

Assessing The Financial Performance Of Construction Companies Using The Entropy Method

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Abstract

The complex and dynamic nature of the construction sector forces stakeholders (construction partners) to look for ways to understand these businesses' financial performance. In order to give business managers, owners, shareholders, and financing agencies a useful instrument with which to assess these companies' performance, an evaluation methodology for construction company performance is presented in the current research. The developed following this theory in the proper decision-making of the company's management.

The current research seeks to evaluate a company's financial performance from the service sector in Iraq using the entropy method, additionally by choosing on a group of financial ratios that accurately depict the financial characteristics of contracting firms

in addition to the measure of the added market value, which are: - 1- "Working capital / current liabilities 2- Gearing 3. RETURN ON ASSETS 4- Cash Flow/ Current Liabilities (5 - PBIDT/Net Assets 6- Earnings Per Share (EPS) 7- Market Value Added (MVA) of Vital Indicators For the companies' financial performance. The company's financial accounts for the last seven years were collected from the official website of the Iraqi market.

The study discovered that the ROA ratio, which measures the company's liquidity condition and being the element with the highest objective weight throughout all years, is the most important one for evaluating financial efficiency., followed by the high relative weight of the PBIDT/N. A ratio. In light of the fact that the company's profit nearly never falters, this is a profitability indicator that contributes more than others. The indicators of profit before depreciation, taxes, and interest are the primary distinction between this model and all others.

Key words: solvency, financial ratios, companies executing government contracts, entropy

1- Introduction

Evaluating the financial performance of a company is critical to many people, especially interested groups such as managers, shareholders, creditors, current and potential investors, and even tax authorities, especially in light of the rapid developments in the world and the

increasing intensity of competition. (Fahami, Norasyikin Abdullah, 2019)

The GATT is the abbreviation for the General Agreement on Tariffs and Trade., which is the globalization of today's globe, gives the "performance evaluation" of contracting firms its significance. GATT is based on the idea that business can be done whenever, wherever, and however.

Whereas many international corporations receive contracts in other nations where they compete with local businesses. Therefore, in order to sustain their reputation on a global scale, both multinational and local contracting firms should seriously consider improving their performance. (Elyamany et al., 2007) (Vibahakar et al., 2020)

Financial performance often shows how financially stable a company is overall and how it compares to other businesses. Analyzing and interpreting financial statements to determine a firm's profitability and financial stability is typically required to evaluate its financial performance. Financial ratios have been used to diagnose the company's strong and weak points in terms of liquidity, efficiency, leverage, and profitability performance because of this. Several studies have been conducted that prove how useful financial ratios are for assessing financial performance. (Fahami, Norasyikin Abdullah, 2019)

The ranking of businesses is essential for evaluating financial performance since firms need to know where they stand in relation to their rivals in the same industry or market. Based on their existing financial situation and ranking, the firms can then execute pertinent initiatives to improve their financial performance. Multi Criteria Decision Making (MCDM) is a crucial decision analysis technique that allows you to choose the best option by considering a variety of distinct criteria or factors. Two crucial components in assessing performance and ranking of alternatives are decision criteria and decision alternatives. Because MCDM uses multiple financial ratios in its decision-making process, evaluating firm profitability is a constraint. (Weng Siew Lam et al., 2021)

Financial ratios have been widely used as a tool for analyzing financial performance, as

some studies also indicate that the competitive advantages and sustainability level of companies within the industry can be assessed based on the company's financial performance, where financial ratios are effective indicators for measuring the financial performance of companies.

While research on PMSs have been carried out at the construction phase, contracting companies have relied mostly on performance measurements that are financially oriented(Yu et al., 2007a)

Since Alarcon and Ashley's 1996 proposal of the idea of performance measurement, which has been divided into cost, schedule, value, and effectiveness, performance measurement frameworks have been in use. Sarkis 1999 emphasized the possibility of creating a more complete multi-criteria model that identifies the interrelated relationships that were originally assumed to be unrelated with regard to performance measurement (Cheng & Li, 2006)

Therefore, several models for measuring performance based on different methods have been established in order to obtain the best models for performance evaluation or to identify alternatives when making a multi-criteria decision. Weight Furthermore, the entropy weighing method is able to make full use of the data to obtain the most important weight for financial ratios (Weng Siew Lam et al., 2021)

Shannon developed the entropy weight approach, which uses data analysis to estimate the objective weight of each decision. Shannon took into account entropy in the information theory because of the ambiguity of signals in information sources. Uncertain information can be measured effectively using the entropy weight approach. The importance of the entropy weight technique in the decision-making process was taken into account by the researchers when evaluating it. The

entropy weight approach was primarily used to establish the relative weight of the choice criteria. (Weng Siew Lam et al., 2021)

2 - Previous studies

Financial ratios have been widely used as a tool for analyzing financial performance. According to certain research, a company's level of sustainability and competitive advantages within an industry can be measured based on a company's financial performance; Where financial ratios are one of the main indicators of the financial performance of companies. (Fahami, Norasyikin Abdullah, 2019)

Beaver established the first financial health prediction statistical evaluation models in 1966, but they were not intended for contracting companies. 30 financial ratios were used as the foundation for comparison. The mean values differed for at least five years in a row prior to failure, and the disparities grew as the year of failure drew approached (Elyamany et al., 2007).

He argues that although while financial ratios are frequently used as indicators of solvency, the cash flow to total debt ratio (according to his study) has a significantly stronger capacity for accurately identifying both failed and non-failed businesses. Although ratio analysis may offer useful information, that ability lasts for at least five years before failing and that ability is greater than would be possible with random prediction., ratios must be used with caution as not all ratios predict well (Beaver, 2010)

By attempting to ascertain whether the entropy measure of information contained in logarithmic functions, developed by Zavgren, would be a reliable indicator for decision makers, (Keasey & Mcguinness, 1990) were able to identify the financial factors that were crucial in explaining the

financial failure of UK industries in the late 1970s and early 1970s. The 80s, and he thinks that the study's most important finding is that the profitability and efficiency ratios play a significant role in understanding how well businesses performed in the years before they failed. (Keasey & Mcguinness, 1990)

(Kangari et al., 1992) developed a quantitative approach based on financial ratios to evaluate the contracting company's financial performance and degree of performance., as well as its chances of survival. The model also considers the impact of the company's size, as well as the characteristics of various occupations within the contracting companies. He used multiple regression analysis in his research to assess the effectiveness of construction firms. and financial ratios, which contain the following six key financial ratios, to evaluate a company's financial performance in the contracting companies.:

- (1) the ratio of "current assets Divided current liabilities"" (the current ratio)";
- (2) "Total liabilities Divided Net working capital";
- (3) Total assets Divided revenue";
- (4) "Net working capital income";
- (5) Return on total assets. and (6) the return on net equity.

This model's primary goal was to combine these six financial parameters into a single performance indicator, which it did. This performance rating system is used to assess a company's financial standing among general contracting companies.

The form can be used as a management tool to assess a company's financial stability. The model gives managers a performance score that shows the proportion of competing firms' financial performance

that is worse than the company. (Kangari et al., 1992) .(Elyamany et al., 2007).

Use (Russell & Zhai, 1996). Multiple regression analysis to anticipate why construction companies will fail and confirm that the quality of the financial management and control of the contractor, which is measured by the fluctuation in the net working capital / total assets of the important factors where the risk of contractor failure increases, meaning the contractor's performance decreases, when the volatility in the variables of financial performance increases, . (Russell & Zhai, 1996)

Performance assessment is on management's agenda for the following seven reasons, all of which are pertinent to the contracting organizations (Neely, 1999): alterations in the nature of work, heightened competition, targeted programs for improvement, National and International Quality Awards; The influence of information technology, shifting organizational responsibilities, and shifting external demands. (Neely, 1999)

According to his study (Edum-Fotwe et al. 1996), according to his study, the process of selecting financial ratios has always been challenging and problematic because of the high likelihood of information overlap. For example, when all ratios were taken into consideration, there was an issue of repetition. On the other hand, it might leave out some crucial information if only entirely independent ratios are taken into account. As a result, there won't be enough data available to fully assess the financial standing of the business. The approach of analyzing these ratios and comparing various businesses and industries gets challenging because of the wide range of ratios that are available. (Edum-fotwe et al., 2010)

In order to prevent information from being lost and to allow for further examination of the reduced number of variables to create the performance appraisal framework, important ratios must be incorporated into fewer numbers of significant factors. to deal with the issue of selection. (Edum-fotwe et al., 2010)

(Alarcón & Mourgues, 2002) used a model to predict the performance of the study's contractors. The chosen predictive technique offers a flexible modeling framework to incorporate all the factors the decision maker deems significant, but it can also add current company information to the selection process to solve an issue. Long-term assurance resulting from prequalification Regarding the model's consideration of the key factors that influence how well projects and contractors execute, He continued by saying that the technique provides a rational framework for the more aggressive use of self-assessments and combines or replaces them with actual data obtained from previous efforts in a rigorous and integrated procedure. (Alarcón & Mourgues, 2002)

use. (El-Mashaleh, 2003) Regression analysis was used to examine the association between performance and information technology using data from 74 construction companies. According to the analysis's empirical findings, IT is favorably correlated with business performance, schedule performance, and cost performance. The total measure of a company's performance includes schedule performance, cost performance, customer satisfaction, safety performance, and profit performance. Each one has financial measures.. (El-Mashaleh, 2003)

(Beatham et al., 2004) Before evaluating the use of key performance indicators (KPIs) in the contracting firms, a brief outline of performance measurement and performance measurement systems (PMSs)

was presented. In addition to identifying the three basic types of measurement—KPIs, Key Performance Results (KPOs), and Perception indicators evaluated how KPIs are currently used before discussing the key features of performance measurement and suggesting the usage of the EFQM Excellence Model criteria. After that, he responds to five major challenges of KPI use in construction (Beatham et al., 2004)

One of the main goals of MADM processes is to determine the appropriate weight for each criterion since (Tang et al., 2006) begins by stating that each criterion has a distinct meaning and that, as a result, it cannot be assumed that they all have equal weights. The most of weighting approaches in the literature can be categorized into two groups: subjective weights and objective weights, where only subjective weights are selected based on decision-makers' preferences. The weighted least squares method, the Delphi method, and the AHP approach are included in this group. But objective approaches, which assign weights by resolving mathematical models, do so without taking the decision-preferences maker's into account.; These include the entropy method, key element analysis of multi-objective programming, etc. The concept of "entropy" is used. The quantification of uncertainty that appears in each probability distribution and has been adopted in a variety of disciplines. Eliminating uncertainty as a means of providing information (Tang et al., 2006) (Mohamadi et al., 2017)

The study (Singh & Tiong, 2006) includes the use of entropy as a technique to figure out the weights that certain financial ratios should have based on how much information they emit. Because they can capture changes in every area of a company's financial characteristic, financial ratios were included in the study. The method, which has an advantage over

conventional ratio analysis, provides a correlation between ratios as they are added together to produce an overall performance score.(Singh & Tiong, 2006a)

In comparison to earlier models created by Kangari et al., the model (Elyamany et al., 2007) accurately represented the effect of macroeconomic, industry-specific, and company-related factors on the success of the company. Without considering the effects of macroeconomic and sector-specific factors on the performance of construction enterprises, both 1992 studies concentrated exclusively on performance evaluation using financial measurements. Additionally, the Goda 1999 model did not account for the impact of the company's size on performance. (Elyamany et al., 2007)

It appears to build on his findings (Cheng & Li, 2006) and, as reported by Meade and Sarkis 1999, by means of the ANP, researchers can create a more complete multi-criteria model that identifies correlative relationships that were originally assumed to be unrelated.

(Cheng & Li, 2006)

In order to determine the performance score using the measuring system developed through quantitative and qualitative surveys, (Yu et al., 2007) conducted a case study using data obtained from 34 Korean construction enterprises. The system contains learning and growth considerations, financial, customer, and internal operations performance standards, key performance indicators, evaluation tools, and relative weights of criteria. (Yu et al., 2007)

(Isabel M. Horta et al., 2010) also suggested a methodology that combines KPIs with the Data Envelope Analysis (DEA) method, presented by Charnes et al. 1978.

He feels that all firms engaged in performance measurement processes, which frequently rely on digital platforms, can benefit from this methodology. One benefit of data envelope analysis technology is that it enables the combination of many business activity dimensions that are measured by various KPIs into a single summary performance measure.

(Isabel M. Horta et al., 2010)

Isabel M. Horta and colleagues, 2010) A Portuguese performance measuring platform for the contracting companies was employed in their investigation. The study's analysis of a sample of 20 Portuguese firms used two separate vantage points to evaluate organizational performance and operational performance. Two types of models—one that enables weights to change freely and another that contains weight constraints to take preferences of managers into account—have been utilized in this analysis to help define strategy in a more realistic approach. Additionally, the manager's judgment was utilized to choose which fictitious units were included in the competency assessment to construct process limitations that were outside the performance levels of the original limits in order to enable the provision of targets for all organizations. (Isabel M. Horta et al., 2010)

Additionally, he offered (I. M. Horta et al., 2012) a model that evaluated each company's financial indicators for each year with a best-practice threshold for the research period. A combined sample of Portuguese construction companies was included in the model. In order for each firm's composite index to be as high as feasible in relation to the composite index of other evaluated companies with comparable weights, the model permitted each company to select its own weights. The reason for this, in his opinion, is that it

is difficult to establish a set of weights that all companies concur upon and that appropriately depict the relative importance of each indication in the year. The value of the composite index equals one, signifying the greatest composite index obtained for all companies, assuming an upper bound of best performance (i.e., scale scores).) (I. M. Horta et al., 2012)

If a firm does not receive the highest score possible, even after being assessed using a set of weights designed to increase its performance score, it indicates that other firms out performed it over the relevant time period. It is feasible to assess the company's relative performance in a specific year when compared to the best practices noticed throughout the investigation based on the model's results(I. M. Horta et al., 2012)

In the Mahamid study (2012) to evaluate the performance of Palestinian contracting companies, 44 workers were identified and included in three groups: financial, administrative and external. The results of the study showed that the failure of construction companies in Palestine is mostly due to financial factors, followed by management skills and related external factors. (Assaf et al., 2015)

Using entropy measurements (information measures) produced from financial ratios, Bal et al. (2013) revised the discriminant analysis to create a multi-criteria decision-making model for the financial performance evaluation problem. Ratios from financial reports can be viewed as a widely regarded tool for evaluation and calculation when it comes to assisting businesses in projecting their financial future. The topic of calculating company financial ratios from financial statements is covered in the first section of the article. The TOPSIS approach then uses the weighted values of the financial ratios to complete its phases and produce its ratings.

Each financial ratio in the model is weighted using the entropy methodology after this calculation. (Bal et al., 2013)

The study's objectives are to identify the critical financial ratios for the various industry sectors and to assess the normalcy of the distributional properties of the financial ratios (Chong, K., Yap, & Mohamad, 2013). 28 selected financial ratios from 40 businesses in the trade and services sector were subjected to factor analysis. Seven different ratios were chosen to represent all the prime ratios used out of the 28 ratios considered. As three ratios—total debt to total assets, total debt to shareholder funds, and long-term debt to total assets—have been selected, it has been discovered that the ratios that measure solvency and leverage are high. The results showed that have for ratios is not necessary (Chong, K., Yap, B., & Mohamad, 2013)

Erdogan (2013) used factor analysis to remove duplication and classify the financial ratios of 500 industrial businesses in Turkey for the year 2010 into factors. Their research found evidence to support of the debt burden theory, which contends that businesses may invest in successful enterprises as a result of having too much debt. Additionally, they were able to offer some support for a rational classification of financial ratios. However, a significant flaw in their study was the fact that before using data reduction, they failed to evaluate the content validity, reliability, dimensionality, and validity (Alarcón & Mourgues, 2002)

(Assaf et al., 2015) identified management reasons, financial reasons, growth reasons, and environmental reasons as the most serious reasons behind contractor failure on construction projects. Data was gathered from 15 owners, 11 contractors, and 10 internal contractors during a survey with 36 participants. It may

be underlined that financial reasons are typically among the most important elements that cause the collapse of contracting firms and the most crucial ones are the lack of knowledge in the field of business and the incorrect cost calculation

(Assaf et al., 2015)

In the study (Tijani, 2015) A construction firm in the Kingdom of Saudi Arabia had its employment record examined using the financial ratio in order to forecast its solid financial situation. As he studied, he relied on the most common reasons for the failure of construction companies. They are as follows: (1) Too fast growth, (2) Acquisition of employment in a new geographic area, (3) Excessive increase in the size of one job, (4) High turnover rate, (5) Insufficient capital, (6) Poorly costing work, (7) poor accounting system, (8) acquiring a new type of work, (9) poor cash flow and (x) buying useless things.

He came to the conclusion that poor financial management is the main reason for business failure. Additionally, it was discovered that Saudi Arabian businesses struggle with cash flow, finding workers, making poor decisions, lacking in managerial expertise, and having low profit margins.. (Tijani, 2015)

BEM (SACEM) and BSC were integrated into one model by (Oyewobi, L. O., Windapo, A. O., & Rotimi, 2015) to be used as a tool for strategic performance monitoring and self-evaluation. The proposed model's primary goal is to assist organizations in achieving performance excellence, enhancing business outcomes, and obtaining sound financial outcomes. This is because the authors recognize that many organizations have grown confused because of the increasing number of models in general and in the construction sector, despite their sincere desire to find ways to

achieve business excellence and long-term competitive advantage.

They agree that BSC and BEM franchise are highly valuable tools for continuous development and business excellence since they must closely align with their strategic objectives despite different operational settings and constraints. So,.

(Oyewobi, L. O., Windapo, A. O., & Rotimi, 2015)

On the basis of the weighted financial ratios of seven Iranian companies listed on the Tehran Stock Exchange (TSE), Shaverdi et al. (2016) also evaluated the performance of these companies. The model's five primary variables ratios, leverage ratios, activity ratios, profitability ratios, and growth proportions degraded using AHP and TOPSIS. Questionnaires are used to calculate the significance of proportions. The weights of main and minor criteria that help lessen uncertainty and ambiguity in the decision-making process are determined using the FAHP.

Finally, the Fuzzy TOPSIS method is proposed for evaluating the performance of companies and doing the final rating by considering financial ratios and criteria weights. In this way, the company's ranking is obtained according to its overall performance. It also confirms that the use of modern measures of financial performance along with traditional measures would greatly enhance the financial evaluation of the company and sees that the most important of these measures is the market value added (MVA), the added economic value. (Shaverdi et al., 2016)

(ONDER & ALTINTAS, 2017) evaluated the financial performance model of the Turkish construction company using the analytical network processes, GRA methods and the following ratios as variables for the model:" asset growth rate,

return on assets, return on equity, trading ratio, quick ratio", and came to the conclusion that users of financial information can benefit from the ratios Finance's quantitative financial information. Particularly for financial analysts and investors. He thinks it makes it possible for stakeholders to evaluate the company's performance and financial situation as well as its position over time within the sector(Onder & Altintas, 2017)

The study (W. S. Lam et al., 2019) used significant financial ratios to verify the financial performance of the Malaysian construction firm. For both ranking and choosing the optimal decision alternative, TOPSIS is a valuable and practical model. The TOPSIS model looks for the optimum decision option That comes closest to the negative ideal solution (NIS) and is the furthest away from the positive ideal solution (PIS) (NIS). One of the most widely used techniques for weighing criteria is the entropy weighing approach, so TOPSIS is a widely used decision tool for ranking alternatives(W. S. Lam et al., 2019)

(Fahami, Norasyikin Abdullah, 2019) also concluded that the use of financial ratios on a large scale as a tool for analyzing financial performance, so according to studies, it is possible to measure the competitive advantages and the level of sustainability of companies within the industry based on the financial performance of the company; He believes that financial ratios such as" current ratio (CR), return on equity (ROE), profit margin (PM), debt-to-equity ratio (DER), earnings per share (EPS) and return on earnings" are vital indicators of the financial performance of companies. (Fahami, Norasyikin Abdullah, 2019)

(Vibahakar et al., 2020) employed a hybrid (qualitative and quantitative) strategy that included factor analysis of the

financial ratios of 100 Indian construction companies over a ten-year period (2008-17) to determine the key variables affecting the performance of the companies' finances. Investor Return, Business Efficiency, Operations Management, Activity Efficiency and Risk Coverage, and Asset Management constitute the remaining five mutual funds. Additionally, interpretation of the percentage variance was used to assess the relative relevance of each of these elements.. (Vibahakar et al., 2020)

Whereas (Dehdasht et al., 2020) makes the case that combining TOPSIS with other MCDM strategies may lead to more effective and adaptable problem-solving. Contrarily, objective constant weight methods like entropy can successfully eliminate subjective judgments because they are made in accordance with the information inherent in the indexes and data. Shannon entropy is recommended for calculating the weight of criteria because it is an effective method that increases decision-reliability making's and accuracy without posing any significant modeling difficulties. (Dehdasht et al., 2020)

The MDCM model, a VIKOR entropy-fuzzy model, is suggested (Weng Siew Lam et al., 2021) to assess and contrast the financial performance of construction enterprises. The suggested model has two stages. Because it can eliminate the subjectivity of weight selection, the entropy weight approach is suggested in the first step to establish the objective weights of the financial ratios. The three most significant financial influencing ratios to take into account for assessing the performance of construction enterprises in this study are CR, DER, and DAR, according to the analysis carried out using the entropy weight approach. (Weng Siew Lam et al., 2021)

When compared to the traditional VIKOR model, the addition of the entropy and ambiguity methodologies has a substantial impact on how financial performance is assessed and how construction companies are ranked. This study proposed an integrated VIKOR entropy and ambiguity model to evaluate, compare, and score the financial performance of construction firms based on a number of financial ratios(Weng Siew Lam et al., 2021).

Because it can eliminate subjectivity in weight selection, the entropy weight approach was used to calculate the objective weights of the financial ratios. Additionally, the entropy weight approach may fully utilize the sample data to determine the financial ratios' important weight. (Weng Siew Lam et al., 2021).

According to the classification of all survey respondents, it was determined that (El-Kholy & Akal, 2021) that the contracting companies had failed., in Egypt, results from the fact that the majority of contractors lack the skills necessary to determine the cost of their contracts. They typically base their estimates of the costs of their project's activities on their prior knowledge of comparable projects. As a result, several variables and elements that vary from project to project are ignored and have a direct impact on the estimation process. As a result, they discover a large gap between the estimated and actual costs during the construction phase, adding new charges to their budget. Contractors ultimately suffer financial losses as a result of this, increasing their risk of failure and insolvency. (El-Kholy & Akal, 2021)

The fourth most significant financial element that contributes to the failure of Egyptian contracting firms is also late interim payments from the client. The study in Egypt also showed that a contracting company beginning operations with a low paid-in capital is the primary financial

factor attributed to the failure of Egyptian businesses (El-Kholy & Akal, 2021)

Weng Siew Lam and others, 2021 The financial ratio can show a company's financial strengths and shortcomings, making it a useful tool for evaluating its financial success. Important financial statistics used to assess corporate financial performance include "Return on Equity (ROE), Return on Assets (ROA), Earnings per Share (EPS), Debt to Equity Ratio (DER), Debt to Assets Ratio (DAR), and Current Ratio (CR)". ((Weng Siew Lam et al., 2021)

In information theory, entropy serves as a general indicator of uncertainty. A conservative probability distribution is used to represent it, with a large distribution indicating increased uncertainty. When the entropy of two evaluation items on the same indication is low while the value difference between them is big, it indicates that this indicator gives more relevant information and its relative weight will be higher. Weight can be determined objectively using the entropy approach. (Alptekin & Alptekin, 2017) (Abate, 2019)

The entropy approach is a technique that makes use of the idea of entropy to establish the weight of the indicator in the research (Yuan & Wanli, 2021) of Chinese firms. The basic principle is to use the change in the index to establish the objective weight as an objective weighting method. By effectively eliminating the subjectivity of the expert scoring method, the index can reflect the majority of the original information (Yufang & Wanli, 2021)

The study of the literature that was reviewed showed that financial performance is the most important criterion in evaluating companies in general and contracting companies in particular, and financial ratios occupied the largest part in

the evaluation methods used, and this certainly comes from what these measures possess of great objectivity in the possibility of performance evaluation, Financial ratios used to measure a company's financial stability are the base for several models. The majority of these models assess the financial ratios (available financial attributes) for businesses.

Studies also show that a set of models and methods are often used in addition to financial ratios in evaluating performance, comparisons, ranking companies, alternatives, or standards, some of which give discriminatory power and others give the character of objectivity or get rid of bias and subjectivity, and these models or methods: Analysis The discriminant, the closest ideal solution, the VIKOR TOPSIS model, the Fuzzy TOPSIS method, AHP, Entropy and the like methods, and in this regard we review some comments of a number of other researchers on the importance of the financial factor in evaluating the performance of contractor companies. which were compiled by Bal et al., 2013) in addition to their comment within their study that aimed to use entropy to predict business failure: a forecasting improvement model for the contracting companies as follows (Bal et al., 2013)

1) According to Bal et al. (2013), one of the most important parts for evaluating the performance of general contractors is their financial stability.

(2) In 1992, Russell and Jaselskis assembled a sample of 344 construction industry experts from American professional associations. They stated that the most crucial selection factor for public contracts is financial stability. The most significant composite decision factors (CDF) for private contracts are financial situation and experience.

3) The findings of a survey of 53 significant British construction enterprises were presented by Holt et al. in 1994 (3). This indicated that everyone believed that financial stability was possibly the most crucial aspect.

4) According to Bushati and Al-Gobali in 1996, financial stability and contractor experience are the essential criteria for work in the Kingdom of Saudi Arabia.

(5) According to Russell 1996's findings for pre-qualifying contractors in the United States, Saudi Arabia follows the same order as the United States for the first two criterion (experience and financial stability).

(A mailed survey of 192 UK client advisory organizations was used by 7Ng 1996 and Skit more. They looked into how different types of organizations implemented different prequalification standards (PQC). The findings indicated that financial stability is the most essential need for quality assurance in all private and public contracts.

8) Maximum resources and financial capacity are two of the top three project-specific criteria for public construction, according to Wong et al 2000.

(9) Topcu 2004 investigated the ability to complete construction projects on time in the Turkish public sector; 70% of the ability is set to "financial condition."

(10) In 2003, Pong Peng and Liston published a study with the goal of creating a set of weighted criteria with a common denominator of material value to evaluate contractor ability for both the public and private sectors in Thai contracting firms. The survey's findings indicated that one of the top five variables in the private sector is the financial ratio.

(Bal et al., 2013)

3- Methodology

The results of this study's analysis of the contracting company listed in the Iraq Stock Exchange for a period of five years was analyzed. The data for this study were obtained from the company's annual financial report.

Six significant financial ratios are taken into account in this study based on earlier studies. These financial metrics include 1- Working Capital to Current Liabilities (WC / CL) 2- Trading Ratio (and will be replaced by leverage to show the impact on weights and assessment) 3. RETURN ON ASSETS 4- Cash Flow of Current Liabilities (CF / CL) 5 - Management Performance Ratio PBIDT/Net Assets 6 - Market Value Added (MVA) 7- Earnings per Share EPS

According to certain studies, traditional ratio analysis fails of measuring a company's financial performance. According to Shannon and Weaver, the entropy weight technique is used to calculate the weights of the choice criterion in this study because it applies the entropy model, which consists of a series of steps (W. S. Lam et al., 2019)

This multi-criteria decision analysis uses financial ratios as criteria and the result is the company's performance ranking according to years. ((Fahami, Norasyikin Abdullah, 2019)

4- Choosing financial ratios

(Edum-fotwe et al., 2010) considers that the process of choosing financial ratios is difficult and problematic because of the high possibility of information overlapping. In the case of considering all proportions, there was the redundant issue. On the other hand, it might leave out some crucial information if only entirely independent ratios are taken into account. As a result, there won't be enough data available to fully assess the company's

financial performance. The process of examining these ratios and comparing various businesses and industries gets challenging due to the wide variety of ratios that are available.

(Edum-fotwe et al., 2010)

As a result, only a set of seven ratios that is representative of financial success has to be used to evaluate financial performance. Additionally, some ratios have been shown to be more significant in two or more sectors, and one or more ratios from the collection of representative ratios have been chosen) (Chong, K., Yap, B., & Mohamad, 2013)

In order to prevent information from being lost and to allow for further analysis of the reduced number of variables to create the performance appraisal framework, important ratios must be incorporated into fewer numbers of significant factors. To solve this selection issue (Edum-fotwe et al., 2010)

The contractor is subject to significantly bigger risks than his counterpart in practically any other industry, in addition to the extent of the hazards that contracting companies are exposed to. Additionally, a contractor's product is frequently debatable and takes a long time to produce. Additionally, when compared to other industries, the construction process exposes the company owner to more risk over a longer period of time. When awarding contracts, this necessitates a study of applicants, which is generally based on an assessment of: (1) the company's financial capabilities; and (2). Technical ability (Kangari, 1988)

Therefore, The short-term liquidity of the company can be used to illustrate the financial aspects of its activities., long-term solvency, cash balance, ability to generate profits, and administrative efficiency in the use of resources (choosing one or two

percentages from each classification to study the financial position of the company would take into account The company's financial profile in its entirety, so the ratios, for the study, which do not all develop in the same way (Singh & Tiong, 2006)

In addition, the measure of the added market value has been integrated as an external measure to measure the financial performance of companies, which is one of the modern measures. (Shaverdi et al., 2016) with a leveraged trading ratio test to show the impact on the company's overall performance.

. 1- Working capital Divided current liabilities (WC/CL).

The working capital ratio (determined as current assets Divided current liabilities) to current liabilities gauges how much cash is likely to be available for a business to make timely payments of its short-term financial obligations. Since net working capital also declines when net working capital is cut in half, this ratio was chosen rather than the current ratio, which is more usually used to evaluate short-term liquidity. (Singh & Tiong, 2006)

2- Turnover (Schmidlin, 2014)

The current ratio, also called the working capital ratio, determines the entire current assets (or only liquidity + debtors + inventory) in relation to short-term liabilities, as the current assets are operational and are usually used within a year. This period of less than a year is exactly what characterizes short-term liabilities. Therefore these liabilities must be adequately covered by their counterparts on the current assets side. (Schmidlin, 2014)

It indicates the extent to which the company is able to pay the short-term obligations within the time and scope and the value of the ratio between 1 and 2 is

usually satisfactory for the contractors. (Edum-fotwe et al., 2010)

This ratio represents part of the financial stability because it is profitable. If the ratio for circulation reaches more than the maximum required, the business ties up too much capital and profitability falls. In fact, this critical ratio is a balance between liquidity and profitability (Schmidlin, 2014)

3. Return On Assets

The ROI metric is often used in a wide variety of forms with other performance indicators such as net profit, but it is most visible in the return on assets (ROA) variation. Return on assets takes into account a company's net profit plus interest expense and puts it in relation to the average total capital provided by equity and debt holders. Unlike return on equity, return on assets is characterized as it is not affected by financial influences as the return of all stakeholders appears, which is why interest expense is added again because it constitutes the return of the creditors of the company. Using net profit and interest as dividends of shareholders and creditors, so the capital provided by both parties appears in the denominator

Return on assets = $\frac{\text{Net profit} + \text{Interest expenses}}{\text{Ø Balance sheet total}}$

. (Schmidlin, 2014)

4 – Cash flow Divided current liabilities for the cash position. And Net income Add to non-working expenditures as cash flow is a significant predictor of the possibility of financial difficulty. The cash flow/CL ratio, also known as the outflow ratio of liquid assets, is a useful indicator of a company's capacity to satisfy its short-term obligations without selling off its illiquid assets. Reduced cash flow is a crucial sign of potential issues that could result in bankruptcy for a corporation.

5- PBIDT/Net Assets refers to the company's effectiveness in using its assets to make a profit before paying contractual obligations such as interest, depreciation, and taxes i.e. the ability of assets to generate profit before contractual obligations are paid in respect of such as interest, depreciation and taxes

Net profit before interest; depreciation and taxes / Total assets - total liabilities

(Vibahakar et al., 2020) (Weng Siew Lam et al., 2021)

6- Market value added

Market value added (MVA) is a measure of value created by management while there is surplus capital invested by shareholders. Value added is often the present value of a series of EVA values. Additionally, the market value the additive, which may be calculated as follows, is the best outside criterion for assessing management's long-term performance.:

"MVA = Total market value - Total capital employed for the firm", Manufacturing Value Added (MVA) is also thought to be an appropriate variable to measure owner wealth maximization considering the relative risk-based costs of doing so (Shaverdi et al., 2016).

7- Earnings per share (EPS)

By comparing a company's earnings per share to prior years, it is possible to tell if it is expanding or not. It is frequently seen as the sole factor that determines a company's profitability Shaverdi et al., 2016)

Earnings per share (EPS) is the most significant decision criterion, according to Lam et al., because it aids in determining the financial performance of the construction firm and the weights of decision criteria when analyzing the financial performance of construction companies (W. S. Lam et al., 2019)

In general, the higher the market capitalization ratio, the higher the company's share price because the market believes the growth prospects are good and/or they think the company is less risky as an investment (Pizzica, 2015)

8- Financial Leverage

It is an important tool for solvency analysis, where we refer to the amount of debt financing in the company's capital structure. It is said that companies with financial leverage are trading on the equity. This indicates that the company is using equity capital as a borrowing base in its desire to generate additional return., and leverage is a double-edged sword. Specifically, when the return on net operating assets is less than the after-tax cost of debt, the return on equity of the risk-free firm is less than the return on equity of the risk-free firm i.e.: (1) the leveraged firm successfully trades on equity when the return on assets exceeds the cost of after-tax debt, (ii) the leveraged company's vain trading in equity is futile when the return on net operating assets is less than the after-tax return and the cost of debt is incremental. (Subramanyam, 2014)

Mason and Harris (1979) using a discriminatory analysis of 40 failed and non-failing UK firms, found that leverage (the ratio of current liabilities to current assets) was one of the most important measures that showed high discriminatory scores. (Langford et al., 1993) ((Shaverdi et al., 2016) (Fahami, Norasyikin Abdullah, 2019) (Chong, K., Yap, B., & Mohamad, 2013)

5 -Description of the method

Shannon According to (Tang et al., 2006) (Mohamadi et al., 2017)), the entropy weight method was primarily used to compare the relative weights of different decision criteria where the data acquired allowed for the determination of the

entropy weight of the decision criteria. The probability distribution's measure of uncertainty was originally created in 1948. Entropy is vital in understanding the decision criteria and the extent to which they differ from one another because it is one of the fundamental requirements for figuring out the weight of the choosing criterion and the valuable information in the data. The selection of building companies has been one application for the method of entropy assessment (Weng Siew Lam et al., 2021)

The researchers took into account the entropy weight approach when analyzing them because of its significance in the decision-making process.:

(Weng Siew Lam et al., 2021) (Bal et al., 2013) (Islamoglu et al., 2015) (

(Bulgurcu, 2013) (Tang et al., 2006) (Mohamadi et al., 2017) (Abate, 2019) (Yufang & Wanli, 2021) (Dehdasht et al., 2020) (Alptekin & Alptekin, 2017) (

Using multiple (usually conflicting) decision criteria, The Multiple Criteria Decision Making (MCDM) method is frequently used to rank or choose one or more options from the collection of available options. Additionally, it is common for no one contractor to consistently exceed all of its competitors in terms of all financial metrics, making it challenging to rank contractors according to their financial skills and gauge their overall success. As a result, The MCDM technique perfectly frames the issue of assessing the financial reputation of construction firms.

Decisions in real-world MCDM situations frequently depend on prior knowledge, empirical evidence, gut instinct, or personal preferences. Zeleny therefore proposed that the proportionate weight given to the standard should reflect both the subjective nature of decision-makers preferences and

the features that are objective to the criterion itself. It is never easy to come to an agreement using a subjective weighting, on the relative weight of the decision-making factors. technique since DMs may have diverse perspectives of the importance of the many DCs used (Singh & Tiong, 2006b)

Since the entropy weighing method is one of the predominant methods used in weighing criteria, the entropy weighing method was used to determine the objective weights of financial ratios because it can avoid subjective selection of weight, moreover, the entropy weighing method is able to make full use of the data to obtain the weight Important for financial ratios (Weng Siew Lam et al., 2021) and the entropy weighing method is one of the predominant methods used in weighing standards. (W. S. Lam et al., 2019)

Thus, in order to make an unbiased comparison between the construction companies, with regard to their financial strength, the materiality the financial ratios' values must be determined through an objective weighting process devoid of subjective preferences. To deal with such an assessment, Zeleny's objective weighting method, which uses Shannon Weaver's entropy concept, can be used to evaluate how essential financial ratios are in relation to one another. (Singh & Tiong, 2006b)

The main idea behind the concept of entropy is that it can be used to determine how much information is contained in each C_j parameter using the equation. The significance for the standard C_j, measured in weight w_j, is a direct function of the information that the standard conveys in relation to the set of alternatives..” - (Bulgurcu, 2013)

$$E_j = -k \sum_{i=1}^m (a_{ij}) \log (a_{ij}) \quad \dots\dots\dots 1 \quad (W. S. Lam et al., 2019)$$

where

$$(a_{ij}) = x_{ij} / [\sum (x_{ij})] , \forall i \quad \dots\dots\dots 2$$

$$K = 1 / \log(m) \quad \dots\dots\dots 3$$

(Alptekin & Alptekin, 2017)

Here x_{ij} is the performance rating of the alternative i on the j criterion, k is a constant such that 0 ≤ E_j ≤ 1 ∀j and m is the number of alternatives and the measure of discriminatory power is expressed as “scale of dispersion” or “degree of difference” and using the degree of difference can easily be calculated The weighted value of the entropy of the parameters used (Bulgurcu, 2013)

$$D_j = 1 - E_j \quad \dots\dots\dots 4 \quad (Islamoglu et al., 2015)$$

Finally, the standard objective weight of each criterion can be calculated as follows. The more significant the criterion C_j is for the given situation, the bigger the value of D_j in evaluating the alternative A_j for criterion j.

$$W_j = D_j / [\sum (D_j)] , \forall i \quad \dots\dots\dots 5$$

c_j the preferences of the DMs can also be reflected in the significance value assigned to the decision criteria by adding a factor (f_j) that reflects their preferences to the weights w_j produced by the entropy technique. Consequently, the equation will represent the weights of the decision-maker.: -

$$w_j^1 = W_j f_j \quad \dots\dots\dots 6$$

The performance of the options was also aggregated using a straightforward additive weighting procedure. ratings into the

decision criteria to get the overall performance scores for the alternatives. This method gives accurate approximations for more complex collection methods despite its simplicity, so it is chosen from among many other collection methods available for this purpose (Singh & Tiong, 2006b)

This can be expressed as the assembly process as in the equation: -

$$\text{Score} = \sum (x_{ij}w_j) \dots \dots \dots 7$$

(Weng Siew Lam et al., 2021) (Bal et al., 2013)

Noting that the greater the score, the more financially stable the business is. In required to accept the necessary data on the official website of the Iraq Stock Exchange, the procedures outlined in the previous item will be applied to Elite Contracting Company. Additionally, in order to consider the effects of various accounting

techniques and administrative practices the analysis was done over a period of seven years in order to take into account as many aspects as possible when proposing different methods to improve the company's financial performance.

-6 case study

The annual reports of the selected contracting company (Company A) have been carefully studied and the company's performance ratings for each year have been calculated for each financial ratio selected for financial soundness analysis and transformation so that all $x_{ij} \geq 0$ It is clear that this shift is neutral in the case of ordinal and basic facilities and this It is for this study.

Using equation (2), normalization was performed for the ratings, performance and matrices for fiscal years (normalization aims to maintain comparable metrics. (Bulgurcu, 2013) (as in Tables 1

Table No. (1)

السنة	(WC / CL)	CR	(ROA)	(CF / CL)	PBIDT/Net Assets	(MVA)	E p s
2009	21.51	27.50	0.12	0.48	0.02	305799739.00	0.13
2010	9.27	14.60	0.21	-0.90	-0.02	1891128126.00	0.28
2011	4.58	5.58	0.16	-3.45	0.21	4253054254.00	0.21
2012	18.91	13.87	0.03	-0.26	0.28	3441617336.00	0.00
2013	14.75	12.97	0.05	4.53	0.19	2239649774.00	0.01
2014	12.73	13.73	0.03	4.23	0.03	-133892627.00	0.02
2015	13.03	14.03	0.02	0.23	0.02	-138914837.00	0.00

Table 2 and Figure (1) for each financial ratio determined by the use of equations (1), (3), and, display the calculated entropy

and the degree of difference (4). which, using equation, have been normalized to produce the objective weights (5).

Table 2

Ratio	(WC / CL)	CR	(ROA)	(CF / CL)	PBIDT/ N.A	(MVA)	(E p s)
Entropy, E	0.452	0.546	0.017	0.558	0.102	0.693	0.585
Divergence, D	0.548	0.454	0.983	0.442	0.898	0.307	0.415

The variations in the financial ratios' objective weights In Table 3 indicate the ability of the entropy method to reflect the amount of variance of the information provided by the contracting company's performance through the specified financial ratios. It is therefore clear from the table that (ROA) and PBIDT/ N.A have greater weight or significant values than

other financial ratios, indicating a stronger discrimination. This indicates that these two ratios are more significant in determining financial soundness since companies have more varied performance assessments on these ratios and have made a greater contribution to the evaluation outcomes. (WC/CL)

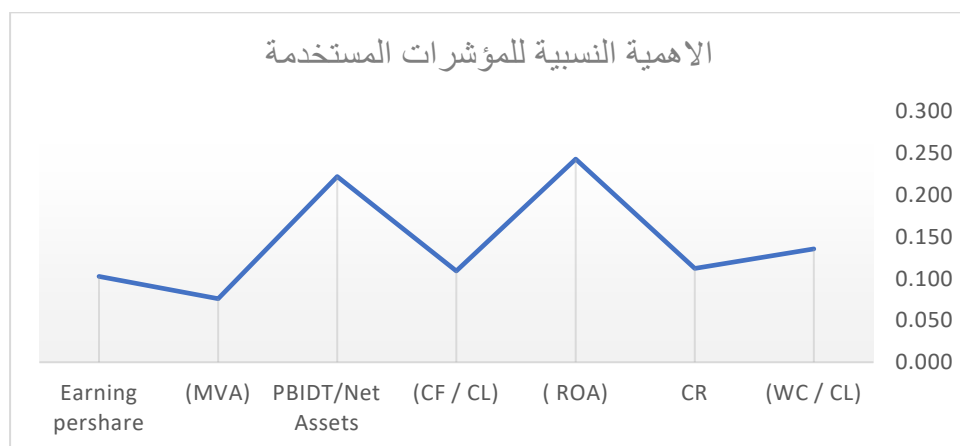
Table No. (3)

Weights	(WC / CL)	CR	(ROA)	(CF / CL)	PBIDT/ N.A	(MVA)	(E p s)
W _{ij}	0.135	0.112	0.243	0.109	0.222	0.076	0.103

The ratio (ROA) Figure No. 1, which measures the company's profitability state and has the highest objective weight value across all years, is the most important

aspect to consider when evaluating financial efficiency, according to the ratios' objective weights.

Figure No. (1)



This is also consistent with the actual circumstance. of the contracting companies as well as it is a given that the company in general becomes a failure when it becomes unable to achieve an adequate return on its assets and it agrees with the study (Bal et al) which proved that “return on assets” is one of the most important discriminatory factors There are good differences between failed and non-failed firms and are inconsistent with those of Beaver (Bal et al., 2013)

Also, the high relative weight of the ratio (PBIDT/N. A) is confirmed by the study (ABIDALI, 1990), where it was concluded that the profitability measure contributes more than others because the company's profit almost never fails. Where the main difference from all other models is the measures of profit after taxes and interest (ABIDALI, 1990) .

However, while the (WC / CL) ratio was of less relative importance, this contradicts the findings (Singh & Tiong, 2006) that the company's ability to create income is less essential than its liquidity situation, particularly at a time when the company is going through a challenging period of economic downturn.

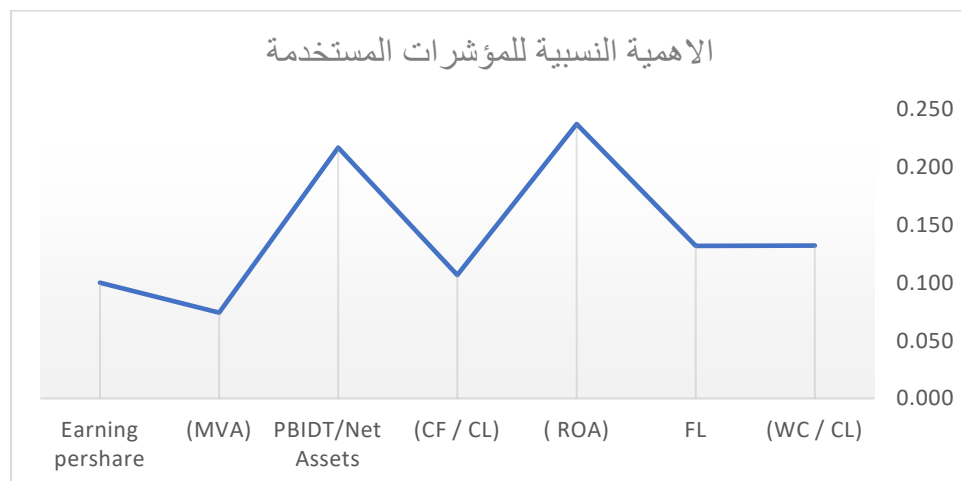
As for the CR ratio, it was of very low relative importance, and this is consistent with what Mason and Harris concluded that the primary feature of the company's capacity to create income weighs more heavily in determining the solvency of the organization than short-term liquidity. continue to operate and grow.

Also, the use of financial leverage instead of the trading ratio, which is linked with an inverse mathematical relationship, did not affect the final evaluation of the company's performance as shown in Figure No. (2)

Table No. (4)

Weights	(WC / CL)	FL	(ROA)	(CF / CL)	PBIDT/Net Assets	(MVA)	Earnings per share
W_{ij}	0.132	0.132	0.237	0.107	0.217	0.074	0.100

Figure No. (2)



Although the financial leverage is more important in the objective weights than the liquidity ratio as shown in the table, which outweighs the measures of solvency over the measures of liquidity in the accuracy of

the evaluation, and this reinforces the findings of the researchers that one or more ratios cannot measure the company's performance A selection of metrics can

provide a suitable model for measuring performance

Additionally, the return on share measure and the economic value added measure both displayed low relative importance, which supports what (Pizzica) assumed that The market believes that the firm's growth prospects are good and/or that the company is less safe as an investment, hence the higher the market value ratio, the higher the company's share price ((Pizzica, 2015)

This defies the conclusions of (Lam et al). that the key performance indicator for top corporations is earnings per share (EPS). (W. S. Lam et al., 2019)

The final step is to assemble the final performance evaluations for the purpose of computing the company's total performance ratings after defining the objective weights for the financial ratios. This is done using equation (7) To determine the combined financial year results and overall performance scores, where the ratios as criteria and the years are the alternatives shown in Figure (3) and Figure (4) using the liquidity ratio and when replacing it with leverage, respectively.

Figure No. (3)

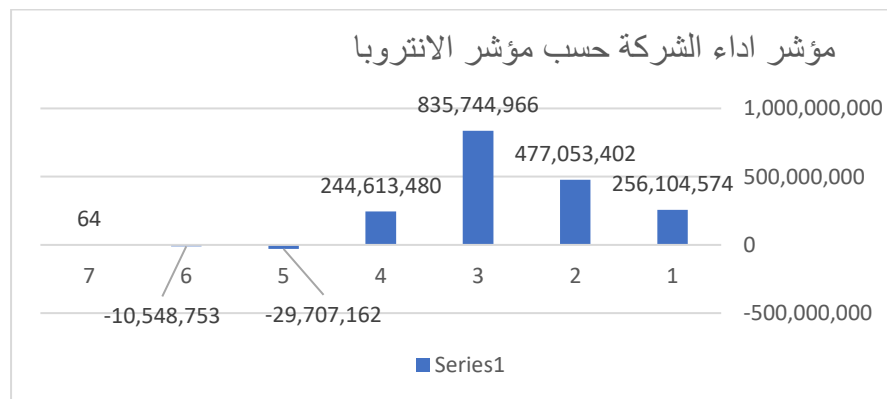


Figure No. (4)

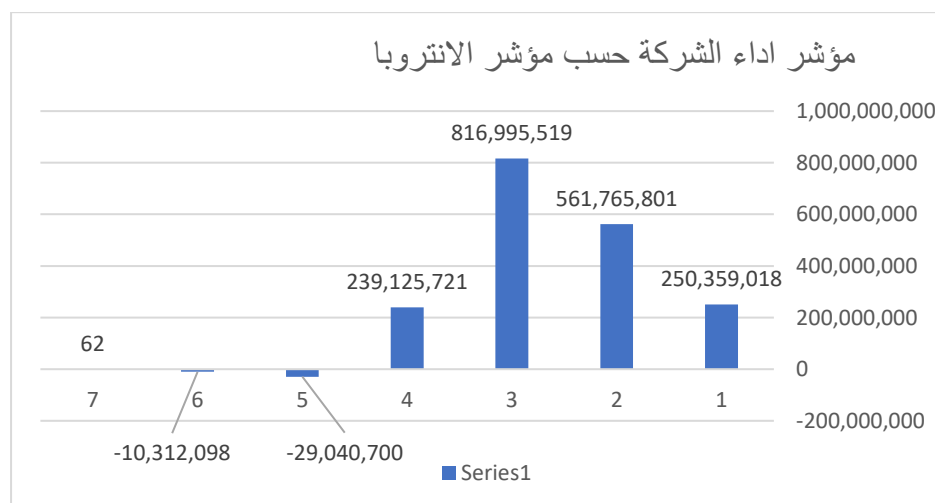


Figure 3 and Figure 4 show a representation of the company's performance trend over

the selected years, as it indicates that the company witnessed a development in its

performance levels during the years 2009, 2010 and 2011, when it was in its best condition in that year, and then began a decline in the company's performance level, which caused it to have a low level during the years That followed, and it seems that the economic and political conditions had a prominent role in that decline.

It should be noted that Tamari (1964) shows that a large percentage of successful companies have at least one weak percentage, about two or three. He concluded that the analyst cannot rely on only one ratio, especially in the contracting companies, and this is evident in Figures (3,4), as replacing the trading ratio with financial leverage did not have a significant impact on the overall performance results.

A set of important financial ratios or a variety of analyses must be combined in order to distinguish between firms, as one financial ratios or measure is necessary to evaluate a company's financial soundness.

According to (Langford et al., 1993) Ratios indicate prior performance and indicate that if management does not take steps to reverse the trend, the tendency may continue.. For this reason, it is impossible to determine with certainty whether the company will fail because what managers, shareholders, creditors, or other parties decide to do is unpredictable.

However, it will be clear if a company is experiencing problems of any type. Given this, it's imperative to pay attention to how businesses function. by tracking changes in the trends of key financial ratios over time and evaluating the financial soundness of the firms.

6- Conclusions

Construction companies have characteristics that distinguish them significantly from other sectors of the

economy. They are very competitive due to the large number of companies and ease of participation. The contractor is therefore exposed to much greater risk than in almost any other industry. In addition, the employer is exposed to a greater degree of risk for a longer period of time during the contract performance process, and the product made by the contractor is often controversial, and requires a long production time. Also, compared to other industries, and when awarding contracts, great emphasis must be placed on the financial performance of the developed company, that is, the most important competitive advantages of companies lie in the solvency, which is generally evaluated through financial ratios, where financial ratios represent useful quantitative financial information so that it can be evaluated Companies during certain periods of time and within the sector in which the company operates. Through a review of the literature that used the MCDM multi-criteria decision model, it is noted that the use of traditional financial ratios is often relied upon in evaluating financial performance. Economic enhances the strength of the evaluation of financial performance. On this basis, the current research used traditional measures in addition to modern measures, which are considered as quantitative financial performance measures.

The study showed that the (ROA) ratio, which measures the firm's profitability state and The most important aspect in determining a company's financial performance is the one that has the highest value for objective weight across all years., followed by the ratio PBIDT / N.A) which is a measure of profitability as well as it contributed a greater percentage than the other measures The study also proved that the financial performance is the outcome of several measures, and therefore changing one measure or ratio does not significantly

affect the overall result of the assessment, especially with the use of the entropy scale in this study.

The direction of performance becomes clearer as the number of years studied in the review process increases, and better results are obtained based on the evaluation results. It should go without saying that any stretch of two or more consecutive years of significantly declining overall performance ratings can be viewed as a warning of bad financial health and necessitates a thorough examination of the organization to determine the causes of this.

This approach may aid beneficiaries in studying about contracting firms' financial performance and in assessing the nominated contractors' economic feasibility during the selection process.

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