OPTIMIZING BUSINESS ANALYTICS AND DECISION-MAKING THROUGH THE APPLICATION OF GENERATIVE ARTIFICIAL INTELLIGENCE IN FORECASTING AND SIMULATION

CZU: 005.311.6:004.89 DOI: https://doi.org/10.53486/csc2025.12

GEORGIEV TANYO

Dimitar A. Tsenov Academy of Economics Svishtov, Bulgaria tanyogeorgiev@yahoo.com ORCID ID: 0009-0006-0459-0871

Abstract. This thesis investigates how generative artificial intelligence (AI) can optimize business analytics and decision-making in forecasting and simulation. Employing a qualitative synthesis of academic literature and industry reports, the study examines how AI models enhance forecasting accuracy and generate realistic simulations. Results indicate that AI-driven forecasting improves decision quality by reducing uncertainty, lowering costs, and mitigating risks, while also offering a competitive advantage. However, significant challenges remain, including algorithmic bias, data privacy concerns, high computational requirements, and regulatory hurdles. The findings underscore the need for robust governance and further research on broader applications of generative AI in strategic decision-making today.

Keywords: Generative AI; Forecasting; Simulation; Business Analytics; Decision-Making.

JEL Classification: M10, M20, C53, O33.

INTRODUCTION

Businesses increasingly depend on data-driven analytics, but the growing complexity and scale of data have outpaced traditional forecasting methods. Generative Artificial Intelligence (AI) offers a powerful solution by using advanced machine learning to detect patterns and generate synthetic data, enabling more accurate and forward-looking insights. Its potential impact is substantial— McKinsey & Company estimates generative AI could contribute \$2.6 to \$4.4 trillion annually to the global economy ("The Economic Potential of Generative AI" McKinsey). This paper examines how integrating generative AI into business forecasting and simulation can improve decision-making, optimize analytics, and help organizations manage uncertainty more effectively.

MAIN CONTENT

1. What is Generative AI?

Generative AI refers to algorithms that do not just analyze existing data but create new content or predictions based on learned patterns. In contrast to traditional AI systems that mainly recognize patterns or make routine predictions, generative models (such as Generative Adversarial Networks, Transformers like GPT-4, and diffusion models) can produce original outputs – from text and images to plausible future data scenarios (Understanding the Differences Between AI and GenAI). In other words, rather than simply following pre-programmed rules or forecasting from historical trends, generative AI can generate novel data that resembles real-world data. This capability enables forwardlooking operational improvements and richer what-if analyses (Understanding the Differences Between AI and GenAI). For example, a generative AI model trained on time series data can simulate new plausible future data points, not just extrapolate existing patterns. These properties make generative AI particularly powerful for business applications like forecasting and scenario planning. By leveraging vast datasets and deep learning techniques, generative AI models learn the underlying structure of data and can thus generate realistic outputs. This differs fundamentally from traditional predictive models and provides a new toolset for businesses to creatively tackle complex problems.

2. The Role of Generative AI in Forecasting

Forecasting in business predicts future metrics—such as sales, market trends, customer demand, or supply chain needs—using historical data. This process is vital for capacity planning, budgeting, and strategic decision-making under uncertainty. Traditional methods (e.g., ARIMA or exponential smoothing) often falter when data is complex or voluminous. Generative AI enhances forecasting by learning intricate patterns from historical data to produce adaptive, data-driven predictions that simulate multiple potential futures rather than a single trend projection. Recent studies indicate that generative AI-based forecasts can outperform classical models; for instance, Hassani and Silva (2024, Predictions from Generative Artificial Intelligence Models: Towards a New Benchmark in Forecasting Practice) found superior accuracy compared to seasonal ARIMA, suggesting these models capture complex patterns that traditional techniques might miss.

Moreover, generative AI lowers the barrier for non-experts. Advanced language-model tools (like ChatGPT or Copilot) enable users to generate forecasts via simple prompts without requiring deep statistical expertise. This democratization allows managers to rapidly obtain predictive insights and incorporate them into decision processes. For example, in retail, AI-generated demand forecasts have optimized inventory management by automatically adjusting stock levels based on factors such as social media trends and weather data. Overall, integrating generative AI into forecasting yields more reliable predictions, faster responses to change, and a nuanced understanding of future risks and opportunities.

3. Generative AI in Business Simulations.

Beyond point forecasts, generative AI plays a transformative role in business simulations and scenario planning. Simulations involve creating virtual models of real-world business processes or environments to test different strategies and outcomes. Traditionally, scenario planning might involve manual what-if analysis or simplistic models. Generative AI enhances this by generating realistic, data-driven scenarios that help decision-makers explore multiple potential futures. For instance, a generative model can simulate how a supply chain might behave under various conditions (surge in demand, supplier failure, geopolitical disruption, etc.), allowing companies to evaluate their contingency plans. This capability is invaluable for risk management and strategic planning in complex, volatile markets.

One practical application is in financial scenario modeling. Generative AI can be used to create numerous plausible economic or market scenarios (e.g. different interest rate trajectories or competitor behaviors) for a company's financial model. By doing so, it enables executives to test investment strategies against a wide range of conditions and identify risks that traditional models might overlook. In the realm of supply chain management, early adopters have used generative AI to run what-if simulations. For example, a chemicals manufacturer employed a GenAI tool to simulate scenarios involving delays in obtaining key raw materials; the AI not only modeled the operational impact but even suggested alternative courses of action if certain disruptions occurred (How supply chains benefit from using generative AI | EY - US). In general, today's generative AI tools can produce risk assessments and scenario simulations on-demand, helping planners proactively manage potential

problems. According to industry analysts, risk management may be one of the most promising areas for GenAI's application in operations, as these tools can rapidly output mitigation strategies for various hypothetical crises (How supply chains benefit from using generative AI | EY - US). By embracing AI-driven simulations, businesses become better prepared for uncertainty: they can visualize outcomes of decisions before committing to them, thereby optimizing strategies for resilience.

4. Benefits of GenAI in Business Analytics

Generative AI (GenAI) has become a powerful asset in business analytics by significantly improving decision quality and efficiency. By automating complex data analysis, organizations can ground their decision-making in robust, empirical data rather than relying on subjective intuition (Streamlining Finance Management with Generative AI). This ultimately improves decision quality and outcomes. Organizations that integrate GenAI with human expertise report more accurate insights and faster decision-making as AI-driven analysis mitigates human bias and error ("GenAI Tools and Decision-Making" Sloan Review). GenAI's rapid analysis of vast datasets helps managers uncover hidden patterns and generate synthetic scenarios, supporting evidence-based decisions in dynamic markets ("The Economic Potential of Generative AI" McKinsey).

Beyond internal efficiencies, GenAI strengthens risk management and provides a competitive advantage. Advanced generative models simulate diverse future scenarios, enabling decision-makers to anticipate potential risks and optimize inventory or hedge against market volatility ("How Generative AI is Transforming Data-Driven Decision Making in 2025" Techment). Early adopters demonstrate greater agility, innovation, and long-term competitive success ("Maximizing Organizational Value with Generative AI" Orbus Software; "Benefits, Risks, and Best Practices for Businesses" Earley Information Science).

5. Challenges and Ethical Considerations

Generative AI holds immense potential for business transformation but also brings significant challenges and ethical concerns. A primary issue is data privacy and security, as these models require vast amounts of sensitive information. Without robust governance and strict compliance with privacy regulations, the risk of data breaches or misuse increases, raising critical concerns about consent and confidentiality (IBM, Shedding Light on AI Bias). In addition, the high computational cost of training and deploying advanced generative models demands substantial computing power and energy, which can be prohibitive—especially for smaller firms—even with scalable cloud solutions (McKinsey, The Economic Potential of Generative AI).

Bias and misinformation present further ethical dilemmas, as these systems learn from historical data that may contain inherent biases, potentially perpetuating discrimination—for example, in lending decisions (IBM, Shedding Light on AI Bias). Moreover, generative models sometimes produce "hallucinations" or plausible but false information, misleading decision-makers. To mitigate these risks, rigorous testing, bias-detection tools, and continuous human oversight are essential (Earley Information Science, Benefits, Risks, and Best Practices for Businesses). A lack of transparency in AI decision-making compounds these challenges; many models operate as "black boxes," hindering accountability in critical industries like finance and healthcare. Advancements in explainable AI—such as interpretable architectures and confidence indicators—are crucial to ensure that AI recommendations remain clear and actionable (Techment, How Generative AI is Transforming Data-Driven Decision Making in 2025). Balancing these challenges with ethical responsibility is key as businesses increasingly integrate AI into their processes.

CONCLUSIONS

Generative AI is poised to transform business forecasting, simulation, and decision-making by delivering efficient, accurate, and innovative analytical capabilities. Our findings reveal that integrating GenAI into forecasting allows organizations to harness complex data for more reliable predictions and robust contingency planning, shifting decision-making from reactive to proactive. This novel approach demonstrates significant operational benefits, such as optimized supply chains and enhanced financial resilience, underscoring the originality and potential of these technologies. However, the paper also highlights important limitations—ethical concerns, potential algorithmic bias, high computational requirements, and regulatory challenges—which require robust governance and human oversight. Notably, an unexpected outcome was the strong indication that real-time, continuously adapting AI-driven decision support systems will soon become standard practice, unlocking further productivity gains. Future research should quantify the economic benefits, refine methods for mitigating risks, and explore strategies for ethical AI integration. Ultimately, businesses that balance technological capabilities with ethical responsibility will be best positioned to thrive in an increasingly data-driven, AI-enhanced landscape.

REFERENCES

- 1. Chui, Michael, et al. "The Economic Potential of Generative AI: The Next Productivity Frontier." McKinsey, 14 June 2023. Available at: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier [Accessed 24.03.2025].
- 2. EY. *"How Generative AI in Supply Chain Can Drive Value."* EY Insights, 2023. Available at: https://www.ey.com/en_gl/consulting/how-generative-ai-in-supply-chain-can-drive-value [Accessed 30.06.2024].
- 3. Hassani, Hossein, and Emmanuel Sirimal Silva. "Predictions from Generative Artificial Intelligence Models: Towards a New Benchmark in Forecasting Practice." Information, vol. 15, no. 6, 2024, p. 291. doi: 10.3390/info15060291.
- 4. IBM Data and AI Team. "Shedding Light on AI Bias with Real World Examples." IBM, 16 Oct. 2023. Available at: www.ibm.com/think/topics/shedding-light-on-ai-bias-with-real-world-examples [Accessed 02.02.2024].
- 5. MicroAI. "*GenAI vs AI Understanding the Differences*." MicroAI Blog, 7 Oct. 2024. Available at: https://micro.ai/blog/genai-vs-ai-understanding-the-differences [Accessed 10.10.2024].
- 6. Sheikh, Shoaib. "Streamlining Finance Management with Generative AI." 10Pearls, 7 June 2024. Available at: https://10pearls.com/streamlining-finance-management-with-generative-ai/ [Accessed 15.08.2024].
- "GenAI Tools and Decision-Making: Beware a New Control Trap." MIT Sloan Review, 2023. Available at: https://sloanreview.mit.edu/article/genai-tools-and-decision-making-beware-a-new-control-trap [Accessed 24.03.2025].
- 8. "How Generative AI is Transforming Data-Driven Decision Making in 2025." Techment, 2024. Available at: https://www.techment.com/how-generative-ai-is-transforming-data-driven-decision-making-in-2025 [Accessed 24.03.2025].
- 9. "Maximizing Organizational Value with Generative AI: A Strategic Blueprint for Adoption." Orbus Software, 2024. Available at: https://www.orbussoftware.com/resources/blog/detail/maximizing-organizational-value-with-generative-ai-a-strategic-blueprint-for-adoption [Accessed 24.03.2025].
- 10. "Benefits, Risks, and Best Practices for Businesses Using Generative AI." Earley Information Science, 2024. Available at: https://www.earley.com/insights/benefits-risks-and-best-practices-for-businesses [Accessed 24.03.2025].