**Enabling Sustainable Development Goals through Artificial Intelligence: A Conceptual Review**

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**Abstract**

The emergence of artificial intelligence (AI) and its expanding impact across many sectors necessitate an evaluation of how it will affect the achievement of the Sustainable Development Goals. Artificial intelligence and other digital technologies that have emerged in the last few years are being currently applied in virtually in every area of society, economy and the environment. Arificial Intelligence could accelerate our progress on the United Nations (UN) [Sustainable Development Goals](https://www.sciencedirect.com/topics/social-sciences/sustainable-development-goals) (SDGs) and can affect global productivity, equality and inclusion, environmental outcomes and several other areas, both in the short and long term. This research paper has explored the role of Artificial intelligence in achieving the United Nations Sustainable development goals particularly with respect to society, economy and environment.

**Keywords:** Artificial Intelligence, Sustainable Development Goals and United Nations.

**Introduction**

Artificial intelligence (AI) refers to a new generation of technologies capable of interacting with their surroundings and attempting to mimic human intelligence as well as holding a significant role in tackling climate change (Filho et al., 2022). With innovative technologies, artificial intelligence has changed the way we live. AI has taken over every industry and has had a significant impact on every sector of society. Even though Artificial Intelligence (AI) has existed as an academic and scientific discipline since the 1950s, AI technology has gained significant attraction in recent years. There are various artificial intelligence techniques such as natural language generation, speech recognition (voice assistants), Virtual agents, Biometrics, machine learning, Robotics process automation, peer-to-peer network, deep learning platforms, and AI-enabled hardware tools available which can help the economy as a whole. Today, Artificial intelligence not only provides a solution to climate change and is also helping the engineering, architecture and construction factors to promote knowledge discovery, intelligent optimization and augmenting the decision-making process (Debrah et al., 2022, Filho et al., 2022). Moreover, artificial intelligence has provided a huge contribution to the suppression of the new coronavirus by predicting the three key areas of AI (prediction, symptom recognition, and development) which were being used to suppress the coronavirus( Peng et al;., 2022). This demonstrates that the coronavirus can be effectively suppressed by artificial intelligence technology (Peng et al., 2022. Artificial Intelligence based prediction models are being used in health care to make predictions about the current health of the patients and estimate the probability of the health outcome in the future. (Hond et al., 2022). From this perspective, it could be argued that it is important to think about the opportunities that AI presents in addressing sustainability-related problems and in achieving the Sustainable Development Goals. In a study conducted by Ullah et al., 2021, the researcher attempted to determine the untapped factors that affect sustainable development in 64 Belt and Road Initiative (BRI) countries and found that financial development, financial inclusion, energy efficiency ratio, per capita health expenditure, per capita income growth, governance, and integration show a significant positive impact on the sustainable development path of BRI countries. The study showed that better regional policies for financial development, financial inclusion for poverty alleviation, and e-government development are required to boost per-capita income and sustainable development in the coming years (Ullah et al., 2021). There are 17 integrated and connected Sustainable Development Goals (SDGs) in the 2030 Agenda for Sustainable Development (Agenda 2030). The Sustainable Development Goals (SDGs) generally refer to measures and regulations that are aimed at reducing the negative externalities of human activity, with a focus on social inclusion (SDGs 1–11, 15, 16), ecological inclusion (SDGs 1, 2, 6–9, 11–15), and relational inclusion (SDGs 3, 4, 10–14, 16, 17). (Gupta & Vegelin, 2016). Additionally, Positive and negative interactions between SDGs can happen, typically depending on important variables like geographic context, resource endowments, time horizon, and governance. (Nilson et al., 2018).

**A contextual framework for AI in the SDGs perspective**

SDGs establish an action plan for people, the planet, prosperity, and peace as well as global priorities for 2030. In this context, AI plays a decisive role in allowing new technologies to improve efficiency and productivity (Vinuesa et al., 2019) through technological improvements that can overcome some current limitations thereby, supporting SDG#12, which encourages "doing more and better with less" by encouraging efficient and responsible use of natural resources, will help ensure sustainable models of production and consumption.

**Table 1. United Nation Sustainable development Goals**



**1. Role of AI in achieving Societal outcomes**

**1.1 Role of AI in achieving SDG-1 (Poverty and Over Indebtness)**

The first global challenge in terms of sustainable development goals for the United Nations 2030 Agenda for Sustainable Development is to "end poverty in all its forms everywhere by 2030" (United Nations, 2019b). The term “over-indebtedness,” refers to debts that cannot be repaid or only with extreme hardship. Each nation has a certain proportion of citizens who frequently overspend and accumulate significant consumer debt regardless of their income. Numerous potential causes or risk factors have been linked to excessive debt. One is a lack of formal education and poor financial literacy. A study in 2021 uses the artificial intelligence tool AI, called Machine Learning (ML) to autonomously extract patterns from over-indebtedness data .The tool of Automated Machine Learning evaluate thousands of models generated by state-of-the-art algorithms with multiple combinations of parametrization, and different types of feature selection methods. In this way, Artificial intelligence automates the configuration and selection of a complex machine learning model of over-indebtedness and fosters the generation of robust models – that is, models that are resistant to data variations and able to provide a more accurate data generalization (compared to single ML algorithms testing), reducing possible errors and biases that may occur using a human-based design of specific machine learning model. AI can help to identify areas of poverty and foster international action using satellite images (Vinuesa et al., 2020).

**Strengths**

* Emergence of new technologies in primary and industrial sectoracross developing countries.
* Predictive power of machine learning upon satellite and aerialimages
* Deep Learning with mobile device data as a strong domestic income predictor.
* Combining digital transaction and property data in regression techniques

**1.2 Role of AI in achieving SDG-2 ( Zero hunger )**

Fair and open political institutions are crucial to the battle against hunger and poverty. Through systems that can track data logs transparently, which is now possible, thanks to blockchain technologies these two qualities—fairness and transparency—may be achieved. On the basis of such recorded data logs, AI systems may also help make better decisions . It has been claimed that blockchain technology can make the procedures used to produce food more efficient, transparent, traceable, and sustainable, reducing food loss and waste and ensuring food security. Additionally, the ability of AI systems and digital technologies for data collection, fusion, and analysis would aid in decision-making processes related to food production.

 **Strength ofAI in achieving SDG -2**

* Partnerships between organisms and technological firms lead tobetter solutions to identify areas under (or prone to) hunger using AI
* Combining demographic and socio-economic information withsatellite data to predict famine, crop diseases/plagues or demandsafter disasters.–
* Optimization and sequential decision-making algorithms helpmanaging theWater-Energy-Food Nexusto guarantee food sustenance

**1.3 Role of AI in achieving SDG -3 (Good health and wellbeing)**

AI is now top-of-mind for healthcare decision makers, governments, investors and innovators, and the European Union itself. An increasing number of governments have set out aspirations for AI in healthcare, in countries as diverse as Finland, Germany, the United Kingdom, Israel, China, and the United States and many are investing heavily in AI-related research. It has recently gained power in the medical field, where there are several examples of its advancements, advantages, and opportunities in prediction, diagnostics, healthcare, or preventive medicine Additionally, AI can be used in the field of public health by leveraging data from social networks and Web 2.0 platforms, which can then be used to combat drug misuse toxic substance use , sexual and reproductive health, and healthy lifestyle.

**Strengths**

* Predictive machine learning is a valuable tool for various medicalprognosis and diagnosis tasks
* Data-driven interpretable decision support systems for intensivecare, including neonatal children
* Deep learning on medical image data brings revolutionaryadvances in medical predictions
* Machine learning with big data and expert judgement drivesadvances in biomedicine

**1.4 Role of AI in achieving SDG -4 (Quality education)**

Artificial intelligence has been used more frequently in the education sector, expanding beyond the traditional understanding of AI as a supercomputer to include embedded computer systems. For example, embedded into robots, AI, or computers and supporting equipment enable the creation of robots that improve the learning experience of the student, from the most basic unit of education, early childhood education. AI-aided education includes intelligent education, innovative virtual learning, and data analysis and prediction. Major scenarios of AI in key technologies and education Diverse techniques, based on machine learning, data mining, and knowledge models, are incorporated into AI systems for learning analysis, recommendation, knowledge understanding, and acquisition. The basic components of an AI education system are learning materials, data, and intelligent algorithms, which can be further broken down into two categories: intelligent technologies and system models (which include learner, teaching, and knowledge models). There are more and more attempts to use AI in the teaching process. Even differences in language are no longer a barrier since one can easily access translations by utilizing Google, Microsoft, et al. AI also plays an ever-increasing role in the scientific assistance that students use as either a helper or as a teaching partner. It cannot be ruled out that in the future a human teacher could be replaced by an AI teacher. Akihiro Teramachi, President and CEO of the Japanese firm THK Co. Ltd. claims that the problem with education today is that “the global education system is still based on the assumption that people are indispensable. Given the degree to which children are already interacting with AI, and the ease with which they do so, it is not difficult to conclude that it will not be ‘unnatural’ for them to assimilate the idea of AI in teaching programs.

**2. Artificial Intelligence and Environment Outcomes (Sustainable development goals -SDG -13 Climate Action, SDG -14 Life below water, SDG -15 Life on land)**

 The three SDGs in this group are related to climate action, life below water and life on land (SDGs 13, 14, and 15).

**2.1 SDG-13 and Artificial Intelligence**

AI is a game-changer towards innovative solutions to pressing climate change threats.The potential impact of the development of artificial intelligence and machine learning on global GHG emissions is of great interest. The ability of AI to process enormous amounts of non-structured, multi-dimensional data using sophisticated optimisation techniques is already facilitating the understanding of high-dimensional climate datasets and forecasting of future trends. AI forecast changes in the global mean temperature predict climactic and oceanic phenomena like El Nio, cloud systems and tropical instability waves as well as to better understand various aspects of the weather system like rainfall both applying artificial intelligence to the "problem space" of climate change could produce significant benefits by, first, assisting in understanding the issue and, second, facilitating an efficient response.

**2.2 Smart water management through Artificial Intelligence (SDG-14)**

Water and sanitation are at the centre of the SDG resource triad. The creation of "smart" solutions and applications to meet societal needs is made possible by improved connectivity and interactions between the physical and digital worlds. Water management is a crucial issue because it is a crucial resource. ICT innovations gradually implemented within the water sector offer a different, clever, and original way to improve water management effectively. Antzoulatos et al., 2020 provided unified framework for urban water management, exploiting state-of-the-art IoT solutions for remote telemetry and control of water consumption in combination with machine learning-based processes. For water utilities, new software-as-a-service platforms can be used to create and manage new dynamic strategic financial operations that will greatly increase productivity and reduce costs. For managing distribution networks and tracking real-time water loss, the system also combines inexpensive sensors and communication networks. "Our water professionals' imaginations are freed by the power of AI". AI's ultimate objective is to perform better than humans, not to be perfect (Kaufman, 2018). The use of AI in water management has the potential to boost productivity, improve water conservation of this precious resource, and thus advance the achievement of a number of Global Goals, including SDG #3 on good health and well-being, SDG #6 on water and sanitation, and SDG #14 on life below water. This is true despite the transition that may present some difficulty and risks.

**2.3 Artificial intelligence and Agriculture ( SDG-15)**

Three major AI techniques; Expert Systems, Artificial Neural Networks and Fuzzy systems are used for general crop management , Pest management , agricultural product monitoring and storage control, disease management, soil and irrigation management.Artificial intelligence helps a farmer by using an app on a common inexpensive smart phone in the field to diagnose the diseases. “Behind the app … is a database of 150,000 photographs of diseased plants – a number the team intends to grow to three million”. With AI being a technology of low-cost prediction and discovery, vast amounts of data can be utilized to identify patterns and make predictions (Sood et al., 2021). Once the app has been downloaded, farmers in remote villages no longer need wireless access to cellular data or remote computing power, which is a significant advantage. According to Hughes, "There is an opportunity to use AI to help break the cycle of poverty in low-income countries that lack human capital in fields like agricultural science" This innovative use of AI that makes use of inexpensive, locally applicable cell phone technology has the potential to boost agricultural productivity, increase agricultural output, and improve food production.

**Artificial intelligence and Economic outcomes**

The technological benefits provided by AI may also positively affect the accomplishment of a number of SDGs under the Economy group. It emphasises economic sustainable development while also taking into account the rights and welfare of the individual. There are two viewpoints inside this dimension: Life is concerned with reducing poverty, providing for one's needs, and maintaining one's health. Economic and technological development is focused on economic growth, sustainable industrialization, and innovation. The various strnghths of AI in economic groeth are STEM jobs in the third sector for better resilience against economic crises along with .Personalized advertisement in social media increase access to job opportunities. Apart from that Smart cities and intelligent transportation systems propel efficient commuting and flexible working. And Lowering sensor costs and Open Dataenable access and application of AI in more sectors. With the help of AI Digital labor and external outsourcing as an engine can be used create employment .Mobile technologies enable universal access to e-commerce andsecure online banking and Ambient intelligence, IoT and machine learning to anticipate job accidents in risk contexts. AI can help in Crop and assembly chain digitisation in transforming agricultureand food manufacturing and in Expert prognosis systems in drones for maintenance of critical resources at work.

**SDG 9**  [**Industry, Innovation and Infrastructure**](http://www.un.org/development/desa/disabilities/envision2030-goal9.html)

There are also multiple prospects related to sustainableinnovation and industrial processes. For achieving the goal of SDG 9 Industry , inovtaion and infrastructure One of them entails aiding innovative startups and small businesses (SMEs) with promising innovation projects for the digital transformation of the economy and industry. On the other hand, smart contracts could enforce con-taminant reduction policies, especially if this course of action is linked with the benefits of AI to automate and create penalties. Finally, it would be useful to encourage AI-guided R&D project review procedures in the scientific landscape in order to detect prospective impacts of industrial and innovation processes and, as a result, nurture the financial support of such efforts with stronger environmental, economic or social implications intheir proposed activities and portfolio.( Plekhanov,2018).

**Strengths**

Intelligent sensors and 5G for real-time infrastructure monitoring

* Remote computer vision and 3D models to detect anomalies andfacilitate maintenance
* Robust traffic prediction with neural networks dge computing, 5G and sensors draw safe autonomous vehiclescloser to reality.
* Automatic systems for efficient route planning.

**Conclusion**

This paper presented a snapshot, general view and reflectionon the role and impact of AI and its surrounding tech-nologies in attaining the Agenda 2030 for sustainabledevelopment, namely its 17 Sustainable Development Goals(SDGs). AI presents a wide array of applications that can serve as game-changers for the pursuit of sustainable development, which will involve multiple actors from different countries, cultures and sectors. Through the UN Global Compact, businesses around the world have been called to play a role in achieving the SDGs. The advances made by the innovators, activists, and global champions of development using AI-enabled applications put them at the frontier of the sustainable development work. Their innovations have enhanced efficiency of industries and sectors, helped to conserve precious, non-renewable resources, diffuse knowledge and expertise, bridge the global gaps in resources and technology, and helped to forge effective multi-sector partnerships (governments, private sector, civil society, and citizens) that contribute to global sustainability. The pursuit of the Global Goals and the implementation of the ambitious vision for a sustainable future embodied in the SDGs are up against powerful and entrenched forces. The fight for global sustainability and the future of humanity on the planet will require a commitment from a range of public and private sector organizations, national governments and civil society, and all the resources they can muster. But they would also do well to leverage on a whole new set of capabilities and technologies made available by artificial intelligence. The advent of SDGs constitutes a very significant business opportunity for the nascent AI industry.. These SDG-advancing innovations and initiatives, however, may have to be adopted and institutionalized at a cost and bear some potential risks. AI is a double-edged sword. It can come with multifaceted pitfalls and complex problems that must be rigorously studied and managed to contain its negative and unintended consequences. Its life-affirming and sustainability-promoting applications may also be used for evil, in activities that will exacerbate the worst impacts of global warming, pollution, unbridled consumption, and irresponsible production methods to feed the culture of perpetual growth endemic to the capitalist global economic order of today. Even some of the most straight-forward and low-cost innovations would need incentives and partnerships between governments, corporations, communities, workers, employers, and academia to adopt, manage and sustain these transformative applications.

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