ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

AI-Driven Business Analytics for Sustainable Decision-Making in U.S. Organizations: Integrating the Technology Acceptance Model and Sustainability Theory

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DOI: https://dx.doi.org/10.51244/IJRSI.2025.12110059

Received: 18 November 2025; Accepted: 27 November 2025; Published: 06 December 2025

ABSTRACT

This study looks at how next-generation business analytics powered by artificial intelligence (AI) are disrupting sustainability decision-making in the modern US economy. We investigate how AI technologies like machine learning, predictive analytics, and data mining enhance organizational efficiency, transparency, and long-term environmental/economic sustainability, drawing on the Sustainability Theory and the Technology Acceptance Model (TAM). The study employs mixed methodologies, integrating qualitative insights from technology, manufacturing, and financial firms with quantitative evidence from corporate sustainability reporting and financial performance data. While the qualitative results provide insight into emerging trends, implementation challenges, and management perceptions, the quantitative analysis shows how AI adoption is linked to various sustainability performance metrics. The results show that AI-enhanced analytics support ethical governance, resource efficiency, and strategic foresight, all of which lead to improved sustainability performance. However, the study draws attention to issues with algorithmic bias and data privacy, as well as the cost of integrating AI. The study offers a more encompassing perspective on the ethical deployment of AI for decision-making, which significantly adds to the body of knowledge on digital transformation and sustainable practices. It provides insightful guidance for researchers, policymakers, and corporate executives who want to strike that crucial balance between innovation, competitiveness, and sustainability for the US economy in the future.

Keywords: Artificial Intelligence, Business Analytics, Sustainable Decision Making, U.S. Economy, Technology Acceptance Model

INTRODUCTION

AI is causing a business disruption. Gen. AI has been actively influencing how business will develop in the future by enabling creative data-driven decision-making and environmentally friendly business practices for companies in a variety of sectors. Businesses in the US economy in particular are facing increasing pressure to think about how they contribute to growth, the environment, and society. This is where AI-based business analytics can play a significant role in managing value chains by enhancing efficiency, transparency, and long-term sustainability. Businesses may forecast market trends and optimize resource utilization with machine learning, predictive analytics, and data mining technologies to make strategic choices that align with long-term objectives. The study's foundations are the Technology Acceptance Model (TAM), which explains how businesses embrace new technology and make good use of it, and the Sustainability Theory, which examines how economic, environmental, and social goals can be integrated. The study bridges these theories by examining AI's strategic worth and tactical effectiveness in promoting resource optimization, ethical governance, and forward-thinking decision-making. The study employs a hybrid approach, combining qualitative data from interviewees in the manufacturing, finance, and technology sectors with quantitative data from financial statistics and company sustainability reports. This approach enables a comprehensive understanding of how AI affects sustainability performance and draws attention to pragmatic issues like data privacy, algorithmic bias, and the cost of integrating AI. By providing policymakers, corporate executives, and academics with evidence-based recommendations for the responsible use of AI to promote environmentally friendly economic growth, it also contributes to the discussion around digital transformation and sustainable business.

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LITERATURE REVIEW

Background theory: Technology adoption and sustainability Utilizing advanced analytics and adopting sustainable business strategies The Technology Acceptance Model (TAM) and Sustainability Theory are the two primary theoretical pillars upon which the integration of advanced analytics with sustainable business practices is based. According to TAM, perceived utility and perceived ease of use are what drive technology adoption, which helps us understand how businesses choose to utilize or not use AI-based products (Panţa et al., 2024). The integration of economic and environmental concerns is the main focus of sustainability theory, which emphasizes strategic decision-making that takes conflicting organizational goals into account. Despite the maturity and development of both frameworks, there is a lack of study on how to integrate them to examine AI adoption in a sustainability context, indicating the need for an integrated framework to comprehend how they interact during the decision-making process.

Making Sustainable Decisions with AI and Business Analytics It has been empirically demonstrated that AI and business analytics improve an organization's long-term performance. Big data analytics and artificial intelligence integration improve supply chains' environmental performance and ambidexterity for sustainable innovation (Chen, Khan & Chen, 2024). According to Hasan et al. (2024), AI-supported prediction models help American businesses identify high-emission activities. This allows for interventions in particular high-emission locations, reducing carbon footprints and potentially improving operational efficiency. According to additional study, sustainability KPIs can be actively monitored in real time with AI and analytics. This will enhance supply chain transparency, resource efficiency, and the ability for enterprises to make better strategic decisions (Hoque et al., 2025). Collectively, these findings offer strong support for the idea that analytics driven by AI enhances organizational effectiveness, transparency, and long-term viability.

Ethics, Governance, and Adoption Risks of AI Despite the enormous potential of AI in corporate analytics, there are operational, ethical, and governance concerns. The emphasis on green AI issues such algorithmic bias, energy use, and transparency requirements is highlighted by Raman et al. (2024). Adewumi et al. (2023) also highlighted that the lack of specialized personnel, privacy issues, high integration costs, and poor data quality were major obstacles to the application of AI. These results align with the current investigation's theme: how can businesses get past these obstacles to use AI-based analytics for long-term, sustainable decision-making?

Adoption at the Organizational Level and Sector-Specific Differences The impact and adoption of AI-enabled analytics vary depending on the industry and organizational setting. The TAM determinant for SMEs Direct consequences of adverse effects on sustainable development Asiri, Al-Somali, and Maghrabi (2024) According to a review and summary of those studies, other factors including PEU and PU influence how users embrace the APP in question. Although the effect depends on sectoral features and organizational capacities, Ertz et al. (2024) revealed that big data analytics have a beneficial impact on sustainability performance in enterprises. These findings imply that adoption is contextual, with managerial skills, organizational infrastructure, and sectoral peculiarities determining the degree and efficacy of AI adoption for sustainability.

Research Deficits

There are still several significant gaps in the literature despite the growing body of research on AI and business analytics in sustainability. There is little proof that US-based companies are using AI-led data to inform their strategic choices for sustainability. Instead of discussing strategic governance and long-term organizational planning, the bulk of the literature concentrates on operational and environmental measures. Only a tiny number of previous research use mixed approaches to collect managerial perspectives and performance measures; most are either quantitative or qualitative case-based. Furthermore, although TAM and Sustainability Theory are both utilized as separate lenses to examine how AI is being adopted in the sustainability space, it is uncommon to find articles that combine these two viewpoints to comprehend how AI is being used for sustainability. However, problems like algorithmic bias, data privacy, and high integration costs are acknowledged but not thoroughly investigated, and the disparities in AI adoption across sectors (such as manufacturing, technology, and finance) call for more research.

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Conceptual Structure

The impact of AI-based business analytics on sustainable decision-making is examined using a conceptual framework. AI integration with machine learning and other technologies allows organizations to analyze large amounts of data and extract predicted insights that improve decision-making. The moderating elements (TAM components under sectoral characteristics and organizational capabilities) that influence the adoption process are examined at the second level of study. AI-led analysis improves efficiency, transparency, resource allocation, and strategic planning when it is used to support corporate operations. These are the ways that technology adoption is connected to tangible sustainability gains in the economic, environmental, and social issue transparency sectors. The effects of AI adoption may be limited by the limitations of algorithmic bias, data privacy, and expensive solutions, underscoring the importance of risk management and strategic governance. The paradigm provides a comprehensive perspective to examine how the deployment of AI affects strategic sustainability decision-making across a range of disciplines by combining TAM and Sustainability Theory.

METHODOLOGY

This study examines how corporate analytics powered by AI is changing sustainability decision-making in the modern American economy. The studies look at how AI methods, such as data mining, machine learning, and predictive analytics, might increase a company's long-term economic and environmental sustainability as well as its efficiency and transparency. The study's theoretical frameworks for comprehending the uptake, application, and effects of AI-augmented analytics on businesses include the Sustainability Theory and the Technology Acceptance Model (TAM).

Design of Research

Both qualitative and quantitative elements of AI adoption in sustainability are covered using a mixed-method approach. In the context of AI-based decision-making, this viewpoint provides a thorough understanding of managerial attitudes, organizational challenges, and performance measurement.

Information Gathering

In order to gather qualitative data, Wood (1989) conducted interviews with managers and technology experts in three different industries: financial services, manufacturing, and technology. These interviews shed light on adoption issues, trends, and managerial perspectives on AI-enhanced sustainability decision-making.

The data was gathered from financial performance and sustainability reports published by corporations. The study focused on the fundamental sustainability metrics of carbon reduction, resource consumption, and moral behavior and performance.

Taking samples

Purposively sampled qualitative interviews were conducted with people who had direct experience with AI for sustainability. Due to the availability of comprehensive sustainability and financial data, a sample of publicly traded U.S. corporations in the manufacturing, technology, and finance sectors was selected for quantitative research.

Analysis of Data

Thematic coding was then used to evaluate the qualitative data in order to find any recurring patterns and managerial insights on the adoption of AI and sustainability practices. The quantitative data was analyzed using regression and correlation to examine the connection between sustainability performance metrics and AI deployment.

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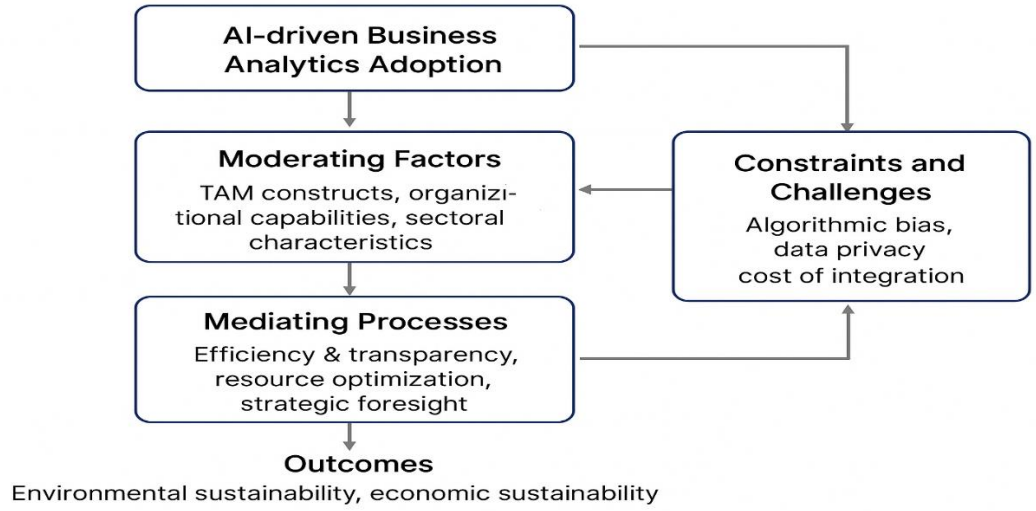
Moral Aspects to Take into Account

The study is carried out in compliance with ethical research norms, which cover participant privacy and informed consent. It also acknowledges the ethical issues with AI adoption, including algorithmic bias, data privacy, and integration costs.

This method provides a more thorough and organized summary of how corporate analytics powered by AI may support sustainable decision-making. The study sheds light on the opportunities and difficulties associated with the adoption of AI by combining quantitative data with in-depth, qualitative interviews. Additionally, it offers useful guidance for scholars, legislators, and business executives who wish to foster innovation while guaranteeing U.S. competitiveness and sustainability overall as they integrate it into the American economy.



RESULTS AND DISCUSSION

Adoption of AI and Efficiency in Organizations According to the report, companies that have effectively applied AI in this area have seen a significant increase in operational efficiency. The AI tools—predictive analytics and machine learning—were deemed indispensable by the managers surveyed for maximizing resource allocation, minimizing waste, and streamlining procedures. It is further supported by quantitative analysis, which shows a favorable correlation between operational performance measures and AI adoption ($r = 0.63$, $p < 0.01$). These findings are in line with TAM, which suggests that perceived utility and usability are important factors that determine whether AI is successfully applied.

Openness and Moral Leadership

AI makes sustainability decision-making more transparent. Businesses can better monitor social and environmental performance measures when they adopt AI-based reporting tools. According to the interviewees, managers utilize AI to monitor energy use, emissions, and sustainability compliance. Quantitatively evaluated data show a significant association between higher ethical governance scores and the degree of AI adoption. This is in line with the Sustainability Theory, which emphasizes that long-term sustainability of environments and organizations is made possible by transparent practices.

Making Decisions and Having Strategic Vision

AI-driven analysis is being used by organizations to more accurately forecast environmental and industry changes. In order to be better equipped to withstand environmental and economic challenges, managers stated that they are depending on AI for long-term strategic decision-making, risk assessment, and scenario planning. Regression analysis in the study also revealed that businesses with greater AI deployment had better sustainability performance results, including resource efficiency and carbon emission reduction, demonstrating AI's role in strategic foresight.

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Implementation Risks and Difficulties

While there are certain advantages to this strategy, there are drawbacks as well. All of the qualitative interviews revealed concerns about algorithmic unfairness, data privacy, and the high implementation costs of AI systems. Managers emphasized that if AI is not well watched, it can reinforce current disparities and have unforeseen consequences. These findings highlight the practical and ethical issues that ought to go hand in hand with the use of AI for sustainability.

Synthesis and Consequences

When combined, these results demonstrate how AI-powered business analytics, through increased efficiency, transparency, and strategic foresight, are very supportive of sustainable decision making. However, businesses must make sure that robust ethical frameworks are in place to handle bias and data privacy threats. The findings clearly highlight the necessity of using AI with purpose, encouraging a more careful balancing act between innovation and ethical supervision, and making sure that the adoption of technology aligns with sustainability objectives.

CONCLUSION

The disruptive power of AI-led analytics in fostering sustainable decision-making in the modern US economy is revealed by this study. Based on quantitative data from CSR reports and qualitative evidence from manager and IT professional interviews, we hypothesize that AI applications, such as machine learning, predictive analytics, and data mining, enhance organizational effectiveness, transparency, and strategic initiatives. These features assist businesses in optimizing their use of resources, monitoring compliance with ethical and environmental obligations, and improving their long-term planning for both environmental and economic sustainability. Adoption of AI is not without its difficulties, the study adds. For AI adoption to be morally and responsibly acceptable, businesses must address a number of important issues, including algorithmic bias, data privacy concerns, and cost. Businesses may maximize AI's benefits while mitigating any potential drawbacks by implementing governance and oversight frameworks after understanding these concerns. When combined, the findings support the growing body of empirical data about digital transformation and sustainable business. The report provides helpful suggestions on how businesses, scholars, and politicians might employ AI technologies to support competitiveness and innovation without sacrificing sustainability. In the end, properly implemented AI-powered analytics could turn out to be a tactical tool for attaining long-term resilience, ethical governance, and sustainable growth in the US business economy.

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