Contemporary challenges of AI tools in the context of business financial analysis

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* *1. Introduction*

Financial analysis plays a key role in assessing the financial health and performance of companies through the systematic evaluation of financial statements and other relevant information. The current understanding of financial analysis dates back to ancient times when entrepreneurs and traders used primitive methods to analyse financial transactions and assets. The use of more advanced and systematic methods of financial analysis can only be discussed from the 19th century onwards, when entrepreneurs were forced to seek and develop more sophisticated financial management tools in the context of the development of organisational structures, particularly in industry. Graham and Dodd (1934) are considered to be the pioneers in the field of financial analysis, whose work laid the foundations for the modern approach to investment analysis, emphasising the nature and importance of financial analysis as a tool for assessing the value of shares. This landmark move made financial analysis an essential part of investment decision-making and portfolio management.

As a continuation and followers developing the field of financial analysis can be considered, for example, Markowitz (1952) with the publication of modern portfolio theory, which laid the foundations of the theory of portfolio diversification and optimization of risk and return. Beaver (1966) further developed the tools of financial analysis and auditing by focusing on the nature of financial ratio analysis and the identification of financial fraud. Beaver analyzes various financial ratios and their ability to predict future problems and corporate failures. His work is considered one of the seminal studies in the field of financial analysis and risk identification. Not the last but very important was Rappaport (1986) who introduced the concept of Economic Value Added (EVA) and thus reinforced the emphasis on shareholder value creation as a key objective of businesses.

Financial analysis tools have gradually evolved to the current form of financial management of business units using enterprise-wide information systems. The evolution of financial analysis is a continuous and dynamic process that responds to changes in the corporate environment, regulation and technological advances. In the past, financial analysis was primarily associated with traditional methods such as horizontal and vertical analysis of financial statements. However, with the advent of

the digital era and the rise of data richness, there is a shift towards the use of advanced analytical tools and methods. This trend is driven by the need to manage increasingly complex business environments and rapidly changing markets where traditional methods may be inadequate.

Today, financial analysis is becoming an increasingly interdisciplinary field, combining knowledge from economics, statistics, computer science and other disciplines. With the advent of advanced technologies such as artificial intelligence (AI) and machine learning, new opportunities are opening up in the areas of financial performance prediction, risk detection and trend identification. These developments bring challenges in data processing, ethics and interpretation of results, but also offer huge potential for improving the accuracy and efficiency of financial analysis.

The most common traditional financial analysis tools include horizontal and vertical analysis of financial statements. Horizontal analysis tracks changes over time in a single financial indicator such as sales, earnings or assets (Anthony and Govindarajan, 2007). Horizontal analysis allows the identification of trend changes in a company's performance and provides information about its growth or decline over a time series. In contrast, vertical analysis compares different items within a financial period, often in relation to total sales or assets (Brigham and Huston, 2012). Vertical analysis allows for a comparison of the relative importance of different components of the financial statements and the identification of their structural relationships. Another traditional tool is ratio analysis, using various financial ratios to assess the performance and financial health of a business (Brealey, Myers and Allen, 2016). The most commonly used ratios are, for example, the accounts receivable turnover ratio, the debt ratio, or the profit to sales ratio (Gitman and Zutter, 2015).

The above indicators provide the user of the analysis with important information on the liquidity, solvency and profitability of the company, while allowing comparison of its performance with other companies in the sector or with historical data. Traditional financial analysis tools provide a basic framework for understanding financial statements and assessing a company's performance, although modern methods such as Cash Flow at Risk (CFaR) or Economic Value Added (EVA) bring an additional dimension and complexity to the analysis process.

Rapid technological advances in artificial intelligence (AI), particularly in recent years, are providing businesses with new opportunities and tools for financial analysis and decision-making. With the development of sophisticated algorithms and machine learning techniques, there is scope for the use of AI in various areas of the corporate world. One of the key areas where AI can bring significant benefits is in business financial analysis.

This article examines the contemporary challenges posed by the introduction of artificial intelligence tools into business financial analysis processes. Today, businesses are increasingly turning to AI and machine learning to improve their ability to understand and predict financial performance, identify risks and make informed decisions.

Analysis of contemporary trends in the use of AI in business financial analysis can provide valuable insights not only for the professional community, but also for managers and entrepreneurs seeking innovative approaches to improve their financial processes and strategies.

2. Methods

The present article is based on the context of the implementation of a broader research framework. The authors' research focuses on the issue of institutional control in the context of foreign and domestic ownership with implications for financial indicators of business entities operating on the domestic market according to the CZ-NACE sectoral classification and the search for the basis for the preparation of extensive empirical research aimed at improving the performance of Czech business entities within individual sectors (Cenek, 2023, →

pp. 28–48). The involvement of artificial intelligence as an analytical tool for exploring the possible effects of ownership structure on the performance of business activities and at the same time as a strategic tool in decision-making on the management of business activities in the future seems to the authors to be an effective link to the future and is in line with the methodological background of the research framework under consideration (Cenek, 2023, pp. 7–19), including providing the potential for addressing sub-methodological challenges (Cenek, 2022, pp. 14–18). The findings are also related in their performance relevance to a series of papers dealing with the solution of strategic cases (Cenek, Holík, and Palatová, 2022, pp. 38–46), (Cenek, 2023, pp. 17–18). For the set of reasons presented, the authors decided to conduct an analysis of contemporary empirical knowledge in the area of linking artificial intelligence and financial analysis.

The present article aims to map the potential of using AI in financial analysis from the perspective of contemporary scientific knowledge published in reputable journals until January 12, 2024. The authors used a structured systematic review of published articles and a systematic literature search of the most relevant ones.

The research was conducted in three phases. In the first phase, the ProQuest and Google Scholar databases were used to map the manifestation of scholarly articles combining financial analysis and artificial intelligence. The aim of the analyses was to determine whether there is an increasing number of scholarly articles linking financial analysis and artificial intelligence as a supporting theme of the authors' scholarly focus. In the selected databases, the authors investigated the number of articles in the period 2017–2024 (note: until 12/01/2024) that deal with the topics of (i) financial analysis, (ii) artificial intelligence, (iii) artificial intelligence and accounting, (iv), artificial intelligence and finance, and (v) artificial intelligence and financial analysis. A progression was made from the more general topics (financial analysis, artificial intelligence) to their interconnection.

In the second phase, the authors focused on an in-depth analysis of the abstracts found in 55 journal articles in the Journal of Risk and Financial Management for the study period 2017–2024, found by combining the keywords (v) artificial intelligence and financial analysis. The periodical was selected based on the results found for the most frequently represented periodicals in order of the top 3 in terms of frequency. The periodical and the keyword combination were chosen by the authors based on their scientific focus and preparation for a future research project.

In the third phase, the authors analyzed 14 full articles selected in the second phase based on the relevance of the primary thematic focus on the use of artificial intelligence in financial analysis. The authors discuss the findings in Chapter 4.

The limitations of the thesis lie in the analysis of scientific articles as of a specific date, i.e. 12 January 2024, in the context of the increasing tendency of published scientific articles on the topic of artificial intelligence, although this is a problem that cannot be eliminated due to the nature of space-time and the current disposition of data as of the date of the article.

3. Results

After a thorough methodological preparation, an analysis of the ProQuest and Scholar Google databases was carried out on 12 January 2024.

The ProQuest database offers a wide range of scholarly publications, academic journals, newspaper articles, books and other information resources, making it a valuable tool for research in many fields. Among the main advantages and benefits of using the ProQuest database is the extensive content that includes access to a wide range of resources, including academic journals, articles, books, reports, dissertations, and more. In doing so, the ProQuest database contains high quality and validated information from peer-reviewed academic sources, providing reliable resources for scholarly research and study. The ProQuest plat-

Table 1 » *Number of articles — ProQuest*

Search term	2024	2023	2022	2021	2020	2019	2018	2017
Financial Analysis	55	2 053	2 331	2 107	1 808	1 468	1 341	1 289
Artificial Intelligence	3 088	80 619	77 086	55 310	36 000	27 405	19 456	13 245
Artificial Intelligence Accounting	350	10 163	8 870	5 760	3 642	2 743	1 847	1 290
Artificial Intelligence Finance	270	7 609	7 240	5 061	3 402	2 348	1 599	1 115
Artificial Intelligence Financial analysis	15	369	354	204	174	110	87	63

Source: ProQuest, c2024

Table 2 » *Number of articles — Google Scholar*

Search term	2024	2023	2022	2021	2020	2019	2018	2017
Financial Analysis	44	1 290	907	899	716	549	484	486
Artificial Intelligence	2 010	44 200	43 800	42 500	24 900	13 100	8 770	5 560
Artificial Intelligence Accounting	525	11700	8840	6950	4690	3200	2320	1730
Artificial Intelligence Finance	315	9380	7490	5670	4210	2920	2140	1640
Artificial Intelligence Financial analysis	16	527	299	224	142	86	80	71

Source: Google Ireland Limited, c2024

form also offers advanced search tools that allow users to efficiently filter and search information according to their needs and interests. The number of articles for the search terms are shown in Table 1.

The interest in AI itself is clear — while the number of published articles dealing with financial analysis increased by 60% in the period under review, the number of articles dealing with AI increased sixfold (the connection between AI and accounting increased almost eightfold).

Google Scholar was chosen as the second database. Google Scholar indexes millions of scholarly documents from a variety of sources, including journals, books, preprints, and websites. Google Scholar offers advanced search options to help narrow results and find relevant materials. An essential feature of Google Scholar is that it is a free tool, which means that users do not have to pay to access the information. This is particularly useful for students, independent researchers and those who do not have access to paid databases. The Google Scholar database followed the same approach as ProQuest.

On the basis of the created set of quantitatively assessed articles, the criteria defined in the methodology for the selection of articles worthy of qualitative assessment were applied. For a more detailed analysis of the published articles, the search was conducted for scholarly articles by year and in English only. Only articles published in Scholarly Journals were analysed. The results of the search for articles combining both "Artificial Intelligence" and "Financial analysis" can be seen in Table 3. If the above numbers of articles are added to the total number of articles (see Table 1), it can be said that the three most represented journals contain between 12 and 20 percent of all articles published in a given year.

Based on the stated purpose, the authors decided to conduct a detailed analysis in the Journal of Risk and Financial Management articles. A total of 55 articles were found for the period from →

Table 3 » *Number of "Artificial Intelligence Financial analysis" articles in journal order over 5 years (2019–2023)*

Year	Source:	Number of articles
2023	Sustainability	31
	Journal of Risk and Financial Management	**20**
	Energies	12
2022	Computational Intelligence and Neuroscience	29
	Sustainability	22
	Journal of Risk and Financial Management	**14**
2021	Journal of Physics: Conference series	10
	Journal of Risk and Financial Management	**10**
	Sustainability	9
2020	Sustainability	16
	Journal of Physics: Conference series	12
	Journal of Risk and Financial Management	**6**
2019	Energies	6
	IOP Conference Series materials Science and Engineering	4
	Journal of Risk and Financial Management	**3**

Source: ProQuest, c2024

01/01/2017 to 12/01/2024 based on a search for the key phrases "Artificial Intelligence" and "Financial analysis". To compare the frequency of articles in journals in the five-year period 2019–2023, there are only 2 fewer articles, i.e. 53 (see Table 3).

An in-depth analysis of the abstracts of these articles revealed that 25 articles are completely unrelated to the issue under study, for example, Malik (2023) discusses the addition of relevant images to teaching materials to support meaningful learning based on content analysis or MD et al. (2022) discuss the impact of the conflict between Russia and Ukraine on the price of major commodity markets (oil, gas, platinum, gold and silver) and their dynamic interconnectedness. The next group consists of 16 papers in which the authors deal with the use of AI in financial analysis only marginally. When, for example, Li et al. (2023) discuss the impact of sustainability disclosures in the context of reducing the financial cost of equity for firms. Ibrahim et al. (2022) focus on the use of robo-advisors from the perspective of their high efficiency in the context of entities' aversion to their use. The context of green and sustainable finance, CSR and human capital is explored by Popescu and Popescu (2019), who come up with the idea of a strong relationship between CSR, intellectual capital and performance in the Romanian business environment.

The authors have identified 14 scientific articles that can significantly enrich the knowledge in the

field of their scientific focus. Specifically, the individual authors address the following areas in their articles:

Adámiková and Čorejová (2021) discuss creative accounting in the context of the use of methods for determining the value of business entities and conclude that accounting interventions can have a significant impact on the resulting value of a business entity. In the context of the findings, they propose a creative accounting coefficient to adjust the resulting value of the business entity.

Čámská and Klečka (2020) examined business entities within the industries of Metal Products Manufacturing, Engineering and Construction from the perspective of using forecasting models to determine the financial position of these business entities at selected stages of the business cycle. The results confirm the expectation under the assumption that the final score with higher values describes a better financial position of the company during the expansion phase for both healthy and insolvent business entities.

Horák, Vrbka and Šuleř (2020) presented a procedure for the development and validation of a model for the prediction of potential bankruptcy of business entities using selected suitable classification methods and artificial neural networks. They used data from the balance sheets and profit and loss statements of industrial business entities in the Czech Republic to validate the 6 models developed.

Chalissery et al. (2022) conducted a bibliometric analysis to identify the key intellectual underpinnings and evolutions of asymmetric GARCH volatility models aimed at forecasting asymmetry in financial time series. The analysis results in recommendations for future research on the subject.

Chopra and Sharma (2021) discuss the external fluctuations, non-linearity and shifts in internal and external environmental variables of stock markets in the context of using artificial intelligence (AI) as a tool to better identify them. They conclude that AI techniques can be successfully used to study and analyze stock market activity.

Jofre-Campuzano and Coenders (2022) examine financial profiles related to non-financial variables, where only one of the profiles examined identifies gasoline retail companies in Spain as being in financial distress, with low turnover, low return on assets, high debt and low liquidity. In particular, they point out that accounting data showing low values have a disproportionate impact on their classification in the statistical analysis of financial ratios.

Kaddumi et al. (2023) examine the impact of financial technology adoption on the financial performance of commercial banks in the Amman Stock Exchange from the perspective of three dimensions, namely financial inclusion, alternative payment methods and automation. They conclude that all the selected dimensions were found to have a positive significant impact on the financial performance indicators of Jordanian commercial banks and hence banks should increasingly invest in developing financial technology tools and applications.

Kalinová (2021) focused on cluster analysis of business entities in the transport sector in the Czech Republic using artificial neural networks. Based on the results, she summarizes that the selected transport sector is mainly influenced by the two largest companies. These companies can significantly influence the whole transport sector in the Czech Republic through their activities.

Korol (2019) examines the determination of bankruptcy risk for business entities from the perspective of investors and decision makers. He builds 4 bankruptcy prediction models using fuzzy sets, recurrent and multilayer artificial neural network, and decision trees to validate changes in indicators as relevant predictors of a business entity's impending financial crisis.

Liu, Liu and Sathye (2021) discuss advanced statistical and computational techniques for examining external and internal bank risks and predicting bank failures. They conclude that machine learning-based models are of greater importance due to their significant predictive ability. In con- →

trast, the ability of statistical techniques to predict bank failures is severely limited. The findings provide recommendations for future research.

Nguyen Thi et al. (2024) conducted a survey to investigate the impact of technological readiness on the adoption of artificial intelligence by accountants and auditors in companies in Vietnam. In doing so, the critical factors were perceived usefulness and perceived ease of use. They concluded that technological readiness positively influences the adoption of AI, supporting the mediating relationship of perceived ease of use and ease of use.

Nurul Izzaty et al. (2022) conducted a study among external auditors in Malaysia to assess factors such as personality traits, competencies and digital technology skills that may affect auditors' assessment of fraud in the audits they conduct. They concluded that an effective fraud risk assessment technique among external auditors requires digital technology skills.

Pisula (2020) conducted research on 1,739 Polish business entities with the aim of developing a scoring model for early bankruptcy prediction that could be applied in practice to assess the risk of bankruptcy of business entities in different sectors. The proposed model can also be used to assess credit risk for corporate borrowers.

Shinkevich, Kudryavtseva and Samarina (2023) examined trends in the development of the financial sector in terms of the use of digital technologies in this sector. The authors sought to identify the key factors for improving the financial sector ecosystem of the Russian economy towards achieving sustainable growth. They identified the weakness in the development of the ecosystem caused by the lack of use of complex digital solutions in the management of financial flows.

Of those examined, some studies focus on specific AI applications such as bankruptcy prediction (Horák, Vrbka and Šuleř, 2020; Pisula, 2020), fraud detection (Nurul Izzaty et al., 2022) or credit risk assessment (Pisula, 2020). These studies demonstrate that AI models achieve high accuracy and represent a valuable tool for financial professionals. Other authors address the broader implications of AI on financial analysis, such as the impact on the role of auditors (Nguyen Thi et al., 2024) or the development of financial technology (Kaddumi et al., 2023). The analysed studies point out that AI will lead to fundamental changes in the entire financial sector.

In summary, the reviewed publications provide a solid foundation for understanding the potential use of AI in financial analysis. However, given the rapid pace of development in this area, the potential limitations and challenges that AI implementation brings must also be considered. The authors of the article consider it necessary to pay more attention to other areas where AI can bring benefits, such as automation of financial processes, personalization of financial services or real-time decision support. Also, data quality and availability are key to the successful deployment of AI. The studies analysed often do not address the issue of data collection, processing and sharing, which is a significant barrier in practice. As the use of AI in finance grows, ethical issues related to algorithm transparency, privacy or potential discrimination become increasingly important. The regulatory framework for the use of AI in finance is also still evolving. There is a need to ensure that regulation encourages innovation while protecting consumers and promoting financial stability.

4. Conclusion

The contemporary business environment has been significantly influenced by technological developments focused on the creation of artificial intelligence and its practical use in various areas, not only in business activities. As part of their research activities, the authors are preparing research focused on the impact of institutional control in the comparison between domestic and foreign ownership with a possible impact on the economic activity of business entities. Artificial intelligence appears to be a possible tool for use in the intended

The results of the authors' analysis open the door to the practical use of AI in financial analysis, which brings a number of concrete benefits for businesses and investors. The primary benefit is that AI enables more accurate prediction of financial performance, which is crucial for informed investment decisions and strategic, tactical and operational planning. With AI's ability to analyze large volumes of data and identify hidden patterns, businesses can better identify potential risks and opportunities. For the risk management space, AI offers early warning tools for financial issues, such as bankruptcy prediction, enabling business management to implement early actions.

large-scale analysis of business entities in the domestic market, possibly for use in the markets of the European Union or with an overlap to the global market. Similarly, it is also necessary to consider the application side of the potentially achieved research results and the design of a methodological procedure or model for business entities in order to increase their economic value. Again, the creation of a learning machine in the form of artificial intelligence, which would become an invaluable management tool for the management of business entities, especially at the strategic, but also at the tactical or operational level, can be considered almost a necessity today.

Using the methods of a structured systematic review of published articles and a systematic literature search of the most relevant ones, the authors conducted a three-stage research in the ProQuest (2024) and Google Scholar (2024) databases. Based on the evaluation of the analyses performed, they concluded that, especially between 2021 and 2023, there was a significant year-on-year increase in published articles dealing even marginally with artificial intelligence. The values found for the year 2024 (i.e. until 12 January 2024) indicate an even stronger increase in the current publication trend. From the perspective of the search of 55 articles published in the Journal of Risk and Financial Management in the reporting period from 01. 01. 2017 to 12. 01. 2024, based on the search for the key connections Artificial Intelligence and Financial analysis, it was found that 25 articles are completely unrelated to the issue under study, 16 articles marginally dealing with the issue of the use of AI and 14 scientific articles with the potential to enrich knowledge in the field of their authors' scientific focus.

In the context of the research focus of the forthcoming research, the authors find it beneficial to link the published findings of Čámská and Klečka (2020) in particular in terms of the use of prediction models used to determine the financial position of business entities under domestic and foreign institutional control. In order to verify the differences and stability comparisons between business entities under domestic and foreign control, the authors consider incorporating bankruptcy prediction models following the published procedure by Horák, Vrbka and Šuleř (2020). A suitable interplay of bankruptcy prediction issues can be seen in the contribution of Pisula (2020) and his proposal of a scoring model for early bankruptcy prediction. Since business entities are created as complex systems, other factors that may affect the resulting value of the entity's economic activity must also be addressed in the research design. At a minimum, a reflection on the perspectives of investors and risk-determining decision makers, provided by Korol (2019), adds another dimension to the potential differences between activ- →

ities under domestic and foreign institutional control of entities.

From the perspective of the considered use of AI in upcoming research, published findings in relation to the use of AI for better identification (Chopra and Sharma, 2021) or for the use of the research itself (Kalinova, 2021) or the importance of usability in model building (Liu, Liu and Sathye, 2021) seem particularly beneficial. Just as the authors assume the usefulness of AI in conducting research on the impact of institutional ownership on the economic value of a business entity, it is necessary to consider AI as one of the potential key success factors for a business entity under both domestic and foreign control. To explore the impact of technology readiness in this context, for example, Nguyen Thi et al. (2024) and Nurul Izzaty et al. (2022) focused on a study assessing the impact of personality traits, competencies and skills in the area of digital technology on professional performance, which should be considered and possibly extended to the individuals working in the management of the enterprises under study.

In order to provide relevant data for the financial analysis of business entities under domestic and foreign control, it will also be necessary to take into account the findings of Adámiková and Čorejová (2021) in terms of the impact of creative accounting of entities in the context of determining the final value of the business entity.

The results of the authors' analysis open the door to the practical use of AI in financial analysis, which brings a number of concrete benefits for businesses and investors. The primary benefit is that AI enables more accurate prediction of financial performance, which is crucial for informed investment decisions and strategic, tactical and operational planning. With AI's ability to analyze large volumes of data and identify hidden patterns, businesses can better identify potential risks and opportunities. For the risk management space, AI offers early warning tools for financial issues, such as bankruptcy prediction, enabling business management to implement early actions. For investors, this means the ability to minimise losses through more informed decisions. AI is also revolutionising the audit and compliance space, automating the detection of fraud and irregularities, increasing efficiency and reducing costs.

The authors of the paper see another significant benefit in improving the efficiency of financial processes. AI can automate routine tasks such as financial report processing and data analysis, freeing up resources for strategic business management. Last but not least, AI enables personalization of financial services leading to a better understanding of customer needs and offering tailored products. In the context of the research conducted by the authors of this paper, which focuses on the impact of institutional control on the economic activity of businesses, AI opens up new opportunities for the analysis of complex datasets. Predictive models and machine learning provide deeper insights into the factors influencing the performance of business entities under different types of ownership. Linking academic research with practice is key. The findings of the authors of the paper can be directly applied in the corporate sector, where AI tools will help improve the financial health and competitiveness of business entities. Investors will gain better tools to assess risks and opportunities, leading to more efficient capital allocation.

The authors believe that this article will contribute to the broader discussion on the use of AI in financial analysis and pave the way for innovative solutions that can transform the financial sector. The emphasis on practical applicability and tangible benefits is key to the successful implementation of AI in practice.

The article represents a partial part of the preparatory phase of the authors' research activities and summarizes potential directions of research focus in the context of possible use of artificial intelligence.

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Contemporary challenges of AI tools in the context of business financial analysis

ABSTRACT
Financial analysis represents a key tool for assessing the financial stability and performance of a company. However, in the context of the current trends changing the context of business entities' operations, it seems necessary to evaluate the available repertoire of approaches in the context of the increasing degree of intervention of artificial intelligence tools within the corporate economy. The aim is to provide entrepreneurs, managers and other financial management professionals with a comprehensive view of the available ap-

proaches, tools and metrics for a comprehensive assessment of corporate financial management, with an emphasis on the implementation of artificial intelligence and its future potential in the field of management. The analytical framework of the paper includes both traditional financial analysis tools and modern approaches, including the integration of aspects of so-called composite assessment tools. The findings of the article thus contribute to the development of effective AI-based corporate governance strategies and stimulate discussion on appropriate directions for the future development of corporate financial management.

KEYWORDS

Corporate economics, corporate financial management, financial analysis, corporate performance, financial health, artificial intelligence.

RODE CLASSIFICATION

G31; G32; G33; G41; M15; M21; M41; Z41 (AI)