CHALLENGES IN THE FIELD OF FINANCIAL FORECASTING IN THE CONTEXT OF ARTIFICIAL INTELLIGENCE APPLICATIONS

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ABSTRACT
Today, it has become clear that artificial intelligence (AI) can help automate time- and labour-intensive tasks such as data collection, comparison and cleansing in financial planning and forecasting. This allows them to spend more time making high-value and informed business decisions. But there are more complex tasks for which AI does not have the necessary capabilities. The interaction between artificial intelligence and the human mind is worth exploring, given the intricacy, unpredictability and ambiguity of corporate decision-making processes. If all aspects are taken into account and their implications for the use of AI are deduced, answers to these questions can be found. Our research, which started in 2023, focuses on this problem, seeking the views of financial professionals on how humans and AI complement each other in this area. Our findings so far are presented in the second part of this paper.

KEYWORDS
Artificial intelligence (AI), Financial planning, Financial decisions, Complex approach, Emotional intelligence, Financial forecasting, Cyber security

INTRODUCTION

The integration of artificial intelligence into financial planning is gaining increasing importance as it facilitates more efficient and informed decision-making, particularly in the context of financial intricacy and significant investments. The collaboration between artificial intelligence and human decision-making holds the potential for successful planning and improved business outcomes.

In our questionnaire survey, I aimed to gather the perspectives of financial professionals regarding their expectations of how AI can best address the three primary challenges in financial and economic forecasting: unpredictability, intricacy, and ambiguity. These challenges complement each other when combined with AI. The categorization of foresight into these three main problem areas is based on the work of Kunnathuvalappil Hariharan 2018 [6]. A preliminary evaluation has been conducted, but the sample size is still relatively small, necessitating further data collection. The results obtained thus far will be presented in the second part of this paper. The sample exclusively comprises professionals involved in financial functions within the for-profit sector (small, medium, and large enterprises), either directly or indirectly contributing to financial planning endeavors.

Financial planning encompasses a multifaceted process, encompassing the analysis of a company's financial operations, strategic investment planning, financing and dividend decisions, and careful evaluation of alternative options [3]. Within this process, financial

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management holds a pivotal position, particularly due to the intricacies involved in a company's operations. Efficient operation relies on securing and utilizing appropriate capital sources. Even in stable economic circumstances, financial planning remains crucial, serving to prevent adverse impacts on company performance resulting from imprudent and ill-suited ad hoc decisions.

Corporate financial planning serves three primary functions. Firstly, it aids in comprehending the company's present status, its historical trajectory, and its future trajectory. Assessing past performance and appraising the current situation are essential to gauge future prospects. Secondly, planning enables the identification of deviations from the established plan or budget, as well as areas of improved performance. This facilitates policy and target revisions to align with expectations. Thirdly, financial planning addresses the challenges associated with acquiring and utilizing cash and cash equivalents. Ensuring long-term success while avoiding present financial difficulties to meet payment obligations is vital for the company.

In addition to planning, control assumes a significant role in financial management, aiming to maximize profit and shareholder value just as planning does [4]. Control ensures that adhering to a plan or budget remains a priority for decision-makers. During the planning phase, the company sets objectives and devises the necessary courses of action to achieve them. Some companies formulate one-year plans, while others develop financial strategies spanning three to five years. However, it is crucial to adjust and review the overall one-year plan in alignment with the longer-term financial strategy.

The evolving presence of artificial intelligence is gaining momentum across various industries and businesses, with increasing utilization in the financial planning process. It is essential to acknowledge that human decision-making is not exempt from cognitive biases and rationality gaps that may result in sub-optimal outcomes. Herbert Simon, one of the most prominent pioneers of behavioral economics, developed the principle of bounded rationality, which posits that the human brain has limited capacity for solving problems that would require perfect rationality [8]. In this regard, AI proves particularly valuable as it complements the thinking of individuals or groups within a multi-agent system. Such systems can handle cognitive tasks more efficiently than human thinking alone. Specifically, when dealing with high-risk decisions, adopting a multi-perspective approach and considering AI-provided insights makes logical sense. According to research by Tzafestas and Verbruggen (2012 [10]), such systems can assist groups of decision-makers in the planning process. However, through the integration of speech, gestures, and data visualization methods, even more effective interactions can be achieved, facilitating the efficient management and utilization of vast amounts of information.

METHODOLOGY OF THE RESEARCH

The aim of the research is to investigate how financial professionals perceive AI as an important tool and maybe they can influence the direction of AI development by sharing the results of this study with software developers. The research tool is a 41-question questionnaire completed by people working in finance. The research is incomplete at this stage, and the sample needs to be extended. Several lessons can be drawn from the results obtained so far, and they may also provide guidance for further research. The questions in the questionnaire were based on and inspired by Anglo-Saxon literature published since 2010, which examines the role of AI in financial planning or forecasting.

After the literature review, I would like to share a noteworthy result that seems to emerge even with a small number of respondents. A research and (partial) results appear at the end of the

study.

THE COLLABORATION OF ARTIFICIAL INTELLIGENCE AND HUMANS IN PLANNING

Experts in the field widely agree that the future of business decision-making will hinge on the collaboration between human and artificial intelligence. The fundamental expectation is that this collaboration will lead to the consideration of more reliable and strategically focused time horizons, resulting in improved business outcomes. Therefore, in the future, the synergy between AI and human minds is expected to determine successful planning in the business world. As business decision-making is often associated with unpredictability, intricacy, and ambiguity, the integration of human and AI efforts in decision-making processes becomes crucial [6].

Artificial intelligence (AI) plays a pivotal role in processing and analyzing vast amounts of data, which would be challenging to accomplish with human labor alone. Moreover, through machine learning and predictive analytics, AI can unveil patterns and predictions that might remain concealed to the human mind. However, the involvement of human decision-makers remains indispensable. Human aspects such as senses, intuition, and experience contribute depth and context to decisions that would be challenging to comprehend or evaluate without AI. Humans possess the ability to humanize business decisions through their knowledge, personal relationships, and consideration of the emotions of the involved parties.

Artificial intelligence in financial planning: personal finance

Since this work focuses on corporate financial planning, we will only briefly touch on aspects related to individual investors and the investment advice provided to them (although these may share similarities with financial investment for companies). Corporate financial planning and personal financial planning operate at different levels and pursue distinct objectives. While corporations oversee their entire corporate activity, individuals engage in personal financial planning tasks. In personal financial planning, financial service providers and credit institutions support individuals in devising and attaining their financial goals.

AI presents significant advantages in data analysis and investment planning. However, the lack of emotional intelligence can pose a major constraint in financial planning services [1]. Although AI has the potential to automate and enhance financial processes, it lacks human emotions and empathy, which are crucial for addressing complex investment needs and effectively communicating with clients.

A lack of emotional connection and empathy can pose a barrier, making it challenging to offer financial planning services. Clients require trust in their financial advisors, and the absence of emotional intelligence may reduce client satisfaction and loyalty. Moreover, emotions play a significant role in human decision-making, and the lack of rationality in this domain can hinder effective financial planning. The implementation of AI in financial planning presents new challenges, especially in the realms of privacy and cybersecurity. AI is still a relatively new technology, and in high-stakes industries involving substantial sums of money, safeguarding data and customers becomes paramount. To mitigate cyber risks, it is essential to closely monitor financial planning processes for clients and implement appropriate measures to ensure data security.

The presence of financial fake news online can substantially impact AI-supported financial decision-making. Such misinformation may mislead investors and cast doubts on the reliability of financial planning and investment strategies. While the human mind, despite its limitations, is believed to be quicker in detecting intentional deception, it should be acknowledged that AI, being a self-learning system, has the potential to evolve over time, resulting in more accurate predictions, data validation, and information verification.

AI continues to revolutionize the realm of financial planning, but the absence of emotional intelligence and the risks posed by online pseudo-news present decision-making challenges. The collaboration between humans and AI holds the potential for achieving optimal outcomes, emphasizing the need to develop both areas and address the challenges [11]. The integration of emotions and data can be the key to success in financial planning and investing, underscoring the significance of prioritizing emotional intelligence in AI development. Adopting a dual approach can enhance the efficiency and reliability of financial planning and decision-making, ultimately leading to improved customer satisfaction and business success

Artificial intelligence in financial planning: corporate finance

With the gradual abandonment of outdated methods and technologies, numerous businesses are now embracing modern design methods and technologies. Digital transformation has driven changes in business planning practices, with further changes anticipated in the future. Consequently, enterprise design is gaining significant attention, as companies seek to leverage the capabilities of artificial intelligence, machine learning, and increased automation.

The financial planning process remains a perpetual challenge, marked by its difficulty and intricacy for nearly everyone involved. When discussing financial data and indicators, most businesses still rely on traditional tools, and even the accuracy of data in spreadsheets is often a matter of debate. Ensuring precise forecasting is crucial for informed data-driven decision-making, but the task is frequently disjointed and lacking collaboration between finance managers and senior management. Financial models must contribute to the true speed and insight of innovation in business strategy, granting finance a place in the new era of digital transformation. Selecting the right solution is pivotal for the future success and financial well-being of the business, even in the long term. AI-powered modern planning tools offer speed, adaptability, and a comprehensive view of enterprise data, enabling businesses to harness it effectively. These tools empower businesses with profound insights into market trends, facilitate forecasting, and enable effective decision-making for business growth and efficiency. AI significantly streamlines planning and financial reporting by offering real-time assessment and transparency of numerous data points, enhancing financial accounting operations. Centralizing data in a database ensures that all parties work with the same information, reducing errors arising from conflicting data. Automation of planning solutions through digital transformation reduces the time spent on manual tasks, enabling resources to focus more on analysis, thereby increasing data transparency and revealing valuable insights. AI facilitates the evaluation of the company's future performance based on various assumptions, aiding in preparedness for different environmental situations before making decisions. Rapid and flexible planning and analysis are crucial across departments such as operations, sales, finance, and human resources. By employing the same tools to manage business effectiveness and efficiency, departments achieve better coordination and superior outcomes. Implementing a unified and integrated system streamlines planning, liquidity planning, and forecasting, resulting in significant cost savings for the business.

AI assists business leaders in automating time-consuming and labor-intensive operations, freeing up more time for high-value tasks and enhancing their ability to make effective business decisions. Leveraging data creates a feedback loop that informs current and future operations, optimizing performance management and measurement following financial planning. The integration of AI into financial and accounting practices enhances the accuracy and reliability of forecasts.

Organizations face two fundamental challenges. First, they often lack confidence in the available data. Second, the data is dispersed across multiple platforms, and decisions are occasionally made by individual business units without consulting others. Nevertheless, notable progress has been achieved in recent years in the context of the modern planning concept. Companies have developed software that supports the idea of joined-up planning, fostering collaboration between different departments and linking their data. However, coordination remains an area that requires further improvement.

In financial planning, artificial intelligence (AI) has proven to be an invaluable tool for planners, removing the tedious and time-consuming aspects from their tasks and allowing them to focus on more critical elements of their role. This technology enhances planning efficiency by analyzing vast amounts of data from document repositories and investment portfolios, offering valuable insights for developing investment strategies and managing portfolios. Financial advisors benefit greatly from this capability, as it improves client communication and grants them more time to engage with investors and adapt their services to meet changing needs.

Predictive forecasting utilizes statistical and predictive analytics to identify and evaluate historical values, actions, and seasonal patterns, significantly enhancing forecast accuracy [5]. This reduces the lead time for generating precise profit and balance sheet forecasts, empowering users to enhance processes, manage exceptions, and rectify errors. Advanced planning tools supported by AI are swift, adaptable, and provide organizations with a comprehensive view of enterprise data. These tools play a vital role in aiding companies to make informed decisions and achieve greater performance.

The absence of emotional connection and empathy can create barriers when delivering financial planning services. As discussed in the section on personal finance, clients require trust in their financial advisors, and the lack of emotional intelligence can diminish client satisfaction and loyalty. Nonetheless, there are at least two reasons why emotional intelligence's role in corporate decision-making also cannot be overlooked. A company comprises individuals, and its operations involve interactions among people. Thus, emotions also play a vital role in human decision-making in this domain, which can impact the effectiveness of financial planning. One crucial aspect is managing conflicts of interest among stakeholders in the company, and another is that even the most effective solution will only yield optimal results if there is sufficient support: plans must be interpreted at the executive level and embraced by the manager responsible for executing the tasks.

Similar to personal finance, cybersecurity is crucial. AI is still a relatively new technology, and in industries where high stakes and large sums of money are involved, safeguarding data and actors becomes critical. To mitigate cybersecurity risks, financial planning processes must be closely monitored, and appropriate measures should be taken to ensure data security. Though fake news is less of a problem in financial planning due to reliance on own databases and reliable industry data, caution should still be exercised, especially when analyzing the external environment, to avoid processing false information.

Many experts argue that addressing these challenges and giving special attention to emotional intelligence in human-AI interactions is essential in both personal and corporate finance [11].

The combination of emotions and data can be a key factor in financial planning and investment. A dual approach can enhance the efficiency and reliability of financial planning and decision-making, ultimately contributing to business success. However, Kunnathuvalappil Hariharan's research (2018) focuses on developing artificial intelligence and its integration with human decision-making to minimize the three forecasting challenges of unpredictability, intricacy, and ambiguity as much as possible [6].

Unpredictability

Unpredictability refers to the absence of knowledge about all potential outcomes or their consequences. This uncertainty poses challenges in evaluating situations and making decisions within companies. Unpredictability may stem from various factors, such as insufficient information about the company's internal and external environment. For instance, shortages of human resources, the introduction of disruptive technologies, the emergence of new markets and competitors, and shifts in government policies and legislation can all contribute to unpredictability [3].

Artificial intelligence (AI) and other smart technologies hold the potential to generate innovative ideas and manage unpredictability. By utilizing probabilistic and data-driven statistical methods, AI facilitates the discovery of relationships between various factors and enables the effective application of new datasets. It aids human decision-makers in making more accurate and comprehensive predictions concerning customers, assets, and operations.

The integration of predictive analytics, a key aspect of AI, opens up new dimensions in decision-making. Leveraging data, AI generates forecasts that provide valuable insights into the evolving market landscape and customer demands. The combination of AI and data-driven statistical methods empowers individuals to respond more effectively to the challenges of uncertainty and unpredictability.

AI and smart technologies are increasingly assisting business professionals in decision-making, particularly in situations where unpredictability and uncertainty have a significant impact. Through data-driven statistical methods, AI creates opportunities and presents novel approaches to enhance business efficiency and make better decisions in a dynamic environment. It is worth noting that addressing unpredictability does not contradict previous efforts in incorporating human emotional intelligence; rather, the approach complements such endeavors.

Intricacy

In the business world, we increasingly encounter complex situations characterized by multiple elements or variables. Handling such intricacy necessitates processing vast amounts of data at a speed surpassing the cognitive capabilities of even the most skilled human decision-makers. Over the years, artificial intelligence has made significant strides in data-driven analytics, equipping human decision-makers with powerful tools for comprehensive data analysis [7]. The capabilities of AI have introduced fresh perspectives on managing intricacy and facilitating more effective human decision-making.

One of the key advantages of AI lies in its ability to provide highly reliable means for acquiring and processing large datasets, thereby reducing the intricacy of problems. AI excels in situations where it is crucial to identify cause-and-effect relationships or causal loops among numerous possibilities. From assessing personal credit risk to optimizing digital marketing strategies or even real estate decisions, AI proves to be beneficial across a wide range of business choices.

In recent years, the advancements in deep learning have propelled AI to an entirely new level. Deep learning enables machines to learn from raw data and expand their capabilities by incorporating larger datasets. In complex scenarios, where an abundance of data might overwhelm human capabilities, AI can offer reliable and precise decision recommendations. When combined with the intuitive abilities and vision of human decision-makers, AI creates synergistic interactions that enhance decision-making processes.

AI technology proves particularly beneficial for startups and venture capital firms when evaluating investment opportunities. The analytical power of AI is effectively harnessed alongside human expertise to yield excellent results. Bots are already proficient at sifting through and processing vast amounts of data, such as detecting inappropriate or controversial web and social media content. However, the ultimate decision to remove social media posts or videos relies on human experts who exercise superior judgement [6].

The effective utilization of AI technologies can significantly aid individuals in making better decisions. AI's capabilities enable the extraction of valuable insights and the implementation of actions based on substantial conclusions. Through the synergistic interaction between AI and humans, intricacy management can be optimized, leading to heightened efficiency in decision-making processes.

Ambiguity

In various decision-making domains, we often encounter situations where the same decision is associated with multiple simultaneous yet distinct interpretations, known as ambiguity. The presence of competing interests from various stakeholders, such as customers and managers, can significantly complicate the decision-making process. Decisions influenced by human interests and the objectives of different stakeholders may yield unforeseen consequences, hindering the achievement of analytically examined and seemingly reasonable conclusions. The application of artificial intelligence (AI) can offer decision makers valuable tools to navigate ambiguous situations and address competing needs effectively [2].

AI has the potential to provide decision makers with valuable insights through tools like internal and external channels, such as social media, which can offer a more accurate understanding of the expected reactions to organizational decisions. However, it is crucial to recognize that managing ambiguity remains primarily the responsibility of human actors. People possess critical skills in interpreting diverse perspectives both within and outside the company. Successfully making, negotiating, and implementing decisions requires the establishment of intangible foundations, such as building coalitions and alliances [9].

In the decision-making process, both formal and informal leaders play pivotal roles in bringing individuals together and reconciling their diverse interests. Formal leaders are essential in establishing credible goals and objectives and persuading others, including employees and external stakeholders, about the significance of their decisions. This requires emotional and social intelligence as a foundation for applying interpersonal skills. On the other hand, informal managers, who may not hold formal authority, also wield significant influence in managing ambiguity during decision-making. Through their interpersonal relationships, finely honed skills, and deep understanding of the organization's social dynamics, informal leaders are well-positioned to align people's interests, mitigate potential conflicts, and foster consensus.

Even the most sophisticated decisions may harbor ambiguities that necessitate intervention. For instance, individuals can employ intuitive approaches to discern which variables or future events might have exerted a more substantial impact on outcomes from countless possibilities.

This aids in determining which factors should be given priority in data collection and analysis by intelligent technologies.

The key to managing ambiguity and making effective decisions lies in the synergistic collaboration between AI and human actors. AI technology provides the capability to analyze intricate data and inform decisions, while the emotional intelligence, social skills, and organizational knowledge of human actors aid in reconciling interests and effectively guiding the decision-making process.

RESEARCH RESULTS

In spring 2023, we launched a 41-question questionnaire, which has been completed by 69 people so far. Although this sample size may not be sufficient to yield definitive conclusions, we can still attempt to provide an overview based on the current results. Questions 1 to 5 inquire about the respondent's company size, the level and depth of planning within their organization, and the extent of their contribution (directly or indirectly) to the planning process. We can assume that the company's size and the respondent's job relevance to the field are crucial factors influencing the respondents' opinions. The majority of the questions were presented in the form of a 7-level Likert scale, and two objectives held particular significance: determining the importance the respondents attribute to the presence of AI in financial planning and identifying the problems they believe AI could best address.

Ultimately, after considering various grouping criteria, the most intriguing observation at this stage of the research is that individuals who view AI as highly important, even revolutionary, in financial planning, perceive its role in overcoming ambiguity as particularly significant. On the other hand, those who deem AI to be less important find it more useful in addressing unpredictability, and even more so in handling intricacy. Relying on AI to address ambiguity, as a means of understanding it, appears to be the most prominent aspect of human involvement. Additionally, it can be inferred that those who encounter issues with ambiguity have likely also faced human mind-related biases, such as desire-driven biases or mental limitations, and recognize AI's potential in mitigating these factors.

With lower expectations of AI, the devaluation of the role of the human decision-maker, and its replacement by AI, is less pronounced. Respondents in this group do not emphasize the importance of AI in taking over the decision-making process but rather in recognizing connections beyond the capabilities of the human mind and simplifying vast amounts of information. However, it should be noted that this perception may change when considering a larger sample size. Nevertheless, based on the current findings and some additional contemplation, the results support the notion that individuals who view AI's truly revolutionary role see it as performing tasks previously attributed to humans, rather than merely serving human activity in a professional capacity.

As a result of the clustering exercise conducted using the k-means method, two main groups of clusters emerge concerning the use of AI in financial planning. The first group of respondents holds high expectations regarding the effectiveness and application of AI, while the second group anticipates lower outcomes from AI implementation.

Group 1: Significant changes in financial planning with the use of AI
- Respondents in this group consider the integration of AI in financial planning as highly important.
- They firmly believe that AI can substantially enhance planning efficiency and accuracy.
- AI offers opportunities for developing customized planning solutions.

- It serves as a valuable tool for generating alternative scenarios and ensuring adaptability in the face of future uncertainties.
- AI-supported data analysis and predictive models effectively tackle financial planning challenges.
- Particularly noteworthy are improved results in addressing ambiguity.

Group 2: Lower expectations regarding the use of AI in financial planning

- Respondents in this group considered AI to have lesser importance concerning the future of the subject studied.
- They believe that, at the current stage, the utilization of AI does not provide sufficient advantages in financial planning.
- They perceive more uncertainty regarding the use of AI and approach its application with greater caution.
- They hold the belief that AI is better suited for addressing unpredictability or overcoming intricacies.

The figures below clearly depict the results for ambiguity and intricacy as two challenges that can be addressed with the help of AI.

Figure 1: The relationship between the level of expectations and complexity and ambiguity
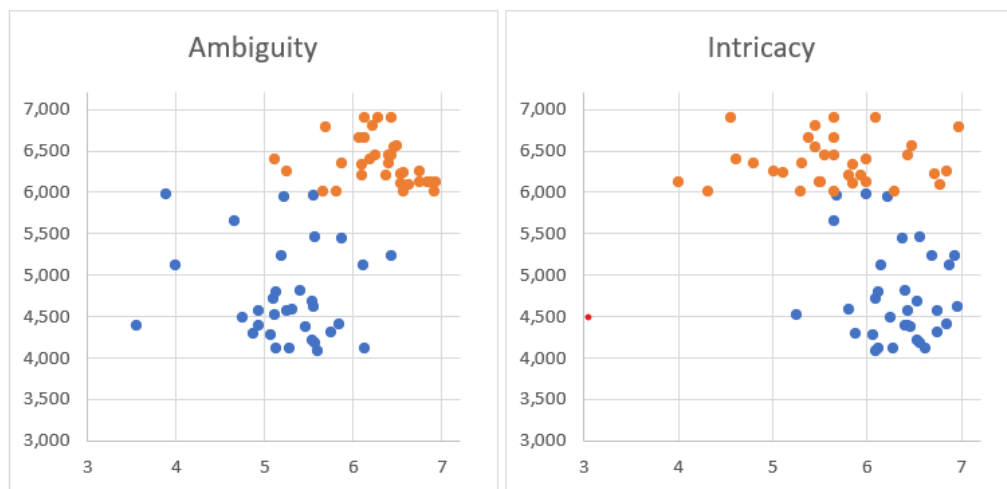
Explanation: ● Group 1.; ● Group 2.
Source: own graph

Explanation: ● Group 1.; ● Group 2.
Source: own graph

The vertical axis represents the level of expectation, while the horizontal axis indicates the degree of ambiguity or intricacy.

By further conducting the survey and significantly increasing the number of respondents, we can anticipate obtaining more precise and complex results. However, this step is also essential to validate the current findings.

SUMMARY

Traditional tools, like manual data analysis and spreadsheets, often lead to inaccurate models and subpar outcomes due to low data quality and inefficient collaboration techniques. It is

imperative for companies to replace outdated tools with modern design methods and technologies to minimize the risk of human error and its associated consequences. The planning process is evolving to align with the changing market environment and business objectives. Embracing new business models, integrating financial planning with a performance-oriented approach, and optimizing resource utilization are crucial for companies to achieve success. AI-powered modern planning tools empower companies to swiftly adapt to changes and effectively manage risks. Swift and flexible adjustments, risk mitigation, and the consideration of external factors in planning are essential for businesses in today's uncertain world.

The research examines, among other things, the factors hindering forecasts and the assessment of the potential solutions offered by artificial intelligence. Extracting relevant questions from the questionnaire survey, it becomes evident that professionals who have higher expectations for artificial intelligence in handling ambiguity see greater potential, compared to the other two problems that hinder forecasting. Since handling ambiguity is an integral part of decision-making, this result raises the hypothesis that a significant difference between artificial intelligence and previous digital solutions is that while the latter supported human decision-making, artificial intelligence takes on, or at least a portion of, the decision-making role. Verification of this hypothesis requires a broader completion of the questionnaires and further research.

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