range of each variable. In this analysis, the variables are divided into four groups: autonomous, dependent, linkage (interface), and independent (Figure 1).

The manner of distribution of the variables on the dispersion indicates sustainability or non-sustainability of a system. In the domain of mutual effects analysis method using Mic Mac, two types of dispersion were defined; known as sustainable and non-sustainable systems. In the sustainable system, distribution of the variables is L-shaped; that is, some variables have high driving, and some have high dependence powers. In the sustainable system, three variables can be observed:

- Variables with significant effects on the system (key factors)
- Independent variables
- Output system variables (outcome variables).
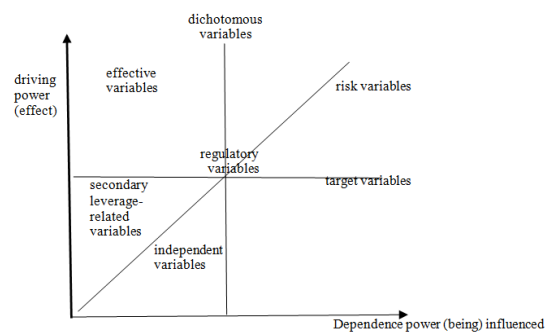
Fig. 1. Dispersion of variables in Mic Mac

In Figure 1; effective variables, dichotomous variables (risk variables and target variables), regulatory variables, variables being influenced (outcome variables), and independent variables can be observed

In this study; Microsoft Excel, MicMac, Pajek, FCMapper software programs were used in different sections.

RESEARCH FINDING

Content Analysis

In content analysis, messages generated are analyzed, and there are attempts to seek answers to research questions. Accordingly, content analysis can provide diverse opportunities for scholars in the fields of social sciences and humanities to make regular use of

documents relating to human affairs; i.e., the content of communications.

Open Coding

To implement this step, an introductory meeting was held for each selected expert to explain research subject, definitions, and objectives; and they were then asked to consider important dimensions in CSR ranking on iron ore mining companies according to the status of their company. Their verbal and

sometimes written statements were subsequently summarized and aggregated in the form of initial open codes in Table 2. In this step, each item was assigned with a title and a label according to conventional methods. The title, so-called the code needed to reveal data content, so that researchers and readers could realize the concepts of statements after observing the given titles and labels [Mills, Huberman, 1994].

Table 2. Initial open codes

Identifiers	Verbal statements	Concepts (Codes)
R1	Efforts to comply more with occupational health	Attention to occupational health
R2	Similar rules for everyone	Equal rules
R3	Utilization of safe machinery and equipment	Safety
R4	Encouragement of employees to use safety equipment	Guarantee of employee health
R5	Job identity for employees	Ethics
R3	Adherence to safety standards at work	Safety
R6	Observance of employee rights	Legality
R7	Use of environmentally reusable tools and implements	Environmental protection
R6	Respect for contractual obligations	Legality
R8	Transparency in employee promotion	Fair promotion
R9	Transparency in signing contracts with contractors	Transparency in contracts
R5	Attention to employees' working conditions	Ethics
R7	Research for optimal water use	Environmental protection
R5	Provision of factual information about work and its resulting damage	Ethics
R10	Equal opportunities and non-discrimination	Justice
R7	Efforts to reduce damage to the environment	Environmental protection
R5	Planning for employee unions at different occasions	Ethics
R7	Recycling and reducing waste	Environmental protection
R7	Increased use of clean energy	Environmental protection
R11	Maintaining and enhancing green space in alternative locations	Green space development
R12	Maintaining quality of product grade	Maintaining quality
R13	Energy saving	Energy efficiency
R7	Restoration of mines to their original states after complete extraction according to existing instructions	Environmental protection
R7	Efforts to reduce toxic and greenhouse gases	Environmental protection
R14	Public works	Philanthropic
R15	Higher priority for recruitment of native individuals in equal conditions	Native individuals' consent
R14	Support for voluntary involvement of employees in social activities	Philanthropic
R14	Development and promotion of community knowledge and culture	Philanthropic
R14	Increase in employee satisfaction and motivation	Philanthropic
R17	Consideration of shareholders' and investors' equity in decisions	Profitability
R5	Fair payment method	Ethics
R16	Improved productivity	Reduced final cost
R18	Attention to customer satisfaction	Long-term profitability
R19	Conducting transparent bids and tenders in the presence of supervisory representatives	Transparency in transactions

Axial Coding

In this step, titles extracted from the data are categorized and compared which can take a lot of time and patience, since the relationship between them is not so obvious at

first; in fact, researchers encounter a huge amount of raw data that is not very interrelated, but invisible links will almost immediately appear. Comparing different concepts, it is possible to discover more common grounds among them, which allows for categorization of similar concepts within

the same groups. This theory, as the process of continuous comparison of concepts with each other has been called a comparison method for sustainability analysis [Selden, 2005]. Using the given technique, the grounds for the emergence of common dimensions of concepts, i.e., an axial coding, become possible. As can be seen, identical concepts had the same identifiers. But, some concepts had meanings that were equal or close together, as aggregated in the next table.

Given the proximity and overlapping of the meanings; identifiers R1, R3, and R4 were placed in safety and health dimension and identifiers R2, R6, R8, and R9 were enlisted in the legal dimension. As well; identifiers R7, R11, and R13 were assigned to environmental dimension, and identifiers R5 and R15 were categorized into an ethical dimension. Furthermore; identifiers R14 and R15 were set in philanthropic dimension, and identifiers R12, R16, R17, R18, and R19 were registered in the economic dimension. So, open and axial codes were extracted according to the above-mentioned analysis, as shown in Table 3.

Table 3. Open and axial codes

No.	Open codes	Axial codes
1	Use of environmentally reusable tools and implements	Safety and health
2	Encouragement of employees to use safety equipment	
3	Adherence to safety standards at work	
4	Observance of employee rights	Legal
5	Respect for contractual obligations	
6	Transparency in employee promotion	
7	Transparency in signing contracts with contractors	
8	Attention to employees' working conditions	Ethical
9	Provision of factual information about work and its resulting damage	
10	Creation of equal opportunities and non-discrimination	
11	Efforts to reduce damage to the environment	Environmental
12	Recycling and reducing waste	
13	Increased use of clean energy	
14	Maintaining and enhancing green space in alternative locations	
15	Energy saving	
16	Restoration of mines to their original states after complete extraction according to existing instructions	
17	Efforts to reduce toxic and greenhouse gases	
18	Public works	Philanthropic
19	Higher priority for recruitment of native individuals in equal conditions	
20	Support for voluntary involvement of employees in social activities	
21	Development and promotion of community knowledge and culture	
22	Increase in employee satisfaction and motivation	
23	Consideration of shareholders' and investors' equity in decisions	Economic
24	Improved productivity	
25	Attention to customer satisfaction	
26	Conducting transparent tenders and bids in the presence of supervisory representatives	

Considering the discussed issues and taking the axial codes derived from the qualitative content analysis into account, the dimensions of CSR ranking on iron ore mining companies (safety and health, legal, ethical, environmental, philanthropic, economic) along with 26 indicators were extracted. In the next step, the relevance of these dimensions in determining the ranking of iron ore mining companies was specified. Therefore, structural relations of the given dimensions were

analyzed through interpretive structural modeling (ISM).

Analysis of Relations between Indicators using FCM

According to FCM, the analysis initially progressed step by step, and FMS eventually emerged.

,
Askari M., Sadrabadi A.N., Mirfakhredini S.H., Sharifabadi A.M., 2021. A model for corporate social responsibility ranking on Iron ore mine companies by fuzzy cognitive mapping method. LogForum 17 (1), 113-130. http://doi.org/10.17270/J.LOG.2021.500

Forming IMS

In this step, the initial matrix was formed based on the scores given by the nine selected experts to 26 factors, illustrated in the following table. It is worth noting that to avoid the bias of responses, the lower limit of 20 and the upper limit of 80 were considered for them. However, all the responses involving a score equal to or less than 20, were considered zero; and all the responses equal to or greater than 80 were set to 100 in the initial matrix. Table 4 showed part of the initial matrix.

Table 4. Part of the initial matrix

9	8	7	6	5	4	3	2	1	
35	60	25	30	55	45	30	0	45	1
60	65	40	65	60	55	55	35	60	2
35	30	35	70	55	60	60	60	45	3
65	35	45	55	30	60	0	40	60	
100	30	70	25	0	65	0	45	30	5
55	55	35	45	30	0	40	40	25	6
45	50	50	55	25	0	30	50	70	7
0	0	55	40	70	55	25	60	55	8
				...					...
65	40	25	40	55	25	70	35	60	26

Fuzzified Data

Table 5. Part of fuzzified matrix of factors

9	8	7	6	5	4	3	2	1	
0.25	0.67	0.08	0.17	0.58	0.42	0.17	0.00	0.42	1
0.67	0.75	0.33	0.75	0.67	0.58	0.58	0.25	0.67	2
0.25	0.17	0.25	0.83	0.58	0.67	0.67	0.67	0.42	3
0.75	0.25	0.42	0.58	0.17	0.67	0.00	0.33	0.67	4
1.00	0.17	0.83	0.08	0.00	0.08	0.00	0.42	0.17	5
0.58	0.58	0.25	0.42	0.17	0.00	0.33	0.33	0.08	6
0.42	0.50	0.50	0.58	0.08	0.00	0.17	0.50	0.83	7
0.00	0.00	0.58	0.33	0.83	0.58	0.08	0.67	0.58	8
				...					...
0.75	0.33	0.08	0.33	0.58	0.08	0.83	0.25	0.67	26

In this step, using formulas (1), (2), and (3); the initial matrix was fuzzified. The results were presented in Table 5.

SRMS

According to formulas (4), (5) and (6) in the third section, the 26*26 matrix was established in this step. Then, a meeting was held with expert groups to form up the final matrix. Considering their opinions, meaningless relations between the factors affecting CSR ranking on iron ore mining companies in Yazd Province were deleted, and the direction of the causal relations was determined. In this step, the raw matrix table was given to each group, and they were asked to specify the potential relations between the variables with number 1. The forms were then collected, and the incomplete cells were assigned with zero. So, nine matrices were calculated using arithmetic mean, and the results were rounded up. Zero values meant no diagnostic relations based on expert groups' opinions. Results were shown in Table 6.

Table 6. FMS

C26	C25	...	C8	C7	C6	C5	C4	C3	C2	C1	
0.00	0.00	...	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	C1
0.00	0.00	...	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.44	C2
0.00	0.00	...	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.38	C3
0.00	0.00	...	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	C4
0.00	0.00	...	0.00	0.37	0.00	0.00	0.43	0.00	0.00	0.00	C5
0.00	0.00	...	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00	C6
0.37	0.00	...	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	C7
0.00	0.00	...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	C8
...	...	0.00	...	...	...	...	...	...	...	...	...
0.00	0.00	...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	C25
0.00	0.00	...	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	C26

FMS

In this section, based on a matrix designed to illustrate the impact of each indicator on each other, a survey was conducted on the selected experts. Then, the mean score was calculated based on the completed matrices to summarize the expert groups' opinions. The completed matrix data were also normalized for cognitive mapping based on FCM, so the data were normalized in the -1 to +1 interval.

Normalized matrix data were then imported into FCMapper as input matrix, and then net output file was obtained. This file was subsequently used as the input into Pajek to draw the FCM. With attention to 26 main factors involved in drawing the cognitive map, 59 relations were extracted between the factors. Of the 26 factors, 12 factors had higher out-degree (Od) than in-degree (Id) and 14 factors had higher Id than Od. 20 variables were normal and six variables were of transferred type. Id could also indicate the degree of being influenced by the factors; so that, the highest Id in this study was associated with factor 11 (Efforts to reduce damage to the environment). Besides, the Od showed the effects of a concept; in other words, it included the effect rate of the factors. Variable 20 (Support for voluntary involvement of employees in social activities) also had the highest Od. Accordingly, the degree of centrality was the sum of the two previous factors. In this study, factors 11 (Efforts to reduce damage to the environment), 17 (Efforts to reduce toxic and greenhouse gases), 22 (Increase in employee satisfaction and motivation), 21 (Development and promotion of community knowledge and culture), and 9 (Provision of factual information about work and its resulting damage) had the highest degree of centrality; respectively. Values associated with each variable were illustrated in Table 7.

To draw the FCM, the output from FCMapper was used as input for Pajek. In Figure 2, FCM indicating the causal relations between the indicators affecting the CSR ranking on iron ore mining companies of Yazd Province was presented.

Table 7. General information about FCM model

indicators	out-degree (Od)	in-degree (Id)	degree of centrality
C11	0.91	2.12	3.02
C17	1.10	1.59	2.69
C22	0.96	1.61	2.57
C21	0.57	1.89	2.46
C9	0.87	1.57	2.44
C5	1.15	1.28	2.42
C8	0.98	1.21	2.19
C23	0.76	1.29	2.05
C25	0.52	1.43	1.94
C7	0.94	0.96	1.91
C24	1.10	0.72	1.82
C1	0.89	0.82	1.71
C20	1.37	0.33	1.71
C4	0.63	0.79	1.42
C3	0.86	0.54	1.40
C10	0.65	0.50	1.15
C16	0.99	0.00	0.99
C2	0.98	0.00	0.98
C19	0.88	0.00	0.88
C15	0.67	0.17	0.83
C26	0.37	0.37	0.74
C13	0.20	0.37	0.57
C14	0.48	0.00	0.48
C6	0.44	0.00	0.44
C12	0.19	0.19	0.37
C18	0.28	0.00	0.28

In Figure 2, the direction of the lines displayed driving and dependence powers. The data inserted in Table 7 as the output of the FCM of FCMapper denoted the importance of each indicator concerning its centrality. The main objective of this study was to present an SCR ranking model of iron ore mining companies of Yazd Province.
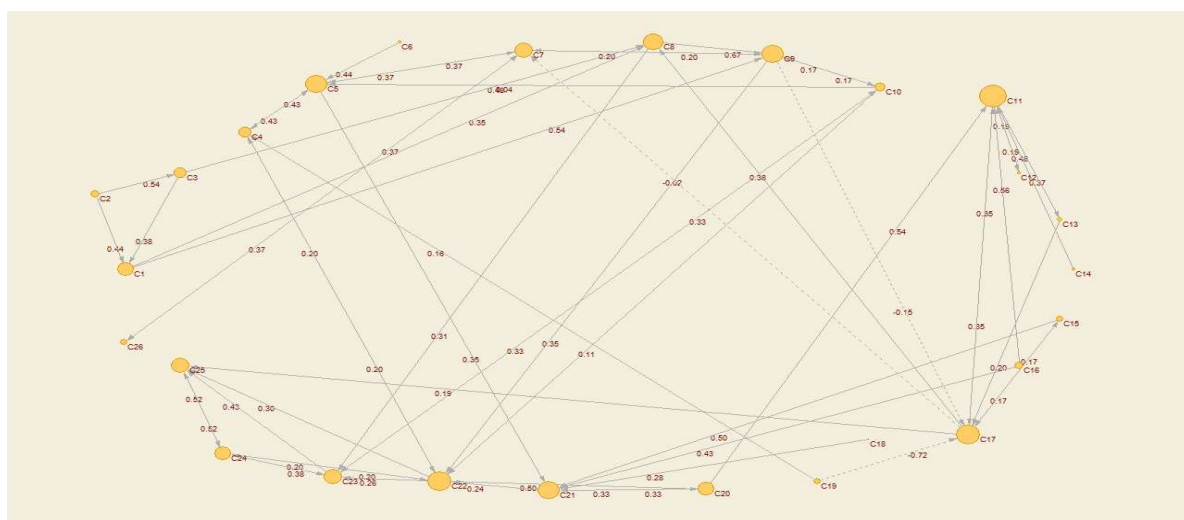

Fig. 1. FCM of indicators affecting CSR ranking

,
Askari M., Sadrabadi A.N., Mirfakhredini S.H., Sharifabadi A.M., 2021. A model for corporate social responsibility ranking on Iron ore mine companies by fuzzy cognitive mapping method. LogForum 17 (1), 113-130. http://doi.org/10.17270/J.LOG.2021.500

Table 8. Weight of each indicator of CSR ranking model

weight	symbol	indicator	dimensions
0/0433	C1	Use of environmentally reusable tools and implements	Safety and health (0/1036)
0/0248	C2	Encouragement of employees to use safety equipment	
0/0355	C3	Adherence to safety standards at work	
0/0355	C4	Observance of employee rights	Legal (0/1569)
0/0613	C5	Respect for contractual obligations	
0/0112	C6	Transparency in employee promotion	
0/0488	C7	Transparency in signing contracts with contractors	
0/0555	C8	Attention to employees' working conditions	Ethical (0/1465)
0/0618	C9	Provision of factual information about work and its resulting damage	
0/0291	C10	Creation of equal opportunities and non-discrimination	
0/0765	C11	Efforts to reduce damage to the environment	Environmental (0/2268)
0/0094	C12	Recycling and reducing waste	
0/0144	C13	Increased use of clean energy	
0/0122	C14	Maintaining and enhancing green space in alternative locations	
0/0210	C15	Energy saving	
0/0251	C16	Restoration of mines to their original states after complete extraction according to existing instructions	
0/0682	C17	Efforts to reduce toxic and greenhouse gases	
0/0071	C18	Public works	Philanthropic (0/2002)
0/0223	C19	Higher priority for recruitment of native individuals in equal conditions	
0/0433	C20	Support for voluntary involvement of employees in social activities	
0/0623	C21	Development and promotion of community knowledge and culture	
0/0651	C22	Increase in employee satisfaction and motivation	
0/0520	C23	Consideration of shareholders' and investors' equity in decisions	Economic (0/1660)
0/0461	C24	Improved productivity	
0/0492	C25	Attention to customer satisfaction	
0/0188	C26	Conducting transparent tenders and bids in presence of supervisory representatives	

Hence, the centrality of each of the indicators in the FCM model could be the basis for determining the weight of each indicator shown in Table 8.

Accordingly, the weight of each dimension was obtained from the sum of the weights of the indicators in the presented model.

Determining Types of Indicators using Mutual Effects Analysis

After identifying the indicators related to SCR ranking on iron ore mining companies in Yazd Province as well as FCM analysis, it was necessary to measure the effect of related indicators dichotomously to identify the most effective indicators in SCR ranking. To this end, a 26*26 square matrix was provided to expert groups. The process of completing the cells was based on the rounded-up mean of opinions derived from expert groups on mutual effects of the indicators. In this step of the study, MicMac was used. It should be noted that the interpretation of numbers 0, 1, 2, and 3 were as follows; number zero=no effect,

number 1=poor effect, number 2=moderate effect, and number 3=strong effect.

After collecting nine matrices and rounding up the mean opinions of expert groups, a single matrix was created and imported into MicMac. Considering the FCM output, a total of 58 cells had non-zero numbers, which meant that there was a relationship. Therefore, the expert groups were asked to assign 1 to 3 to the same fields based on driving power. The results were summarized in Table 9.

Table 9. Map of characteristics

Indicator	Value
Matrix size	26
Number of iterations	2
Number of zeros	618
Number of ones	27
Number of twos	18
Number of threes	13
Number of P	0
Total	58
Fill rate	8.579882%

The single matrix formed up was derived from the rounded-up mean opinions of the expert groups, which was used as an input in MicMac, outlined in Table 10.

Table 10. Input matrix of MicMac

|	1: Var01	2: Var02	3: Var03	4: Var04	5: Var05	6: Var06	7: Var07	8: Var08	9: Var09	10: Var10	11: Var11	12: Var12	13: Var13	14: Var14	15: Var15	16: Var16	17: Var17	18: Var18	19: Var19	20: Var20	21: Var21	22: Var22	23: Var23	24: Var24	25: Var25	26: Var26
1 : Var01	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 : Var02	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 : Var03	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 : Var04	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
5 : Var05	0	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
6 : Var06	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 : Var07	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3
8 : Var08	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
9 : Var09	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
10 : Var10	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
11 : Var11	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0
12 : Var12	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 : Var13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
14 : Var14	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 : Var15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0
16 : Var16	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
17 : Var17	0	0	0	0	0	0	0	2	1	0	1	0	0	0	2	0	0	0	2	0	0	0	0	0	2	0
18 : Var18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
19 : Var19	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 : Var20	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0
21 : Var21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
22 : Var22	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	0	0
23 : Var23	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
24 : Var24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	3	0
25 : Var25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
26 : Var26	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
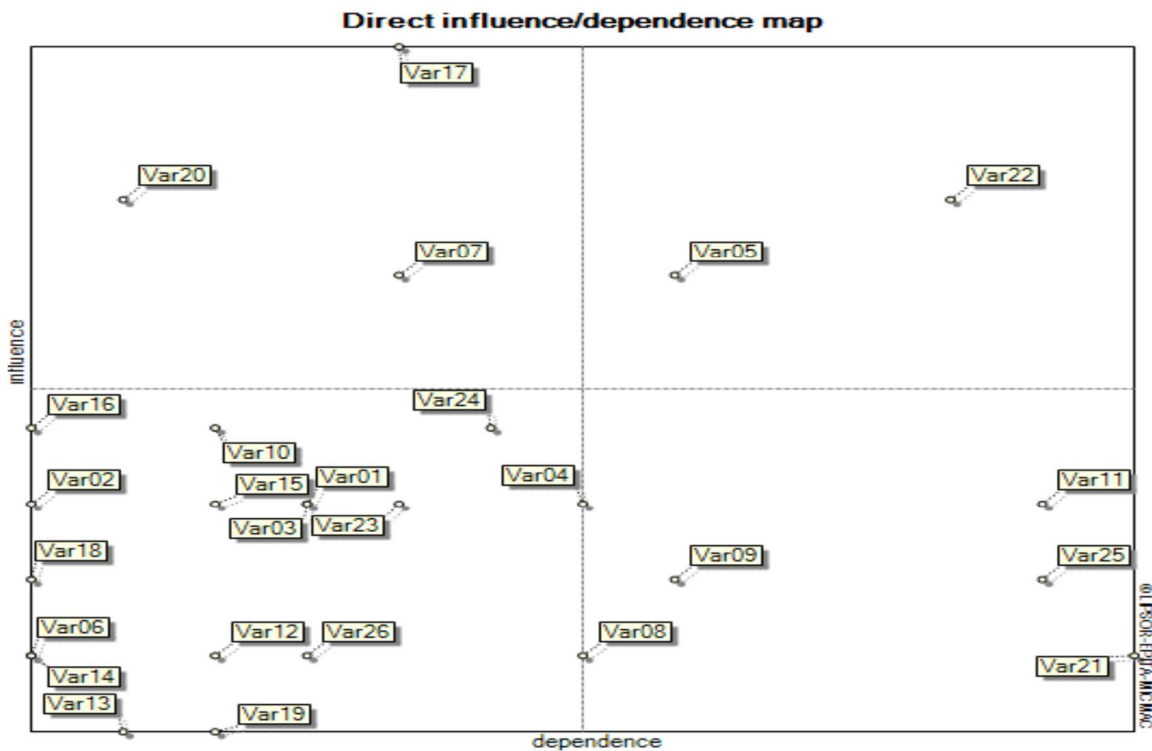
Fig. 3. Mutual effects of indicators

MicMac output was illustrated in Figure 3. As can be seen, the shape of the dispersion of the variables was continuous along the axis and represented a sustainable system. Based on the distribution of the indicators in the four areas above, the indicators in each area had their interpretations, which were discussed below.

Driving (Effective) Indicators

According to the definitions as well as placement of variables in Figure 3, indicators located on the northwestern area of the figure above were called driving (effective) variables; in other words, they were the most critical indicators including "Support for voluntary

,
Askari M., Sadrabadi A.N., Mirfakhredini S.H., Sharifabadi A.M., 2021. A model for corporate social responsibility ranking on Iron ore mine companies by fuzzy cognitive mapping method. LogForum 17 (1), 113-130. http://doi.org/10.17270/J.LOG.2021.500

involvement of employees in social activities", "Efforts to reduce toxic and greenhouse gases", and "Transparency in signing contracts with contractors".

Dichotomous Indicators

Indicators located in the northeastern area of the figure were dichotomous ones which could be influenced or affect other ones. These variables were divided into two categories of risk and target ones. The risk variables were located near the diagonal line of the northeastern area of the figure. Indicators 5 and 22 were located in the northwest corner and near the diagonal line. These variables were endowed with a very high capacity to become key actors in the system. These indicators included "Respect for contractual obligations" and "Increase in employee satisfaction and motivation."

Dependence (Influenced) Indicators

Indicators located in the southeastern area of Figure 3 had a very low effect, but they could be significantly influenced. These indicators had been called outcome indicators including "Attention to employees' working conditions," "Provision of factual information about work and its resulting damage," "Efforts to reduce damage to the environment", "Development and promotion of community knowledge and culture," and "Attention to customer satisfaction".

Independent Indicators

Indicators in the southwestern area of the figure had a low effect and they could not be influenced also significantly. In other words, these indicators did not play a role in the development or evolution of the system and even in discontinuing it. Other indicators in this area were referred to as independent indicators.

CONCLUSIONS

The concept of CSR means how to responsibly create wealth through businesses.

Therefore, the behavior of an organization encompasses employees, customers, contractors, the environment, and society. Given that iron ore mining companies in Yazd Province were included in this study, a total number of 26 indicators (open codes) in 6 dimensions (safety and health, legal, ethical, environmental, philanthropic, and economic) were extracted after analyzing the content of 34 verbal statements. The relations between the indicators were also determined via FCM. Using FCMapper, the weight of the indicators was also measured. Indicators of "Efforts to reduce damage to the environment," "Efforts to reduce toxic and greenhouse gases," "Increase in employee satisfaction and motivation," "Development and promotion of community knowledge and culture," and "Provision of factual information about work and its resulting damage" had the highest weight from the perspective of the expert groups. The severity of the effects of variables on each other was also calculated through MicMac. Accordingly, indicators of "Supporting voluntary involvement of employees in social activities", "Efforts to reduce toxic and greenhouse gases", and "Transparency in signing contracts with contractors" were considered as effective ones. As well, dichotomous indicators with very high capacity in becoming a key actor within the system included "Respect for contractual obligations" and "Increase in employee satisfaction and motivation". The indicators influenced were "Attention to employees' working conditions", "Provision of factual information about work and its resulting damage," "Efforts to reduce damage to the environment," "Development and promotion of community knowledge and culture," as well as "Attention to customer satisfaction". The remaining indicators were placed in the independent group.

ACKNOWLEDGMENTS AND FUNDING SOURCE DECLARATION

REFERENCES

Abd-RazakAhmad, Ida-Normaya M.Nasir, Wan-Asma'Wan-Abu-Bakar, FaizahDarus, Noor Zahirah MohdSidek, 2015. i-CSR Ranking in the Workplace, Procedia Economics and Finance, 31, 2015, 520-524. https://doi.org/10.1016/S2212-5671(15)01196-X

Aluchna M., 2010. Corporate social responsibility of the top ten; examples taken from the Warsaw Stock Exchange. Social Responsibility Journal, 6(4), 611-626. http://doi.org/10.1108/17471111011083473

Ardalan M.R., Ghanbari S., Beheshti-Rad R., Navidi P., 2015. Investigation of the relationship between social capital, social responsibility, and organizational commitment (A case study on employees at Razi University of Kermanshah). Educational Measurement and Evaluation Studies, 109-132.

Asayesh F., Feizpour M.A., 2014. Development in Iran and its comparison with countries in the region: Vision Document. Journal of Parliament and Strategy, 21(78), 85-119.

Bakhshi H., Jalaeian V., 2016. Content Analysis Guide, Academic Center for Education, Culture, and Reserach, First Ed.

Castka P. Balzarova A.M., 2007. "ISO 26000 and Supply Chains – on the Diffusion of the Social Responsibility Standards". International Journal of Production Economics. 111, 274-286. http://doi.org/10.1016/j.ijpe.2006.10.017

Davis K., 1975. Five Propositions for Social Responsibility, Business Horizons. https://doi.org/10.1016/0007-6813(75)90048-8

Erin H., Kao Chih-ChuanYeh, Li-HsunWang, Hung-GayFung, 2018. The relationship between CSR and performance: Evidence in China, Pacific-Basin Finance Journal, 51, October 2018, 155-170. http://doi.org/10.1016/j.pacfin.2018.04.006

Freeman R.E., 1998. A stakeholder theory of the modern corporation, in Pincus, L. B.

(Ed.), Perspectives in business ethics, McGraw-Hill, Singapore. http://doi.org/10.4236/jss.2015.37019

Gao Y., 2011. CSR in emerging country: a content analysis of CSR reports of listed companies, Baltic Journal of Management, 6, 2011, 263-291. http://doi.org/10.1108/17465261111131848

Ghasemi-Hosseinabadi F., 2016. Corporate social responsibility and how to measure it. Bi-Monthly of Applied Studies in Science Management and Development, 1 (2).

Harrison J., Freeman R., 1999. Stakeholders, social responsibility, and performance: Empirical evidence and theoretical perspectives. The Academy of Management Journal. 42. 479-487. 10.2307/256971. http://doi.org/10.2307/256971

Hasas-Yeganeh Y., Barzegar G., 2013. Developing components and indicators of corporate social responsibility and its current status in Iran. Quarterly Journal of Social-Cultural Development Studies, 2 (1), 209-234.

Hirigoyen G., Poulain-Rehm T., 2014. The corporate social responsibility of family businesses: An international approach. International Journal of Financial Studies, 2,240-265. http://doi.org/10.3390/ijfs2030240

John M., et al. 2006. Corporate Social Responsibility: The 3C-SR Model. International Journal of Social Economics.33:5-6. http://doi.org/10.1108/03068290610660661

Karabašević D., Paunkovic J., Stanujkić D., 2016. Ranking of companies according to the indicators of corporate social responsibility based on SWARA and ARAS methods. Serbian Journal of Management, 11(1), 43-53. http://doi.org/10.5937/sjm11-7877

Kitzmueller M., Shimshack J., 2012. Economic perspectives on corporate social responsibility. Journal of Economic Literature, 50 (1), 51-84. http://doi.org/10.1257/jel.50.1.51

Kosko B., 1988. Hidden patterns in combined and adaptive knowledge networks,

International Journal of Approximate Reasoning, 2, 4, 377. http://doi.org/10.1016/0888-613X(88)90111

Lantos G.P., 2001. The boundaries of strategic corporate social responsibility, Journal of Consumer Marketing, 18, 7, 595-630. http://doi.org/10.1108/07363760110410281

Albareda L., Lozano J.M., Ysa T., 2007, Public Policies on Corporate Social Responsibility: The Role of Governments in Europe, Journal of Business Ethics, 74, 391-407. http://doi.org/10.1007/sl0551-007-9514

Levitt T., 1958. The Dangers of Social Responsibility, Harvard Business Review, 33 5, 41-50. https://doi.org/10.4236/tel.2018.83031

Mattera M., Baena V., Cerviño J., 2012. Analyzing Social Responsibility as a Driver of Firm's Brand Awareness. Procedia-Social and Behavioral Sciences, 58, 1121-1130. http://doi.org/10.1016/j.sbspro.2012.09.1093

Mills M.B., Huberman M. 1994. Qualitative Data Analysis: Sourcebook of New Methods, London: Sage Publications Ltd. http://doi.org/10.3102/01623737008003329

Norman W., MacDonald C., 2009. Getting to the bottom of triple bottom-line. Business Ethics Quarterly March, 1(1): 1-19. https://doi.org/10.5840/beq200414211

Nowrouzi M.R., Danaeefard H., Asghar-Fani A., Hasanzadeh A., 2014. Theoretical processing of corporate social responsibility based on grounded theory. Improved Management, 8 (26).

Rhou Y., Singal M., Koh Y., 2016. CSR and financial performance: The role of CSR awareness in the restaurant industry. International Journal of Hospitality Management, 57, 30-39. http://doi.org/j.ijhm.2016.05.007

Rodriguez-Repiso L., 2005. Indicators of Success for IT Projects .Case Study. MSc Systems Engineering with IT Applications .Cardiff University.

Salehi-Omran I., Fatemi A., Hassanzadeh Barani Kord S., 2012. Examining the importance of corporate social responsibility indicators in industrial centers and universities. Higher Education in Iran, 1-35.

Selden L., 2005. On grounded theory - with some malice. Journal of Documentation, 61(1), 114-129. https://doi.org/10.1108/00220410510578041.

Senowbar N., Baz-Mohammadi S., 2017. Applications of analytical methods of gray relation entropy in corporate social responsibility ranking: Evidence of Iranian pharmaceutical companies. Industrial Management Studies, 15 (44), 51-74.

Seyyedjavadain R., Hashemi M., Mahmoudain O., 2016. Providing a model to explain corporate social responsibility of oil and gas companies using interpretive structural modeling. Governmental Management, 75-92. http://doi.org/10.22059/JIPA.2016.57505

Valmohammadi C., 2014. Impact of corporate social responsibility practices on organizational performance: an ISO 26000 perspective. Social Responsibility Journal, 10(3), 455-479. http://doi.org/10.1080/10508422.2018.1501566

Wood D.J., 1991. Corporate social performance revisited- Academy of Management Review 16, 691–718. http://doi.org/10.5465/amr.1991.4279616.

Zakaria SF., Ahmad AR., 2019. AHP Ranking of CSR Human Resource Theme of Takaful Operators. In: Kor LK., Ahmad AR., Idrus Z., Mansor K. (eds) Proceedings of the Third International Conference on Computing, Mathematics and Statistics (iCMS2017). Springer, Singapore. http://doi.org/10.1007/978-981-13-7279-7_63

MODEL RANKING ODPOWIEDZIALNOŚCI SPOŁECZNEJ KOPALNI RUD ŻELAZA METODĄ KOGNITYWNEGO ROZMYTEGO MAPOWANIA

STRESZCZENIE. **Wstęp:** Ze względu na rosnące znaczenie globalnych współzależności, niektóre koncepcje typu odpowiedzialność społeczna firmy (CSR) ma istotne znaczenie w dynamicznym i rozwijających się sektorze składającym się z zakwaterowania, transportu, itp. Nawet małe decyzje czy działania pojawiające się w tych centrach, niezależnie od bezpośrednich efektów na określony obszar, mogą mieć też bezpośredni lub pośredni, jasny lub ukryty, materialny lub niematerialny wpływ na wszystkie obszary społeczności i w konsekwencji prowadzić do serii akcji i reakcji zwrotnych na nie we wszystkich obszarach i poziomach.

Celem tej pracy jest wyjaśnienie oraz uszeregowanie czynników wpływających na odpowiedzialność społeczną firm (CSR) kopalni rud żelaza w prowincji Yazd, w Iranie. Dodatkowo, po raz pierwszy, metoda rozmyta FCM została użyta do stworzenia rankingu odpowiedzialności społecznej firm.

Metody: Wskaźniki I wymiary CSR zostały wydzielone przy użyciu analizy treści wywiadów z grupami ekspertów z 9 kopalni rud żelaza, zlokalizowanych w prowincji Yazd, w Iranie. Następnie określono relacje pomiędzy tymi wskaźnikami przy użyciu rozmytej kognitywnej mapy. Kolejnym etapem było ich uszeregowanie przy pomocy narzędzia FC Mapper. W ostatnim etapie wyliczono intensywność wpływu wskaźników na pozostałe przy pomocy Mic Mac.

Wyniki: Wymiary, uzyskane poprzez analizę treści, obejmowały bezpieczeństwo i ochronę zdrowia, jak również były to wymiary prawne, etyczne, środowiskowe, charytatywne oraz ekonomiczne. Najwyżej w modelu znalazły się wskaźniki: „starający się zredukować szkodliwy wpływ na środowisko", „rozwijający i stymulujący kulturę i wiedzę społeczności", „dostarczający aktualnej informacji o pracy i jej wadach". Przez zastosowanie metody Mic Mac, określono intensywność wpływu poszczególnych wskaźników na siebie. Najbardziej wpływającymi na inne były: „dobrowolne wsparcie pracowników w działalności społecznej", „działania mające na celu redukcję gazów toksycznych i cieplarnianych" oraz „transparentność w kontaktach z partnerami".

Wnioski: Wyniki uzyskane w tej pracy mogą wspomóc organy rządzące, naukowców oraz organizacje w zrozumieniu przez nich wskaźników odpowiedzialności społecznej firm w celu zintensyfikowania ich działań na rzecz społeczeństwa.

Słowa kluczowe: odpowiedzialność społeczna firm, analiza treści, rozmyte kognitywne mapowanie, Mic Mac

Mohsen Askari
Ph.D. Student of Industrial Management
Faculty of Economics, Management and Accounting
Department of Industrial Management, Yazd University
University Blvd , Safayieh, PO Box: 98195-741, Yazd, **Iran**
e-mail: mohsenaskari@stu.yazd.ac.ir

Corresponding author
 Alireza Naser Sadrabadi
Associate Professor of the Department of Industrial Management
Faculty of Economics, Management and Accounting
Department of Industrial Management, Yazd University
University Blvd , Safayieh, PO Box: 98195-741, Yazd, **Iran**
e-mail: alireza_naser@yazd.ac.ir

Seyed Heidar Mirfakhredini
Associate Professor of the Department of Industrial Management
Faculty of Economics, Management and Accounting
Department of Industrial Management, Yazd University
University Blvd , Safayieh, PO Box: 98195-741, Yazd, **Iran**
e-mail: mirfakhr@yazd.ac.ir

,
Askari M., Sadrabadi A.N., Mirfakhredini S.H., Sharifabadi A.M., 2021. A model for corporate social responsibility ranking on Iron ore mine companies by fuzzy cognitive mapping method. LogForum 17 (1), 113-130. http://doi.org/10.17270/J.LOG.2021.500

Ali Morovati Sharifabadi
Associate Professor of the Department of Industrial Management
Faculty of Economics, Management and Accounting
Department of Industrial Management, Yazd University
University Blvd , Safayieh, PO Box: 98195-741, Yazd, **Iran**
e-mail: alimorovati@yazd.ac.ir