Journal of Trends and Challenges in Artificial Intelligence

ASPUR PUBLISHING

Vol. 03, No. 01 (2026) 39-46, DOI: 10.61552/JAI.2026.01.004 - http://jai.aspur.rs

PROPOSED APPROACH CAPITAL STRUCTURE MANAGEMENT RELATED TO AI: EVIDENCE FROM AUTOMOBILE MANUFACTURING COMPANIES

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Received 20.01.2025.
Revised 12.04.2025.
Accepted 05.05.2025.

Keywords:

Capital structure, AI solutions, AI model forecasts, Solvency, Liquidity.

Original research

A B S T R A C T

In the last decade, automobile manufacturing companies face significant challenges in the process of controlling liquidity and solvency under constantly intensifying competition. While paying off financial obligations on time is always desirable and honorable, the ongoing crises negatively affect the overall financial situation of organizations. Therefore, with sufficient liquidity reserves, it becomes easier for companies to regulate their solvency levels.
This article presents an approach that includes artificial intelligence solutions for optimizing the capital structure of leading listed automotive companies. This research is a logical continuation of our research entitled "The proposed approach controlling capital structure in the AI context: Case study of the machine tool manufacturing company." One of the main advantages of this article is the need for forecasting current assets in the capital structure.
The aim of this research is to forecast the capital structure in the context of AI solutions in top automotive companies and assess the impact of capital structural changes on liquidity and solvency. The novelty of this article lies in the proposed comprehensive approach, which includes forecasting the capital structure for effective control over liquidity and solvency.
This highlights the relevance and significant of the article conducted within the scope of the survey.

1. INTRODUCTION

In the automotive production sector, capital structure, solvency, and liquidity are interconnected components of financial management that directly impact the long-term stability of an organization (Bhattacheryay, 2023).
In the evaluation approaches related to capital structure, priority is given to the debt/equity ratio. The optimal capital structure minimizes the cost of capital and supports the financial flexibility of the organization.
It demonstrates the organization ability to fulfill its long-term obligations and maintain financial stability. A strong solvency position depends on a balanced capital structure and consistent profitability (Blessing & Sakouvogui, 2023).
Progressive solvency management solutions are applied by organizations across various sectors. General Electric

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uses AI-based tools to model solvency scenarios, improving its ability to adapt to market changes and manage financial risks. Nestlé employs blockchain to ensure transparency in its financial transactions, enhancing trust among stakeholders and improving solvency assessment.

Microsoft integrates ESG considerations into its solvency metrics, aligning its financial strategies with its sustainability commitments.

Liquidity is the ability to meet short-term obligations and maintain daily operations. Effective management of liquidity ensures operational continuity and supports solvency by preventing cash flow shortages.

The digital transformation in the economy continues to develop, and organizations are increasingly aware of the advantages offered by modern technologies, especially solutions derived from artificial intelligence.

This research indicates capital control issues in automobile manufacturing companies at the current stage and new methodological solutions for evaluation.

2. LITERATURE REVIEW

The management of capital structure in automobile manufacturing companies is the cornerstone of financial strategy. Given the capital-intensive nature of the industry, maintaining an optimal balance between solvency and liquidity is crucial for long-term success. Solvency ensures the company ability to meet its obligations, while liquidity ensures operational continuity, providing the necessary buffer for solvency. In recent years, new advanced solutions have emerged to address these issues more efficiently, emphasizing the use of cutting-edge technologies and innovative financial strategies.

Global economic crises and regional conflicts lead to market instability. Fluctuations in consumer demand and raw material prices create liquidity crises in automobile manufacturing companies, which, in turn, impact solvency ratios. Currently, stricter environmental, social, and governance (ESG) standards demand additional investments, which also affect both liquidity and solvency indicators.

Over the past two decades, artificial intelligence (AI) has experienced rapid development and is being used in a wide range of sectors and activities, including finance. In the meantime, a growing and heterogeneous strand of literature has explored the use of AI in finance (Bahoo et al., 2024).

Trading firms are looking to AI and machine learning to use data to improve their ability to sell to clients. For example, analyzing past trading behavior can help anticipate a client's next order. Trading generates large quantities of data, and this scale is typically required by machine learning tools to work effectively (Financial Stability Board, 2017).

By 2011 and 2012, driven by the vast increase in the computational power of modern computers, machine learning algorithms, especially deep learning algorithms, began to consistently win image, text, and speech recognition contests. Noticing this trend, major tech companies began to acquire deep learning start-ups and rapidly accelerate deep learning research (Dettmers, 2015).

The automobile industry, characterized by complex supply chains and rapidly changing consumer demands, faces significant challenges in managing working capital effectively. According to Rahman (2024) research explores the transformative role of Artificial Intelligence (AI) in optimizing working capital management processes within this sector. Through a comprehensive literature review, the study examines how AI technologies, including predictive analytics, machine learning, and automation, enhance demand forecasting, streamline accounts payable and receivable, and improve inventory management.

Wang et al. (2019) highlight that using AI-driven forecasting models can reduce inventory holding costs and minimize stock outs, essential for maintaining optimal working capital levels in the automobile industry. This capability allows firms to align production schedules with actual market demand, thereby improving cash flow and operational efficiency. AI technologies also play a crucial role in automating accounts payable and receivable processes. According to a study by Gupta et al., AI-driven automation can significantly reduce processing times for invoices and payments, leading to improved cash flow management (Gupta et al., 2020). By automating repetitive tasks, firms can reallocate resources to more strategic activities, thereby enhancing overall efficiency. Furthermore, AI can help identify discrepancies in financial transactions, reducing the risk of errors and fraud (Zhang & Zhao, 2018).

Solvency assessment is one of the crucial foundations for ensuring financial stability in organizations. It determines the organization's ability to meet long-term obligations and maintain operational continuity. Traditional solvency evaluations often rely on static financial ratios and historical data.

In their joint research, Eliasy and Przychodzen (2020) assessed whether artificial intelligence (AI) can be used in capital asset pricing models (CAPM) and whether the use of AI could lead to a more accurate estimation of expected returns.

To predict stock prices, data from January 2013 to 2019 were used. The traditional CAPM value was calculated using recurrent neural networks (RNN) with trained data. A deep learning network was developed using long short-term memory (LSTM) and dropout layers. After calculating the returns using both traditional and AI approaches, the researchers compared the two methods of CAPM calculation. The hypothesis was supported that the use of AI improves the accuracy of estimating the cost of equity by 60%, while the accuracy of estimating returns for predicting stock prices improves by 18%. The conclusion is that AI holds significant potential for replacing traditional asset pricing models in the near future.

In their joint research, Amoa-Gyarteng and Owusu-Adusei (2024) have examined the relationship between capital structure and solvency in listed manufacturing companies in Ghana. To achieve this, data from 13 publicly traded manufacturing companies for the years 2010–2019 was collected and analyzed. The sample size comprised 130 observations. In the framework of the study, the researchers used equity and debt ratios to assess the capital structure, while the interest coverage and current liquidity ratios were used to evaluate long-term and short-term solvency.
Using multivariate regression analysis, empirical evidence was provided to support the impact of equity and debt on both long-term and short-term solvency.

3. MATERIALS AND METHOD

We will present the proposed methodological solutions for forecasting capital structure in the context of AI and evaluating the impact of capital structure on solvency and liquidity according to the corresponding steps.
In the first step, the solvency of the organizations under study is assessed using the following ratios.

- Accounts Payable / Total Current Assets, S_1
- Long Term Debt/ Total Assets, S_2
- Net Cash Flow/ Total Liabilities, S_3
- Gross Profit/ Total Current Liabilities S_4

Based on the calculated values of these indicators, we determine

$$\textbf{SUMA solvency} = S_1+S_2+S_3+S_4 \quad (1)$$

In the secondt step, the liquidity of the organizations under study is assessed using the following ratios.

- Cash on Hand/ Total Current Liabilities, L_1
- Inventory/ Long Term Debt, L_2
- (Cash on Hand + Accounts Receivable) / Accounts Payable, L_3.

Based on the calculated values of these indicators, we determine

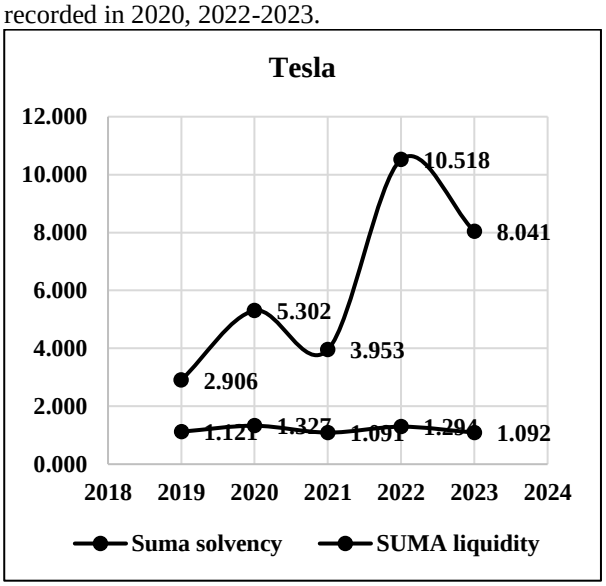
$$\textbf{SUMA liquidity} = L_1+L_2+L_3 \quad (2)$$

In the third step based on the model of capital structure applied by us, based on Artificial Intelligence and Kh. Baboyan's models for Y_1; Y2 pairs (Baboyan, 2022), the predicted values for the components of the current assets A1-A3, while leaving the structure of liabilities unchanged (Baboyan, 2024).
In the forth step, actual and artificial intelligence forecasting solutions are combined, based on which conclusions and recommendations derived from the analysis results will be presented.

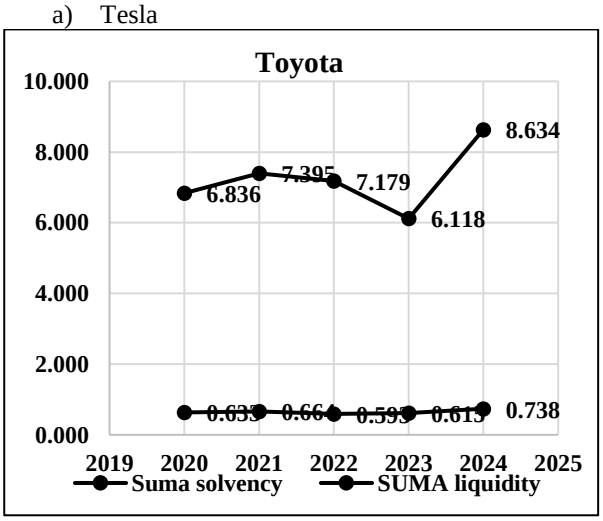
4. RESULTS

We will present the proposed methodological solutions for forecasting capital structure in the context of artificial intelligence and evaluating the impact of capital structure on solvency and liquidity according to the corresponding steps.
First step: We have calculated and presented the solvency ratios and SUMA solvency values of the studied automotive companies.
Based on the values of SUMA solvency and SUMA liquidity, we will graphically analyze the solvency and liquidity control issue in the studied three companies under the actual capital structure.
The total solvency assessment of Tesla in 2019, due to the pandemic crisis, exhibited fluctuating behavior. In 2022, compared to the previous year, an improvement was observed: Suma solvency = 1.294. Solvency control was stable for the S1 indicator. The loss of solvency for the S2 indicator in 2019-2023 is obvious. There was a significant loss of solvency for the S3 indicator in 2021. Growth trends are recorded for the S4 indicator, which is directly related to the high growth rate of gross profit.
The total solvency assessment in Toyota in the post-epidemic period has shown a stable growth behavior. The highest value was recorded in 2024: 0.738. Solvency control was stable for indicators S1, S2 and S4, and in 2024: a growth trend was recorded. The S3 indicator is problematic, the loss of solvency in 2022-2023 is especially evident.
The sum of the solvency assessment in the Mercedes-Benz Group AG organization also demonstrated a continuous fluctuating trend due to the pandemic crisis. In 2023, it improved: Suma solvency = 0.768. The solvency level for the S1 indicator gradually improved, reaching 0.114 in 2023. Solvency for the S2 indicator demonstrated stable behavior. Solvency for the S3 indicator suffered a significant loss, a decline is recorded. Growth trends are recorded for the S4 indicator, which continuously improved in the period from 2019 to 2023, reaching 0.768 in 2023.
Second step: Calculate and present the values of the liquidity ratios and SUMA liquidity of the studied automobile manufacturing companies.
The total liquidity assessment in Tesla in 2019-2023 gradually showed a tendency to improve (Tesla, 2025), reaching a maximum value in 2023 - 10.513. Due to the pandemic crisis, in 2022 this indicator showed a downward trend. In 2023, an improvement in the indicator was observed: Suma liquidity = 2.105. Liquidity in terms of L1 and L2 indicators gradually stabilized in the post-crisis stage. Liquidity in terms of L3 indicator showed a fluctuating nature, downward trends are recorded in 2021-2022.
The total liquidity assessment in Toyota in 2020-2024 gradually showed a tendency to improve (Tesla, 2025), taking a maximum value in 2024 - 8.634. Liquidity in terms of L1 and L2 indicators also gradually stabilized in the post-crisis period and became stable. Liquidity in terms of L3 indicator showed a fluctuating nature, downward trends are recorded in 2022-2023, but in 2024 there was some improvement in relation to the L3 indicator.
The total liquidity assessment in the Mercedes-Benz Group (2025) organization in 2019-2023 gradually

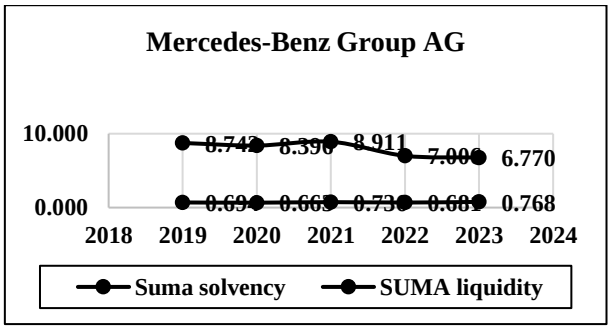
showed a downward trend (Mercedes-Benz Group, 2025), taking a maximum value in 2021 - 8.911. The liquidity trend in the L1 indicator has shown stable behavior. The liquidity in the L2 indicator has gradually stabilized in the post-crisis period and took a maximum value in 2023 - 0.428. The liquidity in the L3 indicator has shown a fluctuating nature, with downward trends recorded in 2020, 2022-2023.



a) Tesla



b) Toyota



c) Mercedes-Benz Group AG

Figure 1. The problem of solvency and liquidity control in Tesla, Toyota and Mercedes-Benz Group AG organizations

Source: Calculated and developed by the author

Conclusion: Based on the values of Suma solvency and Suma liquidity, let us graphically clarify the problem of solvency and liquidity control in the three organizations studied in the case of the actual capital structure. We have presented the graphical solutions in Figure 1.

Conclusion: The presented graphical solutions show that in all three organizations studied there is a problem of integral control of solvency and liquidity, differentiation of common zones, and harmonious management in the case of the actual capital structure.

These are the predicted values of the components A1-A3 for the studied companies.

Based on the predicted values, in the next sub-step, we calculated the SUMA solvency and SUMA liquidity for the studied companies, assuming the unchanged structure of liabilities. The results are presented in Table 2.

Table 1. Predicted values of A1-A3 for the studied organizations

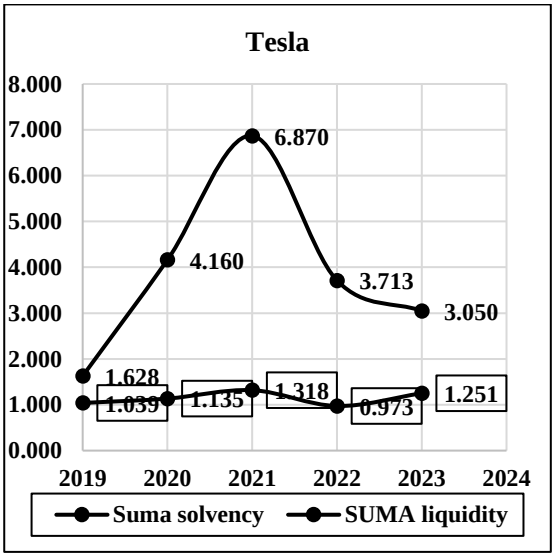
	Years	Y_1	Y_2	A_1	A_2	A_3
Tesla	2023	42.06	32.93	14.8	17.4	10.2
	2022	34.72	31.23	5.4	2.6	8.6
	2021	27.29	23.84	22.4	32.7	23.2
	2020	46.67	54.04	10.4	17.2	12.6
	2019	11.86	19.23	8.7	9.4	4.2
Toyota	2024	15.95	15.71	7.2	7.4	7.8
	2023	9.45	8.54	14.3	15.2	14.8
	2022	7.93	6.92	16.8	14.3	14.8
	2021	5.78	5.42	2.3	2.4	2.7
Mercedes-Benz Group AG	2023	20.76	23.27	11.3	10.8	9.4
	2022	14.07	16.72	16.7	16.4	14.3
	2021	14.82	20.85	10.9	11.7	13.8
	2020	13.41	24.83	3.2	3.9	3.7
	2019	17.21	35.01	11.2	10.7	9.4

Source Calculated and compiled by the author

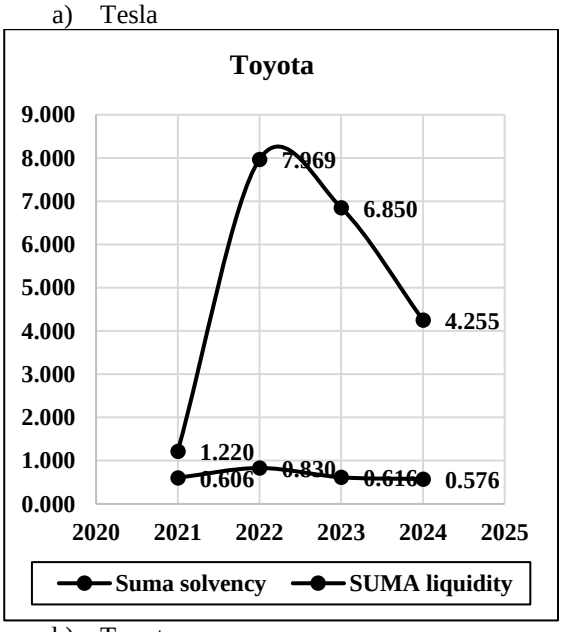
Table 2 The calculated values for SUMA solvency and SUMA liquidity for the studied companies, with predicted A1-A3 values.

	Years	SUMA solvency	SUMA liquidity
Tesla	2023	1.251	3.050
	2022	0.973	3.713
	2021	1.318	6.870
	2020	1.135	4.160
	2019	1.039	1.628
Toyota	2024	0.576	4.255
	2023	0.616	6.850
	2022	0.830	7.969
	2021	0.606	1.220
Mercedes-Benz Group AG	2023	0.705	5.256
	2022	0.720	7.942
	2021	0.856	8.080
	2020	0.579	2.270
	2019	0.696	5.900

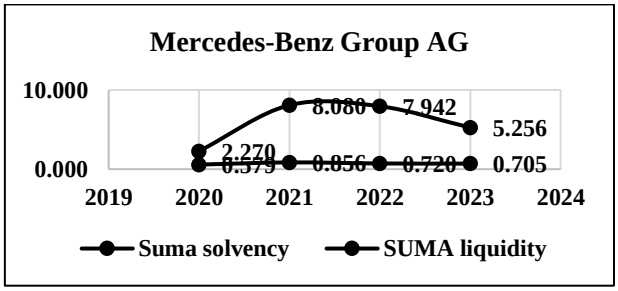
Source: Calculated and compiled by the author



a) Tesla



b) Toyota



c) Mercedes-Benz Group

Figure 2. The issue of solvency and liquidity control in Tesla, Toyota and Mercedes-Benz Group AG organizations.
Source: *Calculated and developed by the author*

From the data in Table 2, it is evident that with the stable structure of liabilities and the predicted values of the components A1-A3 of the current assets, SUMA solvency is considered effective for Tesla for 2021 (actual for 2020), Toyota for 2022 (actual for 2024), and Mercedes-Benz Group AG for 2021 (actual for 2023) (Figure 2).

Inference. The calculated SUMA solvency and SUMA liquidity, based on artificial intelligence model predictions, show that when the structure of liabilities remains unchanged and the focus is on improving financial management of components of current assets such as Inventory (A1), Receivables (A2), and Cash on Hand (A3), the proposed methodological solutions improve both solvency and liquidity levels.

The graphical solutions demonstrate that for the three studied organizations, with a stable behavior of liabilities and predicted structure of A1-A3, it is considered preferable to maintain high liquidity and the minimum level of solvency in the management process. From a financial management policy perspective, a high liquidity level in the studied organizations is linked with a certain level of caution, enabling continuous control over solvency.

5. CONCLUSION

The results of the evaluation are summarized as follows:

- The connection between solvency and liquidity in automobile manufacturing companies is a complex yet critical area of capital structure management. By applying advanced solutions such as AI-based forecasts, dynamic management of cash flows, and blockchain technology, organizations can achieve financial stability and operational high efficiency. These innovations not only increase organizational flexibility but also provide the possibility to achieve desirable results in the fast-developing automotive industry.
- Tesla has successfully applied blockchain technology in its supply chain financing, which has improved liquidity in its supplier network and reduced reliance on short-term debt.
- Toyota uses AI-based cash flow management tools to balance liquidity and long-term debt, ensuring smooth operations during market fluctuations.
- Volkswagen issued green bonds to finance its electric vehicle initiatives, linking solvency with sustainability goals while maintaining liquidity.

Based on the analysis, we recommend:

- When managing solvency and liquidity, special attention should be given to risk scenarios that pose significant threats to each organization. Specifically:
  - Regarding price risk, the organization needs to address urgent financing issues, which directly impact profitability.
  - Regarding compliance risk, if the organization fails to meet contractual obligations, it may face financial penalties or early repayment demands, leading to a solvency and liquidity crisis.
  - Regarding reputation risk, rumors about non-payments or liquidity losses can spread among partners, creating a snowball effect that could lead to freezing credit lines, tightening payment terms, and falling stock prices.
- By using dynamic systems for cash flow management, companies can optimize working capital. By analyzing payment cycles, inventory levels, and receivables, companies can ensure the efficient use of short-term resources and reduce dependence on external financing.
- Similarly, based on the forecasting solutions for component A2 – receivables, the studied automobile manufacturers can ensure high liquidity, which is essential for meeting long-term debt obligations in the future.

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