

# **Nature and Sustainability in Digital Media: Indian Context**

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## **INTRODUCTION**

### **Two Transformations and Their Convergence**

Two transformations define the present century, and they are increasingly entangled. The first is ecological. Climate change, biodiversity loss, land degradation, air and water pollution and unsustainable patterns of consumption have moved from the margins of public policy to its centre [1,2]. The second is technological. Digital systems have reorganised communication, knowledge production, governance, commerce and everyday life, and have done so within a single generation [3]. The subject of this paper lies where these developments meet: the relationship between digital communication and environmental sustainability.

Digital media has altered the structure of environmental communication itself. Public understanding of ecological questions was once mediated largely through newspapers, radio, television, educational institutions and government campaigns, all of which carried information in a single direction and through a small number of institutional gatekeepers [4,5]. The online media is interactive in nature. Social networking platforms, internet, and mobile applications are eminent platforms of environmental information as creators, not just as users. [6].

This shift has implications for sustainability because environmental issues are not presented in a neutral space. What counts as an environmental issue, whose account of it is credible, and which solutions appear reasonable are all outcomes of discursive contest [7,8]. A change in the architecture of communication is therefore a change in the conditions under which environmental politics is conducted. The question this paper pursues is whether that change, in the Indian case, works in favour of ecological sustainability, and at what material cost.

## **The Indian Setting**

India gives the transformation a particular character. In addition to significant environmental pressures caused by population density, urbanisation, industrialisation, waste production, climate variability, and shifting consumption, the country has exceptional ecological diversity, encompassing Himalayan systems, coastal zones, forests, deserts, river basins, and biodiversity-rich landscapes [9]. In this sense, digital communication opens up possibilities that were previously unavailable through traditional media platforms. Natural catastrophes, wildlife conservation, pollution, deforestation, and climate change are all topics that are widely discussed. Citizen and environmental organisations use digital networks to plan campaigns and recruit volunteers. Communities monitor local ecological change with the use of digital mapping tools and smartphones. Rather than waiting for traditional news cycles, scientists and environmental organisations actively disseminate their findings with a wider audience.

The scale of that infrastructure is considerable. India recorded 969.10 million internet subscribers at the end of March 2025, of whom 944.12 million were broadband subscribers and 927.70 million accessed the network wirelessly [10]. Average monthly data consumption per wireless subscriber reached 21.53 GB, and total wireless data traffic rose by 17.46 per cent over the preceding year [11]. A communication environment of this size and intensity is not a marginal factor in how a country understands its own ecology.

The relationship between digital media and sustainability is nonetheless not uniformly positive. Digital technologies depend on physical infrastructures and natural resources. Smartphones, computers, servers and communication networks require energy and raw materials across their lifecycle, and accelerated device replacement adds to a waste stream that is already the fastest growing in the world [12,13]. India's estimated generation of electronic waste from the categories notified under the E-Waste (Management) Rules, 2016 rose to 1,601,155 tonnes in the financial year 2021–22 [14]. Digital infrastructure expanded at a comparable pace: total data-centre capacity in the country grew from about 375 MW in 2020 to approximately 1,500 MW by 2025, and the Ministry of Power projects data-centre electricity demand of 13.56 GW by 2031–32 [15].

A paradox follows. Digital media can communicate environmental consciousness while simultaneously contributing to environmental pressure.

## **Statement of the Problem**

Many individuals praise digital media for its ability to enhance environmental awareness and promote sustainable development. An environmental campaign can reach millions of users in a couple of days thanks to social networking sites and mobile technologies that allow individuals to access information, participate in public debate, and plan collective

action. However, increased visibility does not lead to long-term environmental action. The attention economy of digital platforms encourages quick switching between issues, which undermines long-term public engagement, and online environmental activism may remain limited to symbolic expression, such as sharing posts, changing profile pictures, or participating in transient campaigns [16,17]. A second issue is the accuracy of environmental data provided over digital networks. Misinformation, altered visual imagery, and unsubstantiated assertions impair public comprehension of ecological issues, and recommendation algorithms may prioritise participation over scientific correctness or public importance [18,19]. A third, and distinct, issue is the environmental impact of digitalisation. It is vital to critically evaluate the concept that digital communication is inherently environmentally helpful. While data storage and transmission need energy-intensive infrastructure, the manufacturing and disposal of digital devices use material resources and generate hazardous waste [20,21].

## Research Questions

The study is guided by one central question: what is the role of digital media in promoting nature conservation and sustainability in India, and what challenges must be addressed to ensure environmentally sustainable digital growth? The central question is disaggregated into seven specific questions:

1. How does digital media contribute to environmental awareness in India?
2. What role do social media platforms play in encouraging public participation?
3. Can digital storytelling help preserve and share indigenous and local ecological knowledge?
4. What are the environmental consequences of the rapid expansion of digital infrastructure?
5. How important are energy use and electronic waste as obstacles to India's sustainable digital development?
6. What institutional and policy frameworks are required to advance sustainable digital communication?
7. How can scholars, policymakers, civic society, and digital platforms create an integrated model of ecologically conscious digital communication?

## Objectives of the Study

1. To examine the relationship between digital media, nature and sustainability in the Indian context.
2. To analyse the role of social media in environmental awareness and conservation communication.

3. To investigate the potential of digital platforms for public participation and environmental activism.
4. To explore the contribution of digital storytelling and local ecological knowledge to sustainability communication.
5. To examine critically the environmental consequences of digital infrastructure and electronic technologies.

## **Significance of the Study**

Research on digital media, which frequently concentrates on technological innovation, communication efficiency, and economic development, pays comparatively less attention to the ecological elements of digitalisation. When it comes to the material imprint of media, studies from high-income settings prevail in the literature [22, 23]. This study connects media studies with environmental sustainability in a setting that warrants further research: India's digital growth coincides with significant environmental and developmental pressures, and the nation's size, linguistic diversity, and inequality make it an essential place to understand how digital technologies interact with public communication and ecological systems. Further the study also extends the field of environmental communication research by studying the transition from one-way environmental messaging to interactive and participatory digital communication and viewing that transition as materially embedded rather than purely discursive. Because their communication strategies must account for both the environmental benefits and drawbacks of digital technology, policymakers, media outlets, IT companies, academic institutions, and civil society organisations find it practically significant. In a more general sense, the study contributes to the expanding field of sustainable digitalisation by proposing an integrated approach that connects technological advancement and ecological responsibility and by describing metrics that could be used to assess that approach.

## **REVIEW OF LITERATURE**

### **Environmental Communication and the Public Sphere**

It entails more than just conveying scientific information: cultural values, political interests, social identities, and conflicting interpretations of nature influence both what is communicated and how it is perceived [24]. The area has consistently considered communication as constitutive rather than merely instrumental, arguing that the way an environmental problem is called and presented determines the range of options possible [7]. The development of mass media greatly increased public awareness of environmental issues. Newspapers, television documentaries, and radio programs helped the public understand pollution, wildlife protection, and climate change, but these systems were defined by institutional control and one-way flow [5]. Research on climate coverage

has revealed how editorial practices, such as balancing requirements, influence public impression of scientific consensus [25].

### **Digital Media, Activism and the Limits of Networked Participation**

Digital media have become a critical infrastructure for contemporary activism, enabling people and organisations to connect quickly, coordinate action and draw public attention [27]. Environmental activism is increasingly hybrid, combining online and offline action: a campaign could start with a hashtag, an online petition or a film, and then move into public meetings, community activities, protest or policy engagement. The power of digital activism is in the speed, accessibility and network building. People join common initiatives across areas, and environmental organisations directly engage with their followers without depending on the old media gatekeepers [28].

### **Environmental Discourse in the Indian Digital Sphere**

Social media and digital news ecosystems are debating environmental issues as a result of India's notable rise in digital communication and mobile connection. Issues including air pollution, river conservation, plastic waste, forest protection, climate change, and wildlife conservation are often discussed in online public discourse. Additionally, local environmental issues are more prominent on digital platforms than they would be through local media alone.

### **Digital Storytelling and Ecological Knowledge**

Digital storytelling has become an important tool for sharing environmental experiences. Stories, photos, films, podcasts, and interactive media help to make abstract ecological issues more relatable. Statistics are frequently used to communicate climate change; while this knowledge is important, numbers alone rarely result in the level of participation required for a long-term response [26]. Environmental challenges are linked to personal experiences, distinct communities, and specific landscapes using digital storytelling. India has a wealth of indigenous and local ecological knowledge regarding forests, water, agriculture, biodiversity, and seasonal fluctuation that has been passed down over centuries [30, 31].

### **The Materiality of Digital Media**

A recurring limitation in discussion of digital media is the tendency to treat digital communication as immaterial. Every digital interaction depends on physical systems: electronic devices, telecommunication networks, servers and data centres, electricity, cooling, minerals and raw materials, and systems for waste collection and recycling. Media scholarship has increasingly insisted on this materiality, tracing media technologies back to mineral extraction and forward to disposal [13,22,33].

## **Electronic Waste and the Circular Economy**

Electronic waste is one of the most important environmental impacts of technology. According to the fourth Global E-waste Monitor, 62 million tonnes of e-waste were produced globally in 2022, with just 22.3% being collected and recycled in an environmentally acceptable manner. By 2030, the generation is predicted to reach 82 million tonnes [12]. India is placed third among global generators in the same survey. Recycling now meets less than 1% of the demand for rare earth elements, and recovery ability varies substantially by location. The E-Waste (Management) Rules, 2022, announced in November 2022 and went into effect on April 1, 2023, established a regulatory framework that strengthened Extended Producer Responsibility with a certificate-based compliance mechanism managed through a central portal and expanded coverage to 106 categories of electrical and electronic equipment [38, 39]. Later improvements added refrigerant management and the exchange of Extended Producer Responsibility certificates at a price range connected with environmental compensation [40].

## **The Research Gap**

Three gaps emerge from this review. First, environmental communication research and the literature on the material footprint of information technology have developed largely in parallel, so that the communicative promise of digital media and its ecological cost are rarely assessed within a single analytical frame. Second, the material-footprint literature draws predominantly on high-income cases, leaving the specific configuration of rapid adoption, high informality in waste handling and pronounced access inequality that characterises India under-theorised. Third, existing frameworks for sustainable digital communication tend to remain normative, offering principles without indicators. This study addresses all three.

## **THEORETICAL FRAMEWORK**

The study is informed by an interdisciplinary framework combining environmental communication theory, participatory communication, the network society and ecological modernisation, held together by an insistence on the materiality of media.

## **Environmental Communication Theory**

Environmental communication theory emphasises the role of communication in shaping human relationships with the natural world. In addition to scientific facts, narratives, symbols, and public discourse are utilised to understand environmental challenges, and the framing of a problem helps remedies appear acceptable [7,24]. By allowing a large number of players to contribute to the construction of ecological narratives, digital media has extended this environment and enhanced pluralism while also increasing the number of conflicting and occasionally untrustworthy stories circulated.

## Participatory Communication

By emphasising interaction, community involvement, and local knowledge, participatory communication challenges the paradigm of experts providing information to passive audiences [32]. Digital technology can encourage participatory environmental communication by allowing citizens to record environmental issues, discuss local observations, contribute to biodiversity mapping, report pollution, coordinate community projects, and interact with lawmakers. However, because access to a platform does not ensure equal voice, participation must be meaningful rather than purely technological. Section 5 explores the distinction between having a channel and being heard.

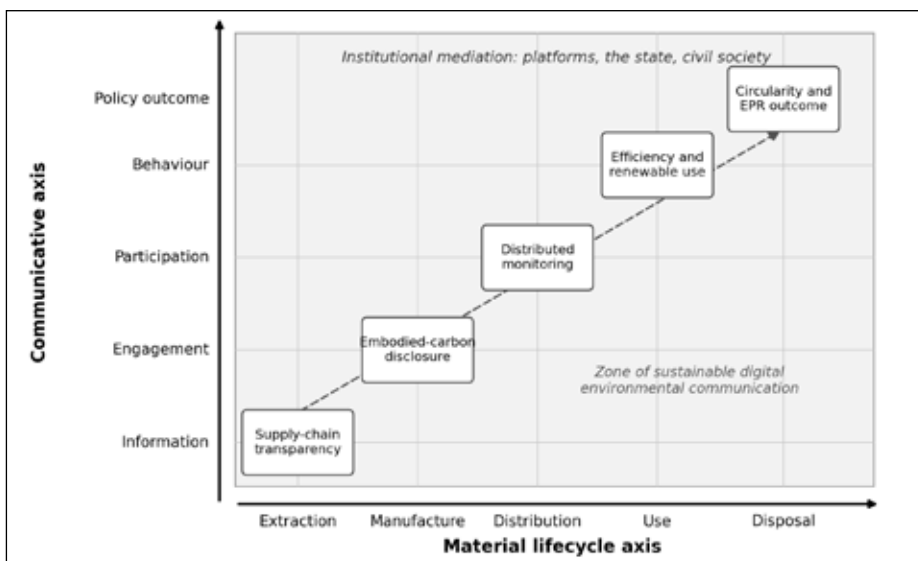


**Fig. 1:** Integrated analytical lens for sustainable digital environmental communication. The communicative axis (information, engagement, participation, behaviour, policy outcome) is plotted against the material lifecycle axis (extraction, manufacture, distribution, use, disposal), with institutional mediation by platforms, the state and civil society shown as the field in which the two axes interact.

## MATERIALS AND METHODS

### Research Design

The study adopts a qualitative, interdisciplinary and analytical design based on critical literature review and reflexive thematic analysis. The purpose is not to measure a single variable statistically but to examine a complex relationship between two domains that are usually studied separately. A qualitative design is appropriate because the research questions concern meaning, framing, institutional arrangement and contradiction rather than magnitude, and because several of the relevant quantities, particularly in the domain of electronic waste, are themselves contested and therefore require interpretation rather than aggregation.

## Sources of Data and Inclusion Criteria

The study is based on secondary sources assembled purposively. Material was included where it met three criteria: relevance to the intersection of digital communication and environmental sustainability; verifiability, meaning that the source is publicly retrievable and attributable to an identified author or institution; and, for empirical claims about India, currency, with statistical and regulatory sources restricted to material published from 2016 onward. Theoretical and conceptual works were admitted without a date restriction. Sources that could not be attributed to an identifiable author or institution were excluded, as were commercial market-research summaries whose underlying method was not disclosed. Table 1 sets out the composition of the corpus.

**Table 1:** Composition of the Source Corpus

| Source category                         | Description                                                                                                                                          | Function in the analysis                                      |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Peer-reviewed literature                | Journal articles and scholarly books in media studies, environmental communication, sustainability science and industrial ecology                    | Conceptual framing; empirical estimates of sectoral footprint |
| Statutory and regulatory instruments    | E-Waste (Management) Rules 2022 and amendments; Digital Personal Data Protection Act 2023 and Rules 2025                                             | Analysis of the policy architecture                           |
| Official statistical releases           | Telecom Regulatory Authority of India performance indicator reports; parliamentary replies and ministry releases on e-waste and data-centre capacity | Quantitative context for the Indian case                      |
| International assessments               | Global E-waste Monitor; International Telecommunication Union and World Bank sectoral assessments                                                    | Comparative benchmarking; triangulation of official figures   |
| Institutional and civil-society reports | Reports of environmental conservation institutions, organisations and public-interest bodies                                                         | Documentation of practice                                     |
| Documented cases                        | Indian citizen-science platforms, government environmental applications and public campaigns with a documented public record                         | Illustration and theme development                            |

**Source:** Sources were retrieved between January and June 2026. Where official and international estimates of the same quantity diverged, both were retained and the divergence was treated as analytically significant rather than resolved by preference.

## Method of analysis

The corpus was analysed using reflexive thematic analysis following the six-phase procedure of familiarisation, initial coding, theme generation, theme review, definition and reporting [47]. Coding was conducted manually and iteratively. Initial codes were

generated inductively from the material; these were then read against the two axes of the analytical lens described in Section 3.5, so that the final theme structure reflects both what the sources emphasised and what the framework required. Themes were retained where they were supported by at least three independent sources drawn from more than one source category, which reduces the risk that a theme reflects the emphasis of a single institutional voice. Table 2 records the resulting coding frame.

**Table 2: Analytical Coding Frame**

| Axis                       | Theme                    | Principal Codes                                                                   |
|----------------------------|--------------------------|-----------------------------------------------------------------------------------|
| Communicative              | Visibility and access    | dissemination; scientific accuracy; multilingual content; visual communication    |
| Communicative              | Engagement gap           | symbolic participation; attention cycles; metrics; online-offline linkage         |
| Communicative              | Distributed monitoring   | citizen science; verification; data quality; ecological security                  |
| Communicative              | Inequality of voice      | rural access; language; gender; community media                                   |
| Communicative              | Information integrity    | misinformation; algorithmic curation; platform transparency; literacy             |
| Communicative              | Knowledge custodianship  | indigenous knowledge; consent; ownership; reciprocity                             |
| Material                   | Infrastructure footprint | energy; data centres; devices; embodied emissions; water                          |
| Material and institutional | Waste and governance     | e-waste estimates; extended producer responsibility; informal sector; circularity |

Themes are reported in Section 5 in this order. The final column lists the principal codes that were consolidated into each theme and not the full code list.

## RESULTS

Eight themes were developed from the corpus. Six concern the communicative axis and two the material and institutional axis. They are reported below in the order established in Table 2.

### Visibility and Access: Digital Media as an Environmental Information System

The most consistently documented contribution of digital media is the rapid dissemination of environmental information. Environmental organisations use video, infographics, podcasts and interactive content to communicate complex scientific material, and audiences reach that material without waiting for traditional news cycles. In the Indian case the state has itself become a substantial digital environmental communicator. The Central Pollution Control Board's Sameer application transforms a technical monitoring

network into a public-facing information service by publishing hourly National Air Quality Index values for hundreds of monitoring stations and allowing the public to register and track pollution complaints [48]. The national ambient monitoring program and early warning systems for air quality share a public interface.

A consistent set of elements, such as scientific accuracy, linguistic accessibility, visual communication, emotional engagement, cultural relevance, and the provision of a real opportunity to act, are required for digital environmental communication to be effective across the corpus. The final one is frequently absent. The mechanism underlying the engagement gap that will be discussed next is attention without a pathway, which is caused by information that fits the first five conditions but lacks the sixth.

The register is the focus of a second observation. Instead of favouring one over the other, successful environmental communication in the Indian digital world usually combines narrative style and scientific substance. The narrative establishes relevance, whereas the statistical presentation builds trust. Campaigns that use only one of the two tend to reach a lesser audience since they are complementary.

### **The Engagement Gap: From Awareness to Outcome**

Environmental communication begins with awareness, not ends with it. The corpus consistently shows that there is just a weak correlation between visibility and behavioural change. By providing pathways into tree planting programs, trash reduction initiatives, biodiversity documentation, environmental education, community clean-up campaigns, and citizen monitoring, digital platforms can facilitate the transition from information to action. In situations when there is no such path, a campaign with millions of views may nevertheless have a small societal impact.

Documented campaign practice in India illustrates both the possibility and the difficulty. An air-quality awareness programme conducted in Delhi between June and September 2025 reported direct engagement with more than two hundred thousand participants across pollution hotspots, combining school sessions, residents' association surveys, demonstrations of the Sameer application, carbon-footprint dashboards and social media outreach with the distribution and planting of more than 1,750 saplings under a national tree-planting initiative [49]. The design is instructive because the digital component was used to route participants toward specified offline actions rather than to substitute for them. Its evaluation is also instructive: the reported indicators are participation counts and saplings distributed, not survival rates of planted trees or measured change in household behaviour, which is the general condition of campaign evaluation in this field.

Table 3 sets out the ladder of engagement implied by the corpus, together with the indicator typically reported at each level and the indicator that would be required to evidence it.

**Table 3:** Ladder of Digital Environmental Engagement and its Evidentiary Requirements

| Level                 | Definition                                | Indicator typically reported              | Indicator required                                                      |
|-----------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------|
| Awareness             | Exposure to environmental content         | Reach; impressions; views                 | Recall and comprehension measured after exposure                        |
| Engagement            | Interaction with content                  | Likes; shares; comments                   | Depth and duration of interaction; onward transmission to new audiences |
| Participation         | Contribution of effort or data            | Sign-ups; pledges; observations submitted | Sustained contribution over defined period; retention rate              |
| Behavioural change    | Alteration of routine practice            | Self-reported intention                   | Verified change in disposal, consumption or mobility practice           |
| Institutional outcome | Change in rule, allocation or enforcement | Petition signature counts                 | Documented regulatory, budgetary or judicial response                   |

The right-hand column is normative and derived from the analysis; it is not a claim about current reporting practice. The gap between the two right-hand columns is the principal evaluative weakness identified in this study.

## Citizen Science and Distributed Environmental Monitoring

Digital technologies have expanded the scope of citizen science, and India provides substantial examples. The India Biodiversity Portal, launched in 2008 by a consortium led by a Bengaluru research institution, functions as an open-access platform on which participants upload, map and validate species observations; the published account of the platform records descriptions of more than 20,400 species and the aggregation of approximately 1.28 million observations covering over 30,000 species [50]. SeasonWatch, established subsequently, enlists participants including schoolchildren to record flowering and fruiting in common trees, producing a phenological baseline against which climate-driven shifts in seasonality can be assessed; participants in Kerala recorded that the flowering peak of *Cassia fistula* had moved earlier relative to the festival with which it is culturally associated [51]. Bird records from Indian participants contribute to a global observation network whose value for filling spatial gaps in biodiversity data has been documented in the ecological literature [52,53].

Three findings emerge. First, these platforms generate true scientific value rather than just public participation; the phenological example shows the discovery of an ecological signal that would be impossible to achieve by a professional survey with equivalent spatial coverage. Second, they succeed when the act of contributing is straightforward, repetitive, and locally significant. Third, they need verification infrastructure. Citizen-generated observations must be validated, and the most effective platforms combine open contribution with expert assessment.

Digital conservation also creates security concerns that open-data regulations do not address. Public publication of the particular location of threatened species might encourage poaching and disturbance, therefore openness must be balanced against appropriate information management, which is often achieved through spatial generalisation of sensitive data. This is an instance in which the participatory logic of digital communication and the protective logic of conservation are at odds and must be resolved consciously rather than by default.

### **Inequality of Voice: The Digital Divide as an Environmental Justice Question**

The distribution of digital involvement is not equal. Poverty, gender, location, language, and technological literacy all contribute to access inequities. Environmental communication limited to advanced digital platforms will fail to reach those most affected by environmental challenges. The amount of the gap is calculated using official data.

**Table 4:** Indicators of Digital Access in India, Financial Year 2024–25

| <b>Indicator</b>                                 | <b>Value</b> | <b>Unit</b>                    |
|--------------------------------------------------|--------------|--------------------------------|
| Total internet subscribers                       | 969.10       | million                        |
| Broadband subscribers                            | 944.12       | million                        |
| Wireless internet subscribers                    | 927.70       | million                        |
| Wired internet subscribers                       | 41.41        | million                        |
| Urban internet density                           | 110.79       | subscribers per 100 population |
| Rural internet density                           | 45.03        | subscribers per 100 population |
| Urban teledensity                                | 131.45       | subscribers per 100 population |
| Rural teledensity                                | 59.06        | subscribers per 100 population |
| Average monthly data use per wireless subscriber | 21.53        | GB                             |
| Total annual wireless data traffic               | 228,779      | petabytes                      |

Figures are for the quarter and year ending 31 March 2025 as published by the Telecom Regulatory Authority of India. Density figures exceed 100 in urban areas because subscription counts include multiple connections held by single users and because service-area boundaries do not correspond exactly to census population units.

The ratio between urban and rural internet density is approximately 2.5 to 1. A rural density of 45 subscriptions per 100 population, given that individuals commonly hold more than one subscription, implies that a substantial share of the rural population has no personal connection at all. The consequence for environmental communication is direct: communities affected by mining, industrial effluent, forest diversion and agricultural distress are systematically less able to participate in the digital sphere in which those questions are increasingly debated.

A sustainable digital strategy therefore combines online communication with community media, radio, educational institutions, local organisations and face-to-face participatory work.

### **Information Integrity: Misinformation and Algorithmic Visibility**

Digital platforms have democratised the creation of information while simultaneously facilitating the dissemination of misleading information. The four most common types of environmental misinformation in the corpus are false claims about climate science, false information about pollution sources and levels, pseudoscientific environmental remedies, and manipulated or decontextualised visual content, such as disaster images circulated from unrelated events. Careful scientific communication has a structural disadvantage since experimental research on the spread of false information demonstrates that it can go faster and farther than accurate information [18].

Where there is a dearth of scientific and computer knowledge, the problem worsens. As a result, environmental literacy must include the capacity to identify credible sources, evaluate scientific data, recognise misleading information, distinguish between opinion and fact, and validate digital content. Thus, digital literacy is an extension of sustainability education rather than a replacement for it.

Ranking methods effect visibility as well. Strongly emotive content may be more extensively shared than scientifically nuanced content, perhaps simplifying complex environmental challenges into spectacular narratives [19, 54]. The structural obstacle is that the visibility of an environmental issue is unrelated to its public importance. Systems that encourage novelty and conflict are unsuitable for long-term challenges such as soil degradation or groundwater depletion, whereas episodic occurrences receive far more attention than they need. As a result, platform accountability is more than a peripheral demand: environmental communicators are fighting against a system whose rules they are unable to obey due to a lack of clarity about the mechanisms governing the presentation of public-interest information [45].

## **DISCUSSION**

### **The Communication–Materiality Paradox**

The central finding of this study is a paradox that the existing literature tends to address only on one side at a time. Digital media has materially improved the conditions for environmental communication in India: it has increased the visibility of ecological problems, lowered the cost of participation, enabled distributed monitoring that generates genuine scientific value, and given local environmental conflicts access to national and international publics. At the same time, the infrastructure that delivers those benefits is itself a growing source of energy demand, resource extraction and hazardous waste, and it is growing fastest in exactly the period when environmental communication most needs to succeed.

The paradox is not resolved by netting the two against each other. A common move in the sustainable-digitalisation literature is to compare the footprint of a digital service against the footprint of the physical activity it displaces, and to conclude that substitution is beneficial. This comparison is true for some bounded substitutions with measurable baselines. When applied broadly, it becomes false for three reasons. First, the displaced baseline is lower than expected because digital services frequently supplement rather than replace physical activity. Second, the empirical footprint literature consistently demonstrates a pattern that the Indian traffic and capacity data replicate: the efficiency of a single transaction has grown while the aggregate impact has increased [20, 21]. Third, even if device manufacturing contributes significantly to sectoral emissions, replacement arguments typically account for operational energy while ignoring embodied burden [21]. As a result, the truth is that digital media may be both an instrument for ecological transformation and a source of ecological pressure, and whether it is more of one or the other is determined by design and policy rather than technology.

### **Why the Sustainability Claim for Digital Media is Under-Specified**

A second conclusion focuses on the quality of the evidentiary base. For overlapping periods, Section 5.8 discovered that national and international estimates of the amount of electronic waste generated in India diverged by more than twice. Section 2.5 provided reliable estimates of the information and communication technology sector's worldwide emissions share, which ranged from 1.4 to 3.9%. Although these uncertainties are not the same, they do have one thing in common: statements about the environmental performance of digital media are being made on a measurement basis that is no longer capable of supporting them with the level of precision that is claimed.

Extended Producer Responsibility obligations are calculated as proportions of estimated generation, so measurement error propagates directly into compliance obligation. Corporate sustainability claims about digital services rest on boundary choices that are rarely disclosed. Public communication that presents digitalisation as environmentally beneficial is, on the current evidence, communicating a plausible hypothesis as an established finding. Improving measurement is therefore not a preliminary to policy but a component of it.

## **CONCLUSIONS**

The relationship between nature, sustainability and digital media is among the more consequential interdisciplinary questions of the present period, and the Indian case makes both its possibilities and its contradictions unusually visible.

Digital communication has created opportunities for environmental awareness, public participation and conservation that earlier media systems could not provide. Social platforms, mobile technologies, government environmental applications, citizen-science portals and digital storytelling now allow citizens to engage with ecological issues in ways that were previously difficult, and in some documented cases to generate scientific knowledge that professional survey alone would not have produced.

Technological optimism should not obscure the environmental consequences of digitalisation. Digital communication depends on physical infrastructures that consume energy and water, require extracted materials, and eventually generate hazardous waste. Digitalisation is not, in itself, sustainable, and the evidence base on which claims to the contrary are made is weaker than the confidence with which those claims are usually asserted.

The analysis leads to twelve principal findings. Digital media has substantially expanded the opportunity for environmental communication. Social media increases the visibility of environmental issues and can support collective action. Awareness does not automatically produce behavioural change, and the evaluative practice of the field does not currently distinguish the two. Successful marketing link specific offline acts with online interactions. Digital storytelling heightens the emotional impact and accessibility of environmental concerns. Where communities retain control, digital tools can help preserve and spread indigenous ecological knowledge. Misinformation and automated curation are substantial structural challenges for environmental communication. The discrepancy in participation created by the digital divide leads to ecological fragility. Digital technologies have significant material and environmental impacts throughout their five-stage lifecycle. Electronic waste has become a major sustainability concern, and its quantification is debatable. Sustainable digitalisation requires a lifecycle strategy rather than a use-stage approach. Public awareness, platform accountability, and government policy must all be coordinated since one cannot thrive without the other.

The fundamental point of this study is that digital media should be considered as more than a technology tool for raising awareness about sustainability. Digital communication must become sustainable in and of itself.

A genuinely ecological digital future will emerge only where the systems that communicate environmental values also operate according to principles of environmental responsibility, and where the performance of both can be independently verified.

## **Recommendations**

1. Integrate environmental and digital literacy. Educational institutions should treat the capacity to evaluate environmental information and the capacity to understand the material basis of digital technology as components of a single competence.

2. Adopt green digital infrastructure standards. Technology companies and public institutions should adopt energy-efficient systems and renewable procurement, and a national efficiency standard for data centres should be established while the capacity now being built is still at the design stage.
3. Strengthen electronic waste communication. Digital campaigns should inform consumers about repair, reuse, collection points and responsible recycling, using the same channels through which devices are marketed.

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## SECTION III

# **Inclusive Growth, Gender, Finance and Institutional Sustainability**

