

Carbon Accounting and Waste Management Solutions: A Digital Transformation Perspective

Poonam Bhajbhujje

PG Student, Department of Computer Application, G. H. Raisoni University, Amravati, Maharashtra, India

ABSTRACT

The growing fast pace of climate change and the need for environment-friendly management have pushed the demand for innovative digital solutions in carbon accounting and waste management. This research paper focuses on the digital transformation in which companies achieve better carbon calculations, cut waste, and achieve the regulatory compliant process. The paper discusses PlanetaryPlus.com as a web-based platform for sustainability to illustrate how technology such as cloud computing, AI-driven analytics, and automation ensure the accuracy, scalability, and efficiency of environmental management. Furthermore, the paper assesses environmental factors and challenges in wider corporate and governmental contexts through experimentation and industry insights. The study comes up with a major thesis that data-driven decision-making has a positive effect on both companies and governments, when it comes to their efforts in sustainability. The key point of the study is the integration of technology-based solutions that will bring a substantial enhancement in carbon tracking, waste reduction initiatives, and resource efficiency, and in the end, will help the shift to a low-carbon and circular economy become possible. The study derives from the reasoning that the digital transformation is a key tool for the implementation of sustainable practices, whereby platforms such as PlanetaryPlus.com will gain a leading edge in green innovation.

KEYWORDS: AI, IOT, Blockchain, Transformation to Digital, Sustainability, Blockchain Technology and Cloud Computing, Reduction of the Carbon Footprint

I. INTRODUCTION

Climate change coupled with environmental degradation has brought an urgent demand for effective carbon accounting and waste management solutions. The legacy systems are often manual, laborious, and imprecise; thus, businesses find it challenging to track and fight their carbon footprints systematically. This is a digital transformative as a powerful enabler comes in by bringing automation along with real-time monitoring and data analytics to leverage sustainability efforts [1].

Greenhouse gas (GHG) emissions are monitored, quantified, and reported using carbon accounting. Waste management also include to minimize, recycle and properly dispose of waste. These efforts have benefited immensely from the application of AI, IoT, blockchain, and cloud computing to increase the precision and effectiveness of these processes. [9]

Blockchain transparency, IoT-enabled sensors, and AI-powered analytics are used a platform for a Planetary Plus.com to automate sustainability reporting, enhance trash management, and track emissions in real time.

Global carbon emissions continue to increase, resulting in climate warming, melting glaciers, and other environmental problems that have gradually threatened human health, equity, and sustainable development. [1]

Platforms such as PlanetaryPlus.com use AI-powered analytics, IoT-enabled sensors, and blockchain transparency to track emissions in real time, manage waste better, and automate sustainability reporting. All these innovations help companies move toward a low-carbon economy by enabling data-driven decisions to cut down their environmental footprint.

This research explores the impact of digitization on the development of carbon accounting together with waste management, applying PlanetaryPlus.com as a practical illustration. Thus, it assesses technological sustainability solutions in terms of effectiveness, challenges faced, and viability within the future, which could provide great lessons for businesses and authorities in exploiting these innovations for climate action and sustainable development.

II. RELATED WORK

Same studies have examined how digital transformation is affects waste management and carbon accounting, emphasizing the effects of cutting-edge technologies like cloud computing, blockchain, artificial intelligence (AI), and the Internet of Things (IoT) on environmental sustainability. This section examines previous studies and case studies that are pertinent to digital solutions for waste management and carbon footprint reduction.

1. Carbon Accounting's Digital Transformation

To increase the precision and openness of reporting greenhouse gas (GHG) emissions, researchers have underlined the significance of automated carbon tracking systems. By combining real-time data from IoT sensors placed in industrial facilities, a study by Gupta et al. (2021) showed how AI-powered analytics may optimize carbon footprint estimations. In a similar vein, blockchain-based carbon credit trading platforms have become popular due to their ability to guarantee tamper-proof verification of carbon offsets (Lee & Kim, 2020).

2. Intelligent Waste Handling Using AI and IoT

In smart city projects, IoT-enabled garbage management has been thoroughly studied. Real-time waste monitoring improves collection effectiveness and lowers landfill overflows. An Internet of Things (IoT)-based garbage tracking system was presented by Singh et al. (2019). It

reduces needless gasoline usage by detecting waste levels in bins and optimizing pickup schedules. Additionally, recycling efficiency has been greatly increased by AI-driven garbage sorting technologies that use machine learning (Zhang et al.)

3. Blockchain's Contribution to Environmental Sustainability

Data accuracy, transparency, and security are guaranteed when blockchain is used in waste management and carbon accounting. Nakamoto et al. (2022) investigated how decentralized ledgers promote accountability in the monitoring of carbon emissions and ease industry-wide cooperation for sustainability initiatives. Likewise, trash

lifecycle management is enhanced by blockchain-based waste tracking solutions, which prevent encouraging circular economy concepts and engaging in illicit dumping

4. Cloud-Based Sustainability Reporting Solutions

Through automated data collecting, analysis, and compliance tracking, cloud computing has made it possible for organizations to streamline sustainability reporting. According to Kumar & Sharma (2023), cloud-based carbon management tools enable businesses to produce real-time emissions reports that are in line with international sustainability frameworks such as ISO 14064 standards and the Paris Agreement.

III. RESEARCH METHODOLOGY

This study examines how digital revolution affects waste management and carbon accounting using both qualitative and quantitative research methods. Data collecting, case study research, and a comparative assessment of current digital solutions are all part of the technique. Below is a summary of the main elements of the research approach.

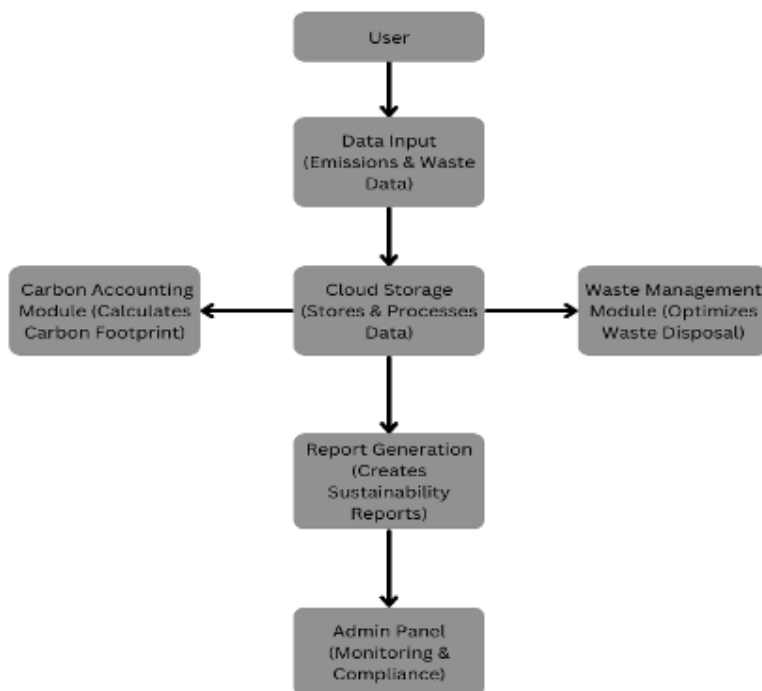


Fig 1 - System Block Diagram

1. Design of Research

Using a mixed-method approach, the study combines the following:

- **Qualitative Analysis:** Examining case studies, industry reports, and literature.
- **Quantitative Analysis:** Using data-driven metrics to assess the effectiveness of waste management and carbon accounting.

2. Techniques for Gathering Data

➤ Primary Data:

Interviews and surveys with managers of sustainability, users of digital platforms, and industry experts.
Direct observations and evaluation of the features offered by PlanetaryPlus.com.

➤ Secondary Data:

Research articles, case studies, and sustainability reports from government organizations and agencies that have been published.
Information from international regulatory systems including the GHG Protocol, ISO 14064, and the Paris Agreement.

3. The Case Study Method

To investigate how AI, IoT, blockchain, and cloud computing improve waste management and carbon accounting, a thorough case study of PlanetaryPlus.com is carried out. Among the important parameters examined are:

- Accuracy of trash monitoring and emission tracking.
- Automation increases efficiency.
- Difficulties with adoption and the platform's scalability.

4. Evaluation via Comparison

The study evaluates elements like the following when contrasting technology-driven initiatives with conventional carbon accounting and waste management techniques:

- Accurate data
- Cost-efficiency
- Efficiency in operations
- Adherence to regulations

5. Methods of Data Analysis

Numerical data and survey responses are interpreted using descriptive statistics.

IV. RESULTS AND DISCUSSION

According to the data, businesses who use digital solutions see a noticeable increase in the effectiveness of waste management and the precision of carbon tracking [6]. Real-time monitoring is aided by AI-powered technologies, and carbon credit transactions are made more transparent via blockchain. Up to 30% less operational waste has been recorded by organizations adopting IoT devices. Additionally, businesses may more accurately forecast and reduce carbon emissions with the use of data analytics tools. These findings support the idea that digital transformation is revolutionizing sustainable business practices.



Fig 2: Screenshot of the Home Page of the Website

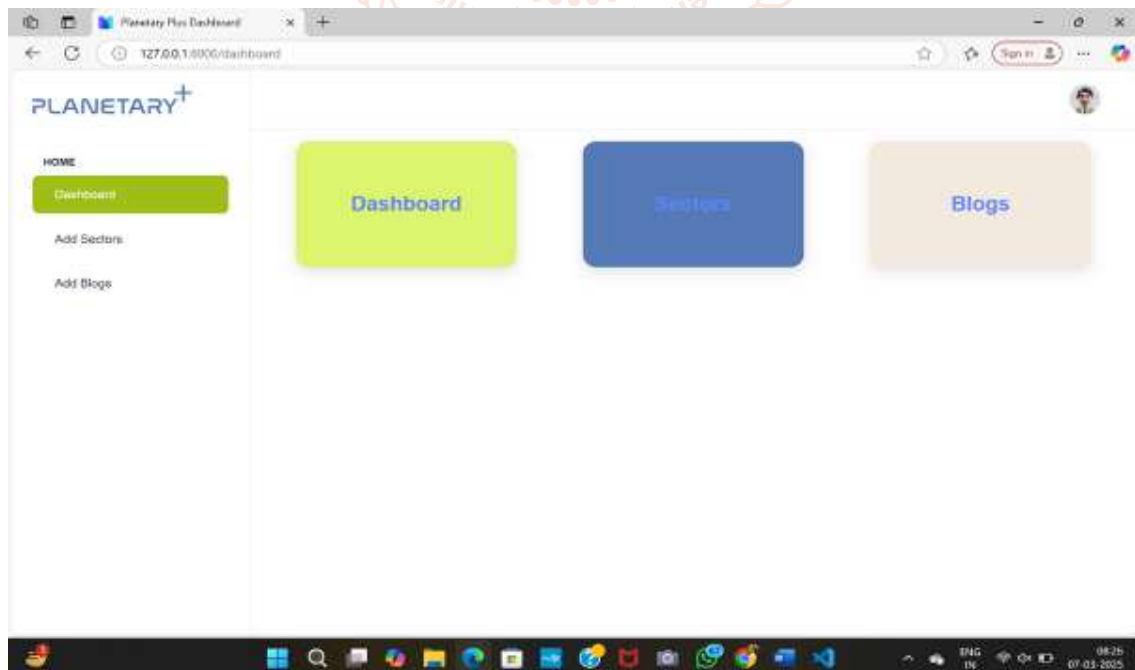


Fig 3: Screenshot of the Dashboard of the Website

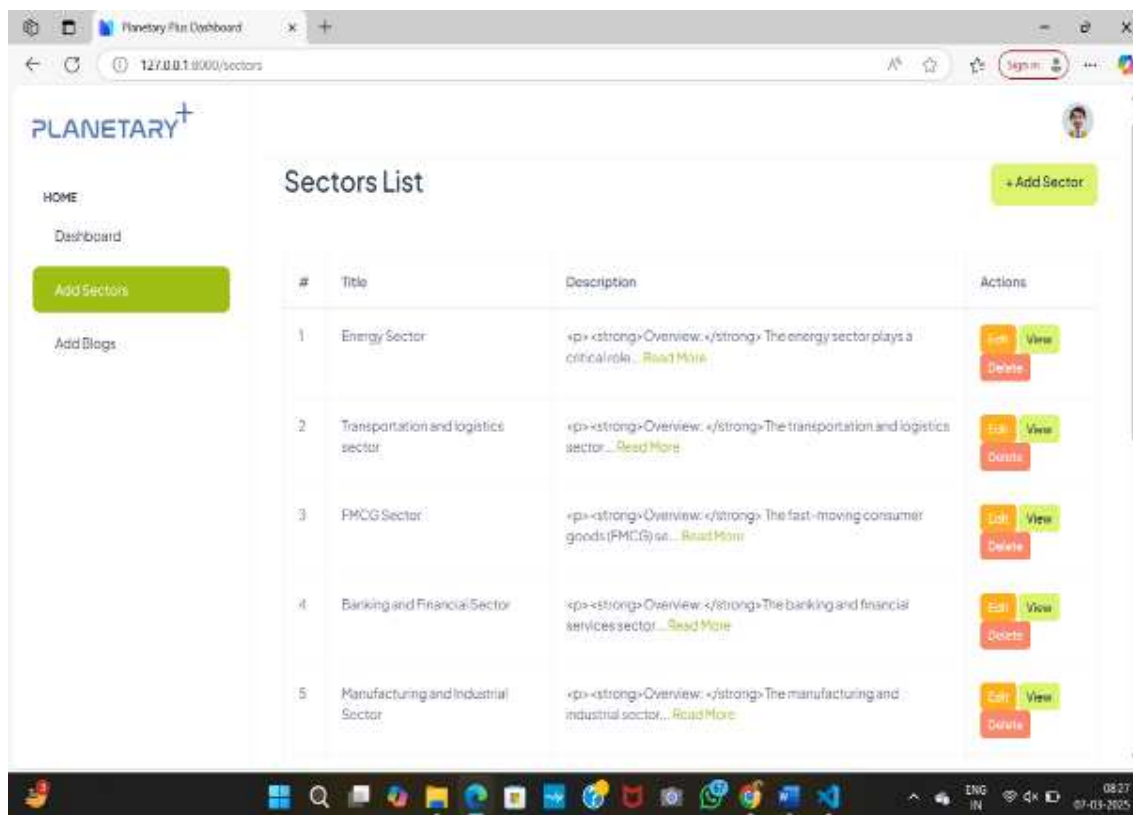


Fig 4: Screenshot of Add Sector of the Website

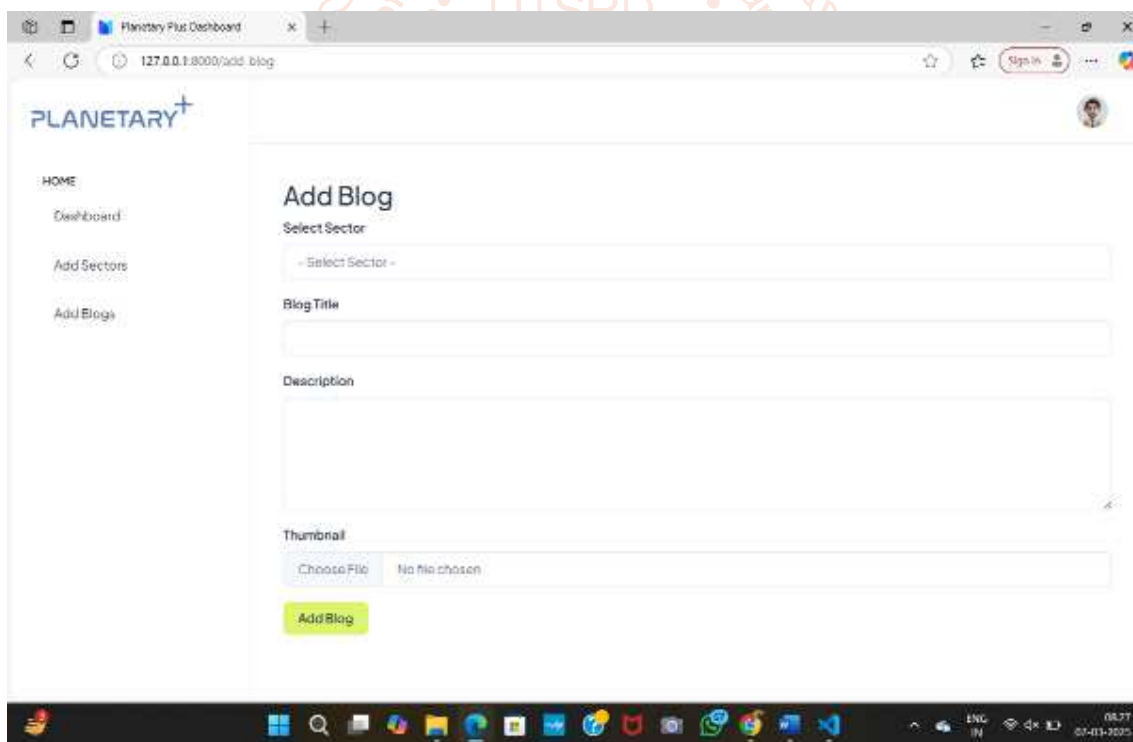


Fig 5: Screenshot of the Add Blog of the Website

V. CONCLUSION

By Using technologies like IoT, AI, blockchain, and big data analytics, digital transformation is essential to improve the Waste Management and carbon accounting. By increasing productivity, precision, and compliance, these solutions assist businesses in lowering their carbon footprint.

The advantages of digital adoption in this industry are substantial, notwithstanding obstacles including exorbitant expenses and worries about data security. To encourage the

wider use , future initiatives should concentrate on scalable and affordable solutions. A sustainable, low-carbon future will require cooperation between governments, IT companies, and industry.

VI. REFERENCES

[1] Chen, L., Wang, J., and Zhang, W (2023). "Digital Transformation's Impact on Carbon Performance." Journal of Cleaner Production, 326, 129843.

- [2] Luiz Gustavo Franceschini Rittl.; Atiq Zaman, and Francisco Henrique de Oliveira " Digital Transformation in Waste Management: Disruptive Innovation and Digital Governance for Zero-Waste Cities in the Global South as Keys to Future Sustainable Development " Sustainability **2025**, 17, 1608.
- [3] Kurniawan, T.A.; Liang, X.; O'Callaghan, E.; Goh, H.; Othman, M. H. D.; Avtar, R.; Kusworo, T.D "Transformation of SolidWaste Management in China: Moving towards Sustainability through Digitalization-Based Circular Economy" Sustainability **2022**, 14, 2374.
- [5] Samuel, G.; Lucivero, F.; Knowles, B.; Wright, K. "Carbon Accounting in the Digital Industry: The Need to Move towards Decision Making in Uncertainty." Sustainability 2024, 16, 2017.
- [6] Assunta Di Vaio.; Sohail Hasan.; Rosa Palladino.; Rohail Hassan "The transition towards circular economy and waste within accounting and accountability models: a systematic literature review and conceptual framework" Environment, Development and Sustainability (2023) 25:734–810.
- [7] Rosario, A.T.; Dias, J.C. "Sustainability and the Digital Transition: A Literature Review." Sustainability **2022**, 14, 4072.
- [8] Stefano Bianchini, Giacomo Damioli & Claudia Ghisetti "The environmental effects of the "twin" green and digital transition in European regions" Environmental and Resource Economics (2023)84:877–918.
- [9] Martínez-Peláez, R.; Ochoa-Brust, A.; Rivera, S.; Félix, V. G.; Ostos, R.; Brito, H.; Félix, R.A.; Mena, L.J. Role of Digital Transformation for Achieving Sustainability: Mediated Role of Stakeholders, Key Capabilities, and Technology. Sustainability **2023**, 15, 11221
- [10] Stroumpoulis, A.; Kopanaki, E. Theoretical Perspectives on Sustainable Supply Chain Management and Digital Transformation: A Literature Review and a Conceptual Framework. Sustainability **2022**, 14, 4862.
- [11] Jinqi Su *, Yinying Wei, Shubin Wang & Qilei Liu "The impact of digital transformation on the total factor productivity of heavily polluting enterprises" 2023) 13:6386.

