مجلة الشروق للعلوم التجارية
الترقيم الدولي ISSN: 1687/8523
ترقيم دولي الكتروني Online :2682-356X
رقم الايداع بدار الكتب المصرية 2007/12870
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موقع المجلة : https://sjcs.sha.edu.eg/index.php
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The Impact of Artificial Intelligence Technology on Improving Firm Sustainability

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الكلمات المفتاحية:

Artificial intelligence, sustainability, industry 4.0

التوثيق المقترح وفقا لنظام APA :

Kamshish, Hadeer Mansour Metwally,(2025), The Impact of Artificial Intelligence Technology on Improving Firm Sustainability, Al-shorouk Journal of Commercial Sciences, volume 17, The Higher institute for computers and Information Technology, Al-Shorouk Academy,

Abstract:

In today's fast-paced business environment, data-driven decision-making has become essential for organizations seeking to remain competitive. Organizations are not just economic entities, but are integral parts of societal systems, influencing and interacting with social, environmental, and economic dimensions. As such, they must skillfully navigate increasingly complex and dynamic ecosystems. Growing concerns about the environment and climate change, along with issues of poverty, growing inequality, and tensions arising from social inequality, have put sustainable development in the spotlight of national and international institutions, policymakers, and initiatives across countries. AI is transforming sustainable business strategies globally, as AI is not only enhancing operational efficiency and productivity and reducing costs, but also driving important environmental improvements, such as improving the use of renewable energy and mitigating emissions. In addition, the impact of AI extends to enhancing workplace safety, promoting diversity, and supporting community initiatives. AI is a powerful tool in advancing the Sustainable Development Goals.

1- Introduction:

In recent years, environmental, social and corporate governance (ESG) has become a vital concept and strategy for promoting sustainable development, and has received great attention from academia and industry. It is necessary for companies to actively embrace social responsibility, promote green innovation, and accelerate green transformation and development to meet their ESG obligations. Improving ESG performance brings many benefits to companies (Bai et al., 2025). Economic, social and environmental sustainability are the three pillars of the development of nations. The three dimensions need a symbiotic approach to advance developing countries. In order to achieve these goals, technology can play a crucial role, and artificial intelligence and machine learning play a crucial role in achieving the sustainable development goals (Kulkarni et al., 2024). AI technologies are transforming various sectors and have great potential to promote sustainable development, and AI plays an important role in progress across key sectors, including healthcare, agriculture, education, environmental

protection and infrastructure. AI has gradually transformed from a specialized technological innovation into a powerful tool capable of solving complex and multidimensional problems in various sectors. Its applications in sustainable development are promising, bringing cutting-edge changes in areas critical to economic growth, social equality, and environmental sustainability (Mienye et al., 2024). The rapid advancement of machine learning algorithms, industrial robots, and other technologies has promoted the deep integration of AI with various sectors, increasing production efficiency, information processing ability, and rational resource allocation, making significant contributions to global sustainable development. The application of AI also reduces energy consumption, improves resource efficiency, and accelerates green transformation (Tao 2024). The combination of AI and bioenergy systems represents a paradigm shift that presents unprecedented opportunities for transforming renewable energy generation, slowing global warming, and enhancing ecological balance. AI also helps predict and mitigate potential impacts on biodiversity. By assessing the complex interactions between bioenergy processes and surrounding ecosystems, intelligent systems contribute to adaptive management plans that protect biodiversity and advance sustainable energy production (Anbarasu et al., 2025).

The problem is that due to the tremendous technological progress, many technologies have emerged, such as artificial intelligence technology, and the world is recently moving towards its application, as there is an agreement that our current era has entered a new revolutionary phase, which is the digital revolution, which will witness an improvement in various industries, as this technology is characterized by flexibility, low costs and innovation. Sustainable development is considered the basis for the axis of progress in institutions and has received great attention from academic circles and industry, as it is the basis for the continuation of institutions in the market and maintaining their competitive advantage. Artificial intelligence technology plays a transformation in various sectors and has great potential to enhance sustainable development.

This working paper attempts to answer the following theoretical question:

Q1: Does artificial intelligence technology affect improving sustainable development?

The working paper aims to study and test the impact of artificial intelligence technology on improving sustainable development.

The working paper derives its academic **importance** from the fact that it contributes to enriching accounting research on the impact of artificial intelligence technology on improving sustainable development. The working paper also derives its practical importance from the fact that it seeks to study the impact of artificial intelligence technology on improving sustainable development, which will benefit companies practically. The motivations for the working paper are represented by the tangible scarcity of academic accounting research that addresses the impact of artificial intelligence technology on improving sustainable development.

Work Paper plan:-

2- Previous studies:

2-1. Artificial Intelligence:

Mienye et al., (2024, p3) defined artificial intelligence as "an umbrella term that refers to a set of techniques and methodologies that aim to give machines the ability to perceive, understand, act, and learn, reflecting certain aspects of human intelligence."

AI refers to the intelligence that computer systems exhibit when performing tasks, including abilities such as learning, reasoning, problem solving, perception, and language comprehension. Academic exploration of AI dates back to the mid-20th century, with a primary focus on symbolic logic and search algorithms. Until the 1990s, expert systems were a popular area within AI, simulating reasoning processes in specific domains (Chen et al., 2024). AI can be described as a branch of computer science that focuses on creating intelligent agents to take actions

that maximize their chances of successfully achieving their goals. It is a technique for simulating human intelligence to accomplish tasks similar to humans. AI systems use algorithms to process data; to accurately produce results and make effective decisions in a timely manner, and often exceed the speed and accuracy of human capabilities in tasks Various (Mienye et al., 2024). AI and machine learning also have a number of advantages, such as cost reduction, improved quality, faster response times, reduced waiting times, and more accurate results (Rashid et al., 2024). AI has become a vital tool for businesses to collect and leverage information, enabling faster and more informed decisions. AI's ability to recognize patterns from large data sets allows businesses to maximize the potential of their data through proactive analytics that enhance operational coordination and strategic planning. US industries are using AI to drive sectors such as energy, healthcare, agriculture, and manufacturing toward sustainability (Balcıo˘glu et al., 2024). AI seeks to create systems that can operate somewhat autonomously, whether it is performing complex calculations, recognizing patterns in data, or interacting with users in a way that feels natural. The potential of AI extends across different sectors, enabling advances in healthcare through predictive diagnostics, in finance through automated trading systems, in the automotive industry through self-driving cars, and in everyday life through personal assistants. The development of AI is characterized by remarkable achievements in computational power and data availability, which has led it from a theoretical pursuit to a practical tool that drives innovation (Mienye et al., 2024). AI has formed a new information management system, which has profoundly affected business processes and organizational operations. Organizations can employ AI capabilities to formulate new skills, thus seizing market opportunities, enhancing operational capabilities, improving customer service experiences, and optimizing supply chains (Chen et al., 2024).

2-2. Sustainable development:

Mienye et al. (2024, p3) defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable development refers to the

organizing principle of achieving human development goals while preserving the ability of natural systems to provide the natural resources and ecosystem services on which the economy and society depend.

Social, economic, and environmental development together contribute to sustainable development. Social sustainability is essential to creating just societies where basic human needs are met and human rights are protected. To achieve sustainable development, policymakers and management must take into account social, environmental and economic considerations together (Kulkarni et al., 2024).

Mienye et al., (2024) also pointed out the dimensions of sustainable development, the first of which is the social dimension, which addresses the fundamental aspects of human well-being and aims to ensure balanced social development across societies. This dimension emphasizes the need for equitable social progress as the backbone of sustainable development. Initiatives seek to ensure that all individuals have access to the basic services and rights necessary for their well-being and dignity. The second dimension, the economic dimension, focuses on the need for strong and inclusive economic growth, which should not come at the expense of environmental health or social justice. Third, the environmental dimension emphasizes the critical importance of protecting and managing the Earth's natural resources to ensure a sustainable future. Finally, partnerships, taking into account the complex and interconnected nature of global challenges, emphasize the importance of strong international partnerships.

The concept of sustainability is not new, but rather has a rather long history and has evolved over time. It is important that this development was influenced by different intellectual and political trends that formulated the concepts of sustainability. The term sustainability began to be widely used in relation to environmental problems. As well as emphasizing social aspects, especially the main factors that determine social equality, such as social justice, distributive justice, and equality of conditions. The final result of companies' interest in environmental and social aspects is to achieve profitability and continue in the markets for a long time (Giovannoni and Fabietti 2014).

The study of Mienye et al., (2024) explained the goals of sustainable development and the first goal is people: where the goal of people's advancement emphasizes the eradication of poverty and hunger and living in dignity and equality. Achieving this goal includes providing access to basic resources such as education and health care. The second goal is the planet: where it includes protecting our ecosystems and ensuring the sustainable management of natural resources to support current and future generations. The third goal is prosperity: where this element is related to ensuring that all individuals have the opportunity to enjoy a prosperous life without harming the environment. The fourth goal is peace: where peace, justice and strong institutions are essential elements of sustainable development. Finally, partnership: where the global partnership for sustainable development must be activated. By enhancing regional and international cooperation to access science, technology, innovation and knowledge exchange.

3-2. Analyzing the relationship between artificial intelligence and sustainable development:

Artificial intelligence is a promising tool to accelerate progress towards the sustainable development goals that aim to address global challenges such as poverty, inequality, environmental degradation, peace and justice (Mienye et al., 2024). The study (Kulkarni et al., (2024) indicated that the ethical culture in the organization plays a vital role in the readiness of business organizations to adopt AI technology, and therefore the role of business ethics in creating social and environmental sustainability, and developing skills, working conditions, work environment, and safety in achieving social and environmental sustainability should be studied. The study (Mienye et al., (2024) indicated that to maximize the benefits of AI for sustainable development, strategic approaches must be implemented that take into account the challenges and opportunities. These challenges include inadequate infrastructure, limited access to technology in rural areas, scarcity of skilled professionals, and significant gaps in regulatory frameworks, which can hinder the effective deployment of AI technologies. These strategies should focus on enhancing the efficiency and scope of AI technologies in sectors vital to development, such as healthcare, agriculture, education,

environmental protection, and industry. The study (Balcıoglu et al., (2024) indicated areas for adopting AI in sustainable business practices, namely agriculture and food industry, enhancing food security through waste reduction, and in the healthcare sector. AI's ability to process massive amounts of data enables rapid diagnosis of diseases and better patient management, thus improving health outcomes while optimizing resource utilization. Energy management is another area where AI is making a significant contribution; it is enhancing energy efficiency and sustainability through smart grid management and predictive maintenance of power systems. AI is playing a transformative role in supply chain management by improving logistics and reducing the carbon footprint associated with transportation and storage. Anbarasu et al., (2025) also indicated that AI-powered predictive analytics can help identify optimal sustainable processing pathways while using bioenergy pathways with the lowest possible environmental footprint. Using AI in this way not only provides benefits to bioenergy producers, but can also help reduce waste and use resources more effectively, thereby reducing costs, and help ensure compliance with environmental regulations to support the sustainable development agenda, thereby improving financial and environmental performance. Tao (2024) also indicated that AI has the potential to revolutionize green productivity by improving resource allocation and enhancing energy efficiency across industries. For example, AI can improve supply chain management, leading to more sustainable production processes and a reduced carbon footprint. As a result, it is expected that companies can reduce costs and comply with increasingly stringent environmental regulations by integrating intelligent algorithms into their operations, thereby gaining a competitive advantage in the global market, ultimately improving environmental and economic performance. AI has demonstrated great potential to enhance sustainable development across sectors including healthcare, agriculture, education, and environmental protection. It provides strategic insights to enhance infrastructure, develop human capital, drive innovation, ensure ethical governance, upskill local talent, and enable an inclusive regulatory environment to ensure that AI can be effectively used to achieve sustainable development. These approaches, if carefully implemented, can help overcome social, economic, and environmental challenges. Locally

adapted AI solutions will not only promote economic development, but also contribute to social justice and environmental sustainability (Mienye et al., 2024).

Balcıoglu et al., (2024) also pointed out that the results of adopting AI technology include streamlining operations, enhancing productivity, and reducing operating costs. The benefits of AI extend beyond improving specific operational tasks to include broader business functions, including supply chain management, customer relations, recycling, enhancing workforce capabilities and retention, promoting social responsibility, and reducing emissions. AI technologies help in predicting emissions, improving waste management, and developing renewable energy sources. Tao (2024) also found that AI strongly enhances green productivity, and indirectly enhances it through increasing the use of renewable energy, attracting skilled labor, and dampening stock market performance. Financial development in general amplifies the positive effects of AI on green productivity. The study (Bai et al., (2025) also indicated that AI applications reduce corporate costs, increase profits, improve productivity, mitigate information asymmetry, and suppress corporate environmental misleading behaviors. AI applications have a more significant suppressive effect for companies with insufficient cash flow, companies without banking relationships, and those located in regions with good institutional environments and high levels of human capital. The study (Anbarasu et al., (2025) also indicated how AI is revolutionizing optimization, waste reduction, and environmental sustainability. Thanks to its ability to make intelligent decisions, predictive modeling, and adaptive controls to maximize bioenergy processes, machine learning algorithms are essential for predicting biomass properties, optimally selecting raw materials, and enhancing energy conversion procedures in general. AI increases energy production, while reducing waste and emissions by improving raw material selection, process efficiency, and supply chain management. In addition, its applications in predictive analytics and real-time monitoring help maintain operational safety and compliance with sustainability standards. A study (Chen et al., 2024) indicated that AI achieves sustainable development for companies by alleviating financing constraints, reducing agency costs, improving supply chain performance, labor productivity, resource efficiency, and mitigating enterprise

risks, among other factors. AI also facilitates sustainable development for companies, with a more significant impact on environmental governance and social responsibility. AI plays a crucial role in meeting stakeholder demands, improving corporate resource allocation, and promoting the application of sustainable development principles in corporate practices. AI and machine learning have a number of advantages, including cost reduction, improved quality, and faster response times. Sustainable manufacturing practices and AI have heralded a digital revolution in the manufacturing industry. AI helps manufacturing organizations reduce waste and hazardous emissions while encouraging the adoption of environmentally friendly resources, achieving social justice, and improving profitability, thus significantly impacting corporate performance in terms of the environment, economy, and society (Rashid et al., 2025).

4- Conclusions:-

- AI is not only enhancing operational efficiency, but also driving important environmental improvements, such as improving the use of renewable energy and mitigating emissions. In addition, the impact of AI extends to enhancing workplace safety, promoting diversity, and supporting community initiatives.
- The integration of AI into firms has profound implications for management practices, particularly in how companies approach sustainability, efficiency, and workforce management.
- Using AI to conduct comprehensive social and environmental impact analyses allows organizations to assess the full spectrum of impacts of their activities.

Recommendations:

- The need to adopt modern technologies, such as artificial intelligence, to achieve numerous competitive advantages and ensure companies' continued presence in the market.
- The need to train company employees on implementing this new technology.
- The need to hold conferences to highlight the importance of achieving sustainable development to maintain the profitability of the company, society, and the surrounding environment

Suggested research areas:-

- the impact of the integrated between big data and cloud computing on sustainable performance.
- the impact of internet of things on improving sustainability.
- the blockchain and green innovation technologies on sustainability.

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