

Harnessing Artificial Intelligence for Global Sustainability: A Systematic Review of Applications, Challenges, and Future Directions



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Artificial Intelligence (AI) has emerged as a transformative force in addressing global sustainability challenges, offering innovative solutions for energy optimization, environmental conservation, waste management, and smart urban development. This systematic review critically examines the role of AI in advancing sustainability initiatives by synthesizing peer-reviewed literature published between 2015 and 2024. The study explores how AI-driven technologies, including machine learning, deep learning, and big data analytics, contribute to improving energy efficiency, optimizing resource utilization, and enhancing decision-making processes in sustainability efforts. Key applications include AI-powered smart grids, predictive analytics for climate change mitigation, intelligent waste management systems, and real-time environmental monitoring. Despite its vast potential, the integration of AI into sustainability efforts presents significant challenges. Ethical concerns such as algorithmic bias, lack of transparency in decision-making, and data privacy issues remain critical obstacles. Additionally, high implementation costs, limited interdisciplinary collaboration, and the need for robust policy frameworks hinder the large-scale adoption of AI-driven sustainability solutions. This review underscores the importance of addressing these challenges through inclusive governance, interdisciplinary partnerships, and ethical AI development. Future research should focus on refining AI algorithms for higher accuracy, improving global data-sharing mechanisms, and developing cost-effective AI solutions that are accessible to developing regions. By leveraging AI responsibly and equitably, policymakers, researchers, and industry leaders can drive meaningful progress toward achieving the United Nations' Sustainable Development Goals (SDGs) and fostering a resilient, sustainable future for both present and future generations.

Keywords: Artificial Intelligence, Sustainability, Sustainable Development, Energy Optimization, Smart Cities, Machine Learning, Environmental Conservation, Waste Management, Climate Change, Sustainable Development Goals (SDGs).

Biography:

Dr. Devesh Kumar is serving as Associate Professor in the School of Commerce and Management, Studies, Central University of Himachal Pradesh, Dharamshala, India. A PhD in Information Systems, Devesh Kumar has vast experience in teaching, research, and administration. He has published several research papers in cloud computing, innovation diffusion, e-learning, and information systems in reputed journals. He has also presented several research papers in conferences in India and abroad. His teaching interests include Business Analytics, Data Mining, Descriptive Analytics, Data Visualization, Predictive Modeling, Machine Learning, and Information Systems. He has more than 25 years of experience in academics & research in higher educational institutes in India and abroad. He holds master's degrees in computer applications & business economics. Currently he is engaged in research in learning analytics, machine learning and predictive modeling.