International Journal of Applied Science and Engineering
Citation: *IJASE*: **13**(01): 47-61, June 2025
DOI: 10.30954/2322-0465.1.2025.6

IJASE
INTERNATIONAL JOURNAL OF APPLIED SCIENCE AND ENGINEERING

REVIEW PAPER **INFORMATION SYSTEMS**

Environmental Factors and Concern in E-Governance for Eco-Friendly & Sustainable Administration

Mahabubul Hoque[1*], Ritam Chatterjee[1], Sarmistha Chowdhury[1], Nilanjan Das[2] and Abhijit Bandyopadhyay[3]

[1]PhD CIS Scholar, Department of CIS, Raiganj University, West Bengal, India
[2]Assistant Professor, Department of Computational Technologies, Brainware University, West Bengal, India
[3]Principal, Raniganj Institute of Computer and Information Science, Raniganj, West Bengal, India

**Corresponding author: mahabul95@gmail.com*

Received: 23 Mar., 2025 **Revised:** 29 May, 2025 **Accepted:** 06 June, 2025

ABSTRACT

Environmental sustainability is a worldwide issue. By the utilization of advanced digital technologies, all governments are suggested to address this challenge for offering better e-Governance administration. The digital technologies play a vital role in providing e-Governance services. Digitalization of services is foundation of green e-Governance. The need for paper-based procedures can be disposed of by the e-Governance platforms, and also minimizing paper consumption and deforestation. Online applications for licenses, tax payments, and public service access reduce in-person travel and therefore lower carbon emissions. Investing in energy-efficient software and technology may be a top priority for governments. To computerize and optimization of governments' activities and to provide better e-services to the public, digital technologies can be used. Big Data, Cloud computing, the IoT (Internet of Things), Artificial Intelligence, wired and wireless networks, and sensor technologies have all advanced technologically, enabling the advancement of active design tools that let citizens participate in e-Governance services that address environmental sustainability. By integrating smart devices into our surroundings and opening the chance for creative applications of ICT used in smart cities, energy efficiency, and home automation, IoT provides many resolutions for our daily lives and for the development of society. Information and Communication Technology & urban advancement have drawn a huge attention to smart cities. In 6 (six) areas— smart environment, smart governance, smart living smart economics, smart people, smart transportation—the smart city idea might be used as a successful, effective, & efficient way to advance the lives of citizens.

Keywords: e-Governance, ICT, Environmental sustainability, smart city, IoT, Green technology, Green Digital Governance

How to cite this article: Hoque, M., Chatterjee, R., Chowdhury, S., Das, N. and Bandyopadhyay, A. (2025). Environmental Factors and Concern in E-Governance for Eco-Friendly & Sustainable Administration. *IJASE.*, **13**(01): 47-61.

Source of Support: None; **Conflict of Interest:** None

e-Governance, in general, is the use of Information and Communication Technology (ICT). Electronic management of the government is possible with the assistance of e-Governance. The utilization of ICT in e-Governance has grown quickly. ICT has a primary role in e-Governance. With the help of e-Governance, citizens can get better e-services form anyplace anytime. Government can provide online services easily and efficiently to the public with affordable cost. People need not to go to offices all the time. They can submit their online application, forms and they can pay their taxes online from home. Also they can get vital services online such as birth & death certificates, land records, telemedicine services, etc. In general, environmental sustainability is becoming more and more important to sustainable growth. To address the related issues, governments must put effective plans and policies into place. Governments have an obligation to take action to ensure environmental sustainability via global collaboration. Governments are more vigilant than ever in their efforts to attain environmental sustainability. Nowadays, environmental sustainability is regarded as the most crucial concern.

MATERIALS AND METHODS

Literature Review

Examining earlier relevant research in this area is vital to developing a more comprehensive understanding. According to the e-Governance's knowledge, environmental factors & concern in e-Governance for eco-friendly and sustainable administration, many research articles and literatures are reviewed. In this article, the following literatures are explored—

Zampou, Eleni & Pramatari, Katerina (2011)[28] in their paper stated that the creation of a sustainable society is currently a focus of organizations, governments, & international entities. Given that the government is one of the main parties that could develop sustainability. One of the primary strategic decisions made by any administration appears to be the shift from government to e-Government. The subject of how environmentally friendly e-Governance services are comes up. Initially, e-Governance initiatives aimed to eliminate bureaucracy and reengineer public procedures to generate a more cost-effective public sector. The environmental effect of e-Governance services is a new dimension that governments should consider when designing their plans, even though minimization of cost and economic burdens are still important factors. There is not much research on this topic, thus it is important to develop a method that determines the environmental aspects of e-Governance services. They present a process-based approach for evaluating the environmental impact of e-Governance services and provides an initial assessment of those services' environmental impact. The findings show that e-Governance services have a distinct environmental profile, and governments should consider this factor when determining priorities for improving sustainability and minimizing environmental factors.

Sapraz, M. & Han, S. (2019)[25] in their research work mentioned various vital research issues for analyzing e-Governance services for environmental sustainability. They have also stated the digital technologies' contribution in support of e-Governance services. Sustainable development is increasingly dependent on environmental sustainability. Governments must implement efficient plans and initiatives to deal with the associated problems. To achieve environmental sustainability, governments are more watchful than ever. Global warming, rising sea levels, drastically increasing droughts, ocean acidification, and biodiversity loss are all consequences of environmental sustainability, which is currently regarded as

the most vital factors. It is recommended that all governments handle these problems by using digital technology to offer e-Government services and applications, in addition to enhancing their strategy and efficacy. Digital technologies are efficient ways to mitigate environmental issues through e-Governance services. Governments can use digital technologies to plan for digital transformation of environmental concerns held by many stakeholders, including citizens and organizations. These exchanges will make it possible to enhance scale, innovation, productivity, teamwork, and process efficiency. They have also mentioned that in analyzing this complex phenomenon various theories, philosophies, and different perspectives should be adopted. They consider that a lot more focus should be placed on the role that digital technologies play in providing e-Governance services for managing this complicated situation.

Ramya, K.S. (2016)[23] in his paper stated that for national development education is considered as the most important tool. The teachers have an important role to shape present and future students for accommodation with the ever changing environment to assure a social harmony. The teachers should have sufficient knowledge about e-Governance and Sustainable development. For socioeconomic and Sustainable development, the awareness related to e-Governance is vital. Relationship among the development of children with society and its socio economic culture, the secondary school education plays a crucial role. Therefore, in this respect the secondary school teachers' should have sufficient knowledge about e-Governance. They should have positive attitude to the advancement of sustainable which drives sustainable society. The author also investigated that the attitude level among secondary school teachers towards Sustainable Development is moderate. The author also found that the awareness level among secondary school teachers about e-Governance is moderate. The relationship between secondary school teachers' attitudes toward sustainable development and their concept of e-Governance is crucial.

Alhassan, G. (2020)[2] explored that the role of e-Governance in increasing sustainable development. The author discovered a connection that might support Ghana's sustainable advancement. In this article, the status of e-Governance and its role in Ghana's sustainable improvement are highlighted. This study investigated the e-Governance in Ghana, development of ICT in Ghana, few e-Governance services, and e-Governance ranking of Ghana. It also highlights on the knowledge of the triple bottom line (TBL / 3BL) concept and sustainable development. e-Governance helps to the sustainable development of Ghana in many ways. The author said that e-Governance minimizes the service delivery cost. Through it public can access government services easily. Public can access health insurance services with efficiently. It increases public administration in developing countries like Ghana. People can easily interact with government. It promotes the sustainable development of a nation. By it transaction is more fast and quick & convenient. This rejects bureaucracy and minimizes corruption.

Pant, D. (2024)[16] the author stated that for promoting both gender equality & sustainable growth, e-Governance plays an important role. This study investigates the different characteristics of e-Governance and how it plays an important role in lowering gender inequities while encouraging long-term socioeconomic development. The study examines how e-Governance processes overcome conventional obstacles, giving women equivalent access to information, opportunities, and resources. The use of digital technology may actively contribute to environmental conservation by minimizing paper use, lowering carbon footprints through remote cooperation, and encouraging the adoption of eco-friendly behaviors. To modulate with greater sustainability objectives, e-Governance projects should prioritize green technology, such as energy-efficient data centers and sustainable e-Waste management. Governments may help to improve a more sustainable and environmentally sensitive approach to e-Governance through including

environmental issues into policies of e-Governance. In this regard of e-Governance and sustainable growth, acquiring social and economic sustainability is vital. e-Governance efforts have an important role in improving inclusion, minimizing disparities, and improving general social well-being. The author mentioned that e-Governance motivates economic growth, and also assure that the benefits of digital governance positively influence all parts of society.

Research Gap Identification & Research Questions

It is found that there is no significant work on the environmental factors in e-Governance for eco-friendly and sustainable administration. The basic objective of the article is to gain a knowledge on the environmental factors in e-Governance for eco-friendly and sustainable administration. This article based on following research questions:

- RQ1: What are the environmental factors in e-Governance for eco-friendly and sustainable administration?
- RQ2: What benefits does e-Governance provide?
- RQ3: What environmental concerns are there in e-Governance for sustainable and environmentally friendly administration?
- RQ4: How e-Governance can help to reduce Environmental Issues?
- RQ5: What are Strategies for Eco-friendly & Sustainable e-Governance Administration?

Objectives Formulation

e-Governance is very important to protect the environment. It is vital to analysis the environmental factors and concerns for Eco-friendly & Sustainable e-Governance Administration. The primary objectives of this article are as follows:

- To analyze about components, characteristics and services of e-Governance.
- To learn how the government activities, services, and the schemes are provided using ICT based e-Governance platform.
- To understand the many forms of e-Governance and how they are developed.
- To be aware of e-Governance environmental factors
- To get knowledge of various Environmental Concerns in E-Governance
- To learn about different advantages and facilities offered by e-Governance.
- To become familiar with the various drawbacks of e-Governance
- To understand of different strategies for Eco-friendly & Sustainable e-Governance Administration

Core Methodology Used

The paper entitled "*Environmental Factors and Concern in E-Governance for Eco-Friendly & Sustainable Administration*" is theoretical and conceptual nature. The nature of the current work is descriptive. It is entirely dependent on information from secondary sources. The sources of the data and information used for analysis including printed articles, government publications, journals, reports, and several official websites of the Government of India.

RESULTS AND DISCUSSION

For Eco-friendly and Sustainable Administration, Environmental Factors and Concerns are very important in e-Governance. In this section the information about e-Governance, environmental factors, environmental concerns and strategies used to manage the eco-friendly & sustainable administration is discussed.

e-Governance: An Overview

e-Governance indicates the use ICT (Information and Communication Technology)[5]. In general, e-Governance allows for the e-management of the government. In e-Governance, ICT has a crucial role. In order to provide services, in digital governance, governance procedures are essentially carried out online. Digital governance may also known as electronic governance, connected governance, internet governance, transformative governance & online governance[6][20][21]. Basically, the objectives e-Governance are-

- ❒ Providing knowledge to empower citizens.
- ❒ Better services provide to public.
- ❒ Accountability and transparency should be managed.
- ❒ Enhance government efficacy, whether it is interstate or center-state.
- ❒ Interconnection between industry and commerce should be promoted.

1. Types of e-Governance

Here different e-Governance types are stated below —

1. **G2G (Government to Government)**: Communication and information exchange in this sort often take place inside the government. Examples of this type of service include policy creation, administration, etc.
2. **G2C (Government to Citizen):** In type of interaction, the public and the government typically communicate with one another. Every person is allowed to express his or her opinions. The example of this kind of services is birth and death certificate, records of land, etc.[22].

G2B (Government to Business): In G2B, the exchange of information occurs between the business community and the government.

1. One of the objectives of the system is to reduce the redtape system. Generally it will increase transparency in the business environment. It will also reduce time and cost. The instances of Government to Business services are Taxation, Tender etc.[22].

2. **G2E (Government to Employee)**: In this type of interaction, communication generally occurs between Government and Employee. Everyday Government can interact with employees. For ICT, it very easy and efficient to interact with employees. The examples of this kind of services are Income tax, pension, etc.[22].

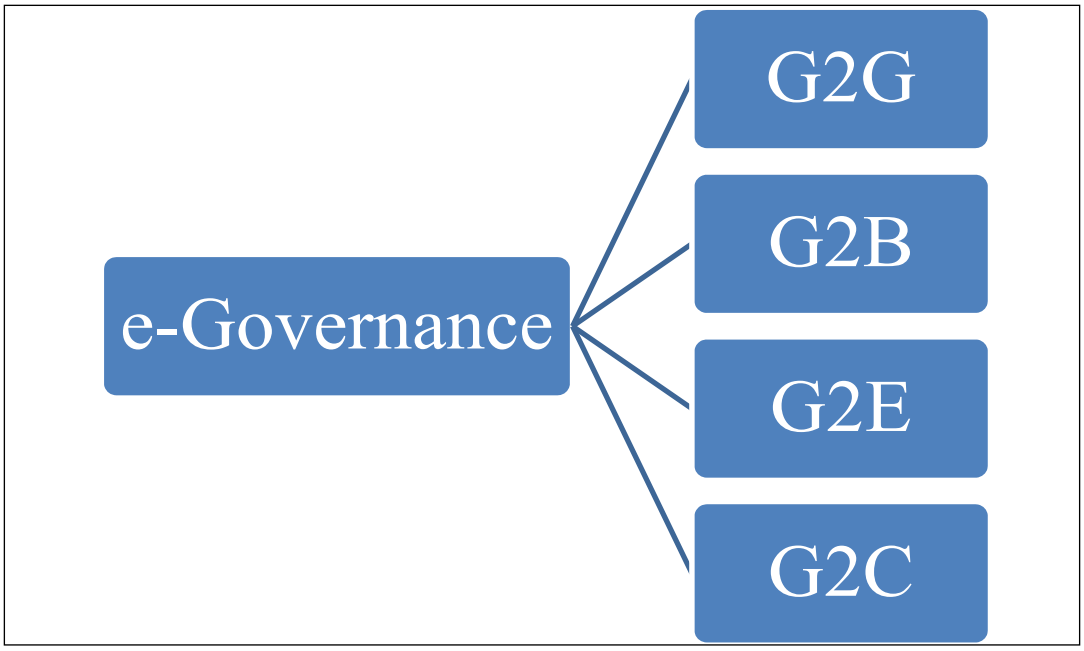

Fig. 1: Types of e-Governance

2. Benefits of e-Governance

Some benefits of e-Governance services are mentioned below —

- **Speed**—Due to advanced technology, transport & communication became so fast and efficient. Nowadays people can send huge volume of data through Internet easily.
- **Saving Costs**—The government has enhanced official cost to purchase stationery. A large number of stationeries are used in the offices in order to write letters, documents, and records. But by replacing these with Internet, computers and smart phones, the government may reduce its annual expenditure by a large number.
- **Transparency**— Transparency is a big advantage of e-Governance. Due to e-Governance entire governmental activities are transparent. All government-related information is uploaded on the internet. Then people can get information. Entire data of government should be open[8][12][24].
- **Accountability**— There is a link between transparency and accountability. Citizens may hold them responsible for their behavior after the information is made public.
- **Minimized Corruption**— With the assistance of e-Governance, Corruption can be minimized.

In the public domain all the information of government are available, so the people can know all about it. Corruption can be minimized in this way[10][11].

- **GDP Growth-** GDP may be enhanced with the aid of e-Governance since it minimized corruption and increases transparency[10].

3. Disadvantages of e-Governance

There are various disadvantages of e-Governance are as follows —

- The network connection issue in rural areas,
- The slow Internet speed,
- Deficit of trust among citizens and Cyber crime,
- The cost of Infrastructure is high, and
- In rural areas, illiteracy of the Internet among public, etc.

Environmental Sustainability

Sustainable growth generally increasingly depends on environmental sustainability. Governments must implement efficient plans and measures to deal with the associated problems.

It is the duty of governments to take steps to guarantee environmental sustainability through international cooperation. To achieve environmental sustainability, governments are more watchful than ever. Environmental sustainability is currently seen as the most important issue, and it is causing vital changes in the ecosystem, including global warming, ocean acidification, rising sea levels, drastically increasing droughts, and biodiversity loss[7]. All governments are recommended to solve this problem by utilizing digital technology to offer e-Governance services and apps, in addition to enhancing their strategy and efficacy. For instance, Cloud Computing, Big Data, Artificial Intelligence, and digital connection, have made it possible to provide more government-based services, such involving citizens in governance and decision-making processes[25]. Many countries are actively creating smart cities and offering a variety of public services related to smart environments, including smart buildings, smart metering & smart grids, efficient lighting for citizen, public gardens & parks, and smart water management (distribution and sanitation), and smart traffic & bus services. Due to the improvement of digital technologies, now governments may better connect their plans, policies, and objectives with technology advancements to the growth of digital technologies. Digital technologies play an important role for providing e-Governance services for environmental sustainability.

Environmental Sustainability generally indicates that stakeholder activities that affect the natural environment and satisfy current demands without jeopardizing the capacity of future stakeholders to satisfy their own needs and necessary. More e-services for the public and the automation and optimization of government processes are both possible with digital technologies. Sensor technologies, IoT, Big data, the wired & wireless networks have all advanced technologically, enabling the improvement of active design tools that let individuals participate in e-Government services that address environmental sustainability[9]. The Internet of Things (IoT) provides many solutions for our daily lives and the advancement of civilization

of society[26][27]. With the advancement of ICT technologies and urban development, smart cities have become a topic of much discussion. The smart city idea might be used as an efficient, effective and successful way to improve the people's lives in six areas like the smart transportation, smart environment, smart living, smart economy, smart governance, and smart people.

Environmental Factors in e-Governance

- **Minimization in Paper Dependency**
  - By digitalization of administrative processes, e-Governance significantly reduces the dependency on paper. It helps to decrease the carbon footprint related with paper production and logistics and also mitigate deforestation[13][19].
  - For example country like Estonia demonstrates that comprehensive digital governance has led to measurable minimization in paper consumption.
- **Energy Utilization and Efficiency**
  - When e-Governance reduces physical infrastructure, it introduces energy-intensive digital infrastructure like data centers. If these facilities is not maximized then it can significantly contribute to carbon emissions[1][14][15].
  - These influence can be mitigated significantly through the adoption of energy-efficient and renewable energy sources technologies.
- **Alleviation of Commuting and Travel Emissions**
  - Citizens can access government services online from their homes. This reduces for public to travel to government offices. It minimizes vehicular emissions and energy consumption.
  - Digital consultations and virtual meetings minimize the environmental effect of in-person contacts.

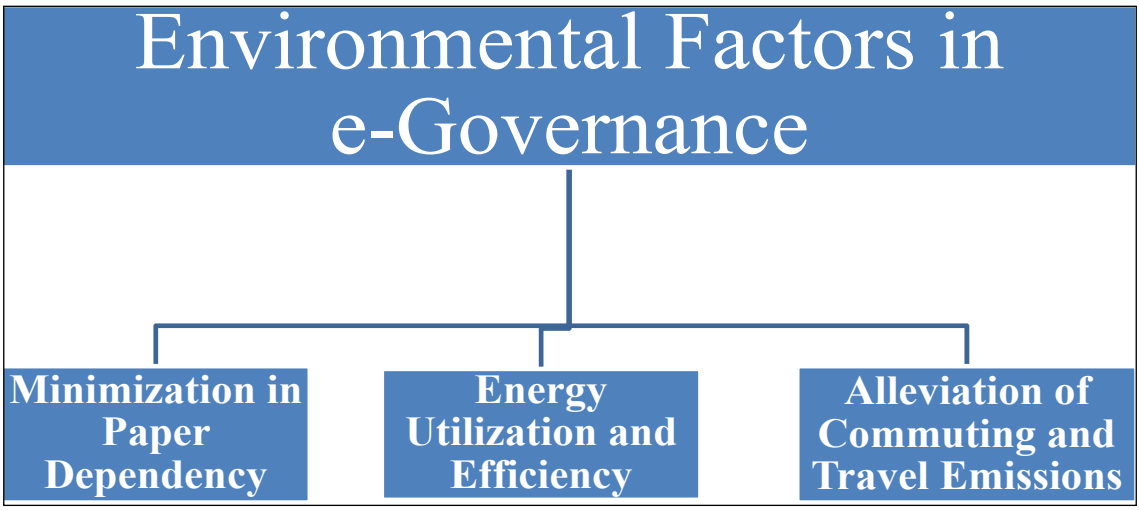

Fig. 2: Environmental Factors in e-Governance

Environmental Concerns in e-Governance

- **E-Waste Management**
  - E-waste generally indicates discarded electronic devices like Laptops, Tablets, Smartphones, VCRs, Cameras, Televisions, Desktop Computers, etc. It has a negative impact on our environment, especially on our water and soil. Electronics tools usually comprise of gold, copper, silver, aluminum, cobalt, platinum, etc. All of these materials are valuable & these can also be recycled but while it mixes into soil, then it disposed into lands which will be very harmful for human being.
- **The environmental effects of E-Waste**
  - The ecology and the local population suffer when garbage is not disposed of appropriately. E-Waste causes huge damage to the environment and it also affects the health of individuals who live in there if it is not properly disposed of.

The E-Waste's bad effects are mentioned here:

- **On air:** Air pollution is caused by E-Waste. The item emits fine dust particles or hazardous gasses that can travel hundreds of kilometers and create air pollution, as well as harm living beings.
- **On soil:** When e-waste is disposed of on normal land or in an unlawful location. The e-waste then contaminates both the soil and the underlying water. A crop planted on contaminated land is more likely to absorb these toxins, leading to a number of serious illnesses, and the soil produces less.
- **On water:** E-waste also pollutes water. E-waste typically includes mercury, lithium, lead, and barium, among other things, so when it is buried in the soil, filters through, contaminates groundwater, and finally finds its way into lakes, rivers, streams, and ponds. As a result, they inflict harm to aquatic creatures, plants, and humans.
- **On human:** E-Waste contains lead, barium, lithium, and mercury which are dangerous compounds. These are dangerous to public health. So, management of E-waste is vital to safeguard our planet and the lives of living creatures.
- A significant number of electronic waste including servers, obsolete computers, printers, laptops and peripherals increases due to the adoption of digital governance systems.
- E-waste management is vital for environment. Inappropriate disposal of e-waste can create environmental pollution which affect water, soil and air quality.

E-waste Management

- Reusing working equipment can help reduce e-waste.
- Consider giving or reselling old, usable devices rather than throwing them trash.
- Many malfunctioning devices, including laptop computers, cell phones, and calculators, may be recycled, so mending them reduces e-waste and saves material.

- E-waste should be returned to electronic companies. Numerous businesses have started to take in outdated electronics and recycle, modify, and resell them for less money. This is a great way to deal with electronic waste.
- Give electronic waste to a certified E-Waste Recycler for appropriate recycling and refurbishment into a new product.
- Keep gadgets clean to extend their life and prevent battery over charging.
- Purchase ecologically friendly electronics.
- Some retailers purchase old phones, and online sites like Flipkart provide the option to exchange them for new phones.
- Limit device purchases to reduce unnecessary E-waste. As a result, it is recommended that users purchase just a limited number of devices that meet their demands.
- **Greater Energy Demand**
  - Large amounts of energy are consumed by the IT infrastructure and Data centers supporting digital governance systems. As a result sometimes it depends on non-renewable energy sources.
  - Some emerging technologies which are being incorporated into digital governance systems may intensify energy demands.
- **Digital Divide and Environmental Inequality**
  - Due to digital divide some communities depends on conventional resource –intensive systems since they are not able to access to digital infrastructure services equally. This may lead to environmental disparities across areas[4].

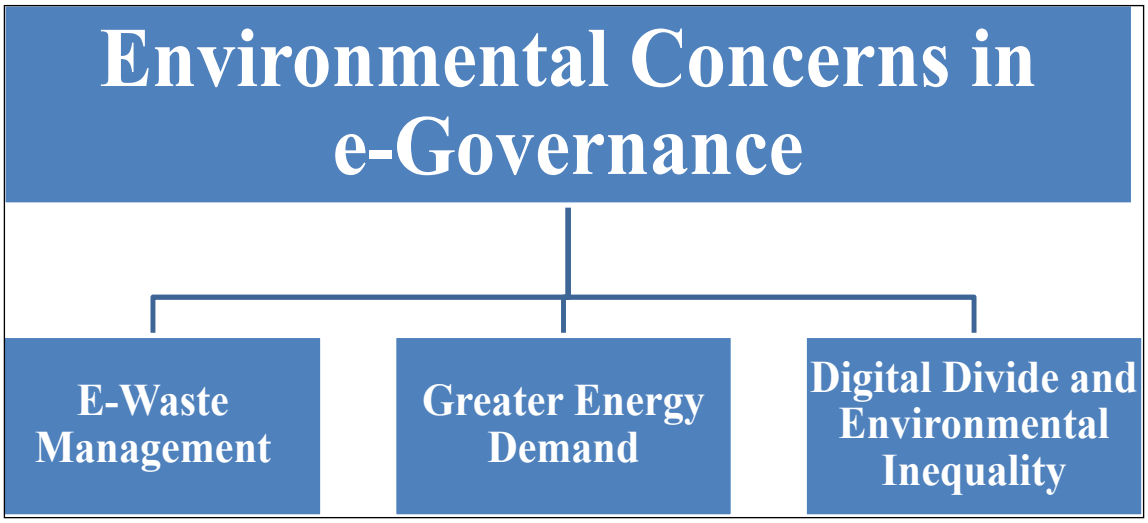

Fig. 3: Environmental Concerns in e-Governance

Strategies for Eco-friendly & Sustainable e-Governance Administration

Some strategies for eco-friendly e-Governance are as follows —

- **Green IT Solutions**
  - To reduce the ecological footprint of e-Governance systems, all governments should emphasize energy-efficient hardware and software[17][18].
  - To reduce the carbon footprint of data centers, cloud computing and virtualization technology can be adopted[3][17][18].
- **E-Waste Management Policies**
  - Electronic waste management is essential because of the expansion of digital infrastructure. To confirm the proper recycling and disposal of electronic devices, the e-Waste Management Rules has been introduced by the government.
- **Integration of Renewable Energy**
  - In e-Governance infrastructure renewable energy sources can be used which can significantly minimize carbon emissions[1].
  - Circular economy models can be set up for sustainable e-waste management is possible public administration, incentives for the adoption of green energy can accelerate this transition.
- **Educating Stakeholders**
  - For sustainable e-Governance administration, awareness among people, government, and policymakers officials about the environmental effect of e-Governance should be enhanced which results in collective action towards sustainability.
  - In green e-Governance initiatives public participation assures extensive adoption of eco-friendly practices.

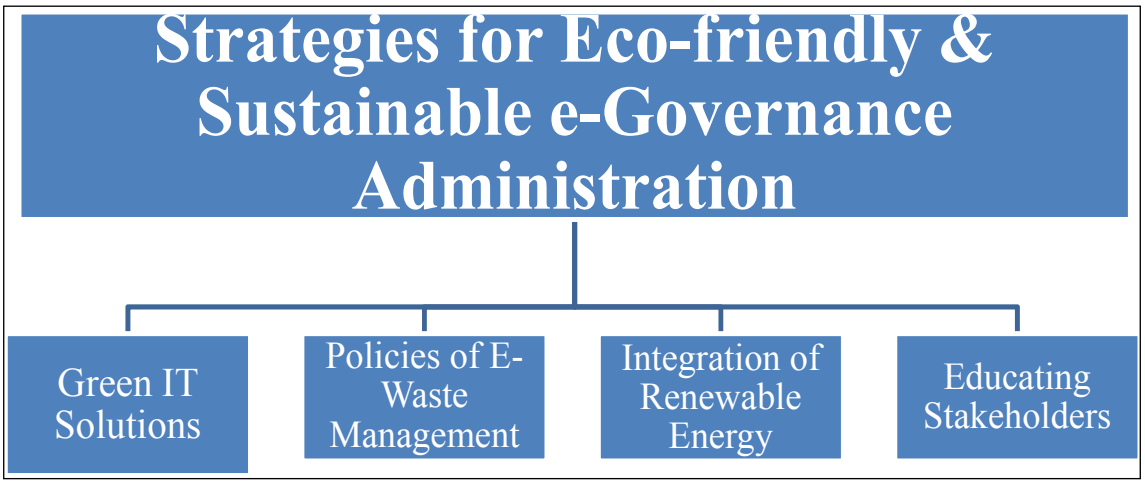

Fig. 4: Strategies for Eco-friendly & Sustainable e-Governance Administration

e-Governance can help to reduce Environmental Issues

- **Data Management and Information Dissemination**

  e-Governance may help to gather, evaluate, and distribute environmental data, allowing for better decision-making and public awareness.

- **Improving Resource Management**

  e-Governance can help to improve water management, reduce land degradation, and promote energy efficiency.

- **Early Warning and Disaster Management**

  Digital technologies can help early warning systems for environmental risks and enhance disaster management skills.

- **Public Participation and Awareness**

  e-Governance can enable individuals to engage in environmental decision-making and promote environmental awareness via digital channels.

- **Promoting Sustainable Practices**

  Online platforms may promote green procurement, e-commerce for sustainable items, and online services to provide jobs connected to environmental conservation.

- **Green Technology Innovation**

  e-Governance can foster green technology innovation through digitization, resource efficiency, and collaborative platforms. Green governance addresses pollution by enforcing legislation and supporting sustainable practices that minimize pollution from diverse sources, such as industrial, agricultural, and home activities[17][18].

- **Enhanced Monitoring and Regulation**

  e-Governance provides real-time monitoring of environmental indicators with the help of IoT devices and satellite technologies. For example, air and water quality may be continually monitored, with automatic alarms for pollution violations. This data enables authorities to enforce laws, reduce harm, and hold polluters accountable.

FINDINGS

Nowadays e-waste is one of the major concerns for e-Governance. Technology is the only thing that keeps civilization functioning. The functions of many electronic devices vary. Additionally, a large number of data is generated every second. To manage the large number of e-Waste is one of the challenging activities. It may be inferred from a theoretical analysis of several parameters and notions that various functions are being offered by the Government. Therefore, huge amount of e-waste are generated. So, it is necessary to take appropriate strategies to manage e-waste and to develop the Sustainable Development, the carbon footprint should be reduced.

The study finds that for better e-waste management, technologies can play a crucial role. Various categories of technologies can be used for the better and safe e-waste management. All governments should prioritize energy-efficient hardware and software in order to minimize the ecological footprint of e-Governance systems. Cloud Computing and virtualization technology can be adopted in order to minimize the carbon footprint of data centers. The e-Waste Management Rules should be introduced by the government in order to the appropriate disposal and recycling of electronic devices. In order to reduce the carbon emissions, renewable energy sources can be used in e-Governance infrastructure.

The study also finds that there is a huge number of benefits of e-Governance which may help to distribute, gather, and assess environmental data. It creates citizen awareness and allows better decision-making. With the use of satellite technology and IoT (Internet of Things) devices, e-Governance offers real-time monitoring of environmental indicators. For instance, automated alerts for pollution violations may be used to continuously check the quality of the air and water. Authorities can enforce laws, reduce harm, and hold polluters accountable.

CONCLUSION

In terms of environmental effect, e-Governance provides a double-edged sword. It presents great opportunity to minimize resource utilization while introduce new difficulties such as e-waste management and energy usage. To manage these environmental factors need proactive measures like adoption of green IT solutions, promoting renewable energy use, and managing e-waste. Through the integration of these strategies into digital governance frameworks, governments can assure a sustainable and eco-friendly administrative future that aligns with worldwide environmental goals. Digital technologies are effective solutions for e-Governance services for mitigating environmental problems. Through digital technologies, governments can plan for a comprehensive digital transformation of environmental concerns of the different stakeholders, either organizations or citizens. These interactions will enable the improvement of productivity, collaboration, scale, process efficiency, and innovation. Since environmental sustainability is a worldwide issue, so all governments are recommended to address this challenge by using digital technologies to offer e-Governance services and applications. Despite its enormous potential, successful integration of e-Governance and environmental management need strong digital infrastructure, skills building, and enough finance. Governments must emphasize digital literacy, protect data security, and encourage cross-sector collaboration to maximize the effect of digital technologies in addressing environmental concerns.

REFERENCES

3. Ahmad, M.J., Javed, J., Habiba, U. and Meer, S. 2025. Pioneering Methanogens: The Architects of Modern Eco-Friendly Renewable Energy Solutions. PP 1-28 DOI: 10.5772/intechopen.1008419

4. Alhassan, G. 2020. E-governance for sustainable development in Ghana: Issues and prospects. [Master's Thesis, the American University in Cairo]. AUC Knowledge Fountain. https://fount.aucegypt.edu/etds/814.

5. Belwal, H. and Sharma, A. 2017. 'Cloud Computing for e-Governance: Indian Perspective'. *International Journal on Emerging Technologies* (Special Issue NCETST-2017), **8**(1): 619-622.

6. Beniwal, V.S. and Sikka, K. 2017. "E-Governance in India: Prospects And Challenges," *International Journal of Computer and Communication Technology*, **8**(2):72-76.

7. Broome, P.A. 2015. 'Before e-governance and e-government, back to basics! The case of the Caribbean', *SAGE Open,* **5**(3): 1–11.

8. Das, N. 2021. Smart City with Reference to Perception, Features, and Stakeholders, pp. 93-102.

9. Gholami, R., Watson, R., Hasan, H., Molla, A. and Bjorn-Andersen, N. 2016. Information Systems Solutions for Environmental Sustainability: How Can We Do More? *Journal of the Association for Information Systems,* **17**(8): 521–536.

10. Gupta, M.P. and Jana, D. 2003. 'E-government evaluation: a framework and case study', *Government Information Quarterly,* **20**(4): 365–387.

11. Hilty, L.M. 2014. Sustainability and ICT – An overview of the field, (December 2011).

12. Hoque M., Chtterjee, R., Das, N., Chowdhury, S.N., Satheesh, K. and Bandyopadhyay, A. 2024. Financial Constraints and Issues of e-Governance in India. *Economic Affairs (An International Journal),* **69**(02): 1167-1173 AESSRA (Scopus Indexed).

13. Hoque, M. 2021. Green Cloud Computing: An Overview. *In* Paul, P.K. *et al.* (Eds.) *Information Systems & Technology: The Advances"* (ISBN: 978-93-88879-94-1), 313-341. (New Delhi Publishers**).**

14. Kalsi, N.S., Kiran, R. and Vaidya, S.C. 2009. Effective e-governance for good governance in India. *International Review of Business Research Papers,* **5**(1): 212-229.

15. Lee, Y.B. 2017. Exploring the Relationship between E-Government Development and Environmental Sustainability: A Study of Small Island Developing States. *Sustainability,* **9**(5): 1–16.

16. Monga, A. 2008. E-government in India: Opportunities and challenges. *JOAAG,* **3**(2): 52-61.

17. Nagaraja, K. 2016. E-governance in India: issues and challenges. *IOSR Journal of Economics and Finance,* **7**(5): 50-54.

18. Pant, D. 2024. The Role of E-Governance in Gender Equality and Sustainable Development. 10.31995/Book. AB306-M24. Chapter 5.

19. Paul, P.K. and Dangwal, K.L. 2012. Green computing: opportunities and problems in the perspective of developing countries. *Asian Journal of Science and Applied Technology*, **1**(2): 15-19.

20. Paul, P.K. and Ganguly, J. 2013. Green computing: The emerging tool of interdisciplinary environmental sciences-problems and prospects in Indian scenario. *International Journal of Pharmaceutical and Biological Research (IJPBR)*, **5**(04): 210-214.

21. Paul, P.K. and Jena, S.K. 2023. Economical, Financial and Allied Concerns in healthy Agricultural Information Systems Practice: The Context of Developing Countries. *Econ. Aff.,* **68**(04): 2161-2170.

22. Paul, P.K. *et al.* 2015. Agricultural Problems in India requiring solution through Agricultural Information Systems: Problems and Prospects in Developing Countries. *International Journal of Information Science and Computing,* **2**(1): 33-40.

23. Paul, P.K., Ghosh, M. and Chaterjee, D. 2014. Information Systems & Networks (ISN): Emphasizing Agricultural Information Networks with a case Study of AGRIS. *Scholars Journal of Agriculture and Veterinary Sciences,* **1**(1): 38-41.

24. Prabhu, C.S.R. 2004. E-governance: Concepts and Case Studies, PHI Learning Pvt. Ltd., New Delhi, pp. 21–40.

25. Ramya, K.S. 2016. "A Study on Awareness of E-Governance and Attitude Towards Sustainable Development", *International Journal of Advanced Trends in Engineering and Technology,* **1**(1): 15-17.

26. Roy, K.C. and Tisdell, C.A. 1998. Good governance in sustainable development: the impact of institutions. *International Journal of Social Economics,* **25**(6/7/8): 1310-1325.

27. Sapraz, Mohamed and Han, Shengnan, 2019. "A Review of Electronic Government for Environmental Sustainability". *PACIS 2019 Proceedings*, 155.

28. Saqib, Muhammad and Al-Muqrashi, Nadia. 2017. Role and Importance of IoT in the Smart City and E-Governance. *Journal of Student Research.* 10.47611/jsr.vi.544

29. Srivastava, R. 2018. Internet of Things (IoT) and e-Governance: The Arrival of a New Era: Processes and Technologies. 10.1201/9780203731451-6.

30. Zampou, Eleni and Pramatari, Katerina. 2011. How Green are e-Government Services? MCIS 2011 Proceedings. 25. http://aisel.aisnet.org/mcis2011/25