Developing a computer model to analyze and improve the financial position of cement companies

.

ABSTRACT

|  |
| --- |
| Industrial companies often use a ready-made computer model to analyze and forecast their overall financial position, but specialized computer models are rarely used to analyze and forecast the financial position of cement companies in particular. **Aims:** This article aims to design and develop a computer model for cement companies to analyze and predict their financial status, thereby improving it.**Study design:** The applied aspect of the article relied on analyzing financial data published on the official websites of Saudi and Iraqi companies operating in the cement production industry to verify the effectiveness of the proposed computer model.**Place and Duration of Study:** Saudi and Iraqi companies operating in the cement production industry, such as: Saudi Cement Company (Saudi Arabia); Yamama Cement Company (a joint stock company) (Saudi Arabia); Southern Cement Company (Iraq); Northern Cement Company (a joint stock company) (Iraq).**Methodology:** This article examines the algorithm and rationale for applying an advanced computer model to analyze and forecast the financial position of cement companies. Based on this model's application in cement production companies, regression analysis is used to evaluate the company's economic indicators. Logical and statistical analyses are employed throughout the article.**Results:** Based on the results obtained from the article, which applied the computer model developed by the authors to analyze and forecast the financial position of cement companies, the feasibility of the computer model's actual application for integrated analysis of the financial position of cement companies has been demonstrated. This model allows for calculating the values of the leading indicators for analyzing the financial position of cement companies, comparing the calculated values of the leading indicators of the financial position of the company with developed benchmark values, and identifying trends and dimensions for improving the financial position of cement companies based on classification assessment and regression analysis. It also provides a basis for future activities of cement companies by informing management decisions related to them.**Conclusion****:** Through the study, we concluded that the new computer model offers significant potential for analyzing the financial situation of the sample institution, including identifying financial difficulties, predicting the economic crisis of the cement production company over any given period, and identifying initial methods for overcoming financial challenges and obstacles. |

*Keywords: Cement companies, financial position, analysis, forecasting, financial optimization, computer model.*

1. INTRODUCTION

As a result of the current global economic crisis, the process of formulating and implementing investment policies in the cement production sector has become more complicated. Cement companies (Abedi, 2020), particularly those in Iraq and Saudi Arabia, have significantly lost their production capacity and competitiveness in the global and local markets. In this context, the failure to resolve many theoretical, methodological, and practical issues related to analyzing and forecasting the financial position of the cement sector has led to a focus on short-term programs that do not guarantee economic growth, but rather limit losses during the crisis. This situation creates a need to develop a computer model to analyze and forecast the financial position of the cement sector.

At the present stage, issues of improving the quality and reliability of relevant financial information, as well as the speed of receiving information about the economic condition of industrial enterprises, are becoming increasingly important. Their value lies in the fact that modern systems for financial analysis automation enable the in-depth examination of an industrial enterprise's activities, particularly a cement production enterprise, as well as the resolution of problems related to investment analysis and financial plan optimization (Peshkova, Kyurdzhiev, & Mambetova, 2020).

The basis of automated financial analysis is an information model of the enterprise's financial activity, which, in turn, is designed to:

• Conducting a broad analysis and evaluation of the activity carried out by companies and identifying different trends (in the financial condition of companies).

• Packages for analyzing the financial condition of enterprises;

• Programs aimed at solving specific problems (Abedi, 2021).

Most automated models for analyzing the financial condition of industrial enterprises are based on calculating specific coefficients that characterize the solvency and economic stability of an enterprise in the cement production industry (Abedi, 2021). The coefficients calculated based on balance sheet data are compared with their normative values, which constitute the final measure for assessing an enterprise's financial condition. However, the authors believe that there is a drawback to the current automated models of software products offered on the market. This drawback is that they lack a gradation by industry, as all enterprises are evaluated equally. However, when conducting financial analysis, a large number of indicators are used, which makes the analysis time-consuming and complex, while simultaneously making it difficult to discern trends and patterns, resulting in incorrect management decisions. These conditions necessitate the development of an automated model for a cement production company, utilizing substantial amounts of financial data (Afanasyev, 2020).

2. MATERIALS and methods

The basis for creating the computer model is the analytical model proposed by the authors for analyzing the financial position of cement companies.

The following key areas can be identified as potential areas for practical use of the computer model presented for analyzing the financial position of cement companies:

• Analyzing the attractiveness and importance of investing in cement companies and predicting measures to improve them.

• Identifying the financial problems and difficulties facing cement companies and predicting measures to overcome them.

One of the advantages of this model is that the user is not required to be involved in the calculations. This requires only the entry of initial data for a significant opportunity to analyze the financial situation, which results in the calculation of all indicators. Working with this software does not require any special training. The model can be used as the primary means of analysis, as well as for verifying manual calculations.

The data collected will identify trends in the development and improvement of cement companies' financial position, based on an assessment of pre-determined classifications and a regression analysis of their financial position. It will also provide a basis for future activities of cement companies by informing management decisions related to them.

In this context, a computational algorithm was used to conduct an integrated analysis of the financial position of cement companies (Figure 1).

**Fig. 1 Flowchart of the computational algorithm was used to conduct an integrated analysis of the financial position of cement companies.**

*Source: Prepared by the authors*.

This computational algorithm is compatible with Microsoft Excel, a built-in Microsoft Office application that is installed on almost every computer. The data processing tools used in the Microsoft Excel environment are comparable in their capabilities to databases; however, working with these spreadsheets does not require the user to have any special programming training (Jusoh & Ahmad, 2019).

To predict the financial position of a cement production enterprise using regression analysis, the regression equation parameters are automatically calculated, the average approximation error matrices are automatically calculated and filled, the regression equation quality indices are automatically calculated, and finally, a matrix is formed to study the dependence of Y on X for each unit of measurement. Finally, conclusions are drawn regarding the financial position prediction of a cement production enterprise.

In general, an algorithm is designed to depend on Y on X for the units of measurement in Figure 2.

Identify the factors and variables that affect the index.

Predicting the index of the current study sample (double regression equation)index.

Result: How much will Y change when X increases by units?

|  |  |  |
| --- | --- | --- |
| Indicators | Revenue sales (Y) credit | Change by one unit increment |
| Y |  |  |
| Х1 |  |  |
| Х2 |  |  |
| Х3 |  |  |
| Х4 |  |  |
| Х5 |  |  |
| Х6 |  |  |

**Fig. 2**  **Flowchart of the calculation “ Determining the results of the dependence of Y on X per 1 unit of measurement”**

*Source: Prepared by the authors*.

3. results and discussion

3.1 results

Based on the computer model proposed by the authors, the financial situation of cement companies can be analyzed and predicted. The authors studied the possibility of practical application by Saudi and Iraqi companies operating in the cement production industry, such as: Saudi Cement Company (Saudi Arabia); Yamama Cement Company (a joint stock company) (Saudi Arabia); Southern Cement Company (Iraq); Northern Cement Company (a joint stock company) (Iraq), using financial data published on official websites (7,8,9,10) .

The selection of cement production companies stems from the need to study the practical application, considering the accounting systems and financial reporting models of Saudi Arabia and Iraq. Iraqi cement companies prepare financial reports by both Iraqi standards (SRIG) and international financial reporting standards (IFRS). In contrast, Saudi cement production companies prepare their financial statements according to International Financial Reporting Standards (IFRS) (7,8,9,10). In this regard, the actual application of the authors' proposed computer model is an effective tool for analyzing and forecasting the financial position of cement companies. The authors also emphasize that the use of this computerized model is equally essential for the practical application of foreign cement companies. As a result of calculating the main indicators to assess the financial position of the cement companies in the study sample, financial stability classification groups were directly identified, as shown in Table 1.

Thus, we see that the clarity of the obtained data demonstrates that the computer model designed to analyze the financial situation proposed by the authors enables the calculation of leading indicators of the economic crisis and the automatic determination of the belonging of cement companies to a particular group of financial stability ratings.

**Table 1. Classification group definition for the studied cement companies**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Probation period** | **Saudi** **Cement Company****(Saudi Arabia)** | **Yamama Cement Company****(Saudi Arabia)**  | **Southern Cement Company****(Iraq)**  | **Northern Cement Company****(Iraq)**  |
| 2021 | 34 | 33 | 42 | 36 |
| 2022 | 35 | 33 | 42 | 37 |
| 2023 | 32 | 31 | 43 | 38 |
| 2024 | 26 | 38 | 44 | 37 |
| **Classification**  | **poor financial position** | **poor financial position** | **Financially stable** | **Financially stable** |

*Source: Prepared by the authors, based on the financial data of the four cement companies in the study sample (7,8,9,10).*

Saudi cement companies mostly fall into the third group of classifications, indicating a financially unstable position. Iraqi cement companies fall into the second group, indicating financial stability.

The extracted classification values obtained for the cement companies in the study sample enable us to conclude that the importance of forecasting (predictive assessment) of the company's financial condition, using regression analysis, is crucial for understanding the desired trends and identifying the improvement potential of the cement companies in the study sample.

It should be noted that there are no special approaches to forecasting the financial condition of cement companies; instead, various individual methods are employed, including expert assessments, deterministic, stochastic, and trend extrapolation methods. The authors believe that the most suitable method for this industry is regression analysis, as it is commonly used for forecasting in the long and medium term (Bondarenko, Gorelova, & Katsko, 2019).

Regression analysis involves a series of procedures that are combined into several stages (Afanasyev, 2020):

• Emphasis on studying the qualitative characteristics of the model;

• Designing a communication model;

• Verifying the appropriateness of the designed model and calculating financial information;

• Analyzing and interpreting the results, emphasizing the details of the topic under study (Afanasyev, 2020).

Therefore, regression analysis is the simplest and most accurate method for determining the financial position and is considered the most effective method for determining the size of current assets for the forecast period.

Table 2 shows the calculations of the dependence of (Y) on the factor variables (X) for the computer model for analyzing the financial position of the cement companies in the study sample.

**Table 2. The results of calculating (Y) and its effect on the (X) factors in the computer model to analyze and predict the financial situation of cement companies, the study sample.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Company** **Name** | **X Y** | Revenues | Net profit | Liquidity | Debt coverage ratio | Net profitability |
| Saudi Cement Company (Saudi Arabia) | **× 1** | 15,14 | 8.75 | 10.79 | 52.50 | 67.44 |
| **× 2** | 99.83 | 0,00 | 72.31 | 24.86 | 78.03 |
| **× 3** | 2.94 | 12.39 | 59.34 | 93.50 | 64.74 |
| **× 4** | 7.56 | 3.25 | 0.03 | 67.37 | 80.58 |
| **× 5** | 7.38 | 45.66 | 93.77 | — | 12.93 |
| **× 6** | 20.83 | — | 32.03 | — | 18.77 |
| **× 7** | — | — | 66.29 | — | — |
| Yamama Cement Company (Saudi Arabia) | **× 1** | 98.28 | 30.59 | 85.31 | 31.11 | 0.90 |
| **× 2** | 98.21 | 65.80 | 10.95 | 24.58 | 3.51 |
| **× 3** | 72.61 | 40.29 | 67.76 | 5.84 | 8.61 |
| **× 4** | 96.85 | 21.60 | 52.40 | 58.07 | 2.84 |
| **× 5** | 42.88 | 97.40 | 40,60 | — | 57.62 |
| **× 6** | 92.95 | — | 32.30 | — | 4.42 |
| **× 7** | — | — | 97.37 | — | — |
| Southern Cement Company (Iraq) | **× 1** | 100,00 | 45.57 | 0.57 | 50.44 | 13.51 |
| **× 2** | 11.51 | 25.78 | 14.23 | 7.01 | 9.04 |
| **× 3** | 45.02 | 10.03 | 75.61 | 58.08 | 1.95 |
| **× 4** | 45.57 | 6.50 | 41,61 | — | 72.79 |
| **× 5** | 82,87 | 100,00 | 27.04 | — | 0.76 |
| **× 6** | — | — | 87,83 | — | 0.90 |
| **× 7** | — | — | 76.53 | — | — |
| Northern Cement Company (Iraq) | **× 1** | 100,00 | 69.72 | 89.59 | 75.15 | 94.62 |
| **× 2** | 71.47 | 94.16 | 0,00 | 71,70 | 48.19 |
| **× 3** | 24.35 | 15.46 | 99.58 | 94.33 | 50.71 |
| **× 4** | 48.41 | 99.32 | 0.67 | — | 96.04 |
| **× 5** | 97.83 | 6.41 | 0.67 | — | 95.87 |
| **× 6** | — | — | 97.23 | — | 20.60 |
| **× 7** | — | — | 82.11 | — | — |

*Source: Prepared by the authors, based on the financial data of the four cement companies in the study sample(7,8,9,10).*

Changes in (Y) in Table 2, with an increase in the factor variables (X) by one unit in the model for analyzing the financial position of the studied companies, generate information that is useful or allows for identifying some of the factors affecting the dependent variable, and thus identifying the unnecessary and necessary factors, and analyzing their declared and actual importance.

Based on the results of the regression analysis, we can focus our efforts on developing measures that improve the situation and eliminate those that worsen the target indicator.

3.2 DISCUSSION

Based on the results obtained from the article, which applied the computer model developed by the authors to analyze and forecast the financial position of cement companies, the feasibility of the computer model's actual application for integrated analysis of the financial position of cement companies has been demonstrated. This model allows for calculating the values of the leading indicators for analyzing the financial position of cement companies, comparing the calculated values of the leading indicators of the financial position of the company with developed benchmark values, and identifying trends and dimensions for improving the financial position of cement companies based on classification assessment and regression analysis , and also providing a basis for making management decisions regarding the future activities of a cement production enterprise.

This research highlight explicitly that the results of the multifactor regression analysis in this automated model possess significant scientific and practical value in analyzing the financial position of cement companies. This is evident in the significantly deeper factor analysis, which identifies the position and role of each factor in shaping the level of the studied indicator, thereby enhancing the reliability of plans, forecasts, and management decisions, and providing a more objective assessment of the results of activities in cement production enterprises.

4. Conclusion

Thus, in this research, the authors focuses on the possible practical applications of the automated model they developed to analyze and forecast the financial position of a cement production company. During this study, the following was done in response to the question:

• It was shown that it is possible to use and implement a computer model to practically analyze and predict the financial position of a cement company using financial statement data per Iraqi accounting standards and international financial reporting standards.

• Procedures were identified, particularly the values ​​of key financial ratios and financial classification figures, and when using the computer model to analyze and forecast the financial position of cement companies.

• Procedures were identified, particularly the values ​​of key financial ratios and financial classification figures, and when using the computer model to analyze and forecast the financial position of cement companies.

To conduct experimental calculations and verify the practical application of the model developed by the researchers, calculations were conducted in the following areas:

• A comprehensive analysis was conducted of the financial position of major cement companies in Saudi Arabia and Iraq.

• Calculations were conducted for the leading indicators of the cement industry, and classification groups were determined for the cement companies studied.

• Calculations were performed on the variable (Y) with the effect of increasing the factor variables (X) by one unit in this computer model to analyze the financial status of the cement companies in the study sample, forming information to identify the factors affecting the dependent variable (Y), identifying the necessary and unnecessary factors (X), and analyzing the stated and actual relative importance.

The results obtained from applying the computer model for financial analysis proposed by the authors indicate that it is possible to identify the dimensions and trends of improvement in the economic crisis of cement companies. This provides the program's users with a basis for making managerial decisions regarding the future activities of cement companies. The practical application of the computer model yields tangible positive results in the form of additional benefits. In other words, when using this model, the requirements for analysis and forecasting are reduced, while at the same time, the efficiency of analytical work increases due to the increased number of indicators used, thus improving the accuracy of the approved forecasts based on primary data from accounting models.

The advantages of using a computer model include:

• Increased accuracy and reliability of calculations;

• Reducing the possibility of errors in calculations;

• Performing large and multiple calculations in optimal time.

It is expected that this computer model will interact with ready-made accounting software developed by accountants in the future, as well as create integration and compatibility of financial reports with Microsoft Word, which will provide practical and scientific significance to the computer model of the economic situation of cement companies proposed in this article.

Consent

Following international or university standards and principles, the authors collected, designed, and preserved the participants' written consent.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Authors hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

COMPETING INTERESTS DISCLAIMER:

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

References

1. Abedi A.A. (2020). Building an automated model to analyze and forecast the financial position of oil production enterprises. Economic Analysis: Theory and Practice, 8(503), 1551–1566. DOI : <https://doi.org/10.24891/ea.19.8.1551>
2. Abedi, A. A. (2021). Modern problems of the oil industry development and their impact on the financial stability of oil production enterprises. In E3S Web of Conferences (Vol. 291, p. 08010). EDP Sciences. DOI : <https://doi.org/10.1051/e3sconf/202129108010>
3. Afanasyev V. N. (2020). Time Series Analysis and Forecasting, Textbook; IPR Media - Saratov, Orenburg State University. 286 p. ISBN 978-5-4497-0269-2 (IPR Media Saratov) <http://elib.osu.ru/bitstream/123456789/13336/1/133563_20201117.pdf>
4. Bondarenko P.S., Gorelova G.V., & Katsko I.A. (2019). Probability Theory and Mathematical Statistics: Textbook], edited by I.A. Katsko, A.I. Trubilin. - Moscow: KNORUS, 390 p. - (Bachelor's degree). ISBN 978-5-406-06704-8. <https://kubsau.ru/upload/iblock/358/3580e286da38faf1e7bab6085f86b389.pdf> (YEAR NOT MATCH0
5. Jusoh, N., & Ahmad, H. (2019). Usage of Microsoft Excel spreadsheet as accounting tools in SME company. INWASCON Technology Magazine, 1, 23-25.‏ DOI : <http://doi.org/10.26480/itechmag.01.2019.23.25> (YEAR NOT MATCH0
6. Peshkova, E. P., Kyurdzhiev, S. P., & Mambetova, A. A. (2020). Modeling forecasting the financial condition of organizations. In International Scientific Conference" Far East Con"(ISCFEC 2020) (pp. 2080-2092). Atlantis Press.‏ <https://www.atlantis-press.com/proceedings/iscfec-20/125936369>
7. Financial statements of Northern Cement Company **(FSoNCGC)**. Official website: <https://ncsciraq.gov.iq/>
8. Financial statements of Saudi Cement Company **(FSoSCC)**. Official website: <https://saudicement.com.sa/category/investor-relations/financial-statements/>

 [file:///C:/Users/HP/Downloads/%D8%A7%D9%84%D9%82%D9%88%D8%A7%D8%A6%D9%85\_%D8%A7%D9%84%D9%85%D8%A7%D9%84%D9%8A%D8%A9\_%D8%A7%D9%84%D8%B3%D9%86%D9%88%D9%8A%D8%A97%20(1).html](file:///C%3A/Users/HP/Downloads/%D8%A7%D9%84%D9%82%D9%88%D8%A7%D8%A6%D9%85_%D8%A7%D9%84%D9%85%D8%A7%D9%84%D9%8A%D8%A9_%D8%A7%D9%84%D8%B3%D9%86%D9%88%D9%8A%D8%A97%20%281%29.html)

1. Financial statements of Yamama Cement Company **(FSoYCC)**. Official website: <https://www.yamamacement.com/Style%20Library/Pages/Preview.aspx?fURL=https://www.yamamacement.com/InvestorRelations/QuarterlyFinancialReports/%D8%A7%D9%84%D9%82%D9%88%D8%A7%D8%A6%D9%85%20%D8%A7%D9%84%D9%85%D8%A7%D9%84%D9%8A%D8%A9%20%D9%84%D8%B9%D8%A7%D9%85%202024.pdf>
2. Financial statements o Southern Cement Company **(FSoSCGC)**. Official website: https://argaamplus.s3.amazonaws.com/cf5d063c-9f59-48e2-ac05-204f5ddf8c00.pdf <https://www.southern-cement.com/arabic/aboutus.htm>