Measuring the Financial Health of Companies Using Z-Score and Data Analytics

SHREENIDHI S[1], PRATHYUSHA PASUPULETI[2]

[1]Student – BNM Institute of Technology

[2]Assistant Professor - BNM Institute of Technology

Abstract- *The study examines the financial health of MCKB Construction LLP, Bengaluru, using Altman's Z-Score model over a five-year period (2020–2024). The research applies ratio analysis combined with data analytics tools to classify the company's solvency status into Safe, Grey, or Distress zones. Findings reveal that while the firm demonstrated robust financial health in the early years, it experienced a steady decline, entering the Grey Zone in 2023–2024. Persistent liquidity shortages, weakening asset turnover, and declining operational efficiency are key concerns. The study concludes with recommendations for strengthening working capital, restructuring debt, and adopting predictive analytics for proactive financial monitoring.*

Keywords: Financial Health, Altman's Z-Score, Bankruptcy Prediction, Data Analytics, Construction Industry, Working Capital Management, Solvency and Liquidity, Predictive Financial Models, Risk Assessment.

I. INTRODUCTION

The construction industry in India plays a pivotal role in economic development, contributing significantly to GDP and employment. However, the sector is highly capital-intensive, vulnerable to liquidity pressures, and exposed to cyclical fluctuations. Mid-sized firms such as MCKB Construction LLP face acute financial challenges due to delayed receivables, rising input costs, and reliance on external borrowings.

Financial stability is a prerequisite for resilience in such conditions. Traditional ratio analysis provides useful insights but often fails to predict future risks. To address these limitations, Altman (1968) introduced the Z-Score, which integrates multiple ratios into a single predictive framework. In the digital era, its effectiveness can be enhanced through modern tools like Excel, Power BI, and Python.

This paper evaluates the financial health of MCKB Construction LLP over a five-year period using Altman's Z-Score, supplemented with data analytics, to assess solvency risks and provide actionable recommendations.

II. LITERATURE REVIEW

Early studies by Beaver (1966) established ratios as predictors of failure, while Altman (1968) introduced the Z-Score, achieving over 80% accuracy in bankruptcy prediction. Subsequent research (Deakin, 1972; Ohlson, 1980; Foster, 1986) emphasized integrating profitability, liquidity, and solvency measures.

Recent literature explores advanced predictive approaches. Platt & Platt (1990) and Altman & Hotchkiss (2006) highlight profitability and leverage as stable predictors. AI-based studies (Ravi Kumar & Ravi, 2007; Yoon & Kwon, 2020) show that machine learning enhances predictive accuracy. In the Indian context, Saini & Mittal (2019) and Gupta & Sharma (2023) validate the Z-Score's relevance, especially for mid-sized firms.

Research gaps identified include limited focus on construction firms, scarce studies on Indian mid-sized companies, and insufficient integration of advanced analytics. This study addresses these gaps.

III. RESEARCH METHODOLOGY

Problem Statement:
Mid-sized Indian construction firms face financial vulnerabilities, yet predictive tools like Z-Score are rarely applied in this sector.

Objectives:
1. To apply Altman's Z-Score to evaluate MCKB's financial stability (2020–2024).
2. To analyse year-on-year variations and identify drivers of change.
3. To integrate data analytics tools for improved accuracy and visualization.
4. To recommend strategies for financial resilience.

Scope:
- Firm: MCKB Construction LLP, Bengaluru.
- Data: Audited balance sheets and income statements (2020–2024).
- Variables: Ratios from Altman's Z-Score model.

Method:
Secondary data were collected from audited reports. Ratios were computed and weighted using Altman's formula. Z-Scores were classified into zones and visualized through graphs and dashboards.

IV. DATA ANALYSIS AND DISCUSSION

The study relies entirely on secondary data obtained from the audited financial statements of MCKB Construction LLP, along with supporting information from Ministry of Corporate Affairs (MCA) filings, Reserve Bank of India (RBI) publications, and industry reports. The analysis covers the company's Balance Sheets and Income Statements for a five-year period (2020–2024). Key financial ratios forming part of Altman's Z-Score model—working capital, retained earnings, EBIT, total assets, total liabilities, and sales—were computed to assess solvency and financial health. Annual observations were selected to capture long-term trends and structural shifts while avoiding the short-term volatility typical of quarterly fluctuations.

Computed Ratios and Z-Scores

The first step in the analysis involves computing the five ratios that form the foundation of Altman's Z-Score model. Using MCKB's financial data from 2020 to 2024, the following measures are calculated:

- $X1$ = (Current Assets – Current Liabilities) ÷ Total Assets → Measures liquidity and short-term solvency.
- $X2$ = Retained Earnings ÷ Total Assets → Captures the firm's profitability history and reinvestment capacity.
- $X3$ = EBIT ÷ Total Assets → Reflects operating efficiency by showing how effectively assets generate earnings.
- $X4$ = Book Value of Equity ÷ Total Liabilities → Indicates solvency, or the ability to withstand financial leverage and repay obligations.
- $X5$ = Sales ÷ Total Assets → Represents asset turnover, demonstrating how efficiently assets are used to generate revenue.

Once computed, these ratios are weighted and aggregated using Altman's formula:

$$Z=0.717X1+0.847X2+3.107X3+0.420X4+0.$$

The resulting Z-Scores classify the financial condition of MCKB Construction LLP for each year into one of the three categories (Safe, Grey, or Distress). These values are further analysed through tables, graphs, and trend lines, making it easier to observe shifts in financial performance over time.

Z-Score Results for MCKB Construction LLP (2020–2024)

Year	X1	X2	X3	X4	X5	Z-Score	Zone
2020	-0.1039	-0.0183	0.4963	-0.0149	7.4194	8.85	Safe
2021	-0.2430	-0.2362	0.1728	-0.1889	8.5842	8.65	Safe
2022	-0.3567	-0.0309	0.2205	-0.0254	3.9898	4.37	Safe
2023	-0.4771	-0.0286	0.1568	-0.0235	2.3099	2.42	Grey
2024	-0.1582	0.0447	0.1388	0.0527	2.0247	2.40	Grey

Zone-Wise Classification
Frequency of Zones (202-2024)

Zone	Years in Zone	Interpretation
Safe	3	Strong health and low bankruptcy risk
Grey	2	Moderate risk; financial caution required
Distress	0	No immediate bankruptcy risk detected

The findings highlight that MCKB Construction LLP maintained strong financial health during the initial

years (2020–2022), supported by high efficiency in asset utilization and stable earnings capacity. However, from 2023 onwards, the company shifted into the Grey Zone, reflecting a period of moderate but growing financial risk. Although it has not yet entered the Distress Zone, the downward trajectory of the Z-Score suggests rising vulnerabilities in liquidity, solvency, and revenue efficiency. If these weaknesses are not addressed, the firm could face heightened financial instability in the near future.

Zone-Wise (Graphical Interpretation)

Year	Z-Score	Zone	Interpretation
2020	8.85	Safe	Very strong financial health
2021	8.65	Safe	Strong performance, stable
2022	4.37	Safe	Noticeable decline, early warning
2023	2.42	Grey	Moderate risk, needs caution
2024	2.40	Grey	Risk persists, fragile recovery

Altman Z-Score Trend Over 5 Years
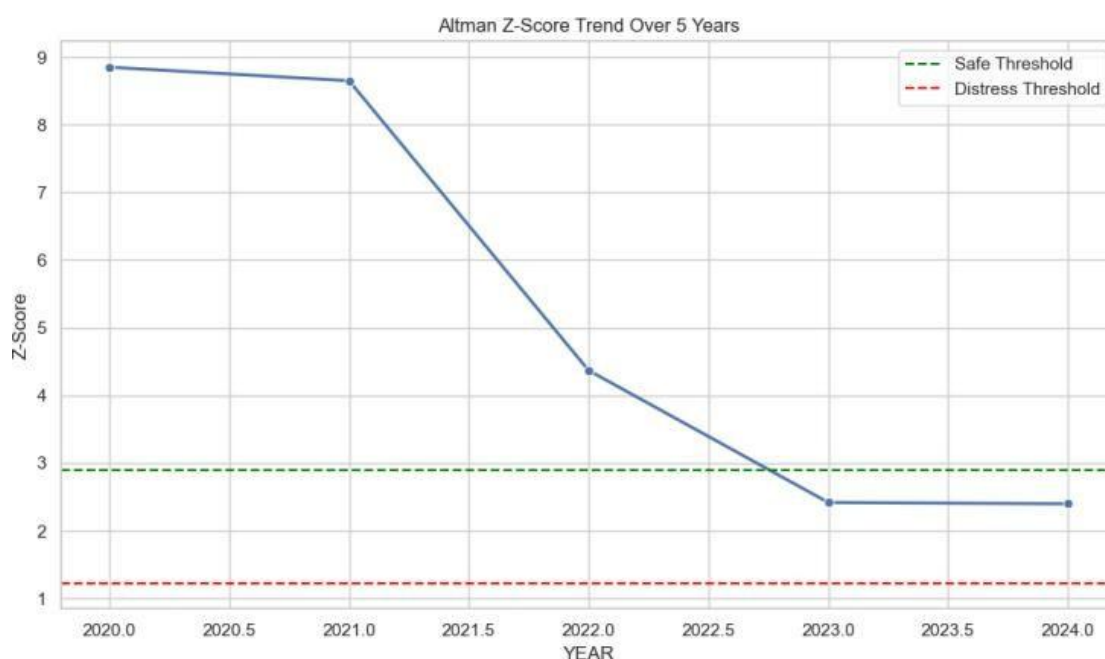
1. Line Graph of Z-Scores (2020–2024):
   o Shows a steep decline from 8.85 in 2020 to 2.40 in 2024.
   o The fall below the 2.9 threshold in 2023 highlights the entry into the Grey Zone.
2. Bar Chart of Z-Scores per Year:
   o Highlights the peak performance in 2020 and 2021.
   o Visualizes the progressive deterioration in later years.
3. Component-Wise Contribution Graph:
   o X5 (Sales/Total Assets) was the dominant contributor in 2020–2021 but declined drastically later.
   o X3 (EBIT/Total Assets) supported financial strength but weakened after 2022.
   o X1 (Liquidity) was consistently negative, showing persistent short-term solvency issues.
   o X4 (Solvency ratio) improved only in 2024, suggesting late attempts to balance equity and debt.

V.   FINDINGS

- Safe Zone (2020–2022): Strong financial health driven by high sales efficiency and operating profits.
- Grey Zone (2023–2024): Decline due to reduced asset turnover, liquidity stress, and higher leverage.
- No Distress Zone entry: Though not yet distressed, the trend is negative.

This suggests that MCKB's challenges stem primarily from liquidity management and declining operational efficiency. The application of Z-Score

with analytics provides actionable early warnings, aligning with findings from recent studies on predictive financial monitoring.

VI.   SUGGESTIONS

- Management should strengthen working capital policies by tightening receivable cycles, negotiating extended credit terms with suppliers, and maintaining liquidity reserves.
- Creditors and investors are advised to use predictive tools like Altman's Z-Score in combination with real-time dashboards to assess solvency before extending funds.
- Policymakers and regulators should encourage mid-sized construction firms to adopt digital financial monitoring systems, ensuring early detection of financial stress.
- Funders and banks can consider restructuring debt for firms in the Grey Zone, shifting from short-term borrowings to long-term financing to reduce default risk.
- Future research may extend this study by applying hybrid models that integrate Z-Score with AI-driven analytics and benchmarking across multiple firms in the construction sector.

CONCLUSION

The five-year financial analysis of MCKB Construction LLP using Altman's Z-Score reveals a clear shift from strong financial stability to growing vulnerability. While the firm remained in the Safe Zone from 2020 to 2022, persistent liquidity shortages, weakening asset turnover, and declining operational efficiency pushed it into the Grey Zone during 2023–2024. Although the company has not yet entered the Distress Zone, its downward trend signals heightened financial risk. This study demonstrates the importance of integrating predictive models like Altman's Z-Score with modern data analytics to provide early warning signals and support proactive decision-making. Strengthening liquidity management, restructuring debt, and enhancing operational efficiency are critical for MCKB to regain resilience and return to sustainable financial health.

REFERENCES

[1] Beaver, W. H. (1966). Financial ratios as predictors of failure. *Journal of Accounting Research, 4*(Empirical Research in Accounting: Selected Studies 1966), 71–111. https://doi.org/10.2307/2490171

[2] Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance, 23*(4), 589–609. https://doi.org/10.2307/2326758

[3] Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research, 18*(1), 109–131. https://doi.org/10.2307/2490395

[4] Platt, H., & Platt, M. (1990). Development of a class of stable predictive variables: The case of bankruptcy prediction. *Journal of Business Finance & Accounting, 17*(1), 31–51. https://doi.org/10.1111/j.1468-5957.1990.tb00548.x

[5] Bellovary, J., Giacomino, D., & Akers, M. (2007). A review of bankruptcy prediction studies: 1930–present. *Journal of Business & Economics Research, 5*(2), 7–14. https://doi.org/10.19030/jber.v5i2.2532

[6] Yoon, J., & Kwon, Y. (2020). Predicting financial distress with machine learning: Evidence from SMEs. *Sustainability, 12*(19), 7865. https://doi.org/10.3390/su12197865

[7] World Bank. (2024). *Finance & Prosperity 2024*. World Bank Publications. Retrieved from https://www.worldbank.org/en/publication/finance-and-prosperity-2024