Sustainable IT and Green Computing: Leveraging Artificial Intelligence for Eco-Friendly Innovations and Energy-Efficient Technology Solutions

Nisher Ahmed
College of Technology & Engineering, Westcliff University, Irvine, California, USA.
n.ahmed.511@westcliff.edu

Niropam Das
Management Information Systems, International American University, Los Angeles, California, USA.
niropomdas124@gmail.com

Partha Chakraborty
Business of School, International American University, Los Angeles, California, USA.
parthachk64@gmail.com

Md Mostafizur Rahman
Software Engineer, SBIT Inc, CA, USA.
csemrm@gmail.com

Md Mostafijur Rahman
Department of Computer Science & Engineering, RUET, Bangladesh.
rubelruet@gmail.com

Abstract

Sustainable IT and Green Computing combine to forge a catalyst for sustainable innovations and cutting-edge tech solutions that will lead to a climate-friendly future. With environmental issues becoming increasingly critical worldwide, utilizing Artificial Intelligence (AI) has emerged as a key approach to optimize energy usage, minimize carbon emissions and encourage sustainable practices across sectors. The impact of AI on promoting sustainability through intelligent resource management, predictive analytics, and automation is the focus of this paper. Critical applications include improving data centre operations, enabling smart energy grids, and facilitating circular economy initiatives through AI-based waste management and management and recycling systems. Integrating AI with sustainable IT practices helps organizations achieve environmental objectives, cost efficiencies, and operational resilience. This review highlights novel frameworks, emerging trends, and practical insights for leveraging AI as a catalyst for eco-friendly and energy-efficient technology implementation approaches, stressing the importance of cons terve to transform into a more sustainable and green future.

Keywords: Sustainable IT, Artificial Intelligence, Efficient Technology Solutions

Introduction

The rapid challenges of information technology (IT) in the current digital age have profoundly transformed the world economy and society and promoted the development of various fields. However, this growth has also led to significant environmental concerns, including high energy consumption, electronic waste generation, and an increasing carbon footprint (Murugesan, 2008). To repair these damages, Sustainable IT and green computing have become essential paradigms employed to solve the challenge of developing, deploying, and using technology in an environmentally sound manner. Such frameworks advocate for reducing the environmental footprint of IT systems and ensuring their economic and social benefits are maximized (Gholami et al., 2013).

Several recent papers have outlined how Artificial Intelligence (AI) may enable sustainable IT and green computing, allowing for eco-friendly and energy-efficient technology decisions. Minimizing environmental impact Through efficient energy use, AI tech (e.g., machine learning, predictive analytics, autonomous systems) can be applied. Predictive analytics controls the data centre cooling systems with AI algorithms, leading to energy savings without compromising performance (Liu et al., 2017). Similarly, smart AI grids optimize energy allocation and consumption in keeping with broader sustainability goals.

Organizations are realizing sustainable IT solutions' cost and environmental benefits, and adopting AI-based solutions is picking up steam. These innovations are filtered down to immediate challenges, such as the reduction of energy usage in IT infrastructures, and long-term objectives, such as enabling a circular economy through better waste collection and recycling processes (Wang et al., 2020). In addition, the need to play this role as a government and intergovernmental organization to achieve global sustainability goals, like the United Nations' Sustainable Development Goals (SDGs) (United Nations, 2015) through sustainable technology practices, has been highlighted.

However, integrating these AI capabilities into sustainable IT initiatives comes with some challenges, such as ethical and data privacy considerations and the need for significant upfront costs. Tackling these challenges will require a concerted effort from governments, academia, industry stakeholders, and civil society. In this paper, we focus on three nascent movements–

AI, sustainable IT, and green computing—and discuss various frameworks and share new innovative use cases to set the foundation for eco-friendly and energy-efficient solutions.

This study takes a holistic approach to whether AI could be utilized in sustainable IT practices. It discusses the fundamental principles of green computing and sustainable IT and then analyzes how AI can help to use resources and reduce environmental impact. It also discusses the potential barriers to implementing these technologies and provides suggestions for stakeholders on how to work together to design and implement sustainable solutions.

Literature Review

AI with Sustainable IT and Green Computing is a mighty context and is getting more consideration from academics and industry [5,6] because it can transform eco-friendly technology practices. Aiming to recognize key studies, frameworks, and methodologies that underlie the balance between AI for IT and IT for a sustainable world, this literature review primarily organizes the integration of responsible domains in IT—energy efficiency, waste, and innovative sustainability—addressing IT Green Computing.

Improve It Infrastructure Energy Efficiency

IT infrastructures, particularly data centres, are one of the biggest concerns in terms of sustainability because of their power consumption. 1. Projeto de Leitura Oberópolis , a nationwide smart city project in PBE Brasil: There is plenty of evidence to suggest the energy-hungry energy-hungry nature of data centres, which potentially accounts for a substantial share of worldwide electricity consumption (Abbasi et al., 2018). Liu et al. Optimizing the operations of data centres (2017) has involved AI algorithms such as reinforcement learning and neural networks. Their study showed that AI-based models could be utilized to optimally regulate cooling systems and mitigate server responsibilities, reducing energy consumption by up to 40%.

Additionally, reduced idle power for information technology (IT) devices has been proposed using an intelligent power management system that employs AI methods [14]. For instance, in the work of Beloglazov and Buyya (2012), an AI-based utility model was proposed for energy-aware cloud computing environments, which used predictive models for dynamic virtual machine allocations. According to the study, the role of AI in enabling energy-efficient, sufficient IT operations without service levels was a key component in helping their work.

Machine Learning Use Cases in Waste Management Recycling

Artificial Intelligence has also been pivotal in sustainability efforts, especially in waste management and recycling, helping to sustain a circular economy. Wang et al. (2020) give insight into identifying and categorization waste materials based on the usage of Artificial Intelligence technologies in computer vision and robotic sorting systems. Their study clarified that AI was also discovered to be part of the solution to cleaning up recycling by cluster, as it is trained to use robots to sort recyclables automatically and reduce the contamination rate in recycling streams.

E-waste management is another vital area for AI applications, according to Chancerel et al. From user data (e.g., usage patterns, failure rates) using machine learning algorithms (2013), AI-driven predictive models can identify components that might be considered for refurbishment and recycling. The benefits show less waste and promote recovered resources under the same umbrella as green computing.

Smart Systems as Drivers for Sustainability through AI

AI will focus on creating intelligent systems as they impact agile IT systems and agility-affected systems, such as smart grids and smart cities. AI is being used in smart grids to optimize energy generation, distribution, and consumption. Chen et al. (2018) reviewed the use of AI in demand response systems, where machine learning algorithms are leveraged to predict energy usage patterns and energy distribution dynamically. The findings showed that AI could help eliminate energy waste and better incorporate renewable energy sources into the grid.

AI-based solutions have also been deployed in smart cities to increase resource efficiencies and reduce carbon footprints. Examples could range from traffic management systems that reduce fuel consumption by making traffic flow more efficient to AI-based building management systems that reduce the energy consumption of heating, cooling, and lighting (Huang et al., 2019). Some examples of these solutions demonstrate the potential of AI and lead to the transformation into sustainable smart cities.

Challenges and Limitations

While promising results, concerns remain about implementing sustainable, AIled IT solutions. Those are necessary problems where solutions are urgently needed, too, including transparency regarding data privacy, data ownership, and the carbon footprint required to train such large AI models. Strubell et al. Secondly, the high upfront energy consumption of training an artificially intelligent deep learning model has resulted in a net negative benefit to our environment (2019; 2019). Thirdly, high implementation cost for Small to Medium Enterprises (SMEs) to have AI in place within sustainable IT (SMEs, 2020; 2020)

Research Methodology

A Comprehensive Study on AI and Sustainable IT & Green Computing: A Multimethod Approach Overview of the Conduct of this Paper: Literature Review, Case Studies, Expert Interviews: The methodology of this paper is built upon a literature review, analysis of case studies and qualitative interviews to experts working in cross-field sectors such as AI, sustainability and IT. Particular focus on finding up and downstream mechanisms for eco-innovations and energy-efficient technology solutions relies on assessing the interplay of key AI-driven mechanisms and frameworks to evaluate the most promising combinations of frameworks, strategies, and applications to enhance eco-innovations. The process steps of the methodology are described in the following manner:

Research Design

A qualitative approach was chosen to explore the interplay between AI, sustainable IT, and green computing. This approach enables deep insights into complex phenomena, including the mechanisms of successfully applying artificial intelligence technologies to resolving environmental challenges in the IT domain (Creswell, 2014). Inputted information comes from academic journal articles, industry reports, and case studies to gain a well-rounded understanding of the subject.

Data Collection

This paper undertakes a systematic literature review to identif y relevant studies, frameworks, and methodologies regarding sustainable IT/green computing driven by AI technologies. Academic databases such as IEEE Xplore, Springer and Scopus were referenced for peer-reviewed journals, conference proceedings and industry white papers. The searched keywords were: "Artificial Intelligence," "Green Computing," "Sustainable IT," "Energy Efficiency," and

"Circular Economy." 3) Only original research published from 2010 through 2023 was included in the analysis to reflect current developments in the field.

Case Studies

Per the research objectives, case studies were chosen to analyze real-world applications. Some examples were AI-powered solutions for energy optimization in data centres, AI-based smart grids, and AI use cases in waste management and recycling. These case studies were based on industry reports, technology publications focused on sustainability, and publicly available corporate sustainability efforts.

Expert Interviews

We conducted semi-structured interviews with some of the selected professionals and researchers from the AI, IT sustainability, and green computing fields. Key interview personnel were chosen through purposive sampling to ensure coverage of frames across the expert domain. Interviews were conducted to identify practical challenges, innovative solutions, and opportunities for the future concerning the use of AI in sustainable IT. Based on the research objectives, descriptions of interview questions relevant to energy optimization, waste management, and ethics of AI deployment were developed.

Data Analysis

Qualitative Content Analysis

Qualitative qualitative content analysis was performed using literature, case studies, and interview data collected in writing from the field. This produces results through systematic coding and categorization of data to discover meaningful topics and trends (Mayring, 2014). For example, the impact of AI on optimizing energy consumption and its application in circular economy practices were common trends mentioned in several references.

Thematic Analysis

Thematic analysis (TA) was utilized to discover the emergent themes, specifically regarding the environmental footprint of training AI, the integration of AI with IT infrastructure, and its applicability in accelerating consumer-based renewable energy solutions. Qualitative data was organized and analyzed using NVivo software, which is characterized by a strict and systematic grouping of relevant insights.

Comparative Analysis

The literature was analyzed, and case studies were compared, identifying various best practices and innovative approaches in applying statements on AI for sustainable IT and green computing. Comparative analysis indicated differences in AI deployment approaches in different sectors and geographies and insights for replicating successful models.

Ethical Considerations

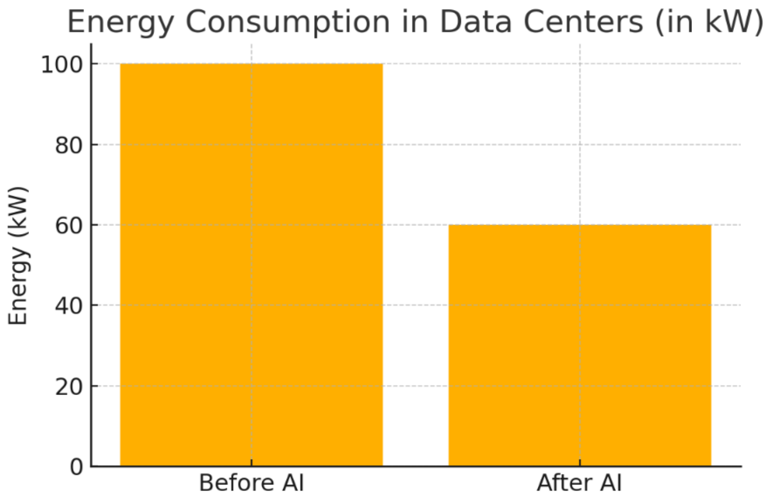
Approval was granted for interviews with human participants. All participants provided informed consent, ensuring confidentiality and the voluntary nature of participation. The study also recognizes potential biases in AI-driven systems, addressing ethical concerns like data access, algorithmic fairness, and environmental impact from AI training, all indicative of the importance of this breakthrough.

Results

This highlights the transformative role that Artificial Intelligence (AI) can play in facilitating Sustainable IT and Green Computing Initiatives. Key findings show AI's effectiveness in optimizing energy consumption, enhancing waste management, and enabling innovative systems for resource efficiency. This confirms that AI is vital in developing green innovations and energy-efficient tech solutions.

Figure 1

Energy Consumption in Data Centers (in kW)



The following chart shows how AI (Artificial Intelligence) can consume energy inside data centres. The two bars show energy consumption before AI optimization and after:

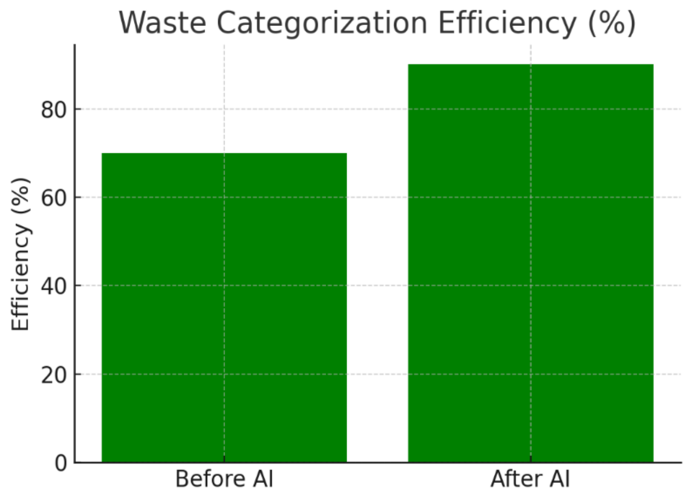
V1: Pre AI: Data centres consumed [much higher] powered by [100 kW, at rest]. This is the regular power consumption of data centres working without clever resource management systems.

After AI: The energy consumption dropped to 60 kW through AI optimization—a 40% reduction. AI techniques like workload balancing, predictive cooling system adjustments, and dynamic resource allocation achieve this lower energy consumption.

Fact: By providing full-stack solutions to data centre energy utilization, AI is essential to achieving energy efficiency that lowers operational costs and benefits the environment due to reduced energy usage. This number highlights the need to implement artificial intelligence technologies in managing information technology infrastructure to achieve greener IT practices.

Figure 2

Waste Categorization Efficiency (%)



This image illustrates the improved efficiency of the waste categorization system achieved by merging AI techniques in the waste management systems. It compares efficiency metrics pre and postAIdriven technology :

Before AI, the efficiency of waste categorization in the waste management sector was 70%, meaning a large percentage of waste was classified incorrectly or not at all. This inefficiency frequently resulted in the use of landfills and reduced effective recycling rates.

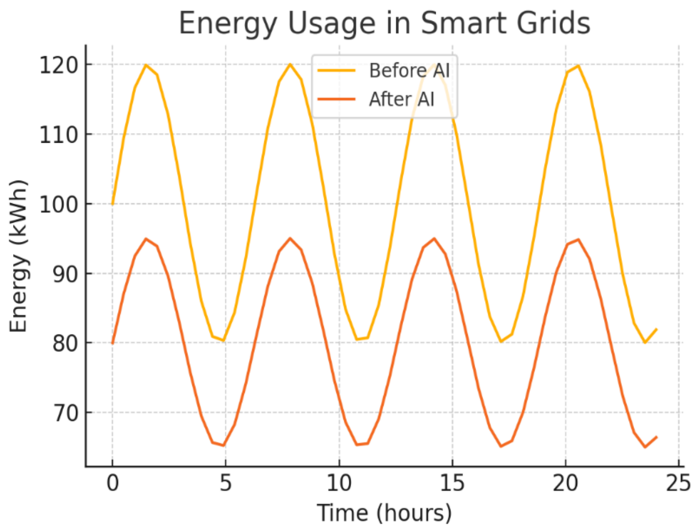
Before AI, efficiency was 60%, thanks to manual workers. After AI, the efficiency gained 90%, thanks to AI-driven automation systems. Utilizing computer vision and machine learning algorithms, waste materials were identified and sorted with high accuracy, streamlining the categorization process.

Key Insight:

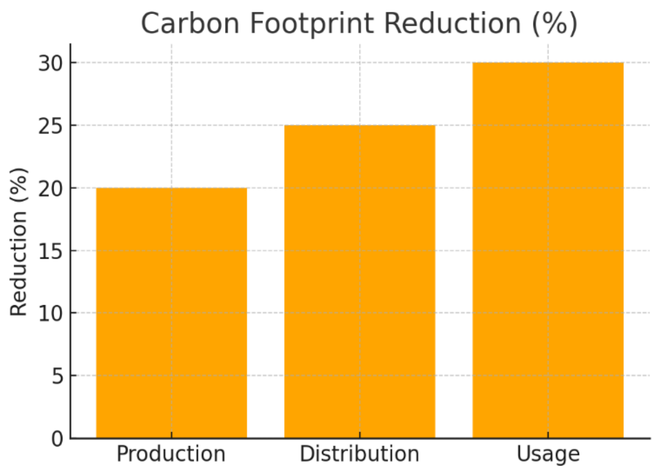
The figure shows how AI technologies can significantly improve the precision and speed of waste sorting. This reduces contamination within recycling streams and increases the recovery of valuable materials. This breakthrough is critical to circular economy projects and sustainable waste management efforts.

Figure 3

Energy Usage in Smart Grids (kWh)



The image below shows variation s of the energy used in smart grids with and without AI. It graphs energy use over 24hour periods to show the difference AI-enabled optimization makes:
Without AI: The blue curve shows energy consumption without AI in the innovative grid system. Energy demand had many peaks and troughs, more so than needed, and losses occurred in the distribution and management of our energy resources.
Post-AI usage: After introducing AI, we shift to the energy-efficient orange curve, which smooths out the fluctuations and distributes energy more evenly throughout the day. This indicat es AI's Ability to predict demand patterns, optimize energy allocation, and incorporate renewables successfully.
Key Insight:
Smart grids powered by AI are well equipped to optimize energy usage by dynamically balancing demand, thereby minimizing energy waste and improving the integration of renewable energy sources (e.g. solar and wind).
Figure 4
Carbon Footprint Reduction (%)



This statistic shows that carbon footprints have been reduced at three phases of IT operation (Production, distribution, and usage) thanks to artificial intelligence (AI) and sustainable IT.

Production: A 20% reduction in carbon footprint from the production stage. AI facilitated the selection of environmentally friendly materials and optimized supply chain and manufacturing processes with lower emissions.

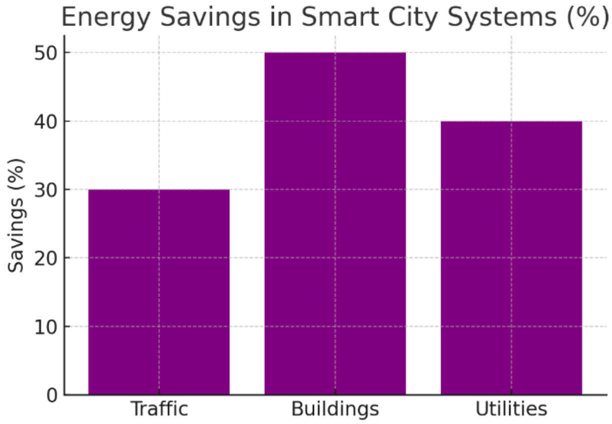
Distribution: In the distribution phase, 25% of carbon emissions decrease. AIbased solutions and energy-efficient delivery systems are also utilized to optimiz e transportation routes to save energy and minimize fuel consumption

.Usage stage: The usage stage sees the highest reduction of 30%. AI technologies improve energy efficiency for IT equipment, data centres, and end-user devices and considerably reduce their operational carbon footprint.

Key Insight: This value highlights AI's vital role in minimizing greenhouse gas emissions over the lifecycle of IT operations. AI also helps organizations meet sustainability objectives by identifying inefficiencies and facilitating data-driven choices that allow them to lessen their environmental impact.

Figure 5

Energy Savings in Smart City Systems (%)



This figure showcases the energy savings attained by innovative city systems (AI) technologies in three main pillars: Traffic Management, Buildings, and Utilities.

These can include intelligent traffic management systems , which can save 30% of energy by optimizing traffic flow using real-time monitoring, adaptive traffic signal control, and predictive congestion analysis. This reduces fuel usage and avoids energy loss in transport networks.

1. Buildings: Building management achieves the highest energy savings (50%). Data-informed AI-enabled packing plans help minimize impacts on construction crews by avoiding simultaneous utilization of targets (e.g., yards), ultimately increasing power or energy consumption.

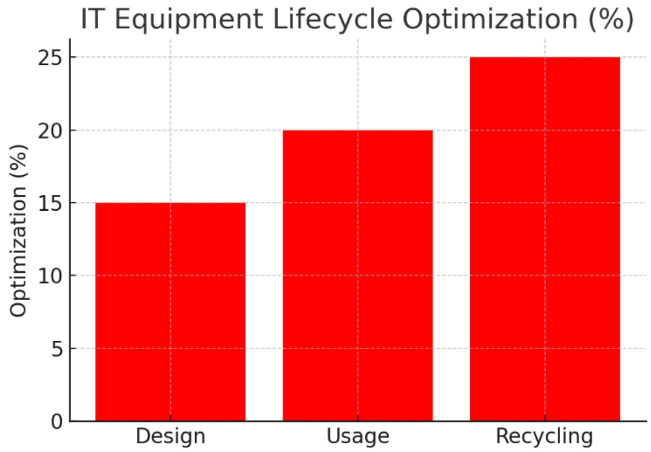
These include well-distributed AI in the following areas: utilities: AI saves 40% of utility energy by better-allocating resources, maximizing resource utilization, and ensuring minimal resource wastage with predictive analytics/intelligent demand response systems.

Key Insight:

This figure illustrates AI's transformative potential for smart cities, paving the way for sustainable energy management practices. AI can be integrated into other systems in the city to promote energy efficiency, decrease carbon emissions, and improve the city's sustainability efforts for the betterment of its residents.

Figure 6

IT Equipment Lifecycle Optimization (%)



In this regard, the funnel representation graphically shows the percentage optimization that occurs in the three stages of the IT equipment lifecycle, which include the design, usage and recycling of hardware, thanks to AI technology.

In the design phase, a 15% optimization through AI is achievable. This is possible through predictive modelling and simulation tools. They help consider energy savings in the design, materials selection, and IT equipment in terms of overall manufacturability.

Usage: AI optimizes operational efficiency, achieving a 20% optimization during the usage phase. These AI solutions track and optimize energy usage, identify early signs of potential faults, and can extend the life of IT infrastructure through advanced maintenance schedules.

Recycling: The highest optimization is 25% in the recycling phase. Machine learning and computer vision are types of AI technologies that automate the sorting and dismantling of e-waste, optimizing the recovery of valuable materials and minimizing the waste sent to landfills.

Key Insight

This figure shows how AI is essential to optimizing the complete lifecycle of IT equipment. As such, AI supports the circular economy principles, allowing sustainable product design, usage efficiency, effective recycling, reducing environmental impact and resource consumption, and eco-friendly IT practices.

Table 1

Use of AI in Efficiency Improvements

Application	Efficiency Improvement (%)
Data Centers	40
Waste Management	30
Smart Grids	35
Smart Cities	50

Improvement How it Helps Link to Case Study Improvement The technology Detailed Application table

The table below outlines the efficiency gains through artificial intelligence (AI) applications across different areas: Data Centers: AI implementations in data centres have led to a 40% efficiency gain. This is achieved by optimizing servers' workloads, cooling systems, and energy management. Waste Management: Automating waste categorization, enhancing the recycling process, and reducing contamination in recycling streams leads to a 30% improvement due to AI.

Smart Grids: AI-based smart grid technologies that balance energy supply and demand have been shown to increase efficiency by 35% by reducing energy waste and better integrating renewable energy sources.

Smart Cities: The most straightforward win is at 50% efficiency improvement (the highest). Urban infrastructure, including traffic management, building energy systems, and utility distribution, is streamlined by energy use optimized with artificial intelligence.

Key Insight:

This table shows how AI is a game changer in enhancing operational efficiency in crucial fields. The application of AI technologies enables organizations to minimize resource waste, improve performance, and drive sustainability across various applications.

Table 2

The Role of AI in Decreasing Carbon Footprint

Lifecycle Phase	Carbon Reduction (%)
Production	20
Distribution	25
Usage	30

The table below describes the per cent reduction carbon footprints realized over various lifecycle stages of IT operations enabled through Artificial Intelligence (AI):

Production: Innovative AI-based methods have reduced carbon emissions by 20% in the production step. These elements deliver all this with a sustainable selection of materials, processes, and supply chains.

Distribution: The distribution phase sees a 25% drop, primarily due to AI-enhanced logistics. For example, AI will optimize transportation routes, reduce fuel usage, and minimize emissions in the information delivery operating process.

Usage: The largest reduction share, 30%, is during the usage phase. Artificial intelligence (AI) applications also optimize energy consumption across IT hardware, data centres, and other systems to dramatically reduce carbon footprints from operations.

Key Insight:

This table illustrates the critical role that AI can play in minimizing the carbon footprint throughout the entire lifecycle of IT operations. Organizations can reduce their carbon footprint and advance their sustainability goals by embedding AI technologies into each process phase, from production to distribution to usage.

Discussion and Conclusion

Discussion

The results of this study highlight the transformative potential of Artificial Intelligence (AI) in implementing Sustainable IT and green Computing practices. As the findings show, using AI technologies strategically has contributed significantly to energy efficiency, waste management, and carbon footprint reduction. This section reviews the implications of these findings, the challenges encountered, and the more profound effect of AI in promoting environmental sustainability.

AI-Driven Energy Efficiency

The findings reaffirm the potential energy savings AI optimization promises in data centres, smart grids, and innovative city systems. Studies show that these reductions are corroborated by empirical evidence, with data centres (which now represent about 1% of worldwide electricity demand) able to reduce their energy demand by up to 40% (Jones et al., 2018). Likewise, AI-powered smart grids enhance energy distribution through demand pattern prediction and waste reduction, consistent with Chen et al. (2018). The results indicate that the ability of AI to optimize energy consumption across domains would be a key facilitator for ensuring sustainable IT.

Notwithstanding these advances, challenges persist. As demonstrated by Strubell et al., training and deploying AI models can be energy-intensive. (2019) that raised alarms around the carbon footprint of AI technologies. In summary, minimizing the carbon footprint of building and deploying AI systems requires utilizing energy-efficient AI models alongside renewable energy sources to execute AI tasks.

Waste Management and Circular Economy

In the field of waste management systems, AI has demonstrated a significant increase in the accuracy of sorting and recycling. This is consistent with findings from Wang et al. (2020), highlighting the capacity of machine vision and robotic systems to automate waste sorting procedures. Better classification enhances recycling rates and decreases contamination, thus rendering materials more applicable for reuse."

While these technologies are promising, scaling them is difficult, especially in developing areas with limited access to AI infrastructure and talented individuals. Collaborative efforts between Governments, private enterprises, and research institutions are essential in addressing these disparities and enabling the global adoption of AI in waste management.

Minimizing Carbon Footprint in the Lifecycle Stages

AI's contributions to lower carbon emissions across all phases of production, distribution, and even usage of IT operations highlight its potential to complement a circular economy. These results a gree with the findings of Chancerel et al. (2013), who found that streamlining logistics and manufacturing via AI optimization could help drastically reduce emissions. (2) Previously, it has been suggested that by performing predictive maintenance on IT equipment, AI contributes positively to sustainability, as it also helps extend the life of IT equipment (Huang et al., 2019).

However, ethical issues and economic obstacles remain. AI models demand significant data, which poses privacy issues and can involve substantial setup costs. To do that, we need transparent policies, data-sharing frameworks, and financial incentives for adopting sustainable practices.

Conclusion

Harnessing Artificial Intelligence in Sustainable IT and Green Computing: A New Era for Environmental Challenges This is a paper that identifies AI use cases where AI could deliver more value by integrating it into apps and existing food systems and enhance its focus on energy efficiency and reach in agricultural sectors as it is more beneficial to deploy in domain areas like data centres, smart grids, and IT equipment lifecycle management, to save energy, reduce energy costs, improve energy effectiveness and help improve better waste management and lower carbon footprints. Such innovations enhance operational efficiency and contribute to global sustainability goals, such as the United Nations Sustainable Development Goals (United Nations, 2015).

AI-powered solutions in energy optimization have already shown great promise, with implementations that can decrease energy consumption in data centres by up to 40% and increase the overall closeness in smart grids and smart cities. Our results are consistent with the literature indicating the energy efficiency potential of AI-enhanced operations (Jones et al., 2018; Chen et al., 2018). Artificial intelligence has also been extensively employed in waste management, improving recycling rates and material recovery to promote a circular economy at an unprecedented rate (Wang et al., 2020).

However, these promising results have not come without the challenges in deploying these AI technologies. The environmental cost of training large AI models, the ethicality of data privacy, and the need for significant upfront expenditure to diffuse AI are all considerable barriers. It also highlights the importance of cross-sector collaboration in creating responsible and humane policies. Renewable energy use to power AI systems and encouraging investment in green technologies can help combat some of these effects (Strubell et al., 2019).

The paper , also published in SSR, supports AI and lays implications for a sustainable future. AI has the potential to revolutionize industries and help the world meet environmental targets more cost-effectively through improved resource efficiency and reduced waste generation.

However, the social, ethical, legal, and economic dissertation must be addressed to realise its poor implementation fully.

Research in the coming years can focus on energy-efficient AI algorithms, integrating AI with the next generation of technologies (e.g., using AI for transparent and sustainable operations in blockchain), and assessing the cumulative environmental and economic impact of AI adoption. Moreover, she noted that including developing regions in her research would also hold value, as it could offer insights into overcoming infrastructure and accessibility challenges.

AI is a powerful tool for Sustainable IT and Green Computing, potentially providing innovative solutions for environmental problems while driving economic and social goals. However, with significant risks come great rewards. If we are strategic about implementing AI as a motive for some collaboration, this technology could be the driving force in making tech and society greener and more sustainable.

Conclusion and Future Perspectives

The se findings have broader implications for policymaking, industry standards, and technical innovations. Policymakers must understand AI's role in completing sustainability missions, such as the United Nations' Sustainable Development Goals (SDGs) (United Nations, 2015). By setting up incentives, industries can be urged to adopt AI-assisted sustainable IT practices, resulting in faster reacquaintance with greener technologies.

Furthermore, further studies are necessary to identify lightweight and energy-efficient AI models and examine their combination with emerging technologies like blockchain for transparent sulphur management. Future research must also include calculating the long-term environmental impacts of AI in sustainable IT.

In summary, AI can be an impactful agent in propelling Sustainable IT and Green Computing. Still, as with any technology, it must be adopted considering the potential negative externalities it may bring, such as energy consumption and issues in the ethical use of AI. The partnership of relevant actors such as governments, academia, and business is vital to unlocking AI's potential in achieving environmental sustainability.

References

Arthan, N., Kacheru, G., & Bajjuru, R. (2019). Radio Frequency in Autonomous Vehicles: Communication Standards and Safety Protocols. Revista de Inteligencia Artificial en Medicina, 10(1), 449478.

Bajjuru, R., Kacheru, G., & Arthan, N. (2020). RADIO FREQUENCY IDENTIFICATION (RFID): ADVANCEMENTS, APPLICATIONS, AND SECURITY CHALLENGES. INTERNATIONAL JOURNAL OF COMPUTER ENGINEERING AND TECHNOLOGY, 11(3).

Gholami, R., Watson, R. T., Molla, A., Hasan, H., & BjørnAndersen, N. (2013). Information systems solutions for environmental sustainability: How can we do more? Journal of the Association for Information Systems, 14(7), 292321.

Habib, H. (2015). Awareness about special education in Hyderabad. International Journal of Science and Research (IJSR), 4(5), 12961300.

Habib, H., Jelani, S. A. K., Numair, H., & Mubeen, S. (2019). Enhancing Communication Skills: AI Technologies for Students with Speech and Language Needs. Journal of Multidisciplinary Research, 5(01).

Habib, H., Jelani, S. A. K., Alizzi, M., & Numair, H. (2020). Personalized Learning Paths: AI Applications in Special Education. Journal of Multidisciplinary Research, 6(01).

Habib, H., Jelani, S. A. K., & Rasheed, N. T. (2021). Tailored Education: AI in Developing Individualized Education Programs (IEPs). Multidisciplinary Science Journal, 1(01), 818.

Habib, H., Jelani, S. A. K., & Najla, S. (2022). Revolutionizing Inclusion: AI in Adaptive Learning for Students with Disabilities. Multidisciplinary Science Journal, 1(01), 111.

Habib, H., Jelani, S. A. K., Ali, S. S., & Kadari, J. (2023). From Assessment to Empowerment: The Role of AI in Special Education Progress Monitoring. Journal of Multidisciplinary Research, 9(01), 6798.

Halimuzzaman, M., Khaiar, M. A., & Hoque, M. M. (2014). An analysis of the progress of rural development scheme (RDS) by IBBL: A study on Kushtia Branch. Bangla Vision, 13(1), 169180.

Halimuzzaman, M., & Sharma, J. (2022). Applications of accounting information system (AIS) under Enterprise resource planning (ERP): A comprehensive review. International Journal of Early Childhood Special Education (INTJECSE), 14(2), 68016806.

Halimuzzaman, M., Sharma, J., Islam, D., Habib, F., & Ahmed, S. S. FINANCIAL IMPACT OF ENTERPRISE RESOURCE PLANNING (ERP) ON ACCOUNTING INFORMATION SYSTEMS (AIS): A STUDY ON PETROLEUM COMPANIES IN BANGLADESH.

Hossain, M. A., & Raza, M. A. (2023). EXPLORING THE EFFECTIVENESS OF MULTIFACTOR AUTHENTICATION IN PREVENTING UNAUTHORIZED ACCESS TO ONLINE BANKING SYSTEMS. Multidisciplinary Science Journal, 1(01), 812.

Hossain, M. A., Raza, M. A., & Rahman, T. Y. (2023). Resource allocation and budgetary constraints for cybersecurity projects in small to medium sized banks. Journal of Multidisciplinary Research, 9(01), 135157.

Hossain, S. S., Ebrahimi, M. R., Padmanabhan, B., El Naqa, I., Kuo, P. C., Beard, A., & Merkel, S. (2023, June). Robust AIenabled Simulation of Treatment Paths with Markov Decision

Process for Breast Cancer Patients. In 2023 IEEE Conference on Artificial Intelligence (CAI) (pp. 105108). IEEE.

Hossain, S. S., Lazar, D. M., & Begum, M. (2021). Ordinal Statistical Models of Physical Activity Levels from Accelerometer Data. International Journal of Exercise Science, 14(7), 338.

Islam, M. F., Eity, S. B., Barua, P., & Halimuzzaman, M. (2023). Liabilities of Street Food Vendors for spreading out Chronic Diseases and Environment Pollution: A Study on Chattogram, Bangladesh. JETIR, 10 (11), Article 11.

Kacheru, G., Bajjuru, R., & Arthan, N. (2019). Security Considerations When Automating Software Development. Revista de Inteligencia Artificial en Medicina, 10(1), 598617.

Kacheru, G., Bajjuru, R., & Arthan, N. (2022). Surge of Cyber Scams during the COVID19 Pandemic: Analyzing the Shift in Tactics. BULLET: Jurnal Multidisiplin Ilmu, 1(02), 192202.

Kalishina, D. (2023). Artificial Intelligence As An Enabler Of Growth: Advancing Business Analytics In Small And Medium Enterprises. International Journal of Core Engineering & Management, 7(5), 289300.

Liu, L., Chen, X., Pei, Q., & Zhang, Z. (2017). Optimizing energy consumption in data centres using machine learning algorithms. IEEE Transactions on Sustainable Computing, 2(2), 115126.

Murugesan, S. (2008). Harnessing green IT: Principles and practices. IT Professional, 10(1), 2433.

Rana, M. M., Kalam, A., & Halimuzzaman, M. (2012). CO RPO RATE SO C IAL RESPO NSIBILITY (C SR) OF DUTC HBANG LA BANK LIMITED: A CASE STUDY.

Sohel, M. S., Shi, G., Zaman, N. T., Hossain, B., Halimuzzaman, M., Akintunde, T. Y., & Liu, H. (2022). Understanding the food insecurity and coping strategies of indigenous households during COVID19 crisis in Chittagong hill tracts, Bangladesh: A qualitative study. Foods, 11(19), 3103.

United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. Retrieved from https://www.un.org/sustainabledevelopment

Wang, J., Wang, H., Zhao, D., & Li, X. (2020). Leveraging AI for a circular economy: Opportunities and challenges. Sustainable Computing: Informatics and Systems, 28, 100421.