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Impact of AI on Sustainable Development

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Abstract. *Automation has changed industrial production; artificial intelligence (AI) is next. AI allows machines and systems to work with people and other living things, and this research examines how AI may establish sustainable economic models. This research examines how computer science, through AI, quick machine learning, and sustainable development (SD), can modify consumer and production habits to accomplish the UN 2030 Agenda's Sustainable Development Goals. The study shows that AI might transform SBMs. AI can optimize resource allocation, boost efficiency, and eliminate waste. AI can create new sustainable products and services. AI sustainability faces certain obstacles, according to the research. AI implementation may be costly, and safely using AI systems can be difficult. The study concludes that AI might boost sustainability. Before using AI in SBMs, examine the pros and cons.*

Keywords: *Sustainability, Artificial Intelligence, Sustainable Development (SD), Automation, Machine Learning*

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INTRODUCTION

A growing number of businesses are impacted by artificial intelligence (AI) (Soni et al., 2020; Dirican, 2015; Carter, 2018; Bharadiya, 2023). Global productivity, inclusiveness, equality, and environmental results will all be impacted by AI in the long run. Numerous impacts of AI on sustainable development are conceivable. This study defines sustainable development as the 17 Sustainable Development Goals (SDGs) and 169 objectives in the 2030 Agenda for Sustainable Development, even though no prior research has examined how AI may influence all aspects of sustainable development. We conclude that the implementation of the SDGs may be hindered by AI, highlighting the pressing need for research (Leal et al., 2023; Abdella et al., 2020).

An overview of the study's conclusions can be seen in Fig. 1: A framework for categorizing the SDGs regarding AI impact. Grewal (2014) said that, software technology and artificial intelligence (AI) are both defined as anything that has at least one of the following capabilities: Perception, which comprises auditory, visual, textual, and tactile (such as face recognition), involves decision-making, prediction, automated knowledge extraction, and pattern detection from data, interactive communication (e.g., social robots or chatbots), and logical reasoning. Machine learning and several other subfields fall within this framework (Sætra, 2021).

AI's SDG impacts: Each colorful square represents a numbered SDG. The inner circle's percentages illustrate each SDG's share, while the upper percentages demonstrate how AI may affect all targets (Bachmann et al., 2022; Singh et al., 2024; Steingard et al., 2023). The outer circle shows social, economic, and environmental discoveries. For each sort of evidence, the darkening inner region shows the results in brackets (Sætra, 2021). Our research shows that AI can help SBMs optimize resources, reduce waste, and boost efficiency. The study also discusses the costs of implementation and the potential for abuse when employing AI for sustainability (Zhuk, 2023; van et al., 2022; Toderas, 2025). After thorough consideration of the difficulties and opportunities, AI may be a significant tool for sustainability in SBMs, according to the study.

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Section 2 of the document and Related work Section 3: Its aims form its structure. Section 4: "The Role of AI in SDGs," Section 5: "Conclusion.".

METHODS

This study employed a qualitative descriptive approach based on literature review to examine the impact of artificial intelligence on sustainable development. The method was selected because the study aims to synthesize and interpret existing scholarly discussions on the relationship between artificial intelligence and the Sustainable Development Goals rather than to test hypotheses through primary field data. Through this approach, the study was able to explore how artificial intelligence has been discussed in relation to social, economic, and environmental dimensions of sustainability and to identify the forms of contribution and risk associated with its implementation.

The data used in this study consisted of secondary data derived from academic literature, including journal articles, scholarly reviews, and relevant conceptual publications discussing artificial intelligence, sustainable development, and the SDGs. The literature was selected based on its relevance to the focus of the study, particularly publications addressing the role of artificial intelligence in supporting development outcomes, improving efficiency, strengthening innovation, and influencing sustainability related policies and practices. Priority was given to sources that directly examined the connection between artificial intelligence and one or more dimensions of sustainable development.

The process of data collection was carried out through document based searching and reading of relevant references. After the literature had been identified, the selected sources were reviewed carefully to extract key ideas, recurring themes, and major arguments concerning the opportunities and challenges of artificial intelligence in the context of sustainable development. The analysis focused on how the literature explains the capacity of artificial intelligence to contribute to the achievement of the SDGs, as well as the limitations, ethical concerns, and implementation barriers that may hinder its positive role.

Data analysis was conducted through qualitative content analysis. The collected literature was categorized according to themes related to the developmental impact of artificial intelligence across SDG related domains. These themes included social implications, economic implications, and environmental implications, along with broader issues such as inclusion, efficiency, governance, and technological readiness. The findings from these sources were then interpreted comparatively in order to construct an integrated understanding of how artificial intelligence may support or inhibit sustainable development across different sectors and goals.

This method was considered appropriate because it provides a systematic way to organize dispersed knowledge from existing studies and to develop a broader conceptual understanding of the role of artificial intelligence in sustainability discourse. By using the SDGs as an analytical frame, the study was able to connect diverse discussions from the literature into a single interpretive structure that reflects the multidimensional nature of sustainable development.

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RESULTS AND DISCUSSION

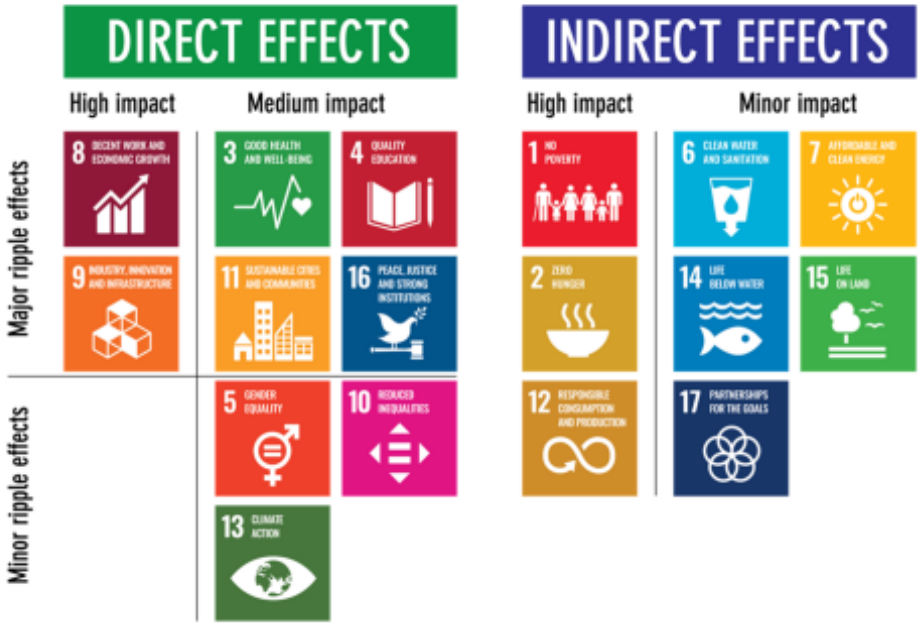

Figure 1. SDG AI Effect Categorization

Related Work

2020, The authors evaluate and integrate AI into water, agricultural, and health leadership and sustainable management efforts. AI-driven projects achieve the SDGs and solve global problems better. The following projects demonstrate how AI might be applied to the UN's Sustainable Development Goals (SDGs): AI and the water crisis They emphasize AI-powered intelligent water management technology to optimize infrastructure decisions and cost commitments. Clean, safe water access is crucial to women's empowerment, gender equality, food and agriculture, energy and climate, infrastructure, and technology (Akurugu et al., 2021; Nyan et al., 2025; Kayser et al., 2019; Jeevanasai et al., 2023; Kevany & Huisingh, 2013). AI in Agriculture: The authors explain PlantVillage, a smartphone software for farmers to diagnose plant diseases. The program uses mobile device photos to diagnose plant diseases to encourage more efficient and sustainable agriculture. AI, Sanitation, and Health: The authors emphasize the need for clean water for everybody and advocate collaboration (Goralski & Tan, 2020; Ibrahim et al., 2025; Nti et al., 2023).

2020, AI's growing influence in numerous areas necessitates assessing its impact on the Sustainable Development Goals. The authors conclude that AI can facilitate 134 objectives and inhibit 59 goals using a consensus-based expert elicitation procedure. Current research neglects critical factors (Stoltenborgh et al., 2013; Rajoo et al., 2017). AI's rapid progress requires regulatory knowledge and supervision to ensure sustainable development. It might compromise openness, safety, and ethics (Vinuesa et al., 2020) This article explores AI and sustainable development in China. Chinese AI and sustainable development strategies aim for global leadership (Liu et al., 2025; Khanal et al., 2025; Kabanda, 2025). China has achieved progress in several Sustainable Development Goals (SDGs), but it is trailing overall, and AI technology may help. The report assesses AI's impact on global and regional sustainable development using 193 nations' newest data. Government AI preparedness positively impacts SDG progress. Government AI readiness strongly correlates with the economy and society but not with the environment or partnerships. To fully harness and scale AI to fulfill the SDGs, the Chinese policymaker should align prospective AI technologies to solve the SDG shortfall, designate priority or focused sectors,

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and build suitable business models and incentive structures for scaling viable solutions. AI may help China achieve the SDGs if used wisely (Liengpunsakul, 2021).

2021, The authors examined how Artificial Intelligence (AI) affects Sustainable Development Goals (SDGs), notably poverty reduction (Goal 1) and industry, innovation, and infrastructure development (Goal 9) in developing countries. Content research showed that AI helps achieve SDGs, notably in poverty reduction and infrastructure dependability, such as in the transport sector, boosting developing nations' economic growth. In (Ridha et al., 2023). The research found that AI reduces poverty by improving data collection via poverty maps and transforming agriculture, education, and finance through financial inclusion. AI also gives previously excluded people access to education and financial services, allowing them to engage more fully in the economy (Mhlanga, 2020; Mhlanga, 2023; Mhlanga, 2021). To achieve innovation, infrastructure, and poverty reduction SDGs, developing nations must invest more in AI and related research. AI can improve citizens' lives and maintain growth in these nations. 2022, The authors evaluated how AI influences SDGs including poverty reduction, industry, innovation, and infrastructure development in poor nations (Tarashtwal et al., 2025; Ajaj et al., 2024; Platania et al., 2025; Raghavendra et al., 2025; Mai et al., 2025). Content research shows that AI affects SDGs like poverty reduction and infrastructure reliability, such as transit, boosting economic growth in developing nations. AI enhances poverty map data collection, revolutionizing agriculture, education, and finance through financial inclusion (Ogbuju et al., 2025; Mhlanga, 2025; Adewuyi et al., 2023). AI gives excluded individuals access to education and finance, allowing them to participate in the economy (Bulathwela et al., 2024; Mhlanga, 2021; Vasile & Manta, 2025). To achieve the SDGs for innovation, infrastructure, and poverty reduction, poor nations must invest more in AI and related research. AI can improve sustainable development and citizen lives in these nations (Rieder et al., 2022).

Agenda and Its Goals

The United Nations today unveiled 17 linked and indivisible Sustainable Development Goals and 169 related targets. Never before have world leaders committed to working together on a broad range of international policy issues. The SDGs usually follow the national policies and priorities of many countries worldwide, according to the United Nations (Georgeson & Maslin, 2018; Bexell & Jönsson, 2017). The United Nations, on the other hand, views the targets that come after the various SDGs as aspirational and global, and each nation sets its national targets while taking into account its circumstances and being guided by the level of ambition at the international level. The targets' second significant feature is that each government must independently decide how to incorporate each global target into its national planning procedures, policies, and strategies (Mhlanga, 2022; Di et al., 2020; Schiff, 2022). as listed below:

Sustainable Development Goals

Goal 1. End poverty in all its forms everywhere. Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture. Goal 3. Ensure healthy lives and promote well-being for all at all ages. Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Goal 5. Achieve gender equality and empower all women and girls. Goal 6. Ensure availability and sustainable management of water and sanitation for all. Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all. Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. Goal 10. Reduce inequality within and among countries. Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainablel. Goal 12. Ensure sustainable consumption and production patterns. Goal 13. Take urgent action to combat climate change and its impacts. Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development. Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Goal 16. Promote peaceful and inclusive societies for

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sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels. Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development. Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

The Role of AI in SDGs

Academic scholars frequently assert that AI is a complicated field of study encompassing a wide range of conceptual frameworks and areas of competence. Knowing how the system should modify its behavior is a fundamental technical challenge (Holmes & Tuomi, 2022). Data-driven AI systems use essential calculus to solve this problem. The system parameters can be changed in many minimal steps to achieve 'good enough' predictions. AI systems can frequently change numerous settings until the system is effective. For instance, the well-known GPT-3 language model from OpenAI includes 175 billion programmable parameters. The human brain had a significant influence on developing self-learning computer systems (Mohammed et al., 2021). Now that the sustainable development goals are broadly and extensively simplified, we will look at how artificial intelligence can support each goal and achieve or nearly reach this objective, as shown in Table 1.

Table 1. Artificial intelligence can support each goal in SDG

NO.	Role of AI
Goal-1	AI can improve farming productivity, reduce energy consumption via intelligent networks, and halt water loss. These boost output and the global population. AI aids agriculture, water, and energy objectives.
Goal-2	To achieve this purpose, tiny devices are concealed in farmed regions and utilized to regulate watering programs by tracking wetness levels, plant and fertilizer performance, and data demand. Also, how much and what sort of fertilizer, water, and time are utilized? Farmland gets more productive. AI may also determine which crops to plant based on farm size, location, and weather.
Goal- 3	There are many applications for artificial intelligence with the Internet of Things for older people who use small gadgets (like watches and healthcare monitoring systems) to check their pulse and pressure and warn the doctor, first aid, or parents if something catastrophic happens.
Goal-4	AI-based gamification may help students earn high grades and build dynamic educational aids suited to their requirements and levels.
Goal-5	Many traders have discussed how AI may attain this aim. The program can compute compensation and promotions and employ individuals. This software will not be gendered.
Goal-6	Artificial intelligence can predict floods and rain so countries can profit. Intelligent water systems reduce agriculture water use and improve home water delivery.
Goal-7	AI can reduce energy wastage and build effective electricity distribution networks. One of the most crucial components of advancement is intelligent electricity distribution networks.
Goal-8	The artificial sector will facilitate both the development of new jobs and the elimination of all jobs. However, those positions that are lost will be replaced. They are replaced by equipment and software that are far more productive than people, boosting economic growth and productivity. Thus, it is necessary to redistribute the labor force. Everyone will be able to obtain respectable employment while maintaining the benefits of artificial intelligence.

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Goal-9	This goal is related to the previous goals related to infrastructure development, such as water and energy.
Goal-10	If emerging nations can apply artificial intelligence effectively across various fields and domains, it helps to increase production and minimize waste, increasing global wealth and reducing the gaps between nations.
Goal-11	By AI. It can be used to enforce the security alarm system and is employed in city planning and street directions to prevent traffic bottlenecks. It can also involve developing intelligent energy transmission networks that monitor electricity consumption and distribute it to ease pressure on cables and power plants. As a result, it lessens the possibility of any problem: water distribution facilities and the amount of water used in agriculture experience a similar phenomenon.
Goal-12	artificial intelligence can forecast a potential rise in commodity consumption which a nation or the private sector accelerates the increase in output,
Goal-13	Using artificial intelligence, highly accurate modeling software for the climate system is created, assisting nations in determining how and by how much to cut carbon dioxide emissions that cause global warming. Additionally, methods for detecting acid rain that is impacted by atmospheric pollutants and air pollution
Goal-14	Here, simulations are utilized to help decide how to deal with this pollution, which might kill all marine organisms, by monitoring the level of contamination in water bodies.
Goal-15	This is monitored by AI. Artificial intelligence can help remedy this pollution imbalance by following species in forests and deserts, utilizing drone photos, and detecting disruptions. Simulations in water bodies assist policymakers decide how to handle this pollution that might wipe out all marine life.
Goal-16	Artificial intelligence is utilized in the country's insurance industry at international borders to deter invasions and combat cybercrime.
Goal-17	This goal is comprehensive and depends on all previous goals.

CONCLUSION

Automation has changed industrial production; AI is next. AI allows machines and systems to work with people and other living things, and this research examines how AI may establish sustainable economic models. This research examines how computer science, through AI, quick machine learning, and sustainable development (SD), can modify consumer and production habits to accomplish the UN 2030 Agenda's Sustainable Development Goals. The study shows that AI might transform SBMs. AI can optimize resource allocation, boost efficiency, and eliminate waste. AI can create new sustainable products and services. AI sustainability faces certain obstacles, according to the research. AI implementation may be costly, and safely using AI systems can be difficult. The study concludes that AI might boost sustainability. Before using AI in SBMs, examine the pros and cons.

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