Important Aspects on the Impact of Artificial Intelligence on Corporate Financial Management in the Chemical Industry

Dariia Drozd[1] **Biruta Sloka**[2]

[1]PhD Student, University of Latvia, e-mail - drozddariia27@gmail.com, ORCID: 0009-0002-7794-8708

[2]Professor and Leading Researcher, University of Latvia, e-mail – Biruta.Sloka@lu.lv, ORCID: 0000-0003-2129-053X

Abstract: Artificial intelligence is on research agenda for very many researchers world-wide performed in all industries covering several aspects getting increased influence. The chemical industry operates in an exceptionally volatile financial environment characterized by unpredictable raw material costs, complex regulatory landscapes, and capital-intensive operations. These conditions create substantial challenges for financial planning, forecasting accuracy, and strategic decision-making which is underlined by many researchers. This study examines previous conducted research findings on how artificial intelligence (AI) applications can transform financial management practices in this sector, specifically addressing the industry's need for adaptive planning tools in uncertain market conditions. The investigation analyse existing AI implementations across chemical enterprises to identify patterns of successful adoption, measurable performance improvements, and persistent implementation barriers. This approach provides both theoretical contributions to financial technology literature and further developments of practical insights for industry practitioners navigating digital transformation.

Key Words: Artificial intelligence; decision-making; chemical industry; limiting aspects.

1. INTRODUCTION

The chemical industry operates in an exceptionally volatile financial environment characterized by unpredictable raw material costs, complex regulatory landscapes, and capital-intensive operations. These conditions create substantial challenges for financial planning, forecasting accuracy, and strategic decision-making (*McKinsey & Company, 2023; Deloitte, 2023*). This study examines previous conducted research findings on how artificial intelligence (AI) applications can transform financial management practices in this sector, specifically addressing the industry's need for adaptive planning tools in uncertain market conditions.

The investigation analyse existing AI implementations across chemical enterprises to identify patterns of successful adoption, measurable performance improvements, and persistent implementation barriers. This approach provides both theoretical contributions to financial technology literature and further developments of practical insights for industry practitioners navigating digital transformation.

2. MATERIAL AND METHODS

Method of theoretical analysis of previous conducted research results, in future application of statistical and analytical methods, comparison method, description method, on basis of theoretical studies will be developed basis for reasonable semi-structured interview method and future application of mixed methods of research.

Artificial Intelligence (AI) is increasingly recognized as a transformative force in corporate financial management, particularly in capital-intensive and highly regulated sectors such as the chemical industry. The literature identifies three major themes: (1) the economic function of AI as a predictive tool, (2) its integration into operational and financial processes, and (3) the organizational and strategic challenges of implementation. Researchers (Kokkinos, et al, 2025) have investigated possibilities in application of different theoretical models on AI in chemical industry. Researchers (Malik, et al, 2024) have discussed on modern application of AI in modern industries including chemical industry. Researchers (Padilla-Esquivel, et al, 2925) have covered process simulation and application of artificial intelligence and mashine learning to find the optimal results in decision making. Researchers (Ma, et al, 2025) have analysed different aspects of the integration of artificial intelligence and high-throughput experiments with findings and discussions on innovative driving force in catalyst design which has big importance in chemical industry. Researchers (Dian, et al, 2025) have analysed what steps have to be taken in achieving the synergy of pollution and carbon emission reductions with important question of their research: can artificial intelligence applications work and what problems it can arise in the respective applications. Researchers (Janga, et

al, 2023) have investigated and reviewed several aspects on integrating artificial intelligence, machine learning, and deep learning approaches into remediation of contaminated sites with development of practical possible applications. Practical research results can be applied as it is recommended by researchers (Shiammala, et al, 2023) for chemical and pharmaceutical industries. Developments of AI for practical applications in decision making in chemical industry are discussed (Mariani, et al, 2024) and practical suggestions are developed by researchers. Researchers (Zarei, et al, 2023) have investigated challenges and problems in AI applications. Researchers (Moradi & Dass, 2022) research results were devoted to applications of artificial intelligence in B2B marketing with special attention to challenges and future directions for chemical industry. Different aspects of opportunities and challenges of artificial intelligence for green manufacturing in the process industry have been analysed already rather in history (Mao, et al, 2019). Several important aspects for energetics systems and artificial intelligence with applications of industry 4.0 were on research agenda for researchers (Ahmad, et al, 2022) with innovative practical findings.

Agrawal, Gans, and Goldfarb (2018) have conceptualize AI as a "prediction machine" that improves forecasting accuracy and reduces uncertainty—an essential function in volatile environments. This view is expanded by Brynjolfsson and McAfee (2017), who argued that the value of AI increases when combined with digital platforms and crowdsourced data, enabling scalable and adaptive business responses.

The chemical industry, characterized by regulatory constraints and high fixed costs, increasingly leverages AI to optimize asset utilization and reduce operational inefficiencies. According to McKinsey & Company (2023), AI is applied in areas such as predictive maintenance, supply chain optimization, and inventory planning. Bughin et al. (2017) have supported this by reporting EBITDA improvements of 20–30% among early AI adopters in heavy industries.

From a practical standpoint, Deloitte (2023) have highlighted the role of generative AI in streamlining financial functions through automation of regulatory reporting and data synthesis. Gartner (2023) forecasts that autonomous AI systems will soon dominate financial planning and analysis (FP&A), introducing self-correcting forecasts, real-time risk simulations, and automated compliance monitoring. Davenport (2018) distinguishes between two phases of adoption: initial task automation (AI 1.0) and more strategic applications (AI 2.0), such as dynamic pricing and market-responsive financial planning.

However, technological capabilities alone are insufficient. Iansiti and Lakhani (2020) emphasize the need to develop “algorithmic networks”—data-integrated ecosystems that amplify AI’s value through continuous learning. Governance also plays a central role; Kaplan and Haenlein (2019) stressed the necessity of human oversight to prevent algorithmic bias and ensure ethical AI deployment. Marr (2019) provides empirical evidence of effective AI adoption, illustrating how firms like BASF succeeded by aligning AI tools with cross-functional workflows and financial models.

In summary, the literature consistently demonstrates AI’s potential to improve financial decision-making in the chemical industry through forecasting, automation, and operational optimization. However, as noted by McKinsey & Company (2023) and Deloitte (2023), realizing this potential requires addressing challenges such as fragmented data systems, cultural resistance, and regulatory complexity. An integrated approach that combines technological innovation, strategic leadership, and cross-functional coordination is essential for sustainable implementation.

3. RESULTS AND DISCUSSION

Theoretical studies are reason to develop a comprehensive theoretical and practical understanding of the impact of artificial intelligence on corporate financial management in the chemical industry and identify the main driving forces and barriers to its effective implementation in an unstable and highly regulated environment.

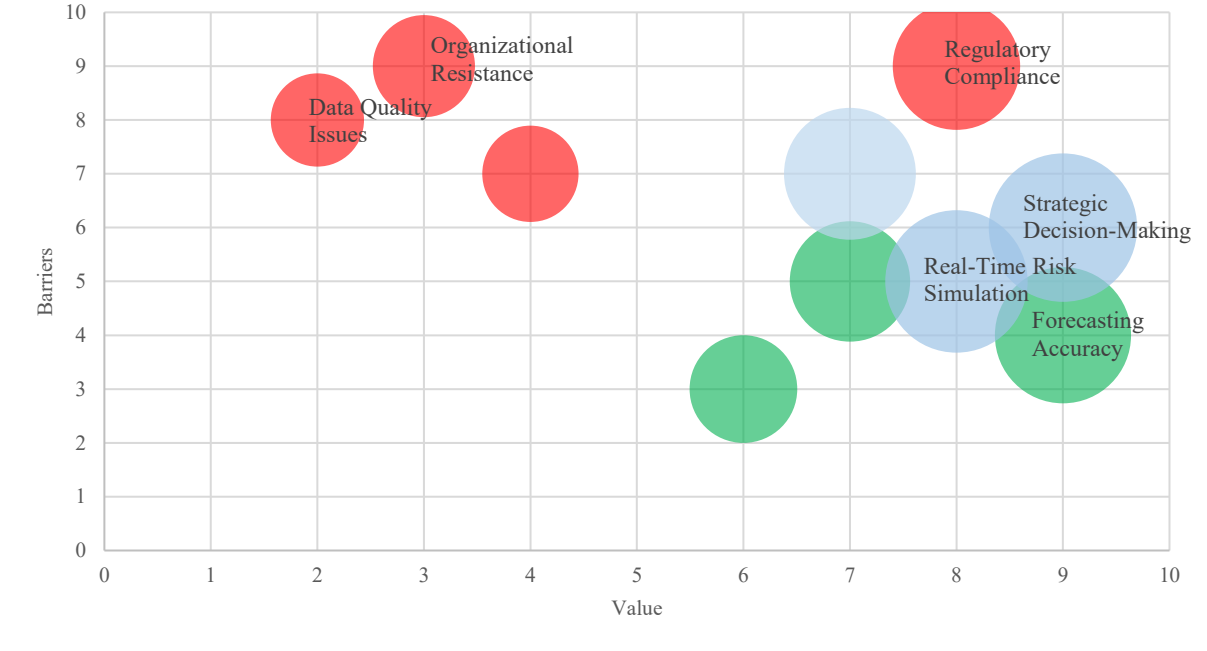
Objectives for further studies:

1. To analyse the development of current state and dynamics of artificial intelligence adoption in corporate financial management within the chemical industry.
2. To identify and evaluate the sector-specific challenges and risk factors affecting the implementation and performance of AI-based financial solutions.
3. To investigate the gap between the theoretical potential of AI technologies and their realised impact on financial decision-making and performance.
4. To develop a structured framework for assessing the effectiveness of AI integration and to formulate strategic recommendations aligned with regulatory and ethical standards.

Hypotheses for further studies

1. The introduction of artificial intelligence into corporate finance management significantly improves the accuracy of financial forecasting and planning at chemical companies.
2. The real impact of AI on financial performance in the chemical industry is limited by internal and external barriers, including poor data quality, complex regulatory requirements, and organizational resistance to change.
3. A structured and adaptive approach to AI integration that takes into account financial performance, compliance standards, and ethical principles increases the effectiveness and sustainability of AI-based financial management practices.

Figure 1. Strategic Value vs. Implementation Barriers of Artificial Intelligence Applications in the Chemical Industry



Source: Dariia Drozd construction based on scientific publications studies

The conceptual bubble diagram developed for this study provides a visual analysis of the relationship between the strategic value of AI, the barriers to its implementation, and its potential impact across ten key applications in the financial management of the chemical industry. This framework is based entirely on an analysis of theoretical literature rather than empirical data. It positions each use case along two axes: strategic value (X-axis) and implementation barriers (Y-axis). Bubble size represents projected impact.

Analysis reveals three high-priority AI applications: Strategic Decision-Making (impact: 38), Forecasting Accuracy (impact: 32) and Real-Time Risk Simulation (impact: 35). These domains combine substantial strategic value with moderate barriers and directly address the sector's need for adaptive planning in volatile markets (Agrawal et al., 2018; Brynjolfsson & McAfee, 2017; Marr, 2019). In contrast, regulatory compliance and organisational resistance emerge as paradoxically challenging areas — despite their high strategic value (8 and 9, respectively), extreme implementation barriers (both Y = 9) severely limit their potential.

The diagram also identifies foundational challenges: Data quality issues (barrier: 8) and the AI talent gap (barrier: 7) represent systemic constraints that existing research confirms as critical adoption bottlenecks (Zarei et al., 2023; Moradi & Dass, 2022). More accessible opportunities appear in the automation of reporting and predictive maintenance, where moderate complexity meets operational value. This suggests that these areas offer practical starting points for AI integration (Mariani et al., 2024; Janga et al., 2023).

This visualisation provides chemical firms with a strategic roadmap for AI adoption, balancing ambition with feasibility. While theoretically sound, the model requires empirical validation through

future case studies and expert evaluations to refine its practical applications.

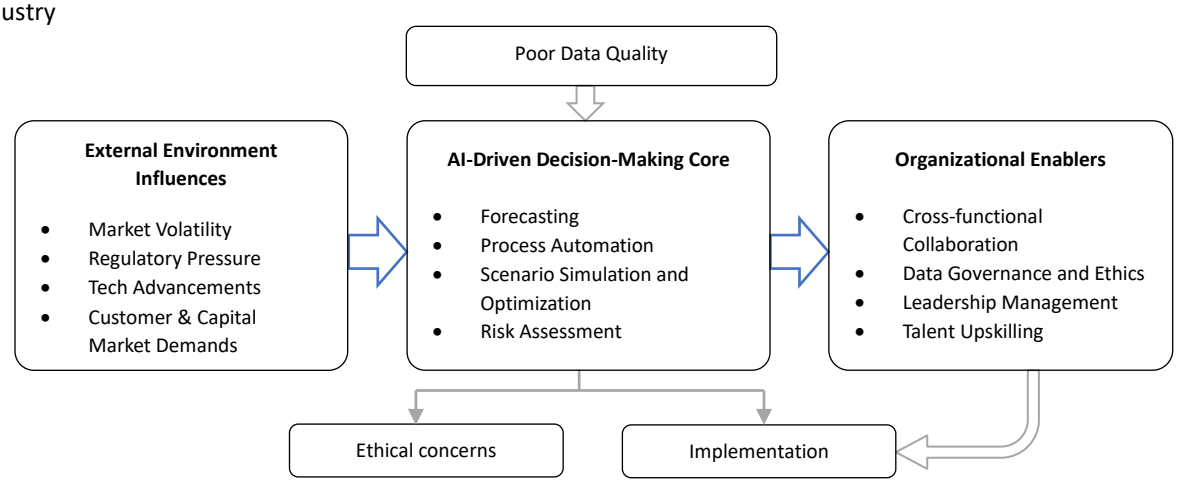
Further steps for reasonable deeper further research will include:

1. Application of qualitative case study design with elements of comparative analysis on the example of an international chemical company. This allows for an in-depth analysis of the integration of artificial intelligence into financial management in a real-world organizational context.
2. The key participants is planned to include senior financial management (CFOs, CFOs), financial operations teams (FP&A, controllers, treasury), and digital transformation managers directly involved in AI projects.
3. Further is planned that the data will be collected through semi-structured interviews, analysis of internal documents, as well as surveys and comparative analysis of other companies' experience, where possible. The methodology also includes theoretical, descriptive and statistical analysis.
4. For further deeper analysis the mixed-methods analysis will contribute to the development of a practical framework for assessing the effectiveness, adaptability, and appropriateness of AI applications in corporate finance in the chemical industry.
5. 1. Possible further research participants – for expert surveys:

1. Senior Financial Leadership (CFO and finance directors)
2. Financial Operations Teams (FP&A managers, controllers, and treasury specialists)
3. Digital Transformation Managers.

The study presents a conceptual framework for AI integration in financial decision-making within the chemical industry, as illustrated in Figure 1. This framework emerged from systematic analysis of academic literature and industry practices, addressing the intersection of technological innovation and sustainable service development in capital-intensive sectors – see Figure 2.

Figure 2. Conceptual framework for artificial intellect integration into financial decision-making in the chemical industry



Source: Dariia Drozd construction based on scientific publications studies

Market volatility and regulatory complexity have emerged as primary external drivers accelerating AI adoption within the chemical industry, particularly in the context of enhancing financial forecasting and ensuring regulatory compliance. The developed analytical framework demonstrates how advances in predictive analytics intersect with evolving ESG disclosure requirements, generating novel pathways for sustainable service innovation in corporate financial management.

Within core AI applications, the framework identifies substantial improvements in forecasting accuracy—especially regarding raw material costs and demand fluctuations—while simultaneously revealing persistent integration challenges during workflow automation. Risk assessment tools based on AI exhibit promising potential, though concerns around algorithmic transparency and ethical governance remain unresolved, particularly in relation to sustainability objectives.

Organizational enablers play a pivotal role in successful AI implementation. Cross-functional collaboration, executive leadership commitment, and high-quality data governance systems emerge as critical differentiators. Additionally, workforce adaptation and digital capability-building mediate the relationship between technological potential and operational realization.

The study introduces the concept of the AI Adoption Paradox, highlighting a misalignment between the rapid advancement of AI technologies and the slower pace of organizational readiness—especially in ESG-sensitive applications such as emissions-aware budgeting. This paradox underscores the necessity of aligning innovation with ethical, regulatory, and sustainability considerations.

The framework contributes to both theory and practice by offering a structured approach for aligning AI-enabled innovation with sustainable development goals. It provides chemical firms with actionable insights to manage the interplay between digital transformation, financial resilience, and responsible service innovation.

4. CONCLUSIONS

Artificial intelligence is taking place into account in all fields including chemical industry management especially in reasonable decision making for successful management of the industry.

The further research is expected to deliver theoretical and practical outcomes. It will provide an in-depth understanding of the current use of artificial intelligence (AI) in corporate financial management within the chemical industry, identifying effective practices and persistent implementation challenges. It will also reveal key internal and external barriers to the effectiveness of AI, such as limitations in data quality, regulatory complexity and organisational resistance to change.

Based on empirical data and expert input, the further research results will be a reasonable foundation to develop a structured framework for evaluating AI applications in finance. This framework will combine traditional financial indicators with adaptability metrics and qualitative criteria to support practical decision-making by financial and digital transformation leaders.

Additionally, the further study will formulate strategic recommendations for the ethical and efficient integration of AI into financial processes. The findings are expected to inform ongoing discussions on digital transformation, responsible innovation and sustainable financial planning in high-risk, ESG-sensitive sectors, such as the chemical industry.

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