

“LAW AT THE GREEN–DIGITAL FRONTIER”

Reimagining Ecological Justice, Sustainability, Economics and Technology in Emerging Environmental Governance

by

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Abstract

Environmental governance is changing fast. Problems in the natural world keep growing. At the same time, money needs and new technology are moving ahead. Law is now pulled into this mix more than before. This work looks at a new area where environmental rules meet digital tools. In this space, environmental law is not only about traditional regulation but it also touches sustainability goals, fairness for affected communities, trade-offs tied to the economy, and fresh technology methods. The paper reviews how economic ideas help with sustainable development. It looks at the polluter pays principle, methods for valuing the environment, carbon markets, green finance, and ways to push environmental costs back onto those who cause harm. It then turns to new tools that are starting to matter. This includes artificial intelligence, remote sensing, satellite-based monitoring, blockchain, and systems that use environmental data to guide decisions. These tools may help with compliance checks, better tracking, clearer reporting, and more solid climate choices. It mentions the risk of bias in algorithms. It discusses who controls environmental data and how rules can be enforced fairly. It notes that new technology may not reach everyone in the same way. The paper puts ecological justice first. It also highlights fairness between generations. It stresses environmental rights and the concerns of people who are often left out. Purely legal changes may not be enough. Economic tools alone will fall short. Even technology by itself will not solve the whole issue. Instead, the paper calls for one joined approach. In that view, law, the economy, ecology, and technology must connect and work at the same time. It then looks at new legal areas that could support fresh ideas. The goal is to encourage change without harming nature. It also aims to protect fair distribution and long-term sustainability. In the end, the paper imagines a legal system that can respond as things shift. It would guide both the green transition and the digital transition. At the same time, it keeps human rights, environmental protection, and accountability as key parts.

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Keywords: Environmental Law; Ecological Justice; Sustainable Development; Law and Economics.

INTRODUCTION:

The rules for the environment are shifting quickly. This change sits at the same time in the world of nature, fresh tools, and how money and markets run. Many people now feel that older rules do not fit as well as they used to. Climate change is one clear driver. Other signs are harder to miss, like species vanishing. On top of that, some key supplies are getting scarce. There is also a widening gap in harm, since pollution and damage do not hit everyone equally. So environmental law has to face connected problems. It cannot pretend each issue is alone. Work in this area is changing too. New tech changes how people do the job. AI can help search for patterns in messy information. Remote sensing and satellites can follow conditions across time. Big datasets can sort and organize huge piles of records. Digital platforms can also link information with decisions, which shifts how risks are spotted, followed, and handled.²

Tech progress does not automatically mean sustainability. The digital system still uses power. It also adds to e-waste and pushes mining for rare inputs. Over time, more devices and services depend on critical minerals. New tools in the economy can help too. “Green” funding, carbon trading, and ESG rules may steer growth in a better direction. Yet they also bring tough issues. Who is held responsible? Who gains and who is left out? Can people access these benefits in a fair way?³

“Law at the Green–Digital Frontier” looks at how ecological justice and sustainability meet economics and new technology in environmental governance. It checks if current laws can keep up with this shift. The paper also asks what happens to communities that have less power, and to people who will live in the future. It calls for rules that can change as conditions change. Those rules should not just allow new tech and new markets. They should also protect environmental rights and the health of ecosystems. The work stresses open processes, public input, and fairness between generations.

²See World Commission on Environment and Development, *Our Common Future* (Oxford University Press, 1987); United Nations, *Rio Declaration on Environment and Development* (1992).

³See International Telecommunication Union & UNITAR, *The Global E-waste Monitor 2024* (2024); ITU & World Bank, *Measuring the Emissions and Energy Footprint of the ICT Sector: Implications for Climate Action* (2024).

HISTORICAL BACKGROUND:

Modern environmental law did not appear all at once. It shifted over time from taking resources to supporting sustainable development. Along the way, ideas like ecological justice and joined-up environmental governance grew stronger. At first, most rules were tied to single topics. There were laws for forests, water, wildlife, and industrial pollution. Each area had its own approach. Later, as factories spread and damage to nature increased, this setup felt too narrow. People began to treat environmental protection as something wider. It touched legal rules, economic life, and also constitutional questions.⁴

From Conservation to Modern Environmental Governance:

In the 1800s and 1900s, factories and cities grew fast. This brought more jobs and output, but it also made the air and water worse. Forests were cut back, natural supplies were used up, and local ecosystems took damage. Because of that, rules for the environment changed over time. At first, the goal was narrow, focused on protecting a few key resources. Later, the focus shifted to limiting the actions that caused pollution and other harm.

In 1972, the Stockholm Conference on the Human Environment became a key international event. It placed the environmental care into the middle of world policy, not as a side issue. It also helped link the environment to people's wellbeing and to long term development.⁵

After that, in 1987, the Brundtland Report, Our Common Future, gained wide attention. It made the idea of sustainable development easier to understand. The core meaning was simple: meet today's needs, but do not block what future generations will need. This mattered a lot because it tried to balance economic growth with environmental protection.⁶

The Rio Declaration from 1992 built on that earlier framework. It sets out several key ideas. These include the precautionary approach. It also includes the polluter pays rule. People should have a say in matters that affect the environment. Environmental concerns must be considered when decisions are made about development. Rio Principle 15 points to caution when there is a risk of serious or long-lasting environmental damage and Rio Principle 16 focuses on how environmental costs should be covered. It supports the idea that the party causing the pollution should pay for it.⁷

⁴See Philippe Sands, Jacqueline Peel, Adriana Fabra & Ruth MacKenzie, *Principles of International Environmental Law* (4th ed., Cambridge University Press, 2018).

⁵United Nations Conference on the Human Environment, *Stockholm Declaration* (1972).

⁶World Commission on Environment and Development, *Our Common Future* (Oxford University Press, 1987), ch 2.

⁷United Nations, *Rio Declaration on Environment and Development* (1992), Principles 10, 15 and 16.

Development of Environmental Law in India:

Indian environmental law grew from several sources at once, mainly constitutional rules, statutes, and decisions by the courts. In 1976, the 42nd Constitutional Amendment changed this area in a clear way. It added Article 48A, this new provision asks the State to protect and improve the environment, also points to safeguarding forests and wildlife. The same amendment brought in Article 51A(g), that clause puts a duty on citizens to protect and improve the natural environment. Later on, the Supreme Court gave more weight to this set of constitutional ideas. It looked at Article 21 and treated the right to life as including a clean and safe environment. That means a person should not have to live with heavy pollution. Many recent Supreme Court rulings still connect Article 21 with Articles 48A and 51A(g) when dealing with environmental questions, because of these steps, environmental protection moved beyond being only a government plan. It became tied to fundamental rights and to the broader way the Constitution governs public life.

Major Environmental Principles and Landmark Cases:

(i) Sustainable Development:

Sustainable development tries to set an even trade-off between growth and protecting nature. In *Vellore Citizens' Welfare Forum v. Union of India* (1996), the Supreme Court said sustainable development is meant to bring together ecology and development. The Court also noted ideas like fairness between present and future people, saving natural resources, the precautionary approach, and the polluter pays rule. This matters for your topic since it gives a legal basis to ask if economic and technology progress can happen without harming ecological stability.

(ii) Precautionary Principle:

The precautionary principle tells environmental regulators to act early. They should use preventive steps if an activity could cause serious or lasting damage to nature. This applies even when science does not yet give full certainty. ⁸

In *Vellore Citizens' Welfare Forum v. Union of India*, the Supreme Court treated this idea as part of Indian environmental law. The judges said that missing scientific certainty alone is not a good reason to delay action meant to prevent harm. The rule matters a lot in new

⁸*Vellore Citizens' Welfare Forum v Union of India*, (1996) 5 SCC 647; Rio Declaration, Principle 15 (1992).

fields. Think about AI tools used for environmental work, geoengineering plans, and biotechnology. In these areas, the effects on ecosystems over time may not be clear yet.

(iii) Polluter Pays Principle:

The Polluter Pays Principle puts the cost of environmental harm on the party that caused it. In *Indian Council for Enviro-Legal Action v. Union of India* (1996), the Supreme Court used this idea for industrial pollution. The Court said that those linked to hazardous pollution may be made to pay for steps needed to fix the environment. Later, the same view was strengthened in *Vellore*. This rule is not only about money for people who are directly hurt. It can also cover the expense of bringing damaged ecosystems back to health. Seen in economic terms, it is meant to make environmental externalities “internal.” In other words, the harm should not be shifted to the public, while the gains stay with the polluter.

(iv) Public Trust Doctrine:

The Public Trust Doctrine says some natural resources belong to the State, but the State holds them for everyone. They are not like normal private property that can be used without limits. In *M.C. Mehta v. Kamal Nath* (1996), the Supreme Court dealt with harm done to the flow of the River Beas. The Court brought the Public Trust Doctrine into Indian law. It noted that rivers, forests, and seashores fall under duties of the State. Those duties are linked to the public’s welfare. This idea also matters for intergenerational justice. Natural resources are not judged only by what the current generation wants.

(v) Intergenerational Equity:

Intergenerational equity says that people alive now should use natural resources in ways that do not harm the ability of future people to meet their needs. The goal is simple. Future generations should not be made to pay an unfair price for what we do today. This idea is also tied to sustainable development. Over time, it has become a key part of how courts in India handle environmental cases. In many rulings, the Supreme Court has treated intergenerational equity as part of the larger plan for sustainable development. Looking at the green and digital side, a new issue comes up. We have to ask if choices we make now, including how we mine key minerals, build data systems that use a lot of power, and carry out other forms of environmental use, can lead to heavy ecological harm later on.⁹

⁹World Commission on Environment and Development, *Our Common Future* (1987); *Vellore Citizens’ Welfare Forum v Union of India*, (1996) 5 SCC 647.

Economic Principles Underlying Environmental Law:

Environmental law is starting to lean more on economics. That shift happens because harm to the environment usually has effects people do not directly pay for.

(i) Environmental Externality:

An externality happens when an activity creates environmental harm, but the people who suffer that harm did not choose to do the activity. Take a factory as an example. It can benefit from making goods, while people in nearby neighbourhoods end up paying for dirty air, polluted water, and health problems.¹⁰

Environmental law tries to deal with it using several tools, for example: ¹¹

- Polluter Pays Principle
- Environmental taxation
- Carbon pricing
- Emissions trading
- Environmental compensation
- Green subsidies
- ESG obligations
- Extended producer responsibility.

(ii) Cost Internalisation:

Cost internalisation matters a lot. Rather than letting harm to the environment turn into a bill paid by everyone, the legal system tries to build those environmental costs into the activity and its price. In Principle 16 of the Rio Declaration, it calls for costs from environmental damage to be taken into account. It also says that, in general, the polluter should carry the cost of pollution.

¹⁰See Richard A. Posner, *Economic Analysis of Law* (9th ed., Wolters Kluwer, 2014), discussion of externalities and corrective rules; see also Rio Declaration, Principle 16.

¹¹See Rio Declaration, Principle 16; OECD, *The Polluter Pays Principle: OECD Analyses and Recommendations* (1975).

From Environmental Law to Ecological Justice:

Environmental law has changed over time. It now moves beyond just protecting nature. It also focuses on fairness and justice. The old way of asking is gone. The main question used to be simple.

How can pollution be controlled? Now the question sounds different. People ask things like this. Who creates the pollution and harms the environment? Who is hurt by it? Who gets to join the decisions about the environment? Who pays the costs of protection?

This view matters most for communities that are already at risk. Many of these groups rely on forests, rivers, land, and other natural resources. Because of that, they can end up taking a bigger hit when the environment gets worse.

The Emergence of the Green-Digital Frontier:

The latest step in this long timeline is where environmental governance meets digital tools. Tools like AI, satellite images, remote sensing, GIS, sensors, and data analytics can help track pollution and support enforcement. At the same time, the same tools add new harm. They use more electricity. They also create e-waste, depend on mining for key minerals, and need heavy digital infrastructure. So a fresh legal issue now appears. Environmental law has to do more than cover older industries. It also has to respond to the environmental fallout from the digital technologies being used to handle environmental challenges.

LEGASLATIVE FRAMEWORK:

(1) *Constitution of India:*

The Constitution of India rests mainly on Article 21, Article 48A, and Article 51A(g). Courts have read Article 21 to cover the right to a clean and healthy environment. At the same time, Article 48A sets out a duty for the State. Article 51A(g) places duties on citizens.¹²

(2) *Environment (Protection) Act, 1986:*

The Environment (Protection) Act, 1986 is the main law in India for environmental protection. Under this Act, the Central Government can set rules for environmental

¹²Constitution of India, arts 21, 48A and 51A(g).

standards. It can also act to stop and reduce pollution. The Act also supports other key environmental rules, such as the EIA framework.¹³

(3) Water Act, 1974 and Air Act, 1981:

India's Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981, are the basic laws used for pollution control. These acts set up bodies and steps that help in keeping track of pollution. They also guide how pollution is handled and checked.¹⁴

(4) Biological Diversity Act, 2002:

The Biological Diversity Act, 2002, was later changed in 2023. The law deals with saving biodiversity and also covers the use of biological resources in a way that does not harm nature. Another aim is to share benefits in a fair manner. This Act matters for ecological justice. It also links environmental resources with economic interests.¹⁵

(5) Environmental Impact Assessment Framework:

The EIA Notification from 2006, made under the Environment (Protection) Act, sets up a way to judge the environmental effects of certain projects. It is meant to follow the ideas of caution, long term growth, and letting the public take part.¹⁶

(6) Energy Conservation Act, 2001:

The Energy Conservation Act of 2001. After the changes made in 2022, it shows how environmental rules and economic oversight are starting to work together more closely. The law backs energy efficiency and sets the legal base for India's carbon market systems.¹⁷

(7) Carbon Credit Trading Scheme, 2023:

The Carbon Credit Trading Scheme for 2023 marks a move toward rules that rely on the market. It links environmental goals with payoffs in the economy. The plan sets up ways to track emission cuts. Those cuts can then be counted as carbon credits.¹⁸

(8) Digital Personal Data Protection Act, 2023:

The DPDP Act of 2023 is mainly about data rules. Even so, it matters for the move toward greener and smarter tech. This is because environmental work now depends more on digital information. People use sensors, smart buildings, satellite tools, and routine automated checks to track what is happening. When these tools handle personal data, the law adds another set of limits.¹⁹

(9) Information Technology and Emerging AI Governance:

13Environment (Protection) Act 1986, ss 3–5; India Code.

14Water (Prevention and Control of Pollution) Act 1974; Air (Prevention and Control of Pollution) Act 1981.

15Biological Diversity Act 2002; Biological Diversity (Amendment) Act 2023; notification S.O. 295(E), 18 January 2024 (effective 1 April 2024).

16Environment Impact Assessment Notification, 2006, S.O. 1533(E), 14 September 2006, issued under the Environment (Protection) Act 1986.

17Energy Conservation Act 2001, as amended by the Energy Conservation (Amendment) Act 2022.

18Ministry of Power, Government of India, Carbon Credit Trading Scheme, 2023; see also Energy Conservation (Amendment) Act 2022, including provisions enabling a carbon credit trading scheme.

19Digital Personal Data Protection Act 2023, Act No. 22 of 2023.

The current information-technology setup, plus new AI rules, matters for AI tools used in environmental work. It can support monitoring, help with forecast-style assessments, and enable automated checks for compliance. It also affects digital choices made for environmental issues. Still, there is a growing policy gap. India does not yet have a single full law that clearly covers AI-based decisions in environmental management.

SOCIAL ASPECTS & LINKAGES:

1. Environmental Justice and Vulnerable Communities:

Poorer communities usually feel environmental harm the most. This is common in rural areas, among Indigenous people, and in groups who rely on forests. Many people also depend on land and water for their work. When pollution rises, forests are cut, people are moved, or climate impacts worsen, these groups can be hit harder than others. Because of that, environmental decisions should not treat fairness as an afterthought. Protection of the environment needs to connect with social equity and fair distribution.

2. Intergenerational Equity:

Some environmental choices affect more than just today. If we take too many natural resources, harm animal and plant life, or worsen the climate, then there will be less to rely on later. Because of this, people use the idea of fairness across generations. It connects what we do now with what others may need in the future. When we make environmental decisions, we should not look only at short term money. We also need to think about what will happen to nature over time.

3. Technology and the Digital Divide:

Digital tools can help with environmental decision making. Satellites can track changes. AI can support analysis. Online platforms can share updates. Still, the benefits do not reach everyone. When access is uneven, a digital divide can form. Some communities lack steady internet. Others do not have the skills needed to use digital tools. In those cases, it can be hard to join online talks about the environment. It can also be hard to find environmental information.

4. Public Participation:

People can influence choices about their local environment. That right is tied to how environmental decisions are made. When governments hold public talks, run environmental reviews, and share environmental records, communities get a chance to speak up. They can raise worries before a project gets the final go ahead. New tools may help too. Online consultation pages can reach more people. Public data sets and maps made with GIS can make details easier to see. Digital ways to file

complaints can also help. This only works if the tools are easy to use and the process stays open.

5. *Livelihoods and Economic Security:*

Nature and other local resources often become the money base for communities. People rely on forests, farms, rivers, fishing, and nearby coasts. These areas bring work and steady income. When the environment declines, life can get financially shaky. In some places, the rules put in place to protect nature can clash with how locals earn a living. That mismatch can spark tension in the community.

6. *Gender and Environmental Governance:*

Environmental damage does not affect everyone in the same way. In many places, women do a lot of the work tied to water, fuel, and forest materials. So when the local environment gets worse, the daily impact on women can be stronger. Because of that, environmental rules should look at who gains and who pays. If one group gets more help while another group faces heavier costs, the policy should take that into account.

7. *Indigenous and Local Community Rights:*

Local and indigenous communities often hold know-how about forests, plants and animals, local water routes, and ways to use resources without running them down. The Biological Diversity Act, along with its benefit sharing plan, points to the value of this local knowledge and the need for community involvement in decisions about biodiversity.

8. *Climate Justice:*

Climate change shows that the harm is not shared evenly. Some towns and regions have added very little to the gases in the air. Yet they still deal with major impacts, like floods, drought, hotter days, rising seas, and damage to local ecosystems. Because of that, climate policy is more than cutting emissions. It also has to cover how people prepare for shocks, where risk is highest, how plans get paid for, and how the costs are split fairly.

9. *Technology, Employment and Just Transition:*

The shift to greener policies and digital tools could change how people work. More clean power, electric transport, machine automation, and AI might open up some jobs. At the same time, they may shake up older sectors and roles. Because of that,

people talk about a Just Transition. It aims to support workers and local communities hit by major economic changes, so they are not abandoned.²⁰

10. Data, Privacy and Environmental Monitoring:

The push for digital oversight in environmental matters now leans on sensors, cameras, phones, satellite tools, and data analysis.

These tools can help with enforcement. At the same time, they can bring up worries about privacy, being watched, who owns the data, and whether people agree to the use of it. This is especially true when individuals or local groups can be recognized. Because of that, environmental goals should not stand alone. They need guardrails that protect personal rights.²¹

Case law analysis:

1. Vellore Citizens' Welfare Forum v. Union of India (1996) 5 SCC 647:

Facts: A case was brought about serious pollution linked to tanneries in Tamil Nadu. The tanneries released large amounts of waste water without any treatment. This waste was poured into fields, canals, and the River Palar. People faced harm because their drinking water was polluted. Farms were also hit, and many plots could no longer be used for crops. The leather industry said, in effect, that its work mattered for the economy. It also claimed it created jobs and brought in foreign exchange.

Issue: Can industries keep running even when their work causes major harm to the environment, just because they also help the economy? Do the Precautionary Principle, the Polluter Pays Principle, and the Sustainable Development approach count as parts of Indian environmental law?

Reasoning: The Supreme Court treated sustainable development as a way to balance the needs of ecology and the goals of development. It said that the economic value of an industry does not allow harmful actions to keep going when there are no real steps to control pollution. The Court also pointed to the Precautionary Principle and the Polluter Pays Principle. It viewed both as key parts of sustainable development and said they already have a place in Indian law.

²⁰International Labour Organization, Guidelines for a Just Transition towards Environmentally Sustainable Economies and Societies for All (2015; endorsed as a central policy reference in 2023).

²¹Digital Personal Data Protection Act 2023; see also ITU & World Bank, Measuring the Emissions and Energy Footprint of the ICT Sector (2024).

2. Indian Council for Enviro-Legal Action v. Union of India (1996) 3 SCC 212:

Facts: In Bichhri, Rajasthan, some factories made hazardous chemical products. They also put toxic waste into the ground. Over time, this led to dirty soil and contaminated groundwater. People in nearby areas also saw harm to the local environment.

Issue: Can the industries that cause pollution be forced to pay for cleanup and environmental repair?

Reasoning: The Supreme Court used the Polluter Pays Principle. It said the companies that caused the pollution have to pay for fixing the harm. The Court also made clear that restoring the environment cannot be viewed as something the State or the public should cover.

Key Principle:

Polluter Pays Principle and Environmental Cost Internalisation:

3. M.C. Mehta v. Kamal Nath (1997) 1 SCC 388:

Facts: A private motel project was linked to problems with how the River Beas normally flows. People also said it harmed the nearby ecological area. The argument was about using natural resources for a private business, not for public needs.

Issue: Whether the industries responsible for environmental pollution could be required to bear the cost of environmental remediation and restoration.

Reasoning: The Supreme Court applied the Public Trust Doctrine, holding that certain natural resources are held by the State in trust for the benefit of the public. The State cannot permit their use in a manner that substantially compromises public and ecological interests.

POLICY CHALLENGES & RECOMMENDATIONS:

1. Fragmented Regulatory Framework

One of the principal challenges is the fragmented nature of environmental regulation. Laws dealing with pollution, biodiversity, energy, environmental impact assessment, waste, carbon markets and digital governance operate through different institutions and regulatory mechanisms. This fragmentation can result in overlapping jurisdictions, inconsistent standards and regulatory gaps, particularly for emerging sectors such as data centres, electric-vehicle infrastructure, renewable-energy projects and critical-mineral extraction.

Recommendation: India should move towards an integrated environmental governance framework that facilitates coordination between environmental, energy, technology, industry and financial regulators. Inter-agency mechanisms and common environmental-data standards should be developed for projects having both environmental and technological dimensions.

2. Environmental Costs of Digitalisation

Digital technologies are often presented as instruments of sustainability, but their environmental footprint cannot be overlooked. Data centres, artificial intelligence systems, electronic devices and digital infrastructure require substantial energy and resources. Mining of critical minerals, production of electronic equipment and generation of e-waste may create additional ecological pressures.²²

Recommendation: Environmental regulation should incorporate a “**digital environmental footprint**” assessment for large-scale digital infrastructure. Energy efficiency, renewable-energy use, water consumption, lifecycle emissions, resource extraction and end-of-life management should form part of environmental assessment for major digital projects.

3. Lack of Clear Regulation of AI in Environmental Decision-Making

Artificial intelligence can assist in pollution monitoring, environmental impact assessment, satellite-image analysis, forest monitoring and climate modelling. However, reliance on algorithmic systems creates concerns relating to transparency, accuracy, bias and accountability. Where an AI-supported system contributes to an environmental decision,

²²International Telecommunication Union & UNITAR, The Global E-waste Monitor 2024; ITU & World Bank, Measuring the Emissions and Energy Footprint of the ICT Sector (2024).

affected communities may have difficulty understanding or challenging the technological basis of that decision.

Recommendation: *AI used in environmental governance should be subject to principles of transparency, explainability, human oversight, auditability and accountability. Significant regulatory decisions should not be based exclusively on automated outputs. Authorities should retain responsibility for verifying technological assessments before taking decisions affecting environmental rights or livelihoods.*

4. Data Gaps and Unequal Access to Environmental Information

Effective environmental governance depends upon reliable and accessible data. However, environmental information may be dispersed across different agencies, collected using inconsistent methodologies, or difficult for ordinary citizens to access and understand. Communities directly affected by environmental projects may therefore be unable to participate effectively in decision-making.

Recommendation: *Environmental authorities should develop interoperable and publicly accessible environmental-data platforms containing information on pollution, environmental clearances, ecological risks and compliance, subject to legitimate privacy and security safeguards. Environmental information should also be made available in regional languages and accessible formats.*

5. Digital Divide and Environmental Justice

Technological governance can unintentionally exclude communities that lack internet access, digital literacy or technological resources. This is particularly significant where environmental decisions involve rural communities, indigenous and forest-dependent populations, informal workers and economically vulnerable groups.

Recommendation: *Digital environmental governance must complement, rather than replace, traditional forms of public participation. Public hearings, local consultations, physical access to documents and community-based monitoring should continue alongside digital platforms. Digital inclusion should be treated as an element of environmental justice.*

6. Weak Integration of Economic and Environmental Costs

Environmental degradation frequently creates costs that are not reflected in the market price of goods and services. Pollution, ecological restoration, biodiversity loss and health impacts

may be transferred to communities and future generations rather than being borne by the entities responsible for environmental harm.

Recommendation: Environmental policy should strengthen the principle of **internalisation of environmental costs** through appropriate economic instruments. Polluter-pays mechanisms, environmental compensation, carbon pricing, green taxation and other market-based instruments should be designed to ensure that economic activity reflects its ecological costs without disproportionately burdening vulnerable communities.

7. Greenwashing and Weak ESG Accountability

The growing importance of sustainable finance and ESG disclosures has created incentives for businesses to present themselves as environmentally responsible. However, inadequate verification may permit exaggerated or misleading environmental claims.

Recommendation: Environmental and ESG claims should be supported by verifiable and standardised indicators. Independent verification, transparent disclosure and meaningful consequences for materially misleading environmental representations should be strengthened. ESG reporting should increasingly focus on measurable environmental performance rather than merely voluntary commitments.

8. Protection of Vulnerable Communities and Intergenerational Equity

Environmental and technological transitions can distribute benefits and burdens unequally. Large infrastructure, renewable-energy projects, mining activities and conservation measures may affect land, livelihoods and access to natural resources. At the same time, present development decisions can impose environmental costs upon future generations.

Recommendation: Environmental policy should incorporate **intergenerational equity and distributive justice** into project planning and regulatory decision-making. Environmental impact assessments should examine not only immediate ecological effects but also long-term consequences for communities, ecosystems and future generations. Benefit-sharing and rehabilitation mechanisms should be strengthened where communities bear disproportionate environmental costs.

9. Need for Stronger Environmental Monitoring and Enforcement

The effectiveness of environmental legislation depends upon implementation and enforcement. Even where environmental standards exist, inadequate monitoring, limited institutional capacity and delayed enforcement can reduce their practical effectiveness.

Recommendation: Regulatory agencies should be equipped with modern monitoring technologies such as remote sensing, satellite imagery, sensors and data analytics. However, technological monitoring should be combined with field inspections, independent verification and community reporting. Environmental violations should attract timely and proportionate remedial and enforcement measures.

10. Towards a Green–Digital Regulatory Model

The central policy challenge is to prevent environmental law and technology regulation from developing in isolation. The green transition and digital transition are increasingly interconnected. Renewable energy requires technological infrastructure; digital technologies require energy and minerals; environmental monitoring increasingly depends upon digital systems; and economic policies influence both technological development and environmental outcomes.²³

Recommendation: India should develop a **Green–Digital Governance Framework** based on five interconnected principles:

1. **Ecological Integrity** – development must operate within ecological limits.
2. **Technological Accountability** – digital tools used in environmental governance must remain transparent, auditable and subject to human oversight.
3. **Economic Responsibility** – environmental costs should be appropriately internalised into economic decision-making.
4. **Participatory Environmental Justice** – affected communities must have meaningful access to information and decision-making.
5. **Intergenerational Equity** – present development must not compromise the environmental rights and opportunities of future generations.

²³See Philippe Sands et al., *Principles of International Environmental Law* (4th ed., Cambridge University Press, 2018), on integration and sustainable development.

CONCLUSION:

This paper has argued that the emerging green–digital frontier requires environmental law to move beyond its traditional, sector-specific approach and develop an integrated framework connecting ecological protection, economic development, technological innovation and social justice. The central argument is that neither economic growth nor technological advancement can be considered sustainable when their ecological and social costs are externalised to communities, ecosystems and future generations.²⁴

The historical development of environmental law demonstrates that principles such as sustainable development, precautionary principle, polluter pays, public trust doctrine and intergenerational equity have already established the legal foundation for balancing development with environmental protection. The jurisprudence of the Supreme Court has further recognised that environmental protection is closely connected with constitutional rights, public welfare and the responsible use of natural resources. However, the emergence of artificial intelligence, satellite technologies, big-data systems, digital infrastructure, carbon markets and green finance has created a new regulatory environment that existing sectoral frameworks do not always adequately address.

The paper therefore contends that technology should be treated not merely as a solution to environmental problems, but also as an object of environmental governance. AI and digital monitoring can improve environmental assessment, compliance and transparency, but digital infrastructure itself consumes energy and resources and generates environmental impacts. Consequently, technological solutions must remain subject to environmental assessment, transparency, human oversight and accountability.

Similarly, the economic dimension of environmental governance cannot be separated from ecological justice. The principles of polluter pays and cost internalisation demonstrate that environmental damage should not become a hidden subsidy for economic activity. Carbon markets, green finance and ESG mechanisms can support sustainability, but their legitimacy depends upon transparency, measurable environmental outcomes and protection against

²⁴See World Commission on Environment and Development, *Our Common Future* (1987); Rio Declaration (1992); ITU & UNITAR, *The Global E-waste Monitor* 2024.

greenwashing. Economic instruments must therefore complement, rather than replace, substantive environmental regulation.

The social dimension further strengthens this argument. The benefits of technological and economic transitions are not automatically distributed equally. Vulnerable communities, indigenous and forest-dependent populations, workers and future generations may bear disproportionate environmental costs. A genuinely sustainable green–digital transition must therefore incorporate participation, accessibility, distributive justice, livelihood protection and intergenerational equity. Digital environmental governance should expand public participation rather than create a new form of exclusion through the digital divide.

Accordingly, the policy challenge identified in this paper is not simply the absence of environmental legislation, but the fragmentation and limited coordination between environmental, economic and technological governance. The future regulatory framework must connect environmental impact assessment, pollution control, biodiversity protection, energy regulation, carbon markets, digital technologies and environmental information systems within a more coherent governance structure.

The paper therefore proposes a Green–Digital Governance approach founded on four interconnected requirements: ecological integrity, technological accountability, economic responsibility and ecological justice, supported by the principle of intergenerational equity. Under such an approach, technology should enable better environmental governance; economic activity should internalise its environmental costs; affected communities should participate meaningfully in decision-making; and development should remain within ecological limits.

The central conclusion is therefore that the future of environmental law lies not in choosing between development and environmental protection, or between technology and ecology, but in legally restructuring their relationship. The green–digital transition will be sustainable only when innovation is made ecologically accountable, economic development is made environmentally responsible, and technological governance remains socially inclusive.

Thus, the task of contemporary environmental law is to ensure that the green transition does not create new digital and economic externalities, and that the digital transition does not undermine ecological justice. By bringing sustainability, economics, technology and ecological justice within a common legal framework, environmental governance can evolve from a reactive system of controlling environmental harm into a proactive system of designing

development within ecological boundaries. This is the essential legal challenge—and the principal opportunity—at the green–digital frontier.



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