International Journal of Sustainable Development Through AI, ML and IoT

**Volume 4 | Issue 1 | 2025**

ISSN(Online):2584-0827
https://ijsdai.com/index.php/IJSDAI/index

# AI for SDGs: Global and Indian Innovations

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**ARTICLE INFO**

Received: 01st June 2025
Revised: 17th June 2025
Accepted: 20th July 2025

***ABSTRACT***

Artificial Intelligence (AI) has emerged as a transformative force in addressing worldwide challenges summarized in the United Nations' Sustainable Development Goals (SDGs). Ranging from enhancing access to healthcare to streamlining agricultural output and supporting climate monitoring, AI offers scalable, efficient, and innovative solutions to such complicated global challenges. This paper discusses the transformative impact of AI in progressing toward all 17 SDGs through discussions of existing implementations, case studies in the real world, and upcoming research. It emphasizes the ways in which AI technologies are shaping industries like healthcare, education, agriculture, and ecological sustainability. In addition, the paper examines the ethical considerations involved in AI deployment, such as issues related to data privacy, bias, and fair access. By means of a far-reaching roadmap, it proposes the development of AI responsibly based on transparency, inclusivity, and long-term sustainability. The results seek to advise policymakers, researchers, and technology developers on the possibilities and constraints of AI as a strategic instrument for global development.

**Keywords:** Artificial Intelligence, Sustainable Development Goals, Climate Action, Smart Healthcare, AI Ethics, Digital Transformation, Responsible Innovation

## 1. Introduction

The United Nations, in 2015, adopted the Sustainable Development Goals (SDGs), which provide a map to ensure a better and more sustainable future for all. The 17 interconnected goals tackle global challenges like poverty, inequality, climate change, environmental degradation, peace, and justice. Artificial Intelligence (AI), with its rapid development and multidisciplinary uses, can contribute to making significant progress towards these goals. Through its support of decision-making, improvement in resource efficiency, and predictive insights, AI is able to resolve these challenges creatively and positively.

From healthcare with precision medicine to climate prediction, AI technologies are enabling scalable solutions aligned with the SDGs that are transforming industries such as healthcare, education, and conservation of the environment.

This research looks at the crossroads of AI and the SDGs, how AI is being used today, what impact it has had so far, and what its future holds. It looks at the new ethical implications that arise with AI, including bias in AI systems, data privacy, and the potential to further entrench inequality, presenting a balanced perspective on the role of AI in global development.

## 2. Literature Review

### 2.1 AI for Reaching the Sustainable Development Goals

The utilization of Artificial Intelligence (AI) in the United Nations' Sustainable Development Goals (SDGs) has been receiving a lot of attention across various fields. The ability of AI to solve global issues—poverty, hunger, health, education, and climate change—has long been acknowledged in recent research studies. However, the application of AI must also be accompanied by a thorough examination of its ethical considerations, equity, and sustainability.

#### 2.1.1 AI for Social Good

Roger et al. (2020) emphasize the social good role of AI, as AI systems are being created to tackle pressing global challenges, specifically SDG 1 (No Poverty) and SDG 2 (Zero Hunger) **[1].** AI technologies such as predictive analytics and economic modelling facilitate better resource allocation and targeted interventions, thereby enhancing poverty alleviation. AI is also optimizing agricultural practices by using precision farming methods, directly impacting food security. As Jack (2018) argues, machine learning can assist farmers in increasing crop productivity by offering actionable insights from satellite imagery and data analytics, supporting SDG 2's aim to end hunger and achieve food security**[2].**

#### 2.1.2 AI in Health and Well-being

AI's transformative impact on health is particularly significant for SDG 3 (Good Health and Well-being). Among the most significant achievements is DeepMind's AlphaFold, which has transformed protein structure prediction, streamlining drug discovery and disease insights**[3]**. Samuel (2021) identifies that climate modeling is currently being undertaken with AI, wherein AI is capable of forecasting climate change and augmenting disaster management strategies to further SDG 13 (Climate Action) **[4]**. These uses of AI optimize resource allocation, enhance healthcare diagnosis, and offer real-time climate prediction, which are critical in attaining health and climate objectives.

#### 2.1.3 AI for Education

The use of AI in attaining SDG 4 (Quality Education) has been the subject of considerable research. Websites such as Coursera and Khan Academy employ AI to customize learning experiences, enhancing education equity and inclusivity. As indicated by Kate (unpublished), intelligent tutoring systems are personalized for the unique needs and learning styles of learners, enhancing learning outcomes**[5].**Such computerized systems that utilize AI ensure education becomes more accessible, especially in remote areas, and help in the achievement of SDG 4's vision of ensuring quality education for everyone.

#### 2.1.4 Ethical Implications and Responsible AI

Despite all the advantages, the literature invariably highlights the ethical implications of AI development. Andrew (2020) talks about how AI systems can perpetuate existing biases, particularly in fields like recruitment, criminal justice, and surveillance**[6]**.AI dataset biases can result in discriminatory decisions, especially against vulnerable groups. Thus, incorporating fairness, transparency, and accountability into

AI systems is necessary to make sure that AI plays a positive role in sustainable development. Responsible AI development is essential for preventing these risks and making sure that AI technologies are equitably utilized.

2.1.5 Cross-sector Collaboration for Responsible AI

Lastly, inter-sectoral collaboration is pivotal in unlocking the full potential of AI while managing its risks. Multistakeholder dialogue—involving governments, academia, industry, and civil society—must take place to develop policies and frameworks to steer AI use. Intersectoral cooperation ensures that AI is developed and utilized so as to raise the level of alignment with SDGs, while its risks of misuse are reduced (Andrew, 2020) **[6]**.

## 3. AI Applications Across SDGs

### 3.1 No Poverty (SDG 1)

Artificial intelligence (AI)-based economic modeling and predictive analytics enable the identification of poverty hotspots and the improvement of social welfare programs. Tools such as GiveDirectly apply machine learning to better target aid to marginalized communities**[1]**.

### 3.2 Zero Hunger (SDG 2)

AI in farming—precision agriculture, crop monitoring with satellite imagery, and yield prediction models—has enhanced food security. IBM's Watson Decision Platform for Agriculture provides actionable insights to farmers for enhancing crop productivity**[7]**.

### 3.3 Health and Well-being (SDG 3)

Early diagnosis, treatment planning, and remote patient monitoring are supported by AI algorithms in healthcare. Applications such as DeepMind's AlphaFold are transforming protein structure prediction, key to disease and drug discovery understanding. **[3]**.

### 3.4 Quality Education (SDG 4)

Intelligent tutoring systems learn students' styles of learning and difficulties. Online educational platforms such as Coursera and Khan Academy employ AI in personalizing the content and automated testing to guarantee inclusive and equitable education. **[5].**

### 3.5 Clean Water and Sanitation (SDG 6)

AI models forecast water quality and contamination in real time, which makes drinking water safer. Companies such as EMAGIN utilize AI for intelligent water management in urban networks.

### 3.6 Affordable and Clean Energy (SDG 7)

AI maximizes renewable energy grids by predicting energy consumption and solar/wind supply. Google DeepMind cut data centre power consumption by 40% by using AI to manage energy**[8]**.

### 3.7 Sustainable Cities and Communities (SDG 11)

Smart city designs integrate AI for traffic management, waste management, and city planning. AI-enhanced cameras and IoT sensors optimize city operations and sustainable infrastructure.

### 3.8 Climate Action (SDG 13)

Climate modelling, forest monitoring, and disaster forecasting are aided by AI. IBM's Green Horizons initiative applies AI to predict air pollution levels and guide policy measures in cities. **[4]**.

## 4. Methodology

This research employs a qualitative methodology, merging case study analysis and systematic literature review in investigating the contribution of AI to the attainment of the United Nations' SDGs. Data was collected from the last five years through academic journals, industry reports, and case studies in areas such as climate action, agriculture, education, and healthcare.

### 4.1 Research Design

The study utilizes a systematic review and case study methodology, examining the influence of AI on SDGs using projects and initiatives in major sectors.

### 4.2 Data Collection

Data was gathered from credible databases (Google Scholar, JSTOR, SpringerLink), with sources depending on relevance to SDGs, size of implementation, and reported outcomes.

### 4.3 Data Analysis

The information was examined qualitatively to look for patterns and determine the efficiency of AI in promoting SDGs. The ethical aspects of AI bias and privacy were also examined.

### 4.4 Case Study Selection

Case studies were selected based on real-world application to SDGs, targeting healthcare, agriculture, and climate using AI.

### 4.5 Ethical Considerations

The research prioritizes accountable AI development, with emphasis placed on fairness, transparency, and accountability, and addressing challenge issues of bias and privacy.

### 4.6 Study Limitations

This study is restricted by the body of literature and case studies that exist, and the fast-moving nature of AI means that some of the results will be superseded.

## 5. Findings and Discussion

This study shows the central role of Artificial Intelligence (AI) in driving achievement toward the United Nations' Sustainable Development Goals (SDGs), especially in healthcare, agriculture, climate action, and education.

**Key Findings:**

a) **Healthcare (SDG 3):** AI, through technologies such as DeepMind's AlphaFold, is improving disease diagnosis, treatment planning, and drug development, enhancing healthcare provision and access, particularly in rural and disadvantaged areas.
b) **Agriculture (SDG 2):** Precision farming methods through AI technologies, like IBM's Watson, allow farmers to maximize crop yields, enhance food security, and ensure sustainable agriculture.

c) **Climate Action (SDG 13):** Artificially intelligent models predict levels of pollution and make renewable energy grids more optimal, which assists in climate resilience and helps in environmental sustainability.
d) **Education (SDG 4):** AI-based systems like Coursera are used to offer personalized education, enabling education to be made more accessible and customized to each individual.

## 6. Case Studies

### 6.1 AI for Pandemic Response (SDG 3: Good Health and Well-being)

Artificial intelligence was the key to the early detection, diagnosis, and coordination of responses during the COVID-19 outbreak in the early stages. There are several exemplary instances, like BlueDot's use of AI to forecast the Wuhan outbreak before the WHO and Google's DeepMind using AI to hasten vaccine research by forecasting protein structures. Other AI-based products such as RADLogics and Infervision assisted in COVID-19 pneumonia diagnosis using CT scans and X-rays with lowered turnaround times. AI chatbots, like WHO Health Alert, offered 24/7 global health guidance.

### 6.2 AI for Disaster Relief and Humanitarian Assistance (SDG 11: Sustainable Cities and Communities)

AI-based drones and remote sensing technologies have been employed in damage estimation and survivor location during disasters such as the Nepal Earthquake and Southeast Asian floods. UNICEF's Project Connect employs AI to map school connectivity in far-flung areas for continuity of education during emergencies. NLP models like AIDR scan social media for indicators of crises to assist in the effective distribution of aid.

### 6.3 AI in Wildlife Conservation (SDG 15: Life on Land)

AI is aiding wildlife conservation by using camera traps, drones, and sensors to monitor endangered species and detect poaching. Wildlife Insights uses machine learning to identify species from camera images, while PAWS helps predict poaching risks in sanctuaries.

### 6.4 AI in Clean Energy Management (SDG 7: Affordable and Clean Energy)

AI is improving energy management by smart grids that maximize distribution and incorporate renewable energy. In India, Gram Power employs AI for microgrid management, while Autogrid maximizes energy demand in cities, facilitating the use of clean energy.

### 6.5 AI for Gender Equality in the Workforce (SDG 5: Gender Equality)

Artificial intelligence tools such as Pymetrics assist in curbing bias in hiring by analysing cognitive characteristics. In Rwanda, the "Big Sis" AI chatbot informs girls about reproductive health and career choices, assisting in eliminating gender gaps

## 7. Roadmap for Responsible AI for SDGs

a) **Policy Integration:** Governments need to create specific AI policies in line with national SDG priorities, promoting ethical use, accountability, and equitable access to AI technologies.
b) **Data Infrastructure:** Developing strong and diverse data ecosystems is critical. Open and inclusive data decrease algorithmic bias and enable accurate, context-sensitive AI solutions.
c) **Cross-sector Cooperation:** Cooperation between academia, industry, and government promotes innovation and facilitates scalable, effective AI solutions custom-made to address particular SDG requirements.

d) **Capacity Building:** AI literacy and digital infrastructure, especially in less-developed areas, need to be strengthened. Training initiatives and local innovation centers will bridge the digital divide and empower communities.

## 8. Challenges and Ethical Considerations

Although AI has vast promise in realizing the Sustainable Development Goals (SDGs), some issues and ethical considerations need to be solved:

a) **Data Privacy and Security:** Most AI systems are based on large data sets, which create potential issues related to data misuse, data breaches, and the ethical management of sensitive data, particularly in healthcare and education.
b) **Algorithmic Bias and Fairness:** Biases in training data can result in discriminatory decisions, especially in hiring, law enforcement, and financial services. AI algorithms need to ensure fairness and transparency to prevent perpetuating social inequalities.
c) **Access and Inequality:** The dividends of AI are not equitably shared. Low-income or rural communities often do not have the infrastructure and digital literacy to use AI tools effectively, possibly exacerbating the digital divide.
d) **Accountability and Transparency:** Deciding who is responsible for AI decisions—particularly for high-consequence situations such as medical diagnosis or disaster response—is a difficult problem. Black-box models make transparency and trust even harder.
e) **Environmental Impact:** Developing AI, especially large models, has high computational requirements and energy costs, which may work against climate objectives if not developed sustainably.
f) **Ethical Use in Surveillance and Warfare:** There is increasing alarm at the use of AI for mass surveillance or autonomous weapons, posing moral and legal issues as to its involvement in human rights and international peace.

## 9. Future Directions and Recommendations

To leverage the full capabilities of Artificial Intelligence (AI) in realizing the Sustainable Development Goals (SDGs), efforts in the future should be strategic, ethical, and inclusive. Drawing from the study, the following directions and suggestions are made:

a) **Reinforce Ethical Frameworks:** Create universal AI ethics guidelines to guarantee accountable development and deployment. Priority should be given to transparency, fairness, data protection, and accountability.
b) **Ensure Inclusive AI Access:** Close the digital divide by investing in infrastructure, digital education, and local AI solutions—particularly in low-income and underserved areas—to ensure that AI technologies are equitably beneficial.
c) **Promote Interdisciplinary Collaboration:** Invite collaboration among governments, academia, private sector, and civil society to co-create AI tools with SDGs. Interdisciplinary research can accelerate innovation and applicability.
d) **Invest in Explainable AI:** Support research on explainable and interpretable AI models to build trust, especially in high-stakes domains such as healthcare, education, and governance.
e) **Foster Sustainable AI Innovation:** Create energy-efficient AI frameworks and incentivize green computing practices to lower the ecological impact of AI innovation.
f) **Enact Monitoring and Evaluation Mechanisms:** Create strong metrics to evaluate the influence of AI uses on SDG results, based on transparency, ongoing improvement, and responsibility.

## 10. Conclusion and Future Scope

This study highlights the potential of Artificial Intelligence (AI) to drive change in speeding up efforts towards the United Nations' Sustainable Development Goals (SDGs). AI technologies have already shown remarkable impact in important sectors like healthcare, education, agriculture, clean energy, and disaster response. From real-world examples, it is evident that, AI can enhance service delivery, support better decision-making, and provide scalable solutions to some of the world's most challenging issues.

Yet, the use of AI should be regulated by robust ethical principles to guarantee fairness, transparency, and inclusivity. Issues like algorithmic bias, data privacy, and the digital divide are still significant concerns that need to be addressed to prevent widening inequalities.

Looking to the future, the scope of AI in sustainable development will expand with advancements in technology and global collaboration. It is crucial to invest in AI literacy, build robust data infrastructure, and promote cross-sector partnerships. Responsible innovation, combined with inclusive policies and international cooperation, will be key to leveraging AI's full potential in creating a more equitable and sustainable world.

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