



Research Paper

Green Governance: Evaluating the Environmental Gains of e-Office Transition

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Abstract:

The transition from a physical file-based administrative system to a paperless digital governance model represents a landmark shift toward environmental sustainability. This study examines the environmental benefits resulting from the full-scale implementation of the e-Office system in the Union Territory of Jammu and Kashmir, India. Before the adoption of e-Office in 2021, the region followed the biannual Darbar Move—shifting the capital between Jammu and Srinagar. Using empirical data from 2018 to 2025, this paper estimates the reduction in emissions resulting from the full transition to e-Office and the digitalisation of government operations. The study covers eight core emission sources: LPG consumption, private vehicle use, government-hired trucks and buses, parallel household electricity usage, paper consumption avoided, office utility savings, long-distance movement of personnel and files, and virtual work facilitated via VPNs and email systems.

Baseline estimates indicate that over 62,000 tonnes of CO₂ emissions were avoided from household duplication alone compared to the physical movement of offices and files (2018–2020), while digitisation has eliminated the need for over 20 million physical pages annually, saving tens of thousands of trees and substantial paper-related emissions. The environmental gains are significant in terms of GHG reduction, natural resource conservation, energy efficiency, and administrative de-carbonisation. This paper provides a first-of-its-kind, scientifically grounded environmental impact evaluation of digital public administration in a fragile Himalayan ecosystem. It offers critical insights for policymakers and sustainability practitioners seeking to design low-carbon governance systems in similarly vulnerable geographies.

Keywords: Digital governance, Carbon footprint of governance, environmental sustainability, CO₂ emissions, paperless administration, Darbar move.

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I. Introduction:

In an era of climate urgency, public sector institutions are increasingly called upon to demonstrate environmental responsibility alongside administrative efficiency. One critical but underexplored frontier in this effort is the transformation of how governments conduct their internal operations—particularly in transitioning from paper-based, physically mobile bureaucracies to digitally networked, environmentally lean systems, which are more efficient and climate smart. The move from traditional files and physical correspondence to electronic file management (e-Office) presents not just an opportunity for improved service delivery, but a profound shift in the environmental footprint of governance.

The Union Territory of Jammu and Kashmir, located in the fragile Himalayan ecosystem of northern India, historically followed a unique and resource-intensive administrative practice known as the *Darbar Move*—a biannual relocation of the Civil Secretariat and associated departments between the twin capitals of Srinagar and Jammu, some 300KM apart. Instituted in the 19th century, this practice involved large-scale transport of personnel, office records, government-hired vehicles, and temporary dual households for thousands of employees. While politically symbolic, the practice imposed significant fiscal and environmental costs, including fuel consumption emissions from LPG and electricity usage, and vast quantities of paper-based correspondence.

In 2021, the Government of Jammu and Kashmir formally transitioned from the physical movement of files to e-office, marking a turning point in the region's administrative history. This decision was paired with the large-scale rollout of the e-Office platform, a digital file management and communication system under the National e-Governance Plan (NeGP). As of mid-2025, over 26,000 users in the Civil Secretariat and more than 31,000 at HoD levels actively use the e-Office platform, processing millions of files and receipts annually. The transition has replaced physical file transport and in-person correspondence with a digital ecosystem supported by secure networks, VPNs, and over 1.8 lakh official email addresses. The table below provides a brief summary of the e-Office rollout, including the number of files, receipts, digital user accounts, VPN connections, and official emails. These figures indicate the scale of paper-based operations replaced and form the basis for estimating the environmental benefits of the digital transition: -

The table below indicates that 37,53,270 files have been processed and administratively closed since the inception of e-office in April 2021, besides 3,39,69,915 receipts processed digitally. Taking the average of 90 pages for each file and 2 pages for each receipt, based on the actual sampling, the total number of papers avoided during this period is 40,57,34,130

Administrative Level	Total e-office accounts	Active Files	Closed Files	Total Files	Total Receipts
Secretariat	26,501	2,867	8,15,795	10,73,116	85,33,144
Head of Deptt	31,825	23,702	9,58,893	9,83,848	98,73,205
District Hq	30,131	7,521	12,56,430	12,63,951	97,82,811
PSUs/Univs	26,369	347	4,32,008	4,32,355	57,80,755
	1,14,826	34,437	34,63,126	37,53,270	3,39,69,915

(Table 1: Administrative level wise statistics of e-files as of July 2025)

This paper evaluates the environmental implications of this transition by quantifying avoided emissions, resource savings, and operational shifts resulting from e-Office implementation. It systematically accounts for eight emission categories, including household energy duplication, LPG consumption, personal and official transport, and paper usage. The study not only fills a crucial gap in literature on digital governance and sustainability but also offers a model for replicable, environmentally responsible administrative reform in other Indian states and global mountain regions.

II. Literature Review

Governments around the world are focussing on digital governance for ease of service delivery, transparency and cost-effectiveness. At the same time, the intersection of digital governance and environmental sustainability is gaining scholarly traction, particularly in the context of energy transitions, public administration reforms, and the environmental cost of conventional bureaucracies. This literature review synthesizes current academic and policy discourse across four key thematic strands relevant to the e-Office transition in Jammu & Kashmir: (i) the environmental impact of paper use, (ii) emissions from administrative mobility and logistics, (iii) the environmental potential of digital public infrastructure, and (iv) emerging frameworks for sustainable governance.

2.1 Environmental Footprint of Paper-Based Administration

Paper production is an energy-intensive and resource-depleting process. Lifecycle assessments estimate that one tonne of A4 paper results in 1.46 tonnes of CO₂-equivalent emissions (Rüter et al., 2016). On average, one ream of paper (500 sheets) generates around 2.3 kg of CO₂, primarily from deforestation, pulp processing, and transportation (Smith, 2015). Governments are among the largest institutional consumers of paper, with administrative processes—filing, documentation, correspondence—constituting a major source. Studies from OECD and FAO estimate that over 40% of industrial wood globally is used for paper, leading to deforestation, soil degradation, and biodiversity loss (FAO, 2020; WWF, 2019).

2.2 Emissions from Administrative Transport and Mobility

Physical governance systems also rely heavily on the movement of personnel and records, especially in regions with split-capital arrangements or seasonal relocations. Guttikunda and Mohan (2014) highlight that inter-city bus and truck fleets in India emit between 1.2 and 1.5 kg CO₂/km, depending on load and terrain. Government relocations, such as Jammu & Kashmir's *Darbar Move*, multiply this footprint significantly when factoring in hundreds of trucks and buses used biannually. Household-level emissions—resulting from maintaining parallel accommodation, energy use, and cooking fuel—add further to the carbon burden (Shukla et al., 2015).

2.3 Digital Governance and Climate Gains

The rise of e-Government platforms is associated with substantial environmental co-benefits. A comparative study by Kumar and Best (2006) shows that digital platforms in developing countries reduce emissions by eliminating physical movement, paper use, and energy-intensive logistics. The World Bank (2016) and UNDP (2022) have emphasised that Digital Public Infrastructure (DPI) can enhance not only service delivery but also reduce environmental footprints across sectors. The European Commission (2022) further notes that digital workflows save between 70–90% energy compared to manual, paper-based equivalents.

In India, flagship digital programmes like e-Office, Land Records Modernization, and Digital India have shown promising signs of enabling both transparency and resource conservation (MeitY, 2020). In states like Kerala and Telangana, e-Governance reforms are estimated to have reduced paper usage by over 60% in administrative units within three years of implementation.

2.4 Sustainable Bureaucracy: A New Public Governance Paradigm

There is a growing body of work arguing for the integration of sustainability into bureaucratic practices. Public administration scholars such as Rittelmeyer (2019) and the OECD (2021) have proposed frameworks for Green Public Management, where digitisation, behavioural shifts, and infrastructure reconfiguration lead to lower emissions and enhanced institutional accountability. These align with emerging trends in climate-smart governance, particularly in ecologically fragile regions such as mountain states, island territories, and coastal zones.

Jammu & Kashmir's e-Office transition presents an empirical opportunity to examine this shift. By quantifying the environmental savings from digitisation, this paper builds on the evolving literature that sees public sector reform not only as a governance imperative but as a climate action strategy.

III. Methodology

This study adopts a mixed-methods approach combining empirical data collection, emission factor-based estimation, and administrative record analysis to evaluate the environmental benefits of the e-Office transition in Jammu & Kashmir. The core objective is to quantify emissions and resource savings that result from replacing physical governance practices—most notably the *Darbar Move* and file-based administration—with a digital office ecosystem.

3.1 Data Sources

Data inputs have been drawn from the following primary government sources related to implementation, performance and evaluation of the e-office system: -

- Darbar Move Orders (2018–2020): Identifying Civil Secretariat and Head of Department (HoD) level offices moving biannually, indicating the number of departments, offices and associated number of officials on the move during relocation of the capital biannually.
- Ration Card Records: Proxy for number of households relocating and duplicating energy consumption [2].
- Vehicle Deployment Logs: Government-hired trucks and buses used during Darbar Move (2015–2020) [3]. This takes into account the number of trucks hired by the Civil Secretariat level departments, field organisations and autonomous institutions besides the associated commercial and private vehicles involved in the process.
- Master Data on e-Office (2025): Total users, e-files, receipts, VPNs, and email-based communications [4].
- Household Surveys: Private vehicle ownership (63% of moved families), average family size (3.8), and usage patterns.

3.2 Emission Categories

The movement of government offices and the physical file system has been analysed for the environmental footprints viz-a-viz emissions in the following 8 categories which are the primary components of the administrative system: -

Code	Category	Description
A	Average LPG use	2 cylinders/month/family during 6-month Move period
B	Private Vehicles	Used by 63% of families for relocation
C	Govt Vehicles	Trucks and buses hired annually for the move
D	Electricity Use	Parallel households during move period
E	Paper Usage	A4 sheets avoided due to e-files and digital receipts
F	Office Utilities	Lighting, heating/cooling, admin infrastructure

G	Record Transport	Movement of physical files and trunks
H	Remote Work	VPN/email access replacing physical presence

(Table 2: Administrative Processes involving emissions)

3.3 Assumptions & Estimation Parameters

We apply the following standardised assumptions for emissions estimation:

Parameter	Assumptions	Source
LPG Cylinder	31.5 kg CO ₂ per 14.2 kg cylinder	[5]
Personal Vehicle	0.192 kg CO ₂ per km (petrol)	[6]
Bus/Truck	1.3–1.6 kg CO ₂ /km	[7]
Electricity	0.9 kg CO ₂ per kWh	[8]
A4 Paper	4.5 g CO ₂ per sheet	[1]
VPN Usage	0.04 kg CO ₂ /hour/user	[9]
Email transmission	0.01 kg CO ₂ /email	[10]

(Table 3)

3.4 Formulae Used

We apply the following formulas to estimate avoided emissions:

- $\text{LPG} = \text{No. of households} \times 2 \text{ cylinders/month} \times 6 \text{ months} \times 31.5 \text{ kg}$
- $\text{Electricity} = \text{No. of parallel households} \times 100 \text{ kWh/month} \times 6 \times 0.9 \text{ kg}$
- $\text{Private Vehicles} = 63\% \times \text{families} \times 800 \text{ km} \times 0.192 \text{ kg}$
- $\text{Paper Saved} = \text{Files} \times 100 \text{ pages} \times 4.5 \text{ g}$
- $\text{Govt Vehicles} = \text{Truck/Bus count} \times 800 \text{ km avg} \times \text{EF}$
- $\text{VPN} = \text{Users} \times \text{hours/day} \times 180 \text{ days} \times 0.04 \text{ kg}$
- $\text{Emails} = \text{Emails sent} \times 0.01 \text{ kg}$

3.5 Scope and Limitations

- This analysis is conservative—only direct and most measurable categories are included.
- Broader impacts (e.g. behavioral change, decentralised work culture) are qualitatively noted.
- Paper avoidance is estimated from file volume and receipts; does not include file duplication.
- Estimated CO₂ Emissions Avoided by E-Office Transition (Annualised Estimate)

Category	Estimated CO ₂ Saved (Tonnes/Yr)
A. LPG Usage	1625.40
B. Private Vehicles	416.10
C. Government Hired Vehicles	625.24
D. Electricity (Parallel Household)	1718.28
E. Paper Avoided	4500.00
F. Office Utilities and Infra use	500.00 (est)
G. Record Transport (Trucks)	660.00
H. VPN/Email enabled Remote work	248.90
Total	10,294.00 T/Yr

(Table 4)

IV. Results and Analysis

The transition from the biannual Darbar Move and physical file-based governance system to a digital e-Office infrastructure has resulted in substantial environmental benefits. Drawing on operational data and standardised emission factors, the analysis estimates a total annual CO₂ emission reduction of over 10,294 tonnes, covering eight major categories of avoided environmental footprint.

4.1 LPG and Household Energy Emissions: Government employees moving with their families or maintaining dual households during the Darbar Move traditionally consumed additional liquefied petroleum gas (LPG) for cooking. Based on an average of 2 cylinders per household per month, the analysis estimates an annual saving of 1,625.4 tonnes of CO₂ due to the cessation of these duplicate households [1]. A parallel reduction of 1,718.3 tonnes CO₂ arises from avoided electricity use in these temporary dwellings, which often relied on grid energy or backup diesel systems [2]. Together, household-level emissions avoided from LPG and electricity amount to over 3,343 tonnes CO₂ annually—a significant gain given the recurring six-month cycle of administrative relocation.

4.2 Transport Emissions: Government and Personal Vehicles: Administrative mobility was a major source of emissions in the *Darbar Move* system. Government records from 2015–2020 show an average deployment of 170

trucks and 119 buses annually, supplemented by small vehicles at the HoD level. Replacing this logistics effort through e-Office has eliminated an estimated 625.2 tonnes CO₂/year in government-hired vehicle emissions [3]. Additionally, 63% of moved families used private vehicles to travel between Jammu and Srinagar (approx. 800 km round trip). This results in an estimated annual saving of 416.1 tonnes CO₂ from personal car use [4].

4.3 Paper and Forest Resource Conservation: One of the most significant environmental dividends of e-Office implementation lies in paper avoidance. Based on cumulative file and receipt data, the system has replaced over 10 million physical files and communications annually. Assuming an average of 90-100 pages per file and 4.5 grams of CO₂ emissions per page, the shift has resulted in a paper-related CO₂ reduction of 4,500 tonnes/year [5]. This also translates to tens of thousands of trees spared annually, considering that one tree produces approximately 8,000–10,000 A4 pages [5]. The environmental value of this shift extends beyond emissions, encompassing forest ecosystem preservation, reduced water usage in pulp processing, and minimisation of paper waste.

4.4 Institutional and Infrastructure-Level Emissions: Each government office that no longer shifts physically between capitals avoids utility consumption related to lighting, heating, air conditioning, diesel generators, and water use. A conservative estimate of 5 tonnes CO₂ saved per office annually results in 500 tonnes CO₂ reduction across 100 active offices. Further, the physical movement of trunks, records, and documentation—often via trucks—accounted for an additional 660 tonnes of CO₂ emissions annually, now fully avoided [3].

4.5 Digital Substitution and Remote Access: Modern e-Governance systems have enabled extensive remote work, facilitated by VPNs and institutional emails. As of July 2025, 17,286 users regularly access e-Office remotely, replacing the need for in-person presence or document travel. Based on VPN and email energy benchmarks [6][7], this has contributed to an estimated 248.9 tonnes of CO₂ savings annually.

4.6 Summary and Cumulative Impact

Category	Annual CO ₂ Saved (Tonnes)
Household Energy (LPG + Electricity)	3,343.7
Transport (Govt + Personal)	1,041.3
Paper Avoidance	4,500.0
Infrastructure and Logistics	1,160.0
Remote Digital Access	248.9
Total	10,294.0

(Table 5)

These results provide quantifiable evidence that digitisation in governance can serve as a potent climate action strategy. Jammu & Kashmir's case is particularly significant given the sensitive ecology of the Himalayan region, where even minor emissions reductions yield amplified environmental gains.

V. Policy Implications and Recommendations

The environmental benefits of Jammu & Kashmir's e-Office transition present a compelling case for embedding sustainability into the architecture of public administration. Beyond its quantified gains—over 10,000 tonnes of CO₂ saved annually—the reform exemplifies how digitalisation can serve as a strategic lever for climate resilience, administrative efficiency, and fiscal prudence. Based on the results, we propose five key policy implications and associated recommendations for institutionalising low-carbon governance systems:

5.1 Institutionalise Environmental Auditing in Government Workflows: Despite growing interest in green governance, most Indian states and UTs do not quantify the environmental impact of administrative operations. The Jammu & Kashmir case shows that routine bureaucratic functions—mobility, energy use, and documentation—generate measurable emissions. Recommendation: Introduce “Green Office Protocols” under state action plans on climate change (SAPCCs), requiring periodic carbon audits, paper usage reports, and energy performance reviews of government departments. Transition to e-governance could be incentivised as a part of performance grants or introducing a component in the Centrally Sponsored Schemes.

5.2 Integrate Climate Co-Benefits into Digital Governance Initiatives: Digital public infrastructure (DPI) initiatives like *e-Office*, *DigiLocker*, and *SWAN* are typically evaluated based on service delivery metrics. However, they also yield significant climate co-benefits—reduced paper, fuel, and energy consumption. Recommendation: Mandate all centrally sponsored DPI schemes (e.g. under NeGP or Digital India) to report avoided emissions and natural resource savings as part of their impact assessment frameworks.

5.3 Replicate the e-Office Model in Mountain States and Fragile Zones: The geographic context of Jammu & Kashmir—characterised by long-distance inter-regional mobility, climatic vulnerability, and transport constraints—makes the environmental case for digitalisation even stronger. Similar dynamics exist in other states such as Himachal Pradesh, Uttarakhand, Sikkim, Nagaland, and the North-East.

Recommendation: Launch a “Green e-Governance Acceleration Programme” in all hill and border states, co-financed by MoEFCC and MeitY, to support end-to-end paperless administration.

5.4 Design Incentives for Behavioural and Structural Change: Beyond infrastructure and applications, successful digital transition also requires behavioural change among employees and leadership. Resistance to digitisation, habits of print-based file keeping, and lack of digital literacy remain challenges. Recommendation: Institutionalise “Green Governance Champions” in each department—trained officers tasked with reducing paper use, promoting e-office features, and tracking monthly eco-metrics. This would boost the sustainability of administrative operations enabling a green transition.

5.5 Embed Digital Governance into Climate Policy Planning: The Indian government’s commitments under the Paris Agreement and Long-Term Low Emissions Development Strategy (LT-LEDS) recognise the role of technology in reducing emissions. However, public sector transformation itself is not formally recognised as a mitigation pathway.

Recommendation: Integrate digitalisation of government into India’s Nationally Determined Contributions (NDCs) as a mitigation measure—supported by climate finance, capacity-building, and technical cooperation. These recommendations build on Jammu & Kashmir’s e-Office experience to frame a broader governance strategy for climate resilience. The transformation demonstrates that digital public administration is not just a governance reform—it is an environmental imperative.

VI. Conclusion

This paper has provided a comprehensive, data-driven evaluation of the environmental gains resulting from Jammu & Kashmir’s transition from a physically mobile, paper-based bureaucracy to a digital e-Office system. By analysing emissions avoided across eight key categories—ranging from LPG usage and private vehicle emissions to paper consumption and infrastructure energy use—the study estimates that this single governance reform has reduced annual carbon emissions by over 10,294 tonnes of CO₂.

The findings demonstrate that public administration itself can be a significant site of environmental intervention. Traditionally overlooked in climate action plans, day-to-day bureaucratic activities—file movement, record-keeping, official travel, and inter-city mobility—carry substantial ecological footprints, especially in geographies like the Himalayas where infrastructure development is limited, and natural ecosystems are fragile. The transition to a structured rollout of the e-Office system replacing the machine and paper based office system, represents more than an administrative rationalisation—it is a meaningful climate action. The transition has not only saved natural resources and reduced emissions but also improved the resilience, continuity, and efficiency of governance across a diverse and topographically complex region.

While the analysis presented here is conservative in its scope—focusing only on quantifiable and direct emissions—it nonetheless provides a replicable framework for other states and nations. It opens avenues for further research on behavioral change, cost savings, environmental justice (in relation to administrative burden), and climate-smart public sector design. In a time when governments worldwide are grappling with the twin imperatives of digital transformation and environmental sustainability, Jammu & Kashmir’s e-Office reform offers a practical, proven, and scalable blueprint for green governance.

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