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Research Paper

A Mathematical Model for Measuring Corporate Governance using Multi-Criteria Decision Making (MCDM)Technique

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ABSTRACT

There has not been presented any comprehensive index for Corporate Governance despite its crucial role in resolution and responsiveness. Although diverse methods have been sought for measuring Corporate Governance in previous studies, this study proposes a comprehensive index for measuring Corporate Governance, taking other indexes into account through mathematical equations. To test and measure the functionality of the designed model, a set of data related to 149 firms from 2014 to 2019 has also been jointly used. To achieve this, a questionnaire is created and distributed to experts to gather their opinions on the weight and significance of the criteria for measuring the Corporate Governance of the firm. The weight and significance of the criteria are determined using the Shannon Entropy method, a multi-criteria decision model. Additionally, a confirmatory factorial analysis is conducted to measure the changeable hidden relationship in the Corporate Governance study, based on the measurement items. The results indicate that the proposed model serves as a suitable index for Corporate Governance.
This mixed index includes criteria such as the size, independence, meetings, and education of the board of directors; the CEO's permanence; the size, independence, financial speciality, financial experience, tenure, and meetings of the auditorship committee; ownership concentration; organizational ownership; governmental ownership; deals with dependent persons; the quality of disclosure; proper information; and weaknesses in internal controls. Among these criteria, the quality of disclosure and proper information hold the most paramount significance and the highest weight, while the meetings of the board of directors have the least importance and weight.

1 Introduction

Corporate Governance has been a subject of international controversy since the early 1890s and continues to be a topic of debate. It is not a newly discovered phenomenon but has been intertwined with the establishment of business [3]. Corporate governance encompasses a set of guiding mechanisms and

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controls for companies. The corporate governance system determines the allocation of rights and liabilities among company stakeholders, including directors, staff, shareholders, and other legal and natural persons affected by and influencing the company's activities. This system, which defines rules and procedures for decision-making processes, goal setting, implementing strategies, and planning control systems, has a close relationship with the methods used by financial resource providers to ensure capital returns. Corporate governance is a collection of instructions, processes, and cultural norms that aid companies in achieving their operational goals, responding to stakeholders, and ensuring the observance of their rights. These mechanisms help mitigate agency problems within companies. The quality of such mechanisms is relative and varies from one company to another [36]. Today, there is no doubt about the significance and state of corporate governance and its impact on the success of companies and social welfare, especially considering the financial crises and events of recent years. Notable corporate failures such as Enron and WorldCom, which resulted in significant losses for stakeholders and shareholders due to poor corporate governance, have led to increased emphasis on optimizing and reforming corporate governance internationally [29]. In recent years, the concept of corporate governance has evolved into a major and dynamic aspect of business, and the international application of corporate governance rights is being observed. International organizations like the Organization for Economic Co-operation and Development (OECD) provide accepted international standards [36].

However, the crucial question remains for stakeholders: how can a measurement index for corporate governance be developed and defined? In response to this question, researchers have relied on various criteria for measuring corporate governance, as it was not universally visible. Abbaszadeh et al. [2] categorized the criteria used by researchers into two general sections related to the board of directors and ownership structure. Deylami and Saffari Garaili [14] added two more sections, namely shareholders' rights and data resolution. Nikbakht and Ahmad Khan Beigi [34] also included the characteristics of accountants. Furthermore, Joudi, Mansourfar et al. [32] categorized corporate governance into two internal and external dimensions. Despite the categorization in the literature of Finance and Accounting, it is evident that a wide range of criteria has been used in the majority of corporate governance studies. The present research aims to introduce a novel index for measuring corporate governance using multi-criteria decision models, which is proposed for the first time. Due to the novelty of this research, the following aspects will be examined:

a. Review and specification of factors influencing the measurement of corporate governance b. Specification of a comprehensive index for measuring corporate governance. It is expected that through this index, taking into account all relevant factors, the corporate governance index of a particular firm can be easily measured at any time to determine whether the firm possesses authentic and well-qualified corporate governance or a poor one. Furthermore, if the corporate governance indexes of multiple firms are measured and compared, it becomes possible to make informed decisions regarding investment in these firms. The foundations of this paper can be highly valuable for investors and analysts, aiding in economic decision-making related to the selection of suitable portfolios, analysis, and a better understanding of firms. The rest of this paper will discuss the research history, followed by the presentation of the research method and its foundations, and then the theoretical basis will be addressed.

2 Literature Review

2.1 The concept of Corporate Governance

Corporate Governance is a set of processes, rules, policies, and methods which deals with different stakeholders' interaction in line with the organization or firm's goals. In Corporate Governance, key stakeholders are shareholders, board of directors, the Senior executive manager, the staff, moneylenders, clients, purveyors and totally all people of the society [6]. Corporate governance is multidimensional. One of its most important and most debatable aspects is the increasing responsiveness in the organization (liability) and the effect of corporate governance systems on economical effectiveness. Although the two said are among the most paramount criteria in corporate governance, other issues such as the beneficiaries' theories have been proposed in this matter. The most significant effect of corporate governance is its positive effect on economy and workplace by which all beneficiaries are benefited. This effect is recognizable from microeconomics to macroeconomics [36]. The origin of Corporate Governance is the Greek word “kyberman” which means to lead or to govern and then, it has altered from Greek to Latin “gubernare” and to ancient French “governer”.

However, this jargon has been defined by the organizations and committees according to their own ideological tenets. Considering the existing literature, there is no all-agreed definition for Corporate Governance. The existing definitions of Corporate Governance arranged in a vast spectrum. Limited and unlimited viewpoints are standing at both sides of this continuum. In the limited ones, Corporate Governance is limited to the firm and the staff’s interaction. This pattern is stated as agent theory. On the other side of the spectrum, Corporate Governance is defined as a network of relationships which not only exists between the firm and its owners (shareholders), but also it does exist among the firm, and many of its stakeholders including the staff, clients, salespeople, owners of securities, etc. Such a viewpoint is seen in stakeholders’ ideology. Some definitions of Corporate Governance are being presented here in accordance with the aforementioned viewpoints. These definitions are commenced from a limited point of view and simultaneously, do delineate the fundamental concept of Corporate Governance and are eventually ended with a highly more extended one which incorporates the liability of the firm to the society and its stakeholders [20].

2.2 Significance of Corporate Governance

Today, public companies are possessed by a set of diverse owners and the ownership duties and the company’s controlling has been separated and it has been passed to professional managers. The key point here is that whether the managers do act for the shareholders’ profits or not [25]. To some extent, protecting people’s profits, observing shareholders’ rights, enhancing data resolution and necessitating the companies to act upon their social responsibilities are of the most principal ambitions which, more than before, are being significantly supervised by varied supervisory and executive bodies. Realization of such ambitions require the existence of stable principles and proper administrative procedures, the utmost one being the Corporate Governance [46]. Preliminary basis of Corporate Governance mostly highlighted the companies’ strategy and the shareholders’ rights and just then, gravitated toward grave attention to stakeholders’ rights and the public only after newer viewpoints were introduced [41]. Corporate Governance has aimed typically at the firm’s lifetime in a long course of time and in this line, it is putting its best forth in order to back shareholders’ right against the companies’ headmasters and save the wealth not to be transferred unwantedly to various groups which won’t let the people’s and the shareholders’ rights to be squandered.

Existence of an apt Corporate Governance can lead to realization of the free accountants’ independence and then an overt informational room will be made at which economic companies can make decisions much more wisely [46]. In recent years, there has been great progresses in the field of Corporate Governance globally and in this regard, progressive countries are still moving forward augmenting their Corporate Governance system and accordingly, they are assigning to participants in Corporate Governance and such issues like shareholders and their interaction, responsibilities to pay grave attention to matters such as accountability, improving the board of directors' function, board of directors' committees, auditors, accountancy systems and domestic management [41]. Clear financial information disclosure minimizes the agency issues and problems via decreasing the information asymmetry between the management and the shareholders. In contrast, poor information disclosure leads to the shareholders' confusion and hence, they might see some unpleasant changes in their wealth [41]. Corporate Governance can also cause an improvement in trading standards of the companies as well as encouraging, supplying, and facilitating capitals and shareholders. Also, it brings leads to the enhancement of the companies' administrative affairs and it is a key factor in the optimization of their economic functionality since they observe the relationships among shareholders, board of directors, headmasters and other stakeholders [46].

2.3 Research Background

Jamil et al [23] studied the effects of the Corporate Governance structure in stability report in a research. The outcomes of the analysis on the hypotheses showed that the number of instructions of stability by board of directors and the number of the headmasters with stable experiences can highly influence the quality of stability reportage.Crisostomo et al [12], studied the power of great shareholders and the quality of Corporate Governance in some Brazilian evidences. The foundations indicated that there is a negative meaningful relationship between the power of the great shareholders and the quality of Corporate Governance. Ownership consistency is disadvantageous to the quality of Corporate Governance and the quality of the composition of the board of directors. The more power gained by the shareholders might prevent the construction of a powerful board of directors and some agency problems might come between the shareholders and the headmasters.

Salyioni and Gennari [43] studied the Corporate Governance stakeholders' and the committees' viewpoints with the liability of disclosing social responsibilities. Foundations showed that a newly found person in the board of directors has stable social and committee responsibilities with regards to the Corporate Governance stakeholders' viewpoint. An increase in the complexity caused by trading responsible manner and the rising significance of the effective management in risks of its influence, spotlights the committees' productivity with consultative and suggestive functions of the social responsibility issues. These committees are relatively new state formations which are less frequently confirmed and they can play a crucial role in amalgamation of social responsibilities in setting strategies and trading models. Bhagat and Bolton's [9] studies on Corporate Governance and company's function resulted in the understanding that the head's share ownership is constantly and positively in line with the company's future activities. General policy makers and long-term investors must accept this outcome since they are passionate about the long-term companies' activities. Kieschnick and Moussawi [28] conducted a study on the company's age, Corporate Governance, and capital structure. The results show that while company's age is positively correlated with the use of debts, it is negatively associated with its debt amount. Likewise, the effect of the company's age on its debt amount is primarily owing to the interaction between its age and Corporate Governance features. The more domestic influence it has, the less the company uses fewer debts beside its getting older.

While disciplines and behavior is kept safe and sound, headmasters would let risk preferences dominate their decisions about the structure of the constant capital. Bae et al [7] perused the interstate Corporate Governance and companies' stability disclosure with concerning the signaling theory. Empirical results show that the total stability disclosure has a strongly meaningful and affirmative relationship with foreign shareholding, organizational shareholding, board of directors' independence, and the board size. On the other hand, the director's shareholding is negative and it is in an impressively close tie with the total stability disclosure. Therefore, it can be claimed that Corporate Governance elements are highly effective in sending positive remarks to the market which leads to a decrease in information asymmetry and a certainty in honest remarks from different stakeholders. Dicko [15] in his study known as "The Political Ties, Ownership Structure, and Corporate Governance Quality", scrutinized the relationship between political ties and the quality of Corporate Governance with the moderating role of ownership concentration using a sample of 259 Stock Market companies of Toronto except for financial companies in 2015. The outcomes of testing the hypothesis and analysis of the data indicated that political ties do not bear a meaningful relationship with Corporate Governance and plus, ownership concentration is not influential in political ties and Corporate Governance and does not moderate them. Xia et al [47] held a survey on the effect of Corporate Governance on the relationship between the social trust and tax avoidance of companies in China's Stock Exchange Market. Their foundations show that the social trust leads to a reduction in tax avoidance of the companies. Moreover, in some companies with poor Corporate Governance, the relationship between social trust and tax avoidance is much sturdier.

3 Methodology

The methodology of the present study is practical in terms of its purpose and it is descriptive in terms of data collection. The research is qualitative or quantitative regarding its data set and in terms of data analysis methodology, the research is done through a mixed approach which is partly qualitative and partly quantitative.

3.1 Statistical Population of the Study

The population of this research paper includes all confirmed public companies in TSE and the time span is from 2014 to 2019. The statistical samplings are chosen through the following filters:

a. They must have been accepted to in TSE until the end of February, 2015.

b. To expand the comparison possibility, their fiscal year must be finalized till the end of February and they must not have made any changes in the company's activities or its fiscal year during the said course of time.

c. The required data must be accessible for measuring the research variables during the time being studied.

d. They must not be investment companies and financial mediators.

e. The desired data is available.

Eventually, the sample used 149 companies with the aforementioned terms and conditions. There are multiple criteria in measuring Corporate Governance. The method used in order to introduce a comprehensive index for Corporate Governance is as follows:

Primarily, the literature and history of the foreign and domestic researches held on the case study are going to be studied and the measuring criteria of the Corporate Governance utilized in the previous studies will be found out. Then, they shall be singled out with regards to the Corporate Governance of Iranian companies. Then, to inquire the experts' ideas about the weight and significance of the considered criteria of Corporate Governance in measuring Corporate Governance with the aid of one of the methods of the multi-criteria decision model, a questionnaire will be constructed and distributed among the experts. Next, they will be collected back and the weight of each effective factor of Corporate Governance will be determined via Shannon Entropy. Afterwards, the requisite data for measuring each and every single effective factors of Corporate Governance are going to be collected via databases which are, then, standardized. Eventually, the comprehensive index of Corporate Governance model is stipulated using those effective criteria and their synthetic weights.

Reviewing the literature of domestic and foreign studies of the same research topic and recognition of the criteria for Corporate Governance measurement which have been utilized in the previous studies and selection of such criteria with attention to Iranian Companies' Corporate Governance. Preparing a questionnaire so as to ask the experts their idea about the weight and significance of the criteria of measuring the Corporate Governance using a method of multi-criteria decision model and distributing them among the experts. Collecting the handed questionnaires and using the Shannon Entropy to determine the weight of the effective criteria on Corporate Governance. Collecting the required data in order for the measurement of each single effective criterion on Corporate Governance through databases and measuring and standardizing them. Mingled Specification of the model of Corporate Governance comprehensive index measurement using effective criteria and their weight.

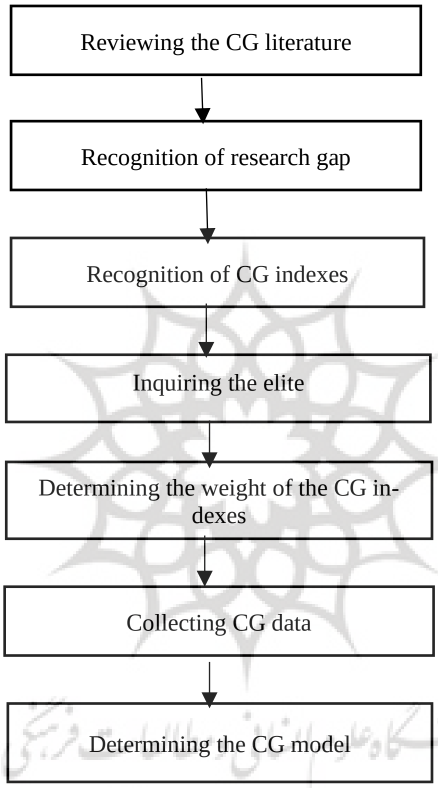

Fig. 1: Research procedures

To answer the first research question, as what the Corporate Governance measurement criteria are, the research literature and the local conditions of the country in order to specify Corporate Governance include 10 following factors, company's size, organizational ownership, growth opportunity, company's life, buying and selling shares' price range, the quantity of the company's shareholders, the directors' profits prediction faults, number of share returns, fluctuation of share returns, and non-liquidity of the share which were all taken into account in the previous studies on Corporate Governance measurement, whether domestic or foreign. The required financial data for this model have been extracted from Rah-Avard Novin software and from www.tsetmc.com. To weigh the aforementioned criteria in Corporate Governance index measurement, the experts' viewpoints were regarded. Thereupon, an electronic questionnaire containing 20 questions, each of which included a used criterion in the model, was submitted to some 36 academic and professional individuals such as university faculty members who were experts and experienced in researches in the field of Corporate Governance, brokers' and investment companies' directors and analysts, and available compilers of accountancy standards and they were inquired about the weight of the 20 effective factors in Corporate Governance. They were sent to 36 professional academic people whom were faculty members, directors and analyzers of the investment companies and accessible brokers and asked for their viewpoint about the weight of the ten effective criteria in Corporate Governance measurement. Then they were all collected back and through Shannon Entropy (discussed next part), the criteria weights were marked. It is notifiable that Cronbach's alpha coefficient of the aforesaid questionnaire was 0.733 which signified its proper stability and credibility. Research procedures are as Fig. 1.

3.3 Research Questions

To achieve the research purpose, our questions are presented as follows:

1. What are the criteria for calculating corporate governance?
2. What is the proposed model for calculating the comprehensive corporate governance index?

3.4 Entropy execution procedures

in order to measure the weight and share of each ten said elements, basic procedures must be taken as follow [31]:

Step 1: specifying the index decisions matrix
Step 2: normalizing the data of decision matrix to be analyzed
Step 3: specifying the EJ value at Entropy is a characteristic of J
Step 4: measuring the DI value for each characteristic by EJ
Step 5: measuring the dimensions' weight, criteria and variables of WJ via the characteristic of J
Regarding the preceding steps, the demographic statistics of the experts and the defined weights are as follow:

Table 1: Demographic Research

Variable	Sub-variable	Number	Percentage
Gender	Man	28	% 78
	Female	8	% 22
Age	Between 30 and 40 years	12	% 33
	Between 40 and 50 years	14	% 39
	More than 50 years	10	% 28
Education	PhD student	4	% 11
	PhD	32	% 89

3.5 The hypothetical model for Corporate Governance measurement

In the present study, the mixed measured index has been used in order to measure Corporate Governance in accordance with Fakhari and Rezaie Pitehnoei study [17]. In this study, to present the proposed model, firstly, it is needed to take into account three primary hypotheses. Firstly, the additivity principle must be accepted in measuring Corporate Governance, meaning that Corporate Governance is the sum of all effective factors. In other words, factors have been assembled altogether with a specific rule which define Corporate Governance. Plus, the effectiveness of each single factor on Corporate Governance relies upon their coefficients or weights which were measured previously (Proportionality). Thirdly, it is accepted that the effectiveness of each factor on Corporate Governance has been normalized. This is done only to define a meaning ful cap and floor or a maximum and minimum for the Corporate Governance measurement. According to the above and taking into accound the said hypotheses, the following method is suggested and presented in order for Corporate Governance to be measured. Observations: article (1) indicates that Corporate Governance has a uniformity feature, meaning that for each company with its sequential element, Corporate Governance is arranged according to the elements' sequence. This justifies the comparability of two companies according to their Corporate Governance. Furthermore, in article (2) it is shown that Corporate Governance taken from the hypothetical model of the study is finite and thereupon, it can be taken in order for a community of companies to be assessed.

$$CG_{it} = \sum_{s \in S} W_{s\,it} \frac{P_{s\,it}}{\max\limits_{1 \le i \le N}\{P_{s\,it}\}} + \sum_{k \in K} W_{k\,it} \frac{\max\limits_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,it}}{\max\limits_{1 \le i \le N}\left\{\max\limits_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,it}\right\}} \tag{1}$$

In this model:

CG_{it} is the Corporate Governance in the "i" company and in the year "t".

"N" is the number of the companies.

"S" is the total number of the indexes of the factors that are in a direct relationship with Corporate Governance.

"K" is the total number of the indexes of the factors that are in a reverse relationship with Corporate Governance.

"$W_{j\,it}$" is the weight of the "j" factor in the "i" company in the year "t".

"$P_{j\,it}$" is the amount of the "j" factor in the "i" company in the year "t".

It is clear that if "M" is the total number of the effective factors on Corporate Governance, then it would be "M - |S| + |K|" in which |S| indicates the whole number of the "S" set and |K| indicates the whole number of the "K" set [18].

Proposition 1: If for two companies with indexes "a" and "b":

$$\forall s \in S \; P_{s\,at} \le P_{s\,bt} \tag{2}$$

And:

$$\forall k \in K \quad P_{k\,at} \le P_{k\,bt} \tag{3}$$

Then:

$$CG_{at} \le CG_{bt} \tag{4}$$

Proposition 2: For a company with an index "a":

$$0 \le CG_{at} \le 1 \tag{5}$$

Reasoning: To prove Prop. 1, it is evident that if $P_{s\,at} \le P_{s\,bt}$ then:

$$\frac{P_{s\,bt}}{\max\limits_{1 \le i \le N}\{P_{s\,it}\}} \le \frac{P_{s\,at}}{\max\limits_{1 \le i \le N}\{P_{s\,it}\}} \tag{6}$$

$$\text{If:} \quad P_{k\,at} \le P_{k\,bt} \tag{7}$$

$$\text{Then:} \max_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,at} \le \max_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,bt} \tag{8}$$

Therefore:

$$\frac{\max\limits_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,bt}}{\max\limits_{1 \le i \le N}\left\{\max\limits_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,it}\right\}} \le \frac{\max\limits_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,at}}{\max\limits_{1 \le i \le N}\left\{\max\limits_{1 \le i \le N}\{P_{k\,it}\} - P_{k\,it}\right\}} \tag{9}$$

And since : $W_{j\,at} \ge 0$

$$CG_{at} \le CG_{bt} \tag{10}$$

To prove Prop. 2, it is evident that $CG_{at} \ge 0$, proves the inequality of the other one:

$$P_{s\,at} \le \max_{1 \le i \le N}\{P_{s\,it}\} \quad \forall s \in S \tag{11}$$

Therefore:

$$\frac{P_{s\,at}}{\max\limits_{1\,\le\,i\,\le\,N}\{P_{s\,it}\}} \le 1 \tag{12}$$

And thus:

$$\max_{1\,\le\,i\,\le\,N}\{P_{k\,it}\} - P_{k\,at} \le \max_{1\,\le\,i\,\le\,N}\left\{\max_{1\,\le\,i\,\le\,N}\{P_{k\,it}\} - P_{k\,it}\right\} \tag{13}$$

So:

$$\frac{\max\limits_{1\,\le\,i\,\le\,N}\{P_{k\,it}\} - P_{k\,at}}{\max\limits_{1\,\le\,i\,\le\,N}\left\{\max\limits_{1\,\le\,i\,\le\,N}\{P_{k\,it}\} - P_{k\,it}\right\}} \le 1 \tag{14}$$

Therefore:

$$CG_{at} = \sum_{s\in S} W_{s\,at}\,\frac{P_{s\,at}}{\max\limits_{1\,\le\,i\,\le\,N}\{P_{s\,it}\}} + \sum_{k\in K} W_{k\,at}\,\frac{\max\limits_{1\,\le\,i\,\le\,N}\{P_{k\,it}\} - P_{k\,at}}{\max\limits_{1\,\le\,i\,\le\,N}\left\{\max\limits_{1\,\le\,i\,\le\,N}\{P_{k\,it}\} - P_{k\,it}\right\}} \le \sum_{s\in S} W_{s\,at} + \sum_{k\in K} W_{k\,at} \tag{15}$$

And since SUK = {1,2,3,...,M} and also $\sum_{1\,\le j\,\le\,M} W_{j\,at} = 1$ the we have:

$$\sum_{s\in S} W_{s\,at} + \sum_{k\in K} W_{k\,at} = 1 \tag{16}$$

Therefore:

$$CG_{at} \le 1 \tag{17}$$

Considerations: proposition no. 1 indicates that Corporate Governance is monotonous (monotone property), meaning that for each company with ordinal factors, Corporate Governance is organized according to the order of the factors. This feature defines the two companies' comparability. Moreover, proposition no. 2 illustrates that the Corporate Governance resulted from the research's proposed model is bounded and hence, to assess a community of compamies, it can be undertaken [17].

3.6 Effective factors on Corporate Governance

a. **The size of the board of directors**: with the growth of the size, there would exist more and more debates between the members of board of directors which signifies that the decisions by the great board of directors reflect much more harmony between the members. In fact, the great board of directors leads to a decrease in improvidence or in personal strategic decisions in Corporate Governance [30].

b. **The independence of the board of directors**: existence of independent directors in the board of directors brings about some improvement in the board's supervising on the directors in line with protecting the shareholders' rights and potentially, decreases the conflicts between directors and the owners. Irresponsible members of board of directors turn to be in charge of appropriate and effective implementation of the Corporate Governance mechanisms with regards to their role in the company's leadership [37]. Hence, the independence of the board of directors is regarded as the direct criterion of Corporate Governance and is equal to the proportion of the irresponsible members to all members.

c. **The number of the meetings of board of directors**: the number of the meetings is a dimension of the board of directors' supervising. These higher-level activities of the board of directors can upgrade the company. Most of the literature review argues that the presence of board of directors, especially the director's, is highly paramount and his/her absence leads to poor supervising and improper function of the board of directors [35]. Meeting are held so that executive directors and other members share and present their own information about the company's function, policies, and its plans. More meetings are beneficial to a better relationship between the directors and the members and it is expected that this will cause an improvement in the supervising and in the Corporate Governance. So, this factor is a direct criterion of Corporate Governance which is measured via the number of the meetings of the board of directors held in a year according to Barros, V. and Sarmento, J. M., [8].

d. **Board of directors' educational background**: Goll et al [19] found that directors with higher educational background are more competence in managing challenging situations and they are more self-confident, they have greater educational expertise and are more adaptive. Therefore, it is expected that the Corporate Governance is enriched when the members of the board of directors' educations are promoted which is considered as a direct criterion in Corporate Governance and for its measurement, the average level of education of the members are used. So, they are categorized as below: those members with Diploma or lower than that, level1, those with Associate degree, level 2, Bachelor's degree, level 3, Master's degree, level 4, and Doctoral degree, level 5; then, via the mean of their degrees, the average level of the members' education of every single company is calculated.
e. **Financial proficiency of the board of directors**: directors with a better knowledge of financial proficiency can act better and the more proficient they are, the less they will cheat and the accountancy information is much more reliable [11]. So, it is expected that with the upgradation of the members' financial proficiency, Corporate Governance is improved and this aspect is regarded as a direct criterion in Corporate Governance. To measure it, the proportion of the financial and accounting specialist members compared to all members is used.
f. **Financial experience of the board of directors**: those financially experienced members of board of directors are much more popular and dedicated they are more inclined to do their administrative roles more suitably. Financially experienced members of board of directors can judge more shrewdly than those unexperienced about Corporate Governance [48]. So, it is highly expected that when the members get more experienced financially, the Corporate Governance improves and it is a direct criterion as well. To measure it, the percentage of the members with higher accounting and finance experience compared to all members is used.
g. **The consistency of the board of directors**: management theoreticians suggest that long-term experienced CEOs are more dedicated and proficient and this leads to the increase in their responsibilities. Moreover, these CEOs dedicate their work and time to formation of long-term strategies of the company. A CEO with a consistent position can increase the members of board of directors' harmony more effectively [10]. Hence, it is expected that with the enhancement of the CEO's consistency in the company, Corporate Governance is improved this aspect is regarded as a direct criterion in Corporate Governance. CEO's consistency is measure by counting the number of his being in the position of a CEO.
h. **The size of the audit committee**: There is a direct relationship between the size of the audit committee and its supervising role and the bigger the size is, the better the company's function would be [13]. Because supervising role of the committee would be played more appropriately. Therefore, it is expected that with the growth of the audit committee's size in companies, Corporate Governance is improved, too. This is regarded as a direct criterion in Corporate Governance. According to Fakhari and Rezaie Pitehnoei [17], the size of the audit committee indicates the quantity of all its members.
i. **The independence of the audit committee**: the independence of the audit committee plays an important role in ascertaining the unity in the process of financial reportage; since the director might manipulate the accountancy information in favor of their own benefits. Therefore, an independent audit committee can make sure of accuracy and objectivity of the financial statements. Jemison and

Oakley [24] believe that it is a vital key factor of Corporate Governance when all members of the audit committee are independent directors. So, it is expected that Corporate Governance is improved when the independence of the audit committee of the companies is risen. This factor is regarded as the direct criterion of Corporate Governance. In the present research paper, to measure the independence of the audit committee, the proportion of the quantity of the independent members of the committee compared to the total number of the members of the audit company is used [17].

j. **Financial proficiency of the audit committee**: proficiency and expertise of the members of the audit committee is one another feature of it which is bound to its efficiency [17]. The audit committee members' financial proficiency helps them in supervising the process of financial reportage much more effectively. It also has a positive impact on the voluntary morale disclosure [40], and then it causes an improvement in the company's information environment (Fakhari and Rezaie pitenoei, [17]) and it gives more reliable information to the directorship [22]. Thereupon, it is expected that with a rise in the financial proficiency of the audit committee, Corporate Governance is promoted. This factor is regarded as the direct criterion of Corporate Governance. In this research, to measure the financial proficiency of the audit committee, the proportion of the number of the members with proficiency in finance and accountancy compared to all the members was taken into account [17].

k. **The financial experience of the audit committee**: to hold the major responsibility of the audit committee, all members had better be financially experienced and they ought to notice the financial reporting issues and the complexity of business measures. The financial experience of the audit committee contributes to an improvement in disclosure quality [26]. So, it is expected that by rising the experience of the audit committee in companies, the Corporate Governance will rise, too. This factor is regarded as the direct criterion of Corporate Governance and it is equal to the proportion of the members with financial experience compared to all the members.

l. **The authority of the audit committee**: when the audit committee members are committed and more experienced, then they can judge more effectively in the field of domestic controls which are of Corporate Governance mechanisms. The members' high commission leads to their more information about the company and empowers them to look upon the quality of financial reportage more influentially [45]. Thus, it is expected that by an increase in the members' commission, the Corporate Governance would increase as well, meaning that it is the direct criterion for Corporate Governance and is equal to the average commission period of the members of the audit committee.

m. **The number of the meeting of the audit committee**: the more number of meetings held by the audit committee, the higher the likelihood of their responsibility. Regular meetings can be held with presentation of fair and punctual information of the shareholders which leads to the decrease in the agency's problems and its information asymmetry. The company with the audit committee who hold more meetings, might be more cautious about its shareholders' profits and this will bring about the improvement of supervisions and Corporate Governance. This factor is regarded as the direct criterion of Corporate Governance. In the present survey, to measure this criterion, the quantity of the annual meetings of the audit committee is taken [44].

n. **Ownership concentration**: it can control the problems of the agency and also, it supports the shareholders' profits. The possibility of supervising and controlling the better function of the directorship is more when the ownership concentration is high [16]. So, it is expected that the increase in ownership concentration leads to the improvement of Corporate Governance. This factor is regarded as the direct criterion of Corporate Governance. To measure this variable, the proportion of the quantity of the shares given to the greatest shareholder of the company compared to all the company's shares is used.

o. **Managerial ownership**: the owners aim at maximizing the wealth in the agency relationships. To do so, they observe the agent and evaluate their functions. Providing that the agent or the company's director owns a percentage of the company's shares, many issues of the agency are solved and it seems as if these companies can look at a long-term future of the company due to the director's endeavors in supplying his own profits, as well; so, the company would be more effective and with more productivity [27]. Hence, it is expected that the Corporate Governance will improve if the company's managerial ownership augments. This factor is regarded as the direct criterion of Corporate Governance. To measure this variable, it is needed to use the proportion of the share quantity of the members of board of directors compared with all the company's share.

p. **Organizational ownership**: great owners such as banks, insurance and investment companies buy and sell massive amounts of securities. According to Securities Constitution of Islamic Republic of Iran, 27th clause of Article 1, any legal or real person who buys over 5 billion of nominal values of the securities in circulation is regarded as an organizational investor [38,5]. Organizational owners align the directors' profits with the shareholders' since they have a great influence on directors of the company and they decrease the agency of the company's problems [16]. Therefore, organizational owners are regarded as the direct criterion of Corporate Governance of the company.

q. **Governmental ownership**: the government, as a major shareholder, is not well motivated to participate in the activities related to effective supervision on the company's activities and this is caused by its political and economic incentives [4]. Governmental ownership makes the companies cold in rising the quality of the information disclosures since these types of companies are not highly in need of financial resources of the exchange market and the creditors and they finance themselves through the government's support and governmental banks. Then it is expected that by an increase in the governmental ownership in the companies, Corporate Governance would abate. This is a reverse criterion of the Corporate Governance and for its measurement, the share percent at the disposal of the governmental and quasi-governmental organizations [37].

r. **Transactions with related persons**: the directors constantly misuse the transactions the related persons in their favor and benefit, in line with seizing the shareholders' resources. Plus, transactions with related persons can be made use of in coaxing the users of the financial statements [42]. The complexity and diversity of the transactions with the related persons is challenging for Corporate Governance. Therefore, transactions with related persons is considered as a reverse criterion of Corporate Governance. In this study, following Jaffar Noudeh and Safari Garayli [21], the proportion of the total number of transactions with related persons recorded in the divided financial statements notes compared with the assets at the beginning of this year is used in order to assess the transactions with the related persons.

s. A**ppropriateness of disclosures and announcements**: it is measured via the points given to each single company by TSE and via the "appropriateness of disclosures and notifications" announcement. TSE calculates points for the quality of disclosures of the confirmed companies for 3, 6, 9, and 12 months' period and they are released by Securities and Exchange Organization annually. They are measured based on accurate and visual indexes such as the data release time and the differences in predictions with real results. A daily negative point is considered in case of any late in representing the accounted financial statement at the end of the year and any disorganization in timing the payment of the shareholders' interests. The resolution and the disclosure are both an index of Corporate Governance, meaning that the higher the level of the disclosure, the more qualified and healthier the structure of Corporate Governance; and this causes less conflict of interests. So, if such procedures are well performed, all informational requirements of all stakeholders is supplied much more suitably [33]. Hence, the appropriateness of disclosure and announcements are known as the direct criterion of Corporate Governance.

t. **Weakness of domestic controls**: those companies with the high quality of Corporate Governance, will have less weakness of domestic controls [18]. Therefore, weakness of domestic control is regarded as a reverse criterion of Corporate Governance. In this study, it is equal to the number of domestic controls' quantity published by the independent auditor's report.

Since employing the aforesaid factor alone can lead to a disruption in the measurement of Corporate Governance, then in this study, to measure Corporate Governance, a mixed measured index is used for each company. Using such a comprehensive index decreases any bias and unreliable outcomes caused by single use of each criterion of Corporate Governance and provides us with a more accurate criterion for testing.

3.7 Defining the weight of effective factors on corporate governance:

Here the weight of each single 20 aforementioned factors has been measure via the Entropy and is presented in the table below.

Table 2: Degree of importance based on entropy for corporate governance components.

Effective factors	Ej	dj=1-Ej	Wj
The size of the board of directors	0.981	0.019	0.053
The independence of the board of directors	0.975	0.025	0.070
The number of the meetings of board of directors	0.992	0.008	0.023
Board of directors' educational background	0.985	0.015	0.040
Financial proficiency of the board of directors	0.985	0.015	0.043
Financial experience of the board of directors	0.986	0.014	0.038
The consistency of the board of directors	0.988	0.012	0.034
The size of the audit committee	0.987	0.013	0.037
The independence of the audit committee	0.987	0.013	0.035
Financial proficiency of the audit committee	0.981	0.019	0.053
The financial experience of the audit committee	0.984	0.016	0.044
The authority of the audit committee	0.981	0.019	0.052
The number of the meeting of the audit committee	0.979	0.021	0.057
Ownership concentration	0.981	0.019	0.052
Managerial ownership	0.977	0.023	0.063
Organizational ownership	0.973	0.027	0.075
Governmental ownership	0.983	0.017	0.048
Transactions with related persons	0.981	0.019	0.052
Appropriateness of disclosures and announcements	0.969	0.031	0.086
Weakness of domestic controls	0.984	0.016	0.043

3.8 The final model of measuring the index of Corporate Governance

According to the abovementioned explanation, the final model of Corporate Governance measuring index is as follows:

$$\text{CG-Index}_{i,t} = 0.053\ P_1 + 0.070\ P_2 + 0.023\ P_3 + 0.040\ P_4 + 0.043\ P_5 + 0.038\ P_6 + 0.034\ P_7 + 0.037\ P_8 + 0.035\ P_9 + 0.053\ P_{10} + 0.044\ P_{11} + 0.052\ P_{12} + 0.057\ P_{13} + 0.052\ P_{14} + 0.063\ P_{15} + 0.075\ P_{16} + 0.048\ P_{17} + 0.052\ P_{18} + 0.086\ P_{19} + 0.043\ P_{20} \quad (18)$$

In this model, $\boldsymbol{P_i}$ is the standardized factor of the Corporate Governance measuring index.

4 Findings

4.1 Descriptive statistics

To present a holistic view of significant features of the used variables in assessments of the company's information area, some concepts of the descriptive statistics of the variables including the number observations, the average, minimum and maximum of observations, and criterion deviation are outlines in table 3. As it is illustrated, the maximum number of the company's shareholders was 151742 related to IKCO in 2015 and the minimum number of the company's shareholders was related to Damavand Mining Company, being 165 individuals in 2013. Moreover, among the variables representing information area, the company has experienced the maximum amount of criterion deviation and on average; the interest prediction's error among the sample companies was 20 percent.

Table 3: Descriptive statistics of the research variable

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
BD.SIZE	5.135	5	5	7	0.402
BD.IND	0.628	0.600	0	1	0.160
BD.MEET	13.098	12	12	31	3.104
BD.EDU	3.772	3.8	2.571	5	0.418
BD.FSPEC	0.141	0	0	0.600	0.168
BD.FEXP	0.244	0.2	0	0.800	0.254
CEOSTAB	2.660	2	1	10	1.852
AC.SIZE	3.143	3	3	5	0.512
AC.IND	0.706	0.667	0	1	0.185
AC.FSPEC	0.726	0.667	0	1	0.223
AC. FEXP	0.634	0.667	0	1	0.262
AC.TEN	4.214	4	1	7	1.593
AC.MEET	17.478	19	8	28	6.726
OWNCON	0.530	0.516	0.114	1	0.200
MAN.OWN	0.649	0.695	0	1	0.240
INST.OWN	0.733	0.763	0.114	0.981	0.158
STATE.OWN	0.204	0	0	0.705	0.282
RPT	0.364	0.057	0	4.709	0.734
DISQUALITY	76.819	82	16	100	16.697
ICW	0.827	0	0	5	1.371

4.2 Validation of the measurement model

After pondering about the credit of the model in the previous part, tables 5 and 6 show the descriptive statistics and the results of the Corporate Governance measurement of some confirmed companies to enter the TSE as an example using the presented model in this survey, all due to the collected data for every and each Corporate Governance elements and the weight of each single element by the help of the Entropy technique.

Table 4: Descriptive statistics of Corporate Governance index

Variable	sign	Mean	Maximum	Minimum	Std. Dev.	skew
Corporate Governance	IE-Index	0.064	0.794	0.459	0.639	0.640

Table 5: The measured Corporate Governance of the companies via the suggested model

Firm	2015	2016	2017	2018	2019	Mean
Iran Transfo	0.572	0.581	0.631	0.683	0.703	0.634
Iran Khodro	0.626	0.630	0.649	0.656	0.667	0.646
Iran Darou Pharmaceutical Co.	0.710	0.736	0.729	0.750	0.777	0.741
Gorji Biscuits	0.590	0.598	0.601	0.600	0.608	0.599
Bandar Abbas Oil Refining co	0.516	0.553	0.598	0.607	0.629	0.581
khorasan Pegah	0.648	0.682	0.604	0.621	0.632	0.637
Aburaihan Pharmaceutical Co	0.702	0.710	0.731	0.676	0.709	0.706
SAIPA	0.563	0.610	0.613	0.602	0.628	0.603
Mobarakeh Steel Company	0.663	0.710	0.722	0.725	0.720	0.708
Mehr Cam Pars Company	0.566	0.589	0.617	0.634	0.623	0.606

With grave regards to the results above, it is observed that in the majority of the companies, the Corporate Governance has changed through the years studied and gradually, they have changed for better. In the picture below, the average changing process of Corporate Governance of the companies in 5 years' time is illustrated.

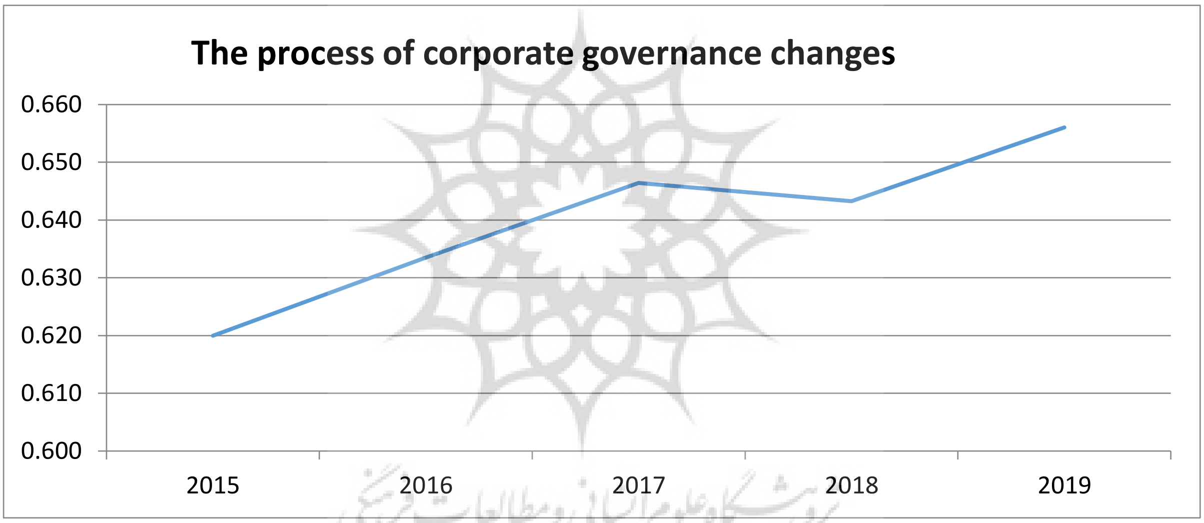

Fig. 1: Changing procedure of Corporate governance in different years

It is also understood that Corporate Governance changes for improvement in the course of time according to the above picture. It results from appropriate mechanisms of Corporate Governance and the related rules and regulations in the field of appropriate information disclosure of the companies.

5 Conclusion

The purpose of creating accountancy information system is to provide us with an area in which the information is easily accessible and the risk of any informational error is eliminated. In fact, any literature progress in all fields of study root in the improvements in measurement techniques. In financial literature, there have been introduced diverse criteria to measure the asymmetry and information area of the company. Since the surface of the Corporate Governance is not visible directly, then researchers have used some of the index criteria to measure it. Thus, the purpose of the present study is to present a new model for measuring the Corporate Governance which was proposed for the first time. In the study, the mixed measured index was used to measure Corporate Governance and after determining the effective factors on Corporate Governance and their weight done by the experts, the proposed model was presented. In the proposed model for measurement of Corporate Governance, a new index was introduced regarding the multi-criteria decision model just to measure Corporate Governance and then, using that index anytime, any particular company's Corporate Governance was measured easily taking into account all the effective factors on Corporate Governance. In addition to that, the strength or weakness of a company's Corporate Governance turned to be crystal clear. Furthermore, it was figured out that which companies and in which year, was their Corporate Governance unblemished or feeble only by measuring the Corporate Governance index in different years.

6 The proposals and limitations of the study

Presenting a comprehensive index for measuring Corporate Governance can introduce new instruments in order for the companies' Corporate Governance to be ranked hierarchically. It can also help the shareholders choose an appropriate portfolio which eventually, leads to agency's cost reduction, stock market's dynamism, and an increase informational symmetry. The foundations of the present study can assist TSE, investment provision companies, broker firms, ranking institutes, investment companies, owners of the future contract papers, analyzers and other major activists of Iran's Capital Market in making ideal decisions about their professional acts. Also it can bring about an expansion in literature theories of Corporate Governance of all business entities.

Introduction of a new field of study for accountancy researchers, especially those active members of Stock Market's studies, can be counted as other foundations of this research. Financial researches and particularly those seeking specification of a comprehensive index, will visit several obstacles and restrictions. Those restrictions were present in this study as well. For instance, it was problematic to collect the non-published data in financial statements and adjacent notes, such as the quantity of the shareholders with the right to control the company. Plus, although some explanation was said about choosing the effective factors on Corporate Governance, non-existence of a certain theory makes the evaluations rigid. Generally speaking, there is no comprehensive theory about choosing the effective factors on Corporate Governance; and this field of study is too bounded and more than that, there is little theoretical or empirical basics in its literature.

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