Application of Resource-Based View Theory in Assessing of Efficiency of Companies Accepted in Tehran Stock Exchange by Data Envelopment Analysis

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ABSTRACT

Resource-based view (RBV) theory analyzes and interprets company's resources in order to find out how organizations gain a competitive advantage. This theory focuses on the implications of the complicated features of a company as the resources for excellent performance and comparative advantage. According to this view, capabilities and resources of the company are the main factors in explaining the functional results or competitive advantage. Resources can be considered as inputs which enable companies to do their activities. The purpose of this research is to introduce a resource-based theory for calculating the efficiency score of accepted companies in Tehran Securities Exchange by using Data Envelopment Analysis (DEA). In this regard, the financial statements of 190 companies accepted in the exchange for the 2009 – 2018 period have been analysed. Efficiency indicators, which include 4 categories of resources (10 inputs) and 5 outputs, have formed the axis of the mentioned technique. The results of implementing this model for companies with the efficiency score of one, indicates first a minimal input consumption compared to competing companies in the same industry while producing more output, and second, using the resource-based view theory (integration of tangible and intangible resources) enables the company to push the boundaries of efficiency. Finally, it can be said that utilizing minimum and maximum resources simultaneously leads to a focus strategy-type competitive advantage.

1 Introduction

Considering the competitive world, the state economy and financial resources, in order to be sustainable, companies and manufacturers need to assess the performance of their supply chain, which aims to deliver a high-quality product not only with the lowest possible costs, but also fast and valuable in all aspects of production [28]. The bases of progress of a company are profitability and the competitive advantage which are reflected by resources inside the company. Companies have different categories of resources and using this strategic tool makes possible the development of a different path [37]. The need to compete and stay comparative in the market, has encouraged managers to manage resources effectively in order to be able to achieve the company's goals [42]. The definition of resource-based view theory is a useful tool for examining the relationship between company resources and its success. The relationship has been examined widely across many industries but it is not examined and considered in

stock exchange companies in Iran. Using the resource-based view theory for the first time for evaluating the efficiency of stock exchange companies may be more suitable than other financial indicators. Therefore, the purpose of this research is measuring the companies' efficiency in using their resources (based on the resource-based view theory, tangible and intangible resources) in order to gain a competitive advantage using the Data Envelopment Analysis method which is a relatively comprehensive, efficient and effective method that can show the companies' successful and unsuccessful directions in efficient allocation of resources. Data Envelopment Analysis technique evaluates the relative efficiency of a set of decision-making units in a period of time [59]. When the information is available as several inputs and output invoices, the Data Envelopment Analysis method is used to calculate the efficiency of companies. Distinguishing between the efficient and inefficient companies enable the financial managers to choose the right securities [12, 24, 25, 27].

Thus, the DEA method was used, which is one of the common methods in assessing the performance of manufacturing and service-providing companies [28]. The question considered in this study is that whether or not the accepted companies in Tehran security exchange, in line with specified purposes and regarding the resource-based view theory, have the required efficiency to gain a competitive advantage, or in other words how successful they have performed and how effective they have been. The most important reason for examining the research topic from this perspective is that organizational resources and more intensive competition cause more trust and increased expression of responsibility, and this causes companies to envision long term programs, achieve decent improvements by relying on resources and direct the attention of executives towards the resources. Therefore, this research determines the efficiency of accepted companies in Tehran security exchange using the BCC (Banker, Charnes, Cooper) model of Data Envelopment Analysis, based on the Resource-based view theory, in order to gain a competitive advantage, and analyses the rate of efficiency by considering and comparing all the resources, and also choosing the type of strategy in order to gain a competitive advantage.

2 Theoretical Foundations

Around 70's and 80's, industrial organization theory had largely covered the strategic management domain. Inspired by industrial organization theory, but with making a specific theory, Porter's studies emphasized on strategic options which stressed analysis of industry as the starting point. Considering the weaknesses and the lack of robust practical evidences in the industrial organization theory, strategic management researchers began to search for and find inner organizational factors without disregarding outer factors in order to find out the reason for organizations' different efficiency. One of these theories is the resources-based strategy. Resource-based view theory is considered to be needed for organizations, because it can improve resources and capabilities that are very essential for organizations' adaptation to outside environment and in turn, enables organizations to benefit from the continues growth. Companies use most of their resources to create competitive advantages with positive impacts on efficiency of the company [42].

In line with the resources-based view theory, competitive advantage is created from within the organization. Organizations' resources are the main resources for the advantage, especially if they are valuable, rare and almost irreplaceable at the same time. Therefore, the emphasis is on how and to what extent these resources are unique and different compared to competitors, or in other words, how they lead to a competitive advantage. So, in order to gain a competitive advantage, the companies should analyse their inner strengths and weaknesses vigilantly and should be able to use the resources [6]. According to resource-based view theory, all the resources of the companies are not considered strategic, so they do not lead to a competitive advantage. A competitive advantage only occurs when there is an imbalance

of resources (different resources in different companies) and lack of dynamism of resources (inability of competing companies to get resources from other companies). In other words, the more mobile the resource is, the less stable it and the obtained advantage from it will be. In the current era of the changing world, if an organization is able to change quickly and become more vigilant toward competitive market changes, it will then be more likely to gain and maintain a competitive advantage [34]. In the resource-based view theory approach, the company's primary goal is to gain a competitive advantage that produces higher efficiency than average for the company. Diversity in benefits resulted from resources explain diversity in performance. To obtain such resources, one should look for intangible resources rather than tangible ones [15]. Organizations' success is fundamentally based on their ability to maintain a competitive advantage and achieving a superior efficiency. A sustainable competitive advantage is more accessible when resources are used to create value for customers and it leads to superior efficiency [2]. efficiency is a central issue for organizations, because it has a major impact on the economics of their members. Organizations should stay competitive, present dynamic operations in a related form and use competitive advantage strategies, they are basically self-helping organizations that support environmental concerns [33]. Companies can provide superior efficiency by applying effective and successful strategies derived from intellectual awareness and by understanding their key competitive advantages which they can create [7]. Bontis [9] believed that there are different tangible and intangible resources that affect company's competitive advantage directly or indirectly.

A tangible competitive advantage is an advantage derived from tangible resources and can be seen in physical forms such as machinery and equipment. In contrast, an intangible advantage is an advantage which cannot be seen in physical form easily. This kind of advantages are usually hidden behind obvious factors. This advantage can be resulted from company's trade names, personnel training and education methods, organizational culture, etc. Generally, it can be said the more the competitive advantage of the organization is based on intangible benefits, the more difficult and time consuming it is to imitate, and also, moving and attracting intangible advantages is more difficult than tangible ones, because an intangible advantage most probably is derived from organizational characters, features and capabilities which are causally ambiguous and socially complex. The main goal an organization seeks with creating a competitive advantage by relying on its resources and capabilities is competitiveness and achieving a superior efficiency position in market [52]. Porter [49] presents theories in which he states three general strategies. Strategies that a company can use to achieve competitive advantage include:

1) Cost Leadership Strategy, 2) Differentiation Strategy 3) Focus Strategy. On the other hand, Miles and Snow [38] introduce three other types of business strategies for companies: exploring, defensive and analytical strategies, which state differences in production type market management by companies. Explorers are inclined towards innovation and rapid simultaneous changes in the product market, while defendants compete based on price and they focus on fewer services and lower quality and as the result reducing the market price. Given the strategies advocated in the context of competitive strategies, companies can achieve superior efficiency by using each differentiation strategy or in other words, the exploration strategy, the cost leadership strategy or the defensive strategy, and the focus strategy, and using each of these strategies leads to sale growth and higher output rate for assets [40]. The majority of studies on the resource-based view framework have been concentrated on the concept. Therefore, resource-based empirical studies suffer from measurement issues. With a focus on these issues, this study aimed to fill this gap by introducing every tangible and intangible resource and proposing a measurement method for each resource type. An RBV-based research, which covers both tangible and intangible resources, can offer many advantages [42]. Therefore, novel frontier efficiency methodologies, including parametric and non-parametric approaches, are typically regarded as good instruments for

analyzing the performance of firms. Two different frontier analysis methods are used to measure the efficiency of firms, the non-parametric and parametric methods. The main parametric method is the stochastic frontier approach, which uses econometric methods; while the main non-parametric method is Data Envelopment Analysis [44], which uses mathematical programming. Both techniques utilize all the information contained in the data. Since the system is a multiple-input and multiple-output organization, an appropriate multiple criteria evaluation technique is essential for comprehensive and objective measuring of its efficiency. Since the existing methods for assessing and measuring the performance of units usually lack a reliable scientific basis, and since these methods are not standardized, their results in different organizations have not been comparable [1].

Also, the findings of some recent researches, for example Pepkani et al [43] and Joulaei and Mirbolouki [27], show the high competency of the DEA method in assessing the efficiency of companies. On the other hand, the inputs and outputs used in this method are very important. In most of the studies conducted so far, net profit or income is one of the outputs of the model [13], but in this study, the efficiency of companies accepted in Tehran Stock Exchange has been analysed, using the variable of competitive advantage (output model) [19-36] which has multiple measuring indices and the resource-based theory (input model) has been comprehensively categorized in neither domestic nor foreign research. Due to the measurement issues, the majority of studies have used either questionnaire or survey methods instead of financial indices [16-34-41-42-55]. Moreover, due to the lack of a comprehensive resource categorization, this study intended to fill this gap based on the measurement of financial indices. Moreover, the utilization rate of each of the introduced resources for achieving competitive advantage strategies has been analyzed for the first time in Iran using Data Envelopment Analysis. This study used the DEA, instead of statistical methods like partial least squares, as a mathematical technique to analyze the importance and popularity of each of the four proposed resources to develop competitive advantage strategies. Thus, Data Envelopment Analysis has become as one of the major research areas in measurement of the relative efficiency of corporations.

3 Literature Review

Galbreath [16] studied which type of organizational resources can have the most important success. He considered an exploring study based on the resource-based view theory. Resource-based view theory is based on the issue that success of the companies is mainly due to the sources which have specific characteristics. In this study a set of hypotheses were determined in order to examine the role of different resources (tangible and intangible) in company's success. This has been tested on Australian manufacturing and service companies. The results supported resource-based view theory in company success.

Sueyoshi et al [56] investigated the impact of research and development costs on the financial efficiency of active companies in the electric equipment industry and machinery in Japan by using the data envelopment analysis-discriminant analysis model.

The result of the study indicated that the research and development cost had a negative impact on financial efficiency of the companies in machinery industry and in the electrical industry, it also had a negative impact. In other words, the results indicated that the impact of research and development cost on financial efficiency (including avoiding bankruptcy) depends on the type of industry. Inmyxai and Takahashi [20] examined the impact of organizational resources on business efficiency of small and middle-sized companies. They believed that resource-based view theory can help companies choose key resources and form strategies for the resources placement in order to achieve a competitive advantage. This article studies the effects of organizational resources (human, tangible and intangible resources) on efficiency of two kinds of companies and the results indicated that regarding resources,

there are some similarities and differences between small and middle-sized companies. In this research and older studies, they confirmed that physical resources of a company can increase production, services and business operation by supporting resources of technology. Madhani [34] in a research studied the views and difficulties of resource-based view theory. The results showed that resource-based view theory mostly in considered as an alternative for Porter's five force model. This view emphasizes inner resources and capabilities of the company in formulating strategies in order to achieve a stable competitive advantage in market position.

Resource-based view theory uses resources and capabilities which are inside the organization in order to develop a stable comparative advantage Meutia and Ismail [37] in their research examine the role of marketing competence in creating a job network, a competitive advantage development and business efficiency in small companies. The result shows that marketing competence intensely impacts business networks, competitive advantage and business efficiency. They believed that the basis of a company's progress, profitability and competitive advantage is usually reflected by its resources. They emphasized that companies have different sets of resources and using this strategic tool will allow a different manner to be developed. Othman et al. [42] in a study examined organizational resources and sustainable competitive advantages of cooperative organizations in Malaysia. This article focuses on examining the effects of the organization's tangible resources on identification and use of resources to nullify threats (competitors). The results of this study show that cooperatives spend most of their company resources in creating competitive advantages with positive effect on company efficiency. Esfandiar et al. [13] examined the efficiency of banks accepted in Tehran Securities Exchange using the DEA method. In this study, the two DEA methods of BCC and CCR were utilized and the efficiency score of banks were calculated using both methods and then the banks were ranked using the Anderson and Peterson model. The results showed the competency of the DEA method in assessing the efficiency of banks. Joulaei and Mirbolouki [27] examined the decrease in the DEA performance indices of companies accepted in Tehran Securities Exchange using the Rough set theory. The results show that the advantageous power of DEA depends on the number of analysed companies and the number of inputs and outputs. When the number of inputs and outputs are high compared to the number of the decision-making units, most units will be assessed efficient, thus, the advantageous power of DEA will be reduced and the results will not be reliable. To counter this problem, the RST was used to decrease inputs or outputs. It should be noted that this algorithm can also use negative data.

Peykani et al [43] examined the Phased Data Envelopment Analysis method to rank the stocks of companies in Tehran Securities Exchange. The main goal of this study was to present a new approach to measure the efficiency and rank of the stocks. DEA is one of the common and practical methods which can be used to achieve this goal. That said, concerns regarding negative data and uncertainty are always present in financial markets since the classic DEA models cannot handle incorrect and negative values. To solve this problem, the researcher must use models that are usable even with negative values. In that article, the possibility ranges directional measure (PRDM) model was used to measure the efficiency of stocks, taking into consideration the negative data, uncertainty, and input and output parameters. The proposed model was executed using data from the insurance industry in order to analyse the efficiency. Khajavi et al. [30] examined the data envelopment analysis technique as a complementary method for traditional analysis of financial ratios. They realized that this technique does convert the ratios and different financial data to a single and comparable criterion called "efficiency." And they reached the conclusion that data envelopment analysis technique can be a good supplement for traditional analysis of financial statements by using financial ratios. Namazi and mousavi nejad [41] examined the relationship between intangible assets and financial efficiency of companies accepted in Tehran Security Exchange.

In this research, intangible assets were divided into two groups of registered and unregistered intangible assets. Alternative variables based on value of the market have been used for calculating unregistered intangible assets. The result of statistic tests indicated that there is a significant relationship between intangible assets of companies and their financial efficiency. The intensity of this relationship is stronger for unregistered intangible assets compared to registered intangible assets. Alavi and allahverdi [3] in a research examined the efficiency of pharmaceutical companies accepted in Tehran Security Exchange by using data envelopment analysis technique. The result of this research states that the use of more up-to-date data and mathematical models to evaluate the efficiency of pharmaceutical companies enables individuals and executives to decide as easy as possible and Eksir pharmaceutical company is ranked number one in terms of efficiency compared to other pharmaceutical companies.

4 Research Methodology

The main models of data envelopment analysis are divided in two categories of Charnels, Cooper, Rhodes(CCR) and BCC. Each one of these models can be evaluated based on input-oriented and output-oriented strategies [5]. The difference between the two CCR and BCC models has to do with hypothesis of constant or variable output towards scale. In the CCR model we hypothesize a constant output toward scale, and in the BCC model the variable output toward scale is hypothesized. The meaning of constant output to scale is that output changes relative to the input changes. For example, if the inputs are doubled, the outputs are doubled too. But the meaning of variable output to scale is that the output does not change proportional to input changes. The hypothesis of constant output to scale is only applicable if the firms act at optimal scale.

Different issues such as competitive effects, constraints etc., make firms not act at optimal scale. Use of the constant return hypothesis to scale, when all firms do not work at optimal scale, will disorder the calculated values for technical efficiency. In this research, to measure efficiency from output to scale perspective, the hypothesis of variable output to scale has been considered and this assumption seems to be logical, because business units usually do not work at optimal scale [30]. Whether we consider this problem of an output or an input nature, depends on whether the purpose of implementation of the model is to maximize the output or to minimize the input. Since our purpose for implementing the model is maximizing output (competitive advantage), so to calculate the efficiency score of decision-making units, the BCC model of data envelopment analysis with output nature has been selected among data envelopment analysis models. Mathematical formula of data envelopment analysis model with output nature is in equation 1 as follows:

$$
\begin{aligned}
& max\ \varphi \\
& \sum \lambda_j\, x_j\ \le x_p \\
& \sum \lambda_j\, y_j\ \ge \varphi y_p \\
& \sum \lambda_j\ = 1
\end{aligned}
\tag{1}
$$

In evaluating congruent decision-making units by data envelopment analysis, we give a score between 0 to 1 to each of decision-making units, and the decision-making unit is efficient if efficiency value is 1. Considering the goal of the research and the stated theoretical basis, the two main variables are the resource-based theory (as the input of the model), and the competitive advantage (as the output), which each have several measuring indices. Since the DEA method is capable of using several inputs and outputs, it is prioritized in this research. DEA is used to assess the efficiency of companies and is one

of the common methods to measure the performance of decision-making units and is one of the main focuses in studying the relative efficiency of companies. Selecting inputs and outputs might be the single most important step in using DEA to measure the relative efficiency of decision-making units.

Thus, it is difficult to assess the performance of companies with various inputs and outputs. That said, DEA combines several inputs and outputs of a company with the general performance criteria of the unit. Therefore, DEA can be used as a helpful tool in various industries present in stock exchanges. The estimated performance of each company (the decision-making unit) is affected by its inputs and outputs. One of the other advantages of data envelopment analysis models compared to the models used to determine efficiency before 1996 is that, these models, in addition to determining efficiency or inefficiency and the rank of each decision-making unit, introduce an efficient pattern to any insufficient decision-making unit, so decision-making unit under evaluation will have efficient efficiency if it reaches the pattern in terms of input utilization and output production. This pattern is usually called ideal or picture point in the literature of data envelopment analysis [26]. The research is descriptive and analytical in terms of purpose, and quantitative in terms of process, the method of data collection and analysis is inductive in terms of logic, and it is applied in terms of results. To do this research, all companies accepted in the Tehran Stock Exchange are considered as the statistical population.

The statistical samples have been selected by using the systematic elimination method and by considering these conditions:

1) In order to increase capability, companies whose financial year ends on March 29th are selected. 2) Financial intermediary companies and banks are excluded from the sample (because they have certain standards). 3) companies which were under the merger or acquisition process in the reported year are eliminated from sample (Because by changing the management in short period, the amount and procedure of disclosure will vary and change and it will not be generalizable for previous and future years) 4) Only companies will be selected that adhere to historical values according to standards requirements. (Companies with biological assets are among the companies that follow the current value. 5) Only companies are selected that their intended data for calculating are available). 6) Only companies are selected that have not changed their activity and their financial year during the years under study 7) in order to make the study more homogeneous, only the companies which were accepted in the Tehran security exchange were selected. Therefore, our sample includes 190 companies out of the 325 companies accepted in Tehran Security Exchange for 10 years since 2009 to 2018.

5 Research Variables

5.1 Resource-Based View Theory for Input of BCC Model

In domestic and foreign reviewed articles and researches, there is no complete and exact classification of resources. So, in this research, it is attempted to accomplish a comprehensive classification regarding prevailing conditions of exchange companies in Iran. Grant [18] believed that tangible resources can be easily identified and evaluated. But this is not true for every intangible resource. So, in this study, due to the wide range of resources and constrains in measuring intangible resources, four categories of resources are addressed that can be measured by accounting indicators, as well as by using intangible resources classification carried out in the research of Sigera and Cahoon [55].

1-1) Financial resources: The two key components of financial resources are current assets and business assets or the same financial assets. Current assets are a kind of asset which has liquidity and it is easily convertible to money. Business assets are also a key factor in maintaining long-term investment for the company profitability. According to Inmyxai and Takahashi [19], a business asset is a key factor for

provision of strategic resources and business reconstruction or expansion. Financial resources include 1) total current assets 2) short term financial facilities [14 -42]. 1-2) Physical resources: include land, building, machinery and equipment that include the total tangible fixed assets which can be extracted from financial statements [42].

2) Intellectual property resources: according to the current accounting system of our country, companies can register trademarks and brands in offices as an intangible asset only if they have purchased them. Therefore, one part of intellectual property includes intangible resources registered in balance sheet. While most trademarks and brands are created inside the company over time and by advertising about products and assessing the perception of customers about the quality of products, according to the current accounting system, it will not be qualified to be considered as an intangible asset, and this expense is regarded as spent costs. In other words, the most of intangible investments are considered spent costs immediately, while the benefits obtained from these investments will be recorded later. Sahay and Piliai [54] advertisement costs make a positive image for company in the customer's mind and it increases the brand value. Advertisement costs impacts on the value of the trademark and brand. So, based on researches, advertising costs is as suitable criteria for measuring intellectual asset resources [4].

3) Organizational resources

3-1) Human capital as a key element in personnel and organization assets development in order to increase productivity and obtaining a stable competitive advantage. In the absence of market value for human capital, the best approximation for its value, is measuring human capital by using statement of profit and loss [61]. The main factor of company's ability in attracting and keeping talented personnel can be calculated by the salary paid by the company to its personnel [35]. Also Lajili and Ze´ghal [32] hypothesized that investors consider the total cost of personnel as a suitable substitute for human capital. Therefore, according to researchers studied, the total salary of employees is as a suitable criterion for measuring human capital [57 - 61]. 3-2) Another component of an organization's capital is the organizational structure. Structural capital creates a situation through which knowledge is created and ready to enter the market. Structural capital is as a map and a guide. Where can we look for knowledge or who has the best skills. This capital is also a function of human capital. Therefore, to calculate the organizational structure, two indices have been used: 1) The public model which is used to calculate the value-added coefficient of intellectual capital and structural capital is one of the components of intellectual capital. 2) Based on Robinson and Shimiza [60], 9% of rewards and management fees are used. He believed that 9% of all working hours of executives spend for organizational reform and restructuring [4 -36].

Structural Capital Factor : $SCEi = SCi/VAi$ (2)

SCi : Structural Capital

The following equation is used to calculate the structural capital:

$SCi = VAi - HCi$ (3)

HCi : The total invested amount for salary

Calculating the added value (VAi) of company i in the equation 4:

$VAi = Ii + DPi + Wi + Di + Ti + Ri$ (4)

Variables of equation "4" are profit costs, amortization costs, salary costs, stock benefits, tax and accumulated profits respectively.

4-1) Reputation sources: Philip Cutler believes that a brand can be defined when goods and services of a seller are distinguished from other sellers', since he distinguishes them from other goods and services. A brand's fame that is the value and life of brand in the research is one of the components of credit resources, and there are several methods to measure it, one of which is the Tobin's Q Index. Therefore, the Tobin's Q Index is used to calculate the brand value. If the indices are higher than 1, it means company has intangible assets. Therefore, the q ratio is derived from the ratio of the market value of the company's security exchange to replacement cost of its assets: MV is market value of the company (included salary of stock owners and debts) RC is replacement cost of company's tangible assets (book value + total current assets) [10].

$$Q = MV/RC \tag{5}$$

Table 1: Introducing Financial Measurement Criteria by Researchers for Input Bcc Model

Introducing companies' resources	Financial measurement methods	resources
Financial- Physical resources	Current assets	Othman et al [42], Fahy [14]
	Short term financial facilities	Fahy [14]
	Total tangible fixed assets	Barney [6], Madhani, [34] and Othman et al [42]
Resources of intellectual property which include intangible resources registered in the balance sheet, brand and trademark in this research	Total intangible assets	Gardberg and Fombrun [17]
	Advertising cost	Sydler et al [57], Kapareliotis and Panopoulos [29], Sahay and Piliai [54]
Organizational resources which include human capital and organizational structure.	Total salary of personnel	Sydler et al [57], Wyatt and Frick [61], Lajili and Ze´ghal [32]
	Pulic model for calculating structural resources	Pulic [50-51]
	9% Reward and management fee	Miyagawa and Hisa [36]
Reputation and Communication resources which are the brand value and communication abilities in this research	Q Tobin Index	Chehab et al [10]
	Pulic model for calculating communication resources	Pulic [50-51]

4-2) Capabilities are other components of intangible resources. Communication resources are one of the components of capabilities which are addressed in this research. The meaning of communication resources (customer orientation) is marketing competence, market intensity and customer loyalty [11]. Fornell believed that customer satisfaction can maintain business relationship and increase a company's authority. Bontis [9] expanded customer investment to relationship investment which includes the knowledge in all the relationships that the company establishes with customers, competitors and providers. Therefore, Pulic model which has been used for calculating value added coefficient of intellectual capital and has communication resources as one of its components, has been used for calculating

communication resources.

Communication capital coefficient: $CEEi = VAi/CEi$ (6)

5.2 Competitive Advantage Variable for Output of BCC Model

For calculating the competitive advantage variable, business strategies propounded in research of Bentley et al [8] and derived from Hasan and Habib [19] have been used. Bentley et al [8] modified the model of Ittner et al [20] and expanded the other measurement criteria for calculating the strategy score based on the Miles and Snow model [38].
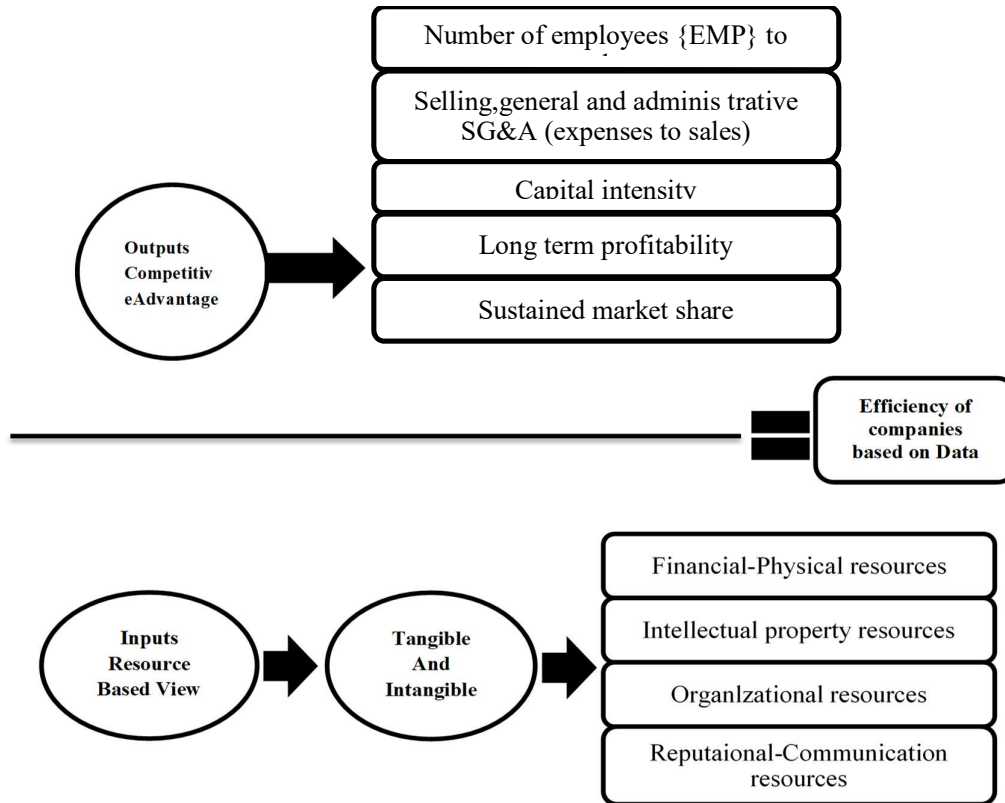
Number of employees {EMP} to

Selling,general and adminis trative SG&A (expenses to sales)

Capital intensity

Long term profitability

Sustained market share

Outputs Competitiv eAdvantage

Efficiency of companies based on Data

Financial-Physical resources

Intellectual property resources

Organlzational resources

Reputaional-Communication resources

Inputs Resource Based View

Tangible And Intangible

Fig. 1: The Conceptual Research Model to Measure Companies' Efficiency

1) Measurement criterion for company's ability in the production and distribution of goods, as well as service efficiency which is calculated by the ratio of the number of employees [EMP] to the net sales. 2) Measurement criterion for companies' emphasis on marketing and net sales which is measured by the ratio of sales, general and administrative (SGandA) expenses to net sales. 3) Measurement criterion for company's concentration in production, which is measured by the ratio of capital intensity is as follow: the capital intensity measured as net property, plant and equipment scaled by total assets.

Also, the other two variables which can be strong barriers to competitors so that the company can achieve a competitive advantage include 4) long term profitability: for measuring long-term efficiency in the past, the average output of assets in the last 3 years can be used.

To calculate the output of assets, profit is divided by the average of total assets before deducing tax.

Then the average of the last 3 year's benefit of assets is considered as company's long-term efficiency. 5) and the last criterion is stability of the market share. This variable reflects the ability in maintaining the company's market share over time. To measure market share, the percentage of total net sale to industry sale in the last 3 years is calculated [19-36]. Finally, we sort and divide companies in quintile according to each of the 5 criteria (proportion) ranging from small to large. So that the observations in the highest and lowest quintiles are 5 and 1 respectively. Then for each year, the scores of 5 criteria are summed. Thus, a company can earn a maximum of 25 points and a minimum of 5 points. A maximum score 25 (highest strategy score) indicates that the strategy of company is exploratory and a minimum score 5 (lowest strategy score) indicates that the company's strategy is defensive and a score between 25 and 5 shows that the company is using a focused strategy.

Table 2: Comparison of Outputs of (DEA) Model in Research

Model output in current research	Model output in previous research
Competitive advantage[19-36]	profitability ratio, valuation ratio [27]
	Rate of Return (ROR), Liquidity, Earnings per Share (EPS) Growth Rate [43]
	sales and net profit [13]
	Number of loan accounts, Number of deposit accounts, Loans, Demand deposits [22]

The efficiency score of companies based on the resource theory by using data envelopment analysis is equal to:

$$E\text{fficiency} = [\text{Competitive advantage}/(\text{Financial and Physical resources} + \text{Intellectual property resources} + \text{Organizational resources} + \text{Reputation and Communication resources})]) \quad (7)$$

6 Data Analysis

As it was mentioned, the BCC method of data envelopment analysis with the output nature is used in this study. Accordingly, by using the GAMS software, the efficiencies companies have been calculated based on the most efficient output from possible inputs. Due to limitations in reflecting results of the 190 companies accepted in the Tehran Security Exchange, which include 16 industries, only four industries, and from each industry, one of the companies with the highest efficiency and one with the lowest efficiency over the 10-year period have been selected. It should be noted choosing each company (decision-making unit) in each industry is completely random and the name of decision-making units are not mentioned and every decision-making unit is nominated by a number.

Among the 190 decision-making units, that have been tested for a 10-year period and include 1900 pieces of data (company/year), the efficiency of only 174 decision-making units is below 50% and the efficiency of the rest is more than 50%. As it is shown in Table 3, one efficient and one inefficient decision-making unit from 4 industries has been selected, due to limitation in reflecting the results. In other words, 4 efficient decision-making units which include decision-making units 22, 48, 152, 188, and 4 inefficient decision-making units which include decision-making units 16, 47, 154, and 185 have been introduced. For example, Decision Unit 22, was efficient and has a score of one in the whole 10-year period under review, and the Decision Unit 16 was inefficient or, in other words, less technically efficient.

Table 3: An Example of Efficiency Score of the Decision-Making Units for the Period 2009-2018

DMU	Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	Industry	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency
22	3	1	1	1	1	1	1	1	1	1	1
16		0.4	0.4	0.5	0.3	0.3	0.7	0.1	0.1	0.5	0.7
48	4	1	1	1	1	1	1	1	1	1	1
47		0.7	0.7	0.4	1	0.6	0.5	0.4	0.4	0.8	0.6
152	14	1	1	1	1	1	1	1	1	1	1
154		0.5	0.4	0.5	0.5	0.6	0.5	0.8	0.9	0.8	0.9
188	16	1	1	1	1	1	1	1	1	1	1
185		0.4	0.3	0.4	0.5	0.7	0.6	0.4	0.5	0.7	0.7

The fact that the introduced decision-making units were effective throughout the period under review is because these decision-making units have been able to produce maximum output with the least amount of input compared to other decision-making units in their respective industries. So an investor or a creditor, by using the results of this research, can easily find the best company among the companies surveyed (ie, the efficient decision-making units) to choose and invest in or give credit to.
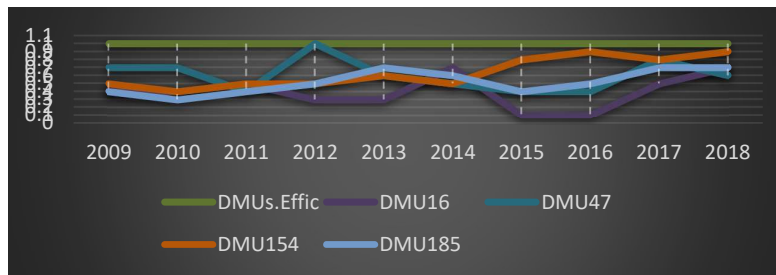

Fig. 2: Efficiency Chart of Sample Companies

As it is evident in Fig. 2, all efficient companies which have the score of 1, are situated along one line, and among the inefficient companies, the decision-making unit 154, which is a member of the food industry, compared to the decision-making unit 16, which is a member of the auto industry, has tries to reach the boundaries of efficiency during the 2015 to 2018 period, and is relative efficient among the inefficient decision-making units.

Table 4: Descriptive Statistics of Strategy's Variable

Variable	Mean	Max	Min	Mode	Median	St.dev
Strategy score	15	24	7	16	15	3

After making quintet of 5 categories of outputs or the same variables introduced to achieve competitive advantage, the results in Table 3 show that none of the efficient companies in their related industry obtained the maximum score of 25 and none of the inefficient companies in their related industries obtained the minimum score 5, and according to the results of Table 4, which shows that the mean strategy score is 15, decision-making units have utilized a focused strategy. The results in Table 5 demonstrate this. In fact, all decision-making units choose a median strategy of offensive and defensive

strategies. In other words, decision-making units achieve competitive advantage neither by minimum resources nor maximum resources but by minimum and maximum resources integration. Table 5 can also be analyzed from another perspective. Irrespective of the industry, to evaluate the strategy score of efficient companies, for example decision-making unit 22 has a strategy score of 15 in 2016, indicating a tendency towards a defensive strategy, and the decision-making unit 48 has a strategy score of 18 in 2016, showing tendency towards an offensive strategy.

Table 5: An Example of the Strategy Scores of the Decision-Making Units for the Period 2009-2018

DMU	Industry	2009 Strategy	2010 Strategy	2011 Strategy	2012 Strategy	2013 Strategy	2014 Strategy	2015 Strategy	2016 Strategy	2017 Strategy	2018 Strategy
22	3	18	18	17	19	18	16	15	15	13	15
16		12	12	10	9	9	12	12	11	9	7
48	4	15	17	17	18	20	19	18	18	17	17
47		13	12	14	16	15	14	14	15	13	12
152	14	14	16	17	18	21	21	19	20	20	20
154		16	16	16	14	14	14	16	18	17	16
188	16	19	19	19	18	17	17	17	17	18	18
185		14	12	15	15	14	14	16	14	14	13

Thus, by examining the 10 components of corporate resources, we came to the conclusion that the decision-making unit 22, has utilized the minimum amount of resources compared to unit 48 and the decision-making unit 48 has utilized the maximum amount of resources compared to unit 22. In other words, the extent of utilization of resource can represent the type of the corporate strategy. This is fully covered in Flowchart Fig. 4.

Table 6: An Example of Decision-Making Units' Efficiency Score Based on Resource Separation for the Period 2009-2018

DMU	Efficiency		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
16	Tangible	Financial and Physical resources	0.3	0.3	0.3	0.2	0.2	0.3	0.1	0.1	0.3	0.4
22			0.6	0.7	0.9	0.6	0.5	0.4	0.4	0.7	0.5	0.9
16	Intangible	Intellectual property resources	0.3	0.4	0.5	0.2	0.2	0.3	0.1	0.1	0.3	0.4
22			0.7	0.7	0.7	0.6	0.5	0.3	0.2	0.6	0.4	0.7
16	Intangible	Organizational resources	0.3	0.3	0.3	0.3	0.3	0.4	0.1	0.1	0.4	0.5
22			0.6	0.5	0.6	0.6	0.5	0.8	0.5	1	0.6	1
16		Reputational and Communication resources	0.3	0.3	0.3	0.2	0.2	0.4	0.1	0.1	0.3	0.6
22			0.8	0.8	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.4

In Table 6, it has been attempted to randomly investigate two efficient and inefficient decision-making units which are illustrated in Table 3, by applying each of the introduced categories. The decision-making unit 16 in Table 3 is a member of inefficient companies for the entire period under review. This inefficient unit has less efficiency score than other types of resources in terms of efficiency score of

financial-physical resource or the same tangible resources, except for years 2009, 2015 and 2016, which enjoys the similar score to other categories of resources and for other years it has less score than other resource categories. In other words, from the point of view of reviewing each resource category, it can be concluded that this unit has achieved higher efficiency assuming that it is an inefficient unit, but for example in 2014, using the organizational resource, which is one of the intangible resource categories, it has been able to obtain more efficiency score than financial resources assuming the use of physical-financial resources. Decision-making unit 22 in Table 3 is included in efficient companies in all studied period. This decision-making unit, except for the year 2010 in which enjoys more advantage than other resource categories, has the same or less advantage than other resource categories for other years in terms of physical-financial efficiency or tangible resources.

In other words, from the point of reviewing the score of each category of resources, it can be concluded that this unit has been capable of achieving a higher efficiency score than assumed for using physical-financial resources if we assume it is an efficient unit, and for example in 2014, by assuming the use of organizational resources which is one of the categories of intangible resources. One the other hand, if the use of intangible resources is assumed (organizational resources), it has been able to reach efficiency boundary. Generally, it can be said that the greater the competitive advantage of an organization is based on intangible advantages, the more impossible to imitate and the more time consuming it will be, and also moving and attracting an intangible advantage is more difficult than a tangible advantage. Because an intangible advantage most likely is derived from characteristics, features and capabilities of an organization which are causally ambiguous and socially complex. Intangible capital is a good resource in obtaining a competitive advantage, because when the company has good knowledge, it can use this knowledge to reduce its final cost in many areas. Galbreath [16] believed that there are few studies that address the practical application aspect of tangible resources in researches based on the resource-based view theory. If in a resource-based view theory research, the scope of resources is expanded and contains tangible and intangible resources, the results will be more practical advantages [42]. Therefore, it can be concluded that in addition to tangible resources, intangible resources lead to companies' success as well.

Resources are the building blocks of market success for a company. Thus, it is important to analyse which one is more important for success. As it can be seen in Fig. 3, for the efficient decision-making unit 22, the organizational resources have the highest efficiency score from among its 4 utilized resources during the 2012-2018 period. Thus, from among the 4 categories of resources introduced in this study, organizational resources are the most important for gaining a competitive advantage. Therefore, a manager must create a work environment which maximizes the efficiency and the performance of employees. The human resources policies can reduce changes or instabilities in employees and developing an organizational structure able to adapt to the ever-changing conditions of the market, must be one of the priorities of a manager. Financial resources, intellectual property resources and communication-credit resources are the next priorities importance-wise.

Anyhow, even though a manager must legally protect the ideas and intellectual property resources, and while the credit and communication resources can create lead to success and competitive advantages, among all the resources, intangible resources (organizational resources) have a higher efficiency score than tangible resources in the 2012-2018 period.
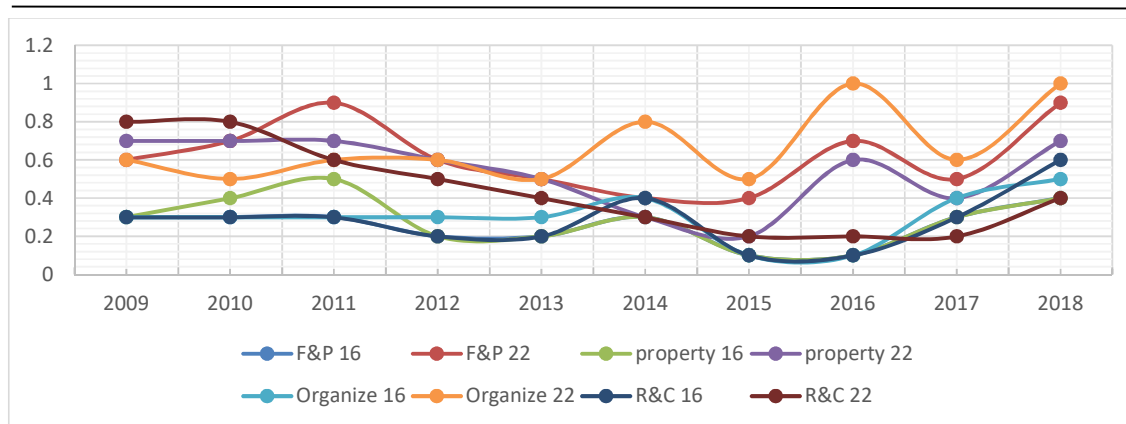
Fig .3: Tangible and Intangible Resource Chart of Two Sample Companies

Table 7: An Example of Input and Output of Efficient and Inefficient Decision-Making Unit for the Period 2016

Year	2016	2016
DMU	47	48
Input 1	4,792,954	202,937
Input 2	1,037,527	8,224
Input 3	867,947	37,351
Input 4	2,183	1,097
Input 5	0	0
Input 6	532,936	34,571
Input 7	0.6589	0.8222
Input 8	100	162
Input 9	1	4
Input 10	0.8289	1.1699
Output 1	0.0008	0.0009
Output 2	0.081	0.089
Output 3	0.149	0.155
Output 4	0.08	0.67
Output 5	0.33	0.42

As it is shown in Table 7, the decision-making unit 48 in year 2016 is selected out of 4 categories (10 components) of resources based on resource-based view theory and is efficient in its related industries with the efficient score one, and compared to its inefficient decision-making unit 47, it has been trying to utilize minimum use of financial resources (minimum use of current assets and banking facilities), physical resources (minimum purchase or investment in registered tangible fixed),Minimum intellectual property resources (registered intangible resources), minimum organizational resources (salary), and maximize other organizational resources (organizational structure and management Reward), and maximize Reputation -communication resources (brand reputation and communication ability), and most other resources Equally, intellectual property (non-investment in advertising) has been applied to decision-making unit 47 to achieve competitive advantage. Ultimately, the ability of the firm (decision-making unit 48) to produce and distribute goods, as well as service efficiency, sales and marketing, firm

focus on production, long-term performance and market share sustainability is more than decision-making unit 47, therefore, it can be concluded that in order to achieve competitive advantage more resources, minimum resources and less amount, maximum resources are employed than inefficient units. In addition to analyze the minimum or maximum use of resources in order to make decision-making units to reach the boundary of efficiency and inefficiency and achieving competitive advantage in all industries, different decision-making units can be analyzed based on their differences in resources' importance and utilization. As it is shown in Table 3, decision-making units 22 and 48 are both efficient decision-making units. In the decision-making unit 48 which is a part of metal production manufacturing industries and the decision-making unit 22 which is a part of auto industry, all the resources of 4 categories of resources presented in this study are addressed except intellectual property.

Also in the decision-making unit 152 which is a part of food industry, unlike the two aforementioned decision-making units, all resources are addressed. So it can be said the amount of resources used in all three decision-making units regarding the presence in their related industries can be different and according to the main theory of resource-based view theory that believes there is a heterogeneity of resources between organizations, benefits derived from such resources can be sustained.

Table 8: Introducing Pattern (Objective) for an Example of an Inefficient Decision-Making Unit to Reach the Efficiency Limit

DMU	Input and Output	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
16	Input 1	0.0008	0.01	0	0.02	0.01	0.01	0.01	0.05	0.16	0.1
16	Input 2	0.0015	0	0	0	0	0.04	0.01	0.05	0.04	0
16	Input 3	0.0059	0.01	0	0.03	0.03	0.05	0.12	0.12	0.12	0.02
16	Input 4	0	0	0	0	0	0	0.05	0.03	0.05	0
16	Input 5	0	0	0	0	0	0	0	0	0	0
16	Input 6	0.0029	0.01	0.01	0	0	0.01	0.01	0.03	0.1	0.01
16	Input 7	0.0128	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
16	Input 8	0	0	0	0	0	0	0	0.01	0	0.01
16	Input 9	0.1448	0.16	0.09	0.16	0.19	0.19	0.17	0.17	0.17	0.17
16	Input 10	0.0006	0	0	0	0	0	0	0	0	0
16	Output 1	0.0134	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0
16	Output 2	0.0007	0	0	0	0	0	0.01	0.01	0	0
16	Output 3	0.6315	0.53	0.33	0.51	0.51	0.58	0.77	0.72	0.32	0.17
16	Output 4	0.0387	0.06	0.06	0.06	0.08	0.02	0.05	0.16	0.04	0.22
16	Output 5	0.0467	0.01	0.01	0.01	0.01	0.01	0.04	0.05	0.01	0.01

In any linear programming, the data envelopment analysis method seeks to maximize the efficiency of the target unit. This search procedure stops when the efficiency of the decision-making unit or at least another unit equals 1. Therefore, for each inefficient unit, there is at least one more unit with the efficiency of 1. It has the same efficiency with the same target unit weights obtained from solving the model. These efficient units are called "reference groups" of inefficient units.

Data envelopment analysis determines reference groups or patterns for each of the inefficient observations and for benchmarking to increase efficiency. As previously shown in Table 3, the decision-making unit 16 is inefficient over the whole studying period. Therefore, the decision-making unit 16 can reach its efficiency to 1, considering the input and output numbers shown in Table 8. This means that to reach

the efficiency limit, it must increase 10 inputs and 5 outputs to the degree shown in Table 8 and follow it and plan policies to achieve these goals. Thus, managers of inefficient companies can reach their financial efficiency to efficiency limit according to Table 8.

To have a glimpse of the presented method used to calculate the efficiency score of companies, Fig.4 depicted the steps as a flowchart.
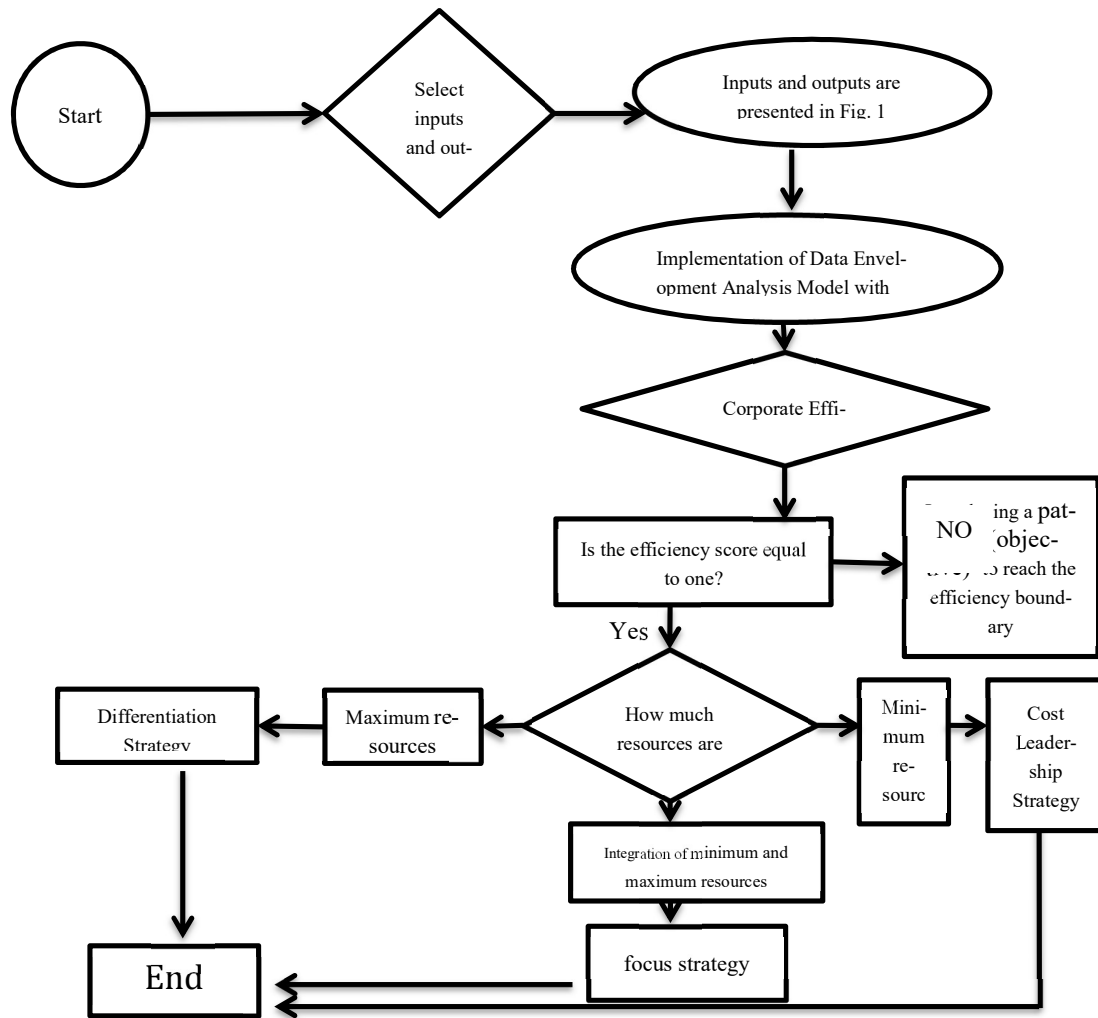

Fig .4: The Steps of Companies' Efficiency Evaluation.

7 Conclusion and Discussion

Resource-based view theory emphasizes resources and the company's internal capabilities in formulating strategies in order to achieve competitive advantages in market position. Resources and internal capabilities are company's implemented strategic choices at the time of competing in the business environment. In other words, it helps companies' managers to understand what the most important asset of a company is to achieve a comparative advantage and how to use these assets to improve business

efficiency. In this theory, traits related to past business, organizational culture and skills are critical to the success of the company. Of course, there is no permanent success unless it is guaranteed. In fact, market success can be eliminated in a relatively short period. In other words, there is no definite answer to the question how managers can make their companies successful and efficient. However, the results of the study provide insights that are probably useful to managers and companies [15- 34]. The results show that in companies with the efficiency score of one, less input is consumed than other companies in an industry and more output is produced. That is, in the decision-making unit 48, which is one of the efficient companies in its related industry, in 2016, out of 10 inputs, the instances of using minimum input are more than that of maximum input. But on the other hand, in the decision-making unit 47, which was one of inefficient companies in 2016, out of 10 inputs, the instances of using maximum input is more than that of minimum input. Second, it can be concluded that, based on resource-based view theory, the companies control special resources under different categories that potentially can potentially help improving efficiency [42].

Therefore, the use of integrated tangible and intangible resources can make the companies reach the efficiency limit. Third, it seems that implementing minimum resources or maximum resources in order to achieve maximum output can be a sign of offensive or defensive strategy. But in this research, by putting output variables (competitive advantage variable) in quintiles, it is concluded that dominant strategy in 190 decision-making units is the focused strategy. This means that the decision-making units have used an integration of minimum resources and maximum resources in order to achieve a competitive advantage. The decision-making unit 48 which in in 2016 used 5 resources at minimum, 1 similarly resource and 4 resources at maximum compared to its inefficient unit, decision-making unit 47, which can be a sign of both its efficiency compared to other competitor units in an industry and also a reason for the dominance of the focused strategy in these decision-making units. The decision-making unit 47 which in 2016 used 4 resources at minimum, 1 resource similarly and 5 resources at maximum compared to its efficient unit, decision-making unit 48, which can be both a sign of its inefficiency compared to other competitor units in an industry and also a reason for the dominance of the focused strategy in these decision-making units. The results of this research indicates the effective efficiency of resource-based view theory and data envelopment analysis to calculate the efficiency score of companies and determine the distance they have to go to reach an efficient unit. The result of the research conforms with the researches of Othman et al [42], Inmyxai and Takahashi [20], Soyushi and Mike [56] and Galbreath [16]. The results of this study provided evidences that are presented the following suggestions:

Utilization of the results of this research by the executives of accepted companies in Tehran Security Exchange to better identify resources in order to improve and increase their performance efficiency. Utilization of the data envelopment analysis by Tehran Security Exchange suggested to provide the right information for investment and attestation decisions. For future studies, taking into account the resource-based view theory to gain a competitive advantage. Firstly, it is suggested that the resources introduced in this research can be identified based on the framework of advantage-generating features of resources (in terms of value, scarcity, non-imitation and non-substitution), then the type of competitive advantage, temporary or sustainable [6-34], can be declared. Also, it is possible in future studies to compare and calculate the efficiency advantage of companies by classifying industries into high, medium and low tech industries. Secondly, for future research, we can use various models of data envelopment analysis that have not yet been explored in combination with other issues being discussed, such as the resource-based theory, so that by using the various models that can be developed from these compounds, we can obtain more useful and at the same time more applicable methods for diverse eval-

uations. In financial markets, most of the times, the inputs and outputs of DEA models contain uncertainty [44-45]. For example we can suggest 1) a novel Robust Data Envelopment Analysis (RDEA) model, which is capable of being used in the presence of discrete and continuous uncertainties [23-44], 2) the robust DEA model based on network DEA models to measure the performance of DMUs with a network structure[48-58], 3) the Interval Network Data Envelopment Analysis (INDEA) approach under constant return to scale (CRS) and variable return to scale (VRS) which is capable of two-stage efficiency modeling with intermediate measures in a single implementation[45-53], 4) and application of fuzzy data envelopment analysis models developed[31-46-47]. Finally, we can suggest that considering that in the real world, we are faced with uncertain data and uncertainty is one of the most important characteristics of financial markets and the slightest deviation in data can lead to significant differences in final results [44], all of the methods outlined in the Recommendations section can be used as new perspectives on the resource-based theory and corporate efficiency measurement.

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