

Financial Performance Evaluation of the Gas Distribution Companies of National Iranian Gas Company¹

Seyed Mohammad Javadi^{*a}, Ali Mohammad Ghanbari^b and Arsalan Anisi^c

^a Assistant Professor, Department of Accounting and Finance, Tehran Faculty of Petroleum, Petroleum University of Technology, Iran, Email: Javadi@put.ac.ir; Corresponding author.

^b Assistant Professor, Department of Accounting and Finance, Tehran Faculty of Petroleum, Petroleum University of Technology, Iran, Email: aganbari@put.ac.ir

^c MSc Student of Oil and Gas Financing and Investment, Tehran Faculty of Petroleum, Petroleum University of Technology, Iran, Email: anisi@put.ac.ir

ARTICLE INFO

Keywords:

PERFORMANCE EVALUATION, FINANCIAL INDICATORS, AHP, TOPSIS, LIQUIDITY, NATIONAL IRANIAN GAS COMPANY (NIGC)

Received: 7 Feb. 2018

Received in revised: 28 Mar. 2018

Accepted: 15 Apr. 2018

ABSTRACT

The purpose of this study is to evaluate the financial performance of 31 provincial gas distribution companies as the affiliates of National Iranian Gas Company (NIGC). To this end, we identified financial performance indicators in accordance with the requirements of NIGC through a review of theoretical foundations and interviews with a number of financial and planning experts and then prioritized them using the analytical hierarchy process (AHP) method. These indicators lied in four groups of liquidity, capital structure, profitability, and activity criteria. Then, the weighted indicators were analyzed using TOPSIS technique and with help of the Expert-Choice (EC) software, and the final ranking of the companies was provided. The results showed that, based on the identified criteria, provincial gas companies of Hormozgan, Yazd, Markazi, and Kermanshah had a favorable financial performance and Ilam, Mazandaran, Chaharmahal and Bakhtiari, and Zanjan provincial gas companies had a weak financial performance with respect to the other companies in the three years reviewed. Finally, some suggestions have been made in this regard.

1. Introduction

In the process of economic transition (from an underdeveloped economy to an expanded or developing economy), mobilizing capital resources, on the one hand, and the appropriation of these resources, on the other hand, are prerequisites for success. In the current competitive environment, one of the hallmarks of which is the scarcity of resources, performance evaluation and management play a vital role in the organization (Halkos and Salamouris, 2004). Experts and scholars believe that performance is a major issue in all organizational analyses, and it is difficult to imagine an organization which is not subject to performance measurement and management (Javadi, 2013). Organizations rely on performance appraisal to provide feedback to managers in relation to strategic goals (Cravens, K. et al., 2010). Assessing the performance of past achievements as a source of decision about the future is important for the survival of organizations. Researchers use different financial and non-financial indicators to evaluate performance. Financial information

provided by organizations should be generally precise, accurate, and reliable for assessing corporate performance. In this regard, financial indicators and ratios are used by managers, investors etc. to assess the current status and predict the future situation (Talebzadeh, 2011).

The functional aspects of organizations which have traditionally been considered are their financial dimensions. This is because of the fact that the main goal of many companies is to make profit. Often, in financial performance studies, the relationship between financial measures and their impact on corporate performance have been emphasized. To this end, regression models have been used to assess the effectiveness of each of these metrics on performance (Talebzadeh, 2011). In this context, determining the the performance level of provincial gas companies and their ranking on the basis of their financial performance makes it easy for weak companies in the field of gas distribution to identify their gaps and develop a tailored strategy for improvement. Top companies will also seek to maintain their superiority by defining optimal plans and strategies. In addition,

* Corresponding Author

presenting information on the performance of companies provides an opportunity for the managers of the NIGC to make sound performance evaluation and economic decisions and apply appropriate strategies to improve the performance of these companies. It should be mentioned that one of the biggest problems with the financial indicators was their one-dimensional assessment. Hence, we needed an ideal method that could simultaneously accommodate and combine a wide variety of indicators to provide a clear and integrated picture of the situation of each provincial gas company.

There are 31 provincial gas companies as natural gas distributors which operate and play a critical role in the interconnected system of Iran's gas distribution network in the household and business sectors, which consume most of the total natural gas produced and refined. Other sectors including power plants, major industries, and petrochemicals also account for a large part of the refined gas, with the total consumption of up to 62% of the currently-selected gas component in the country's fossil energy portfolio, which is projected to grow in the near future (Iran Energy Exchange, 2013). Thus, the importance of pre-evaluating the performance of provincial gas companies is highlighted. The assessment and ranking of companies are one of the most important procedures for identifying the strengths, weaknesses, opportunities, and threats of their outsiders. Given that provincial gas companies have a special place in the gas value chain as natural gas distributors, they play a decisive role in creating value added in the gas chain. Hence, the assessment and ranking of these companies, which are the subsidiaries of the NIGC, has been of great importance to the parent company in order to optimize the allocation of resources and increase control over its resources.

The purpose of this research is to evaluate the financial performance of provincial gas distribution companies as affiliates of NIGC. At first, we identify the financial performance indicators in accordance with the requirements of NIGC through the review of theoretical foundations and interviews with a number of financial and planning experts. Then, we prioritize the above-mentioned indicators within four categories (i.e. liquidity, capital structure, profitability, and activity indicators) using the AHP method. Finally, the weighted indicators are analyzed using TOPSIS technique with the help of Expert-Choice software, and the final ranking of affiliate companies is provided.

This paper is structured as follows: section two reviews the literature and theoretical foundations, and section three discusses the research methodology and design. Section four represents the empirical findings of the interviews, paired comparisons, AHP, and TOPSIS analyses. The final section is devoted to conclusions and discussions.

2. Literature review and theoretical foundations

Managers measure, evaluate, and manage performance as a mechanism to achieve their organizational goals and strategies

(Broad and Javadi, 2009). Evaluating the performance of companies is assessing the overall financial situation and the results of operations in order to make logical decisions. Performance appraisal is also a process that helps shareholders to decide on optimal investment. One of the most important issues for investors, creditors, and, in general, internal and external decision makers of companies is the issue of assessing the performance of companies (Asadi and Kiani Nejad, 2013). Evaluating and predicting future financial performance of business units are the two key elements in decision making for investment. To this end, financial and performance management scholars around the world are working on providing models for predicting financial performance (Bayrakdaroglu and Yalcin, 2012). To succeed and improve the performance of companies, it should be conducted through a certain procedure within a determined framework. This process framework is called "the performance cycle" as illustrated in Figure 1 below. This cycle starts with the measurement, and, in the next step, the performance is evaluated. The third step is the performance improvement program, all steps of which and the chain lead to improved performance.

If an organization wants to function properly, it should evaluate its performance (Kennerley and Neely, 2002). Among the various methods for performance assessment, the financial dimension of performance is the most considered and studied (Safaei Ghadikalaei and Khalili, 2014), and, in this manner, the financial performance metrics have been used to a large extent due to features such as being quantitative, feasible, objective, and tangible.

Over the recent decades, several performance measurement models such as: the model of Sink and Tuttle, performance measurement matrix, results and determinants model, strategic measurement and reporting technique (SMART) performance pyramid, three dimensional model, performance prism model, triangle service model, balanced scorecard model, business process model, value for money model, the analysis of stakeholders, and organizational excellence model are among non-financial performance evaluation models which have been used broadly (Kennerley and Neely, 2002). Performance measurement methods using the financial dimension are divided into four categories:

1. Financial ratios as the ratio of return on assets and the ratio of return on investment etc.
2. Combination of accounting and market information for performance evaluation such as the Tobin's Q or the price/earnings per share.
3. Ratios used by financial information such as earning per share.
4. Economic measures such as market /economic value added

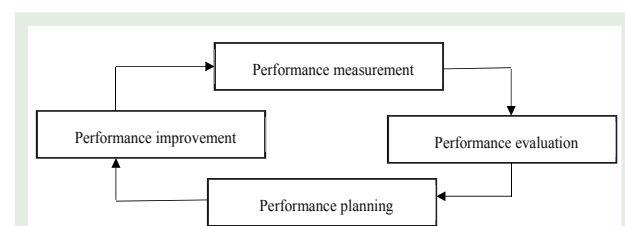


Figure 1: Performance cycle (Latham et al., 2002)

indexes.

Many financial management texts divide ratios into different categories, in which the ratios in each category represent an indicator. In the present research, the ratios are listed in four categories (Ross et al., 2014) as follows: liquidity, capital structure (debt), profitability, and activity ratios.

Given that competition is the essence of a free-market or capitalist economy, at least theoretically, it is stated that, in fully competitive markets, economic factors are at the equilibrium point; therefore, the parties to the contract can also achieve these points. Basically, performance is at a direct communication with goals (Panahian, 2003). Also, economic entities pursue different goals for attracting scattered capital, but the common goal for both groups is to achieve more benefits and maximize shareholder wealth. Generally, the benefit in this market is generated as return on investment in the form of interest payments, increases in stock prices, or both, which is expressed in terms of return on equity. For many years, financial analysts have been looking for criteria to measure performance. It allows them to predict the returns and fluctuations for the stock of a company with the closest approximation. Stock returns usually have a direct impact on the stockholders' wealth. In other words, if the decision makers of securities market can predict stock returns (in a way that they sell stocks at lower future yields and buy stocks at higher returns), they will be able to generate wealth (Browne et al., 2000).

One of the requirements for reforming the current economic and capital structure of the NIGC is to design and implement a budgeting model and allocate funds based on performance, objectives, and plans. Therefore, the main distinction between this model and the current (traditional) model of budgeting and allocating financial resources is its emphasis on performance, goals, outcomes, and long-term plans. Since the goal-oriented assignment of resources to the activities can allow for operational monitoring and expectations of performance and access to cost results, the use of the budgeting model and the allocation of financial resources with the above characteristics are an effective step for increasing efficiency, effectiveness, transparency, and accountability. Moreover, the design and implementation of the budgeting model and the allocation of national gas resources to achieve the objectives of operational budgeting (performance-based) as one of the essential goals of the governmental budget are inevitable.

Worthington (1998) in a study compared the financial performance of thirty gold companies using the data envelopment analysis (DEA) technique. His research results showed that simple ratios did not lead to a ranking and comparison of the company's performance, and multiple inputs and outputs should be used. In 1999, William F. Bowlin (1999) examined the financial performance of defense-oriented business segments compared to non-defense-business segments for the years between 1983 and 1992. A financial performance measure developed from data envelopment analysis was evaluated by using both cross-sectional and longitudinal methods.

The data envelopment analysis was supplemented and compared to the traditional financial ratio analysis, which provided additional insight into the financial performance of defense-business segments. Rózsa Andrea (2002) used data envelopment analysis to perform a comprehensive and comparing analysis of the most significant Hungarian-owned companies in the Hungarian dairy industry from a financial point of view. It was demonstrated that the industry called for strengthened focus because of the degree of concentration in the sector and the resulting sharp competition. Feroz et al. (2004) used a data envelopment analysis technique to analyze the financial statements of an oil and gas industry company. Researchers have shown that this technique can be a complement to the traditional analysis of financial ratios of business units. Halkos and Salamouris (2004) used the data and financial data capture technique to evaluate performance and determine the efficiency of the Greek banking sector. Ertuğrul and Karakaşoğlu (2009) investigated the performance evaluation of Turkish cement firms with a fuzzy analytic hierarchy process and TOPSIS methods.

Broad and Javadi (2009) indicated that the performance measurement systems (PMS) are among the most complex and important systems in any organization. Adopting a PMS is not a simple technical procedure and takes lots of time, efforts, and resources. Furthermore, "poorly managing the PMSs risk being burdensome without helping to reach the objectives... Nonetheless, an organization really cannot have a successful PMS without a deep understanding of its requirements and critical success factors (CSF's)". In their beliefs, "if a PMS is not well adopted, it will not bear fruit". Therefore, "recognizing the requirements and CSFs of PMSs are among the major challenges confronting PMSs and contribute significantly to their success in this highly competitive environment". Lee et al. (2012), in a study, compared the financial situation of four shipping companies in Taiwan and Korea during the period of 1999-2009, using several multi-criteria decision-making techniques. First, the entropy technique was used to determine the relative weight of financial ratios, and, in the next step, a gray relational analysis was used to rank companies. Delen et al. (2013) measured firm performance using financial ratios.

In this research, an analysis was performed in two stages. In the first phase, the exploratory factor analysis method was used. In the next phase, the decision tree was used to predict and discover the potential relationships between firm performance and financial ratios. The results showed that among the four algorithms used, the Chaid and C5 algorithms more accurately predicted the data. In another study, Beikkhakhian et al. (2015) ranked the performance of the suppliers of raw materials in Turkey using fuzzy TOPSIS (FTOPSIS). The results of their research showed that higher driving power and lower dependence for raw materials distribution were the most important performance-related indicators of suppliers. ChengWu et al. (2016) examined the effect of profit management on the performance of their three banks. This study was designed to analyze banking performance

with managerial productivity and profitability. The results showed that Singapore banks had high productivity and profitability, while the Brunei banks had the lowest banking performance. Luciano and Rodrigues (2018) tried to characterize the economic and financial status of the sugarcane energy industry in Brazil by providing relevant information on new investors, on the directors of companies, and on the government to make more rational decisions. The data used in the survey were obtained from financial statements presented by about 150 plants in the harvest seasons. Following the logic proposed by the approach known as financial ratios analysis, financial indicators were calculated to measure the liquidity, profitability, and leverage of the plants. The results showed high heterogeneity in the industry marked by the presence of four different groups of companies. The first group included high-liquidity and low-debt plants, whereas the fourth group was characterized by companies with high debt, low liquidity, and negative operating margins. The two intermediate groups were made up of plants with moderate leverage and liquidity, but with operational performance levels fluctuating from high to low.

Some internal studies have also been carried out to evaluate the performance of companies and executives. For instance, Mohammadi (2004) studied the application of mathematical programming (hierarchy and data envelopment analysis) to analyze financial statements of pharmaceutical companies in 2004. In another research, Talebnia and Shoja (2011) examined the relationship between the ratio of market value added to accounting profit and the ratio of economic value added to accounting profit in companies listed on Tehran Stock Exchange (TSE). Javadi, Alimoradi and Ashtiani (2017) investigated and found positive relationship between financial leverage, Tobin's Q and firm growth indicators among oil and gas companies within the organization of the petroleum exporting countries (OPEC). Taghizadeh and Fazli (2011) conducted a research to investigate performance measurement method of the companies listed on TSE using the combined approach of analyzing gray relations and fuzzy TOPSIS. Mahmoudi (2011) in his research, with the aim of introducing and applying some performance evaluation models to the companies of metal industries group in TSE during 2002 to 2007, used TOPSIS technique and then evaluated the performance using financial variables including price to equity (P/E), earnings per share (EPS), return on investment (ROI), return on equity (ROE), operational cash flow to capital (OCFC), the TOPSIS algorithm, DEA technique, and regression test. He found no meaningful relationships between performance variables and observed different and contradictory results in different years. Goly Ayask and Dehdar (2015) studied the impact of using balanced scorecard (BSC) metrics on the financial performance assessment of the urban water and wastewater industry. Their work showed that there was a direct relationship between the benchmarking criteria and the partners' performance. As a result, improvement in benchmarking measures enhances performance of the company.

Finally, Khajavi et al. (2016) developed a new fuzzy hybrid model to evaluate the financial performance of the selected companies in TSE and rank them using AHP and VICOR. In that study the AHP was used for weighting performance indicators and the VICOR for rating companies.

From the theoretical point of view, as far as the authors are aware, no such research has ever been conducted in the oil and gas industry either inside or outside the country. To fill this gap, the current work is the first study seeking to evaluate financial performance of the NIGC's distribution companies through investigating their historical financial statements, related reports and documents, meeting notes, archives, interviews and paired comparisons. Furthermore, there is an implicational gap in previous studies, which the present work tried to cover it up. In fact, most of the studies have investigated a single or a number of companies, but not a nationwide big parent company with more than 30 subsidiaries all around the country which were quite different in several aspects (such as size, geographical location, type and number of customers, etc.). To bridge this gap, this research measures the financial performance of distribution companies and ranks them from the perspective of the parent company (NIGC). The study simultaneously uses complementary analysis and ranking techniques and covers the methodological gap as well.

Table 1- Interview result summary

Criteria	Sub-criteria	Symbol
Liquidity	Current ratio	C1
	Quick ratio	C2
	Cash ratio	C3
Capital Structure	Long-term debt ratio	C4
	Short-term debt ratio	C5
	Equity ratio	C6
	Common rights ratio	C7
	Retained earnings/equity	C8
Profitability	Return on sales	C9
	Return of fixed assets	C10
	Gross profit margin	C11
Activity	Fixed assets turnover	C12
	Days sales outstanding	C13
	Sale per employee	C14
	Fixed assets/number of employees	C15

3. Research Design and Methodology

The current study is a functional type in terms of philosophy and inductive in terms of research approach. Since the authors do not try to test the hypothesis, there is not any aforementioned theory. Based on the research aims and objectives, the following main questions were propounded:

1. What are the financial (accounting-based) indicators which must be considered in the assessment of the financial performance of provincial gas companies of NIGC?

2. How are the rankings of provincial gas companies of NIGC in terms of various financial indicators?

To answer the abovementioned questions, we selected our strategy as a case study in NIGC and chose quantitative-qualitative (mixed methods) in a descriptive-correlational form. This study is based on the fact that the data collected from the audited financial statements of the NIGC affiliated companies were valid and reliable. Therefore, the researchers did not have any interference in controlling and changing the values of the variables. Hence, in terms of the choices, this study is a post-event descriptive research type. Furthermore, as the study had been requested by NIGC, it is an applied research in terms of the purpose. In fact its purpose is the development of implicational knowledge in a particular field and its results can be used in the performance evaluation of gas distribution companies. The time horizon of this study for historical financial data is the cross-section which uses a three years' scope from 2015 to 2017. Furthermore, the time horizon related to the identification of financial performance measurement indicators tailored for NIGC (interviews and paired comparison) was limited to 2017. The primary data and information of this research including information on the position and financial performance of gas distribution companies have been collected from the audited financial statements (balance sheets, income statements, statement of cash flows, and complementary notes to these statements) and other related internal reports and documents of NIGC. In addition, the primary information needed to identify and determine the key financial indicators and criteria for the evaluation of financial performance of the population companies suited for NIGC have been gathered by interviewing directors and heads of the finance and accounting; budget and cost control; final and consolidated accounts; and financing and investment departments of the NIGC. In order to provide the final list of financial indicators and determine the priorities of these indicators, we used the paired comparison technique, and to analyze the data collected from the interview, descriptive (interpretive) analysis was used. Eventually,

the AHP and TOPSIS ranking as multi-criteria decision-making methods have been used to prioritize gas distribution companies in terms of identified indicators.

4. Empirical Results

The respondent population for interviews and paired comparison analyses (collected through questionnaires) consisted of all the key expert informants of NIGC (as mentioned above). To approve the interview and paired comparisons validity, the influential factors and variables were identified and extracted from reliable sources. Then, five experts in this field were randomly selected, and a list of the mentioned factors and a sample of the paired comparison test were presented to them as a pre-test (sub-test). They then approved the validity of the paired comparison test. In order to determine the weight of the criteria, eight expert opinions were analyzed, and the final weight of each criterion was determined using the group decision-making (AHP) technique.

The interviewees unanimously acknowledged that the indicators for assessing the financial performance of provincial gas companies should be categorized into four categories of liquidity, capital structure, profitability, and activity. They considered current ratio, quick ratio, and cash ratio as the most important elements indicating the liquidity position of gas distribution companies. Table 1 below shows the results of identifying performance indicators (decision-making criteria) along with their classification.

4.1. Univariate Analysis

The liquidity situation of the provincial gas companies has not been the same for the years under review, and companies have fluctuated with some exceptions. Some provincial gas companies (such as Khuzestan, Bushehr, Esfahan, Hamedan, and Ilam) had suffered from a weakness in the liquidity situation from 2015 to 2017, while some other companies (Hormozgan, Qom, Kermanshah, and Northern Khorasan) had been able to improve their liquidity over time. Considering the ratios of the capital structure of provincial gas companies showed that these ratios were fairly flat (with some exceptions) in 2015 and 2016, while they experienced significant fluctuations in 2017. This showed that, in the reviewed years, the composition of the capital structure of the provincial gas companies had not undergone any serious changes. As a result, long-term debt, short-term debt, and common rights had the largest share in the capital structure of provincial gas companies respectively. The only

Table 2- The hierarchy tree of the research

Financial ranking of provincial gas companies																													
Activity					Profitability					Capital Structure					Liquidity														
C15	C14	C13	C12	C11	C10	C9	C8	C7	C6	C5	C4	C3	C2	C1															
A30	A29	A28	A27	A26	A25	A24	A23	A22	A21	A20	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1

exception was attributed to Mazandaran gas company. Moreover, the ratio of gross profit to the sale of provincial gas companies was positive except for Hamedan, Kurdistan, Ardebil, Ilam, and Mazandaran gas companies. However, after taking into account the net profit or pre-tax profit, the number of companies with an inappropriate profitability status was increased (Kohkiluyeh and Boyer Ahmad, Lorestan, West Azarbaijan). It meant that management of operating expenses in many provincial gas companies had faced major challenges, and measures (indices) should have been taken in this area through increased gas sale or cost reduction. The most important aspect of the activity which was very critical to NIGC and should have been considered in this context was the collection period; or days sales outstanding (DSO). The time periods for collecting receivables in all the provincial gas companies except Hormozgan were very long, which, coupled with the unfavorable situation of the liquidity of companies. Such situation increases the risk and potential for default and disability in any company. The discussion of the liquidity of receivables in the NIGC was a serious and fundamental consideration, and has been considered and supported by the managers of the company in recent years due to increasing bad debt and write-off cases. In this context, solutions and alternatives such as reducing the billing period have been presented and tested, but the results were not satisfactory and further research in this area is still being implemented and tested. It should be noted that shortening the collection period requires the provision of incentive mechanisms by the NIGC's headquarters or the use of factoring methods. Putting DSO aside, the status of other indices of activity (sales per employee, assets to employees, and fixed assets turnover) of provincial gas companies was not appropriate either. They showed that the operations of these companies were not properly managed, and the resources were not used economically, efficiently, and effectively, which forces managers to take measures in this respect.

4.2. AHP Analysis

AHP is one of the most popular multi-criteria decision-making techniques developed by Thomas saati in the 1970's. This approach can be useful when deciding upon an action with multiple options and decision-making indicators. Herein, in order to find the weight associated with each of the indicators, the AHP method is used. This method is based on paired comparisons and can determine the priority of the options in decision making. In short, in this method, the decision maker or decision group defines a goal, and after identifying it, which is in fact the subject of decision-making, the various options involved in the decision are listed; then, the different criteria between the options are compared two by two. Next, the priority of a choice can be specified based on a series of simple rules like normalization (Namazi, 2015). In summary, the AHP analysis employs four steps in this work to determine the final weight of each indicator. These steps are comprised of (a) the determination of decision options, (b) preferential comparisons, (c) relative weight calculations, and (d) the final integration of the relative weights. In the current research, all

these steps have been taken by use of the expert choice (EC) software which are summarized below.

The hierarchical tree for the ranking issue of the provincial gas companies is illustrated in Table 2. It is obvious that the issue has four main criteria (including liquidity index, capital structure index, profitability index, activity index) and fifteen sub-criteria (C1 to C15). In addition, thirty decision options represented by symbols A1 to A30 are also specified.

The four general indicators in the rating issue are liquidity, capital structure, profitability, and activity. Table 3 tabulates the scores derived from the group judgment used and the relative importance of each of the main indicators. Each of the elements in the matrix is the result of the geometric mean of the decision matrix corresponding elements obtained from each expert.

Table 4 lists the standardized decision matrix of the AHP method plus the final weight of each of the main criteria. The matrix layers (elements) are obtained by dividing each of the layers of the matrix of Table 3 into the sum of the elements of the corresponding column. Gradually, the final weight of each major index is calculated from the average of the elements of the corresponding row.

Liquidity and profitability are two important issues which are of particular interest to financial analysts and financial managers. Although some scholars see liquidity as a more important factor and believe that if a company is not profitable, it is ill, but if it does not have liquidity, it is dying. In other words, there is the likelihood that the company will not be profitable and continue to survive, but without liquidity it cannot survive. Liquidity management is one of

Table 3- Paired comparisons of the main indicators

Main Indicators	Liquidity	Capital Structure	Capital Structure	Profitability	Activity
Liquidity	1.0	6.031009	6.031009	2.54573	3.672974
Capital Structure	0.354948	1.0	1.0	1.795802	3.464102
Profitability	0.392815	1.903377	1.903377	1.0	1.235931
Activity	0.3826.3	0.420448	0.420448	1.244666	1.0
Total	2.130366	9.354834	9.354834	7.081546	9.373006

Table 4- Ranking of main indicators

Main Indicators	Liquidity	Capital Structure	Profitability	Activity	Final Weights
Liquidity	0.469403	0.644694	0.359488	0.391867	0.466363
Capital Structure	0.166614	0.106897	0.253589	0.369583	0.22417
Profitability	0.184388	0.203465	0.211161	0.131861	0.182719
Activity	0.179595	0.044944	0.155762	0.106689	0.126748
Total	1.0	1.0	1.0	1.0	1.0

the main issues of the financial management of companies. Liquidity shows the ability to meet short-term obligations. In other words, the liquidity of the company is the relationship between the cash available to the company in the short term and the cash to be paid by the company. Hence, according to the importance of liquidity in the survival of organizations, the highest rank of importance is devoted to this index in decision making. Deciding on the capital structure is one of the most challenging issues facing the company, but, at the same time, it is the most crucial decision affecting the survival of the company. Referring to academic studies and literature, the main reasons for the failure of companies are the lack and/or inadequacy of financing. In this way, ranking the capital structure second according to the views of the experts is justified.

Table 5 tabulates the final weight of each of the sub-indices using the AHP model. The weight of each sub-criterion is obtained by multiplying the original weight of the index by the final weight obtained from the internal weighing of each index. The matrix layers are obtained by dividing each of the layers of the matrix in Table 4 into the sum of the elements of the corresponding column. The final weight of each major index is calculated from the average of the elements of the corresponding row. As expected, it is seen that the most important sub-categories are those of liquidity.

Main Criteria	Weights	Sub-criteria	Primary Weights	Final Weights
Liquidity	0.466363	Current ratio	0.268930585	0.125419302
	0.466363	Quick ratio	0.323083446	0.150674199
	0.466363	Cash ratio	0.40798597	0.190269603
Capital Structure	0.22417	Long-term debt/assets	0.167052161	0.037448165
	0.22417	Equity ratio	0.144650541	0.032426383
	0.22417	Common rights/assets	0.156088811	0.034990506
	0.22417	Short-term debt/assets	0.272908587	0.061178052
	0.22417	Retained earnings/equity	0.2592999	0.058127386
Profitability	0.182719	Return on sales	0.385766382	0.070486744
	0.182719	Return on fixed assets	0.230641827	0.042142582
	0.182719	Gross profit margin	0.383591791	0.070089405
Activity	0.126748	Fixed assets turnover	0.228157001	0.028918369
	0.126748	DSO	0.408102957	0.0517261
	0.126748	Sales per employee	0.258492438	0.032763315

4.3. TOPSIS Analysis

TOPSIS method is a decision matrix composed of m rows and n columns, which contains m options with n criteria. TOPSIS is based on the notion that the preferred option should have the minimum distance from the positive ideal solution and should have the maximum distance from the negative ideal solution. TOPSIS considers the distance between the positive and negative ideals at the same time. Finally, the optimal solution, which has the minimum distance from the positive ideal and the maximum distance from the negative ideal, is obtained (Opricovic and Tzeng, 2004). The input information in this method includes the weights vector of the indices, and the output is a ranking of the options.

To use TOPSIS method, the decision matrix, which consists of the options and indicators corresponding to each option, is first normalized. Then, the normal matrix (V) is obtained by multiplying the normalized matrix (N) by the weighted diagonal matrix (W). The ideal positive solution V^+ is the vector of the best values of each index of the matrix V, and V^- represents the worst value of any negative ideal solution index. The best values of the positive indicators are the largest values, but those of the negative indicators are the smallest ones. The worst values of the positive indicators are the smallest values, and those of the negative indexes are the largest values. After determining the distance between each positive (d^+) and negative (d^-) ideal option, the relative proximity to the ideal solution is calculated.

To sum up, in the present work, in order to identify the decision-making criteria, an interview is firstly conducted with experts. In this interview, the ranking criteria are set and met by the criteria derived from the previous research. These criteria are used as the input to the AHP method, and the relative weight of each one is determined. In the next step, the financial information of the companies examined is extracted from the financial statements and used as the inputs into TOPSIS method for the final ranking of the options. All of the required calculations were carried out using the EC software. Tables 6, 7, and 8 show the distance values from the ideal answers and the final ranking of the options for 2015, 2016, and 2017 respectively.

According to Table 6, the top five provincial gas distribution companies in 2015 were Khuzestan, Esfahan, Hormozgan, Hamadan, and Khorasan Razavi respectively. Also, gas companies in the provinces of Ilam, Mazandaran, Lorestan, Ardebil, and West Azarbaijan had the lowest rates in terms of financial indicators respectively.

According to Table 7, the top five companies in 2016 were Yazd, Qazvin, Markazi, Kermanshah, and Hormozgan province gas companies respectively. In addition, gas companies in the provinces of Mazandaran, Ilam, Chaharmahal and Bakhtiari, Kohkiluyeh and Boyer Ahmad, and Kordestan had the lowest rates in terms of financial indicators respectively.

As can be seen in Table 8, the top five companies in 2017 were Markazi gas company, Yazd province gas company, Hormozgan gas company, Kermanshah gas company, and Qom province gas

company respectively. Moreover, gas companies in the provinces of Chaharmahal and Bakhtiari, Golestan, Ilam, Hamadan, and Zanjan had the lowest rates in terms of financial indicators respectively.

5. Summary, Conclusion and Discussions

Today, due to the importance of corporate financial performance in a competitive environment, the use of accurate and appropriate tools for the performance evaluation of organizations is a critical issue. Financial performance criteria should also be carefully

identified so that they can be able to reflect the competitive ability of companies (Broad and Javadi, 2009). In this research, in order to answer the first question, semi-structured interviews were conducted with eight members of NIGC financial and planning managers and experts. Then, we used paired comparison with AHP technique to rank the financial indicators into groups and criteria. As a result, the four measures of liquidity (with the sub-criteria of cash ratio, quick ratio, and current ratio), capital structure (including short-term debt ratio, retained earnings to equity ratio, long-term debt ratio, common rights to assets ratio, and equity ratio), profitability (with the sub-criteria of sales return, gross profit margin, and return on assets), and

Table 6- Ranking of gas distributing companies in 2015

Distance from Negative Ideal	Distance from Positive Ideal	Options	Final Ordered (Ranked) Scores		Corresponding Company
			Option	Score	
A1	0.0334	0.1526	A1	0.828225	Khuzestan
A2	0.0687	0.123	A2	0.398579	Esfahan
A3	0.1029	0.1097	A30	0.394523	Hormozgan
A4	0.078	0.113	A7	0.391018	Hamadan
A5	0.1082	0.0995	A4	0.384948	R. Khorasan
A6	0.1028	0.1033	A13	0.8206	Qom
A7	0.0865	0.1255	A12	0.6418	Yazd
A8	0.1157	0.0896	A10	0.5969	Markazi
A9	0.0983	0.1016	A28	0.5918	Bushehr
A10	0.0933	0.114	A22	0.5917	Kermanshah
A11	0.1106	0.0917	A18	0.5765	Kordestan
A12	0.0878	0.1189	A14	0.5752	Kohkiluyeh and Boyer Ahmad
A13	0.0826	0.1125	A3	0.5497	Tehran
A14	0.0935	0.1002	A16	0.5461	Qazvin
A15	0.099	0.1031	A6	0.5409	Kerman
A16	0.0977	0.1033	A9	0.5206	Gilan
A17	0.1084	0.1045	A15	0.5172	Semnan
A18	0.0965	0.1048	A23	0.5161	Golestan
A19	0.1209	0.0902	A29	0.5139	Sistan and Baluchestan
A20	0.1068	0.103	A27	0.5102	South Khorasan
A21	0.1177	0.0902	A20	0.5084	West Azerbaijan
A22	0.0922	0.1086	A17	0.5012	Zanjan
A23	0.1002	0.0998	A26	0.499	N. Khorasan
A24	0.1295	0.0813	A5	0.4984	Fars
A25	0.1331	0.0801	A11	0.4971	Chaharmahal and Bakhtiari
A26	0.1072	0.1025	A8	0.4909	East Azerbaijan
A27	0.1067	0.1055	A21	0.4907	Ardabil
A28	0.1003	0.1207	A19	0.4886	Lorestan
A29	0.104	0.1033	A24	0.479	Mazandaran
A30	0.0805	0.1193	A25	0.4533	Ilam

activity (considering DSO, sales per employee, fixed assets turnover, and assets to the number of employees) were identified as the main criteria and their sub-criteria to assess the financial performance of provincial gas companies. To answer the second question, AHP priority results were incorporated into TOPSIS model, and the final ranking of provincial gas companies was provided based on the above criteria.

It should be noted that the rankings of companies in line with their financial performance were not exactly the same for the reviewed years due to fluctuations in the performance of provincial gas companies, but they were close and interconnected to each other; hence, we could not provide a unit ranking. A summary of the rankings is presented in Table 9. Considering the results achieved in the unit-criterion and multi-criteria analyses and regarding the

frequencies, in general, based on the identified factors, Hormozgan, Yazd, Markazi, and Kermanshah provincial gas companies showed favorable financial performance, and Ilam, Mazandaran, Chaharmahal, Bakhtiari, and Zanzan gas companies appear to have weaker financial performance compared to the other companies during the years studied.

The analysis of the underlying reasons for the poor financial performance of some provincial gas companies is exactly in the opposite direction compared to the analysis of the reasons for the outperformance of some of these companies. It is very important to pay attention to the factors such as climatic conditions, geographic features, cultural and social characteristics, anthropological features, subscriber density, plurality and variety of gas subscribers etc. which are

Table 7- Ranking of gas distributing companies in 2016

Options	Distance from Positive Ideal	Distance from Negative Ideal	Final Ordered (Ranked) Scores		Corresponding Company
			Option	Score	
A1	0.0981	0.1069	A12	0.7569	Yazd
A2	0.0751	0.128	A16	0.7261	Qazvin
A3	0.1021	0.1104	A10	0.6758	Markazi
A4	0.0897	0.1048	A22	0.6602	Kermanshah
A5	0.082	0.1141	A30	0.6553	Hormozgan
A6	0.0929	0.1044	A2	0.6302	Esfahan
A7	0.1008	0.1039	A5	0.5819	Fars
A8	0.1099	0.0943	A28	0.5614	Bushehr
A9	0.1182	0.0981	A29	0.5519	Sistan and Baluchestan
A10	0.064	0.1333	A13	0.541	Qom
A11	0.1263	0.0867	A4	0.5388	Khorasan Razavi
A12	0.0468	0.1457	A15	0.5317	Semnan
A13	0.0909	0.1071	A6	0.5293	Kerman
A14	0.1197	0.0846	A26	0.529	North Khorasan
A15	0.0896	0.1017	A1	0.5213	Khuzestan
A16	0.0519	0.1376	A3	0.5194	Tehran
A17	0.1159	0.0986	A7	0.5078	Hamadan
A18	0.1221	0.095	A19	0.4974	Lorestan
A19	0.0962	0.0952	A23	0.49	Golestan
A20	0.119	0.0978	A8	0.4619	East Azerbaijan
A21	0.1159	0.0926	A17	0.4595	Zanzan
A22	0.0629	0.1223	A27	0.4558	South Khorasan
A23	0.1043	0.1002	A9	0.4535	Gilan
A24	0.1334	0/0683	A20	0.451	West Azerbaijan
A25	0.1294	0.082	A21	0.4441	Ardabil
A26	0.097	0.1089	A18	0.4376	Kordestan
A27	0.1201	0.1006	A14	0.4139	Kohkiluyeh and Boyer Ahmad
A28	0.0931	0.1192	A11	0.4071	Chaharmahal and Bakhtiari
A29	0.0924	0.1138	A25	0.3878	Ilam
A30	0.0659	0.1253	A24	0.3388	Mazandaran

the most important factors that differ from a provincial gas company to another and ultimately lead to a difference in the performance evaluation and comparison of these companies. These factors are often extraneous and are not in control of corporate executives. Therefore, in the current work, some indicators which were available and in control of managers were used. From a financial perspective, liquidity was the most important measure in assessing the performance of provincial gas companies. The unavailability of liquidity was a huge threat, and when we looked at reasons for unfavorable liquidity, the long collection period (DSO) was considered to be the most important reason, which was also an indicator of corporate activity. When we discussed this issue with the managers of the provincial gas companies and NIGC, they

considered liquidity as the most important subject, and their main reason was the bad debts and doubtful accounts they had experienced. Moreover, inability to manage and reduce costs, lack of optimal use of physical assets and human resources, difficult access to financial resources, gas loose (waste), weak accountability, low supervision etc. were the main causes of the poor financial performance of provincial gas companies. According to the results obtained for the years 2015-2017, the gas companies of Ilam province, Chaharmahal and Bakhtiari in all the three years and the gas companies of Mazandaran and Ardebil in 2015 and 2016 were among the five companies with the weakest financial performance. The reasons for the poor performance of these companies can be classified into two categories: uncontrollable factors and controllable factors. The

Table 8- Ranking of gas distributing companies in 2017

Options	Distance from Positive Ideal	Distance from Negative Ideal	Final Ordered (Ranked) Scores		Corresponding Company
			Option	Score	
A1	0.1222	0.0963	A10	0.6738	Markazi
A2	0.146	0.0827	A12	0.5248	Yazd
A3	0.1365	0.0975	A30	0.4998	Hormozgan
A4	0.1354	0.0878	A22	0.4739	Kermanshah
A5	0.1476	0.0799	A13	0.4626	Qom
A6	0.1227	0.0951	A16	0.4495	Qazvin
A7	0.1413	0.0694	A19	0.4479	Lorestan
A8	0.1471	0.0737	A26	0.4445	North Khorasan
A9	0.1422	0.0818	A1	0.4409	Khuzestan
A10	0.0767	0.1585	A28	0.4379	Bushehr
A11	0.1576	0.071	A6	0.4366	Kerman
A12	0.1081	0.1193	A3	0.4166	Tehran
A13	0.123	0.1059	A14	0.4025	Kohkiluyeh and Boyer Ahmad
A14	0.1461	0.0984	A15	0.3951	Semnan
A15	0.132	0.0862	A4	0.3934	Khorasan Razavi
A16	0.1229	0.1004	A21	0.3676	Ardabil
A17	0.1589	0.0791	A9	0.365	Gilan
A18	0.1562	0.0794	A2	0.3615	Esfahan
A19	0.1281	0.1039	A29	0.3559	Sistan and Baluchestan
A20	0.156	0.0815	A5	0.3513	Fars
A21	0.1414	0.0822	A24	0.3441	Mazandaran
A22	0.112	0.1009	A20	0.3431	West Azerbaijan
A23	0.1516	0.0713	A18	0.337	Kordestan
A24	0.1431	0.0751	A8	0.3336	East Azerbaijan
A25	0.1612	0.077	A27	0.3326	South Khorasan
A26	0.126	0.1008	A17	0.3323	Zanjan
A27	0.1619	0.0807	A7	0.3293	Hamadan
A28	0.1307	0.1018	A25	0.3231	Ilam
A29	0.1537	0.0849	A23	0.3199	Golestan
A30	0.1138	0.1137	A11	0.3105	Chaharmahal and Bakhtiari

low volume of natural gas sales of these companies compared to the other gas distribution companies was due to the reasons such as the number of customers, the covered population, and the absence of institutional consumers such as power plants, which were among uncontrollable factors negatively affecting (weakening) their economic and financial capability.

Although no research has been conducted so far to match the results of this study, regarding the more reliable and relevant information provided by use of multi-criteria decision-making methods such as AHP or TOPSIS aligned with financial ratio analysis, it can be concluded that the results of this study are compatible and consistent with Ertug˘rul and Karaka sog˘lu (2009), Mahmoudi (2011), Bekehnia et al. (2015), and Luciano and Rodrigues (2018). Using multi-criteria decision-making techniques along with financial ratios, with respect to univariate methods, leads to better decision-making related to performance evaluation and resource allocation.

5.1. Research-based Suggestions and Implications

Gas companies should pay attention to the performance indicators and measurement to improve their performance. Therefore, it is suggested that NIGC (especially the headquarter) should apply the results of this research to designing and implementing the budgeting and resource allocating models as a tool for controlling, planning, and financial and strategic management. NIGC should focus on the budgeting and allocating financial resources system and provide the necessary platform(s) for the full implementation of the performance-based budgeting system as the target of the government in optimal budgeting. The results of this research will be useful in this regard. It is also recommended that the managers of NIGC and its affiliated companies

should use multi-criterion techniques for evaluating the performance of companies and organizational departments in various financial, operating and economic fields because these techniques cover a wide range of performance criteria and provide the possibility of comparative assessments for organizations. Given the importance of liquidity and the significant amount of gas sale receivables, NIGC and provincial gas companies should take steps to accelerate the liquidity of these receivables. To this end, using incentive mechanisms and new methods such as receivable-based financing and factoring are recommended.

The present study provides theoretical and methodological bases for the financial performance evaluation of distribution companies from the perspective of NIGC (parent company) and uses endogenous (firm-specific) financial indicators. Therefore, NIGC is the main user of the research. Such phenomenon has not been previously touched in such unique environment. Thus, it can be considered as an implicational contribution. In terms of the performance evaluation of subsidiaries, these contributions are considerable for financial and planning managers of NIGC.

This study was subject to some limitations, mainly, due to the inherent differences among companies and unevenness in terms of geographic characteristics, population density, size, the type and composition of subscribers etc. In fact, it is quite controversial to compare and judge the performance of all the subsidiary companies with each other. To overcome this obstacle, it is suggested that the 31 provincial companies are categorized in 4 groups based on the uncontrollable permanent criteria which distort the companies' performance comparability (such as size, climate, type of customers, etc.) and the performance of the companies within the same group is measured and evaluated. The statistical discrepancies between the financial numbers and figures of different resources was also among the limitations.

Table 9- Summary of rankings	
Top Five Underperformers	Top Five Outperformers
2015	
Khuzestan PGC, Esfahan PGC, Hormozgan PGC, Hamadan PGC, and Khorasan Razavi PGC	Ilam PGC, Mazandaran PGC, Lorestan PGC, Ardebil PGC, and West Azarbaijan PGC
2016	
Yazd PGC, Qazvin PGC, Markazi PGC, Kermanshah PGC, and Hormozgan PGC	Mazandaran PGC, Ilam PGC, Chaharmahal and Bakhtiari PGC, Kohkiluyeh and Boyer Ahmad PGC, and Kordestan PGC
2017	
Markazi PGC, Yazd PGC, Hormozgan PGC, Kermanshah PGC, and Qom PGC	Chaharmahal and Bakhtiari PGC, Golestan PGC, Ilam PGC, Hamadan PGC, and Zanjan PGC

References

- Andrea, R. (2002). Financial performance analysis and bankruptcy prediction in Hungarian dairy sector. 936.
- Asadi, K., & Kiani Nejad, A. (2013). Reviewing financial performance criteria in Tehran stock exchange companies. *Journal of accounting knowledge and research*, 43-61.
- Bayraktaroglu, A., & Yalcin, N. (2012). Strategic financial performance evaluation of the Turkish companies traded on ISE. *Ege academic review* (12 (4)), 529-539.
- Beikkhakhian, Y., Javanmardi, M., Karbasian, M., & Khayambashi, B. (2015). The Application of ISM Model in Evaluating Agile Suppliers Selection Criteria and Ranking Suppliers Using Fuzzy TOPSIS-AHP Methods. *Expert Systems with Applications*, 12, 6224-6236.



- Bowlin, W. (1999). An analysis of the financial performance of defense business segments using data envelopment analysis. *Journal of Accounting and Public Policy*, 18(4-5), 287-310.
- Broad, M., & Javadi, S. (2009). Modelling a successful performance measurement system. In first conference on Executive MBA.
- Browne, S., Dongarra, J., Garner, N., Ho, G., & Mucci, P. (2000). A portable programming interface for performance evaluation on modern processors. *The international journal of high performance computing applications*(14(3)), 189-204.
- Cheng, C., Chen, C., & Huang, S. (2012). Combining fuzzy integral with order weight average (OWA) method for evaluating financial performance in the semiconductor industry. *African journal of business management*(6(21)), 6358.
- ChengWu, Y., Kiong Ting, I., Luc, W., Nourani, M., & Long Kwehe, Q. (2016). The impact of earnings management on the performance of ASEAN banks. *Economic Modelling*, 156–165. Retrieved from www.elsevier.com/locate/econmod
- Cravens, K., Oliver, E., & Stewart, J. (2010). Can a positive approach to performance evaluation accomplish your goals. 269-279.
- Delen, D., Kuzey, C., & Uyar, A. (2013). Measuring firm performance using financial ratios: A decision tree approach. *Expert systems with applications*. 3970–3983.
- Ertuğrul, İ., & Karakaşoğlu, N. (2009). Performance evaluation of Turkish cement firms with fuzzy analytic hierarchy process and TOPSIS methods. *Expert Systems with Applications*, 702-715.
- Feroz, E., Kim, S., & Raab, R. (2003). Financial statement analysis: A data envelopment analysis approach. *Journal of the operational research society*. 54, 48-58.
- Goly Ayask, M., & Dehdar, F. (2015). Evaluation of the financial performance of urban water and wastewater industry based on BSC model. *Water and wastewater*, 31-41.
- Halkos, G., & Salamouris, D. (2004). Efficiency measurement of the Greek commercial banks with the use of financial ratios: a data envelopment analysis approach. *Management accounting research*, 15, 201-224.
- Iran Energy Exchange. (2013). Energy consumption report. Research and development and risk studies department.
- Javadi, S. (2013). Performance management in higher education: a grounded theory study.
- Javadi, S., Alimoradi, A., & Ashtiani, M. (2017). Relationship between Financial Leverage and Firm Growth in the Oil and Gas Industry: Evidence from OPEC. *Petroleum Business Review (PBR)*, 1(1), 9-21.
- Kennerly, M., & Neely, A. (2002). Performance measurement frameworks: a review. *Business performance measurement: Theory and practice*. 145-155.
- Khajavi, S., Fatahi Nafchi, H., & Ghadirian Arani, M. (2016). Ranking and evaluation of financial performance of selected industries of Tehran stock exchange using fuzzy combined model - AHP-Vicon; case study: company's pharmaceutical industry, basic metals and automotive and parts. *Audit knowledge*, 15(60), 25-46.
- Khajavi, S., Salimi Fard, A., & Rabieh, M. (2008). Application of Data Envelopment Analysis (DEA) in determining the portfolio of the most efficient companies accepted in Tehran Stock Exchange. *Journal of Social Sciences and Human Sciences*, 26, 117-135.
- Latham, G., Locke, E., & Fassina, N. (2002). The high performance cycle: standing the test of time. *Psychological management of individual performance*. 201-228.
- Lee, P., Lin, C., & Shin, S. (2012). A comparative study on financial positions of shipping companies in Taiwan and Korea using entropy and grey relation analysis. *Expert systems with applications*, 39(5), 5649-5657.
- Mahmoudi, M. (2011). Measurement of Financial Variables in Performance Evaluation of Tehran Stock Exchange Companies Using TOPSIS Algorithm and DEA Technique. *Journal of Financial Engineering and Management of Securities of Tehran*, 121- 143.
- Namazi, M., & Namazi, N. (2016). Companies Rating Based on Performance Measurement Indicators Using TOPSIS Multi-Attribute Technique and Comparison of Evaluation Criteria (Evidence from Tehran Stock Exchange). *Financial Accounting Research*, 2(Eighth), 39-64.
- Opricovic, S., & Tzeng, G. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *European journal of operational research*, 445-455.
- Panahian, H. (2003). Application of economic value added in financial decision making. *Capital magazine*, 12-18.
- Rodrigues, L., & Rodrigues, L. (2018). Economic-financial performance of the Brazilian sugarcane energy industry: An empirical evaluation using financial ratio, cluster and discriminant analysis. *Biomass and bioenergy*, 289-296.
- Ross, S., Westerfield, R., & Jaffe, J. (2014). *Corporate finance*. Irwin.
- Safaei Ghadikalaei, A., & Khalili, S. (2014). Evaluation of financial performance of companies active in Tehran stock exchange by applying multi-criteria decision-making techniques. *Journal of management executive*, 54-71.
- Taghizadeh, R., & Fazli, S. (2011). Corporate performance measurement method using combined analysis of gray relationships and fuzzy TOPSIS. *Industrial management outlook*, 150-125.
- Talebnia, G., & Shoja, I. (2011). Investigating the Relationship Between the Value Added Market to the Profit of Accounting and the Ratio of the Value Added to the Profitability of the Companies Accepted in the Tehran Stock Exchange. *Management Accounting Magazine*, 47-60.
- Talebzadeh, S. (2011). Using grey principal component analysis approach in evaluating the financial performance of the factually of economics. *Management and social sciences*, 55-68.
- Worthington, A. (1998). The application of mathematical programming techniques to financial statement analysis: "Australian gold production and exploration. *Australian journal of management*, 97-113. ▲