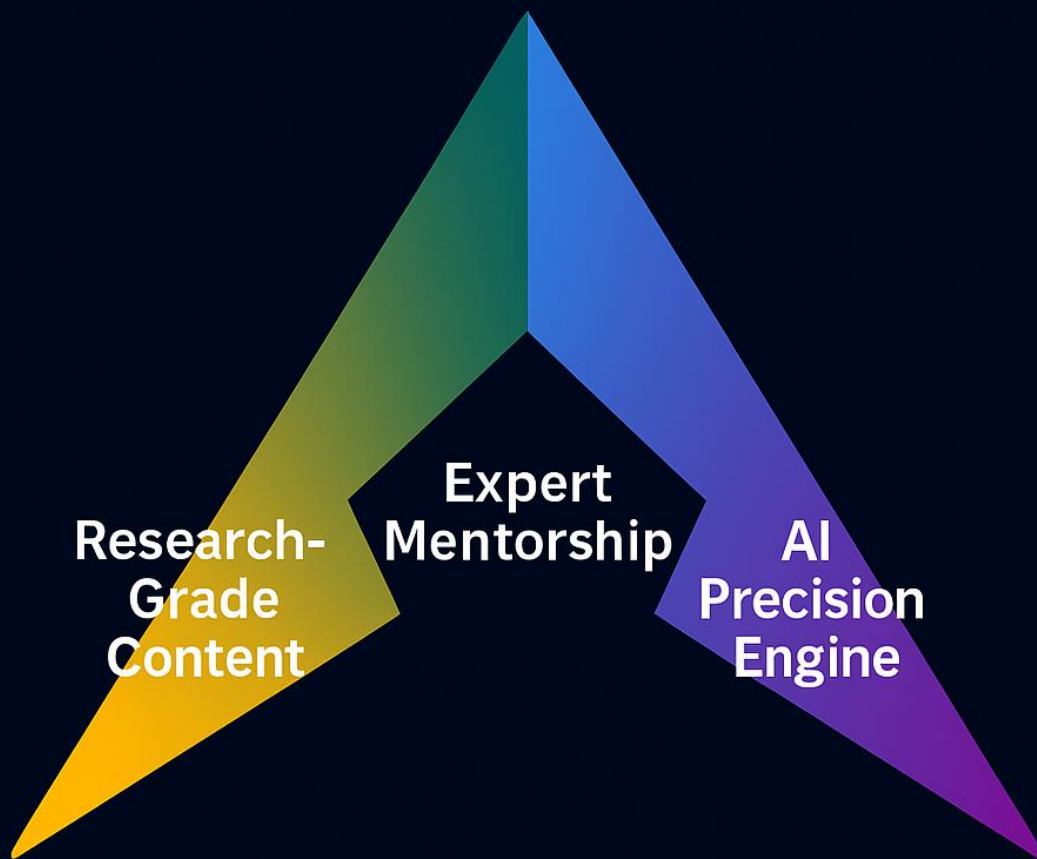


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GS Paper III: Environment

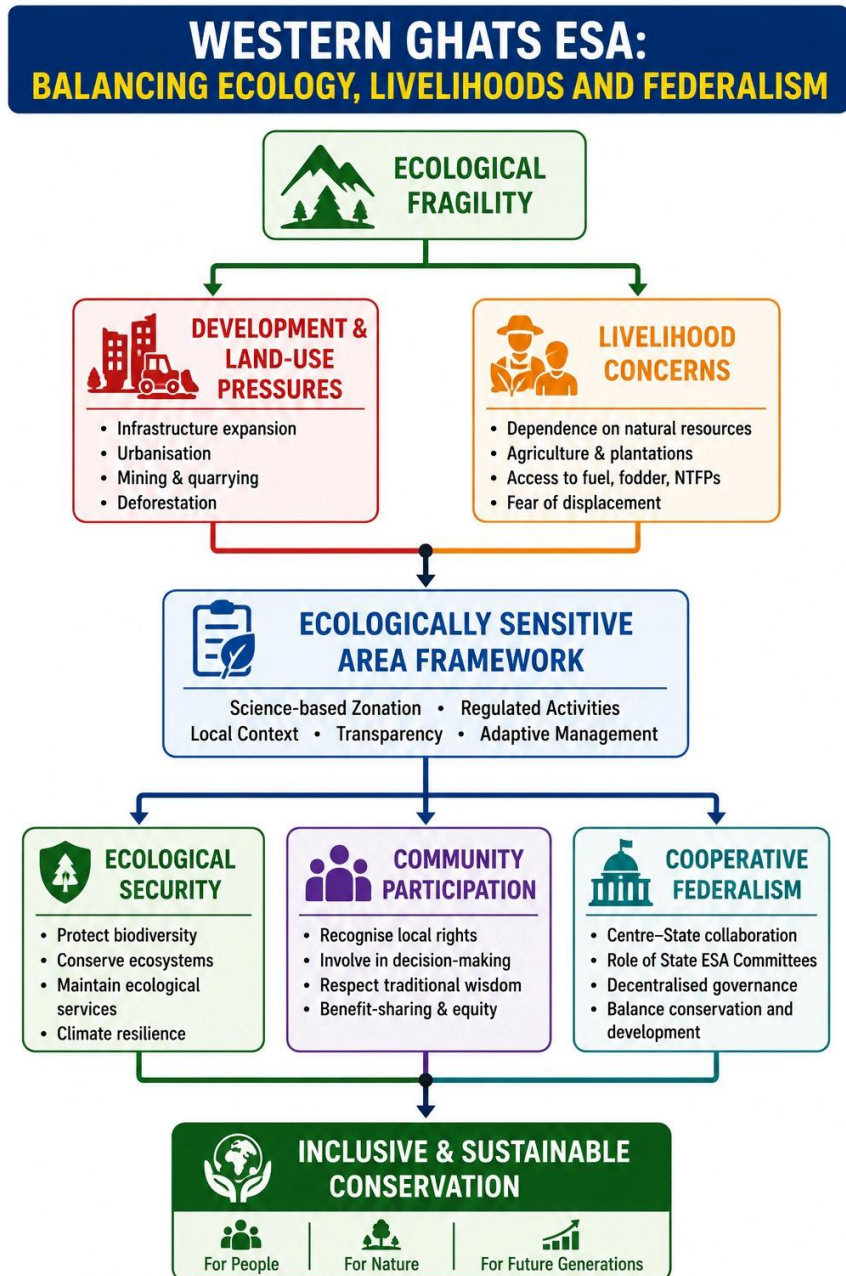
1. Ecologically Sensitive Area Notification for the Western Ghats

a. Introduction

The Western Ghats are among India's most valuable ecological regions. They support rich biodiversity, regulate river systems, influence rainfall patterns and provide essential ecosystem services to millions of people. The Centre's attempt to finalise the Ecologically Sensitive Area notification for the Western Ghats is therefore an important environmental governance issue.

The matter has remained unresolved for more than a decade because of continuing differences between the Union government and the six Western Ghats States over the extent of the proposed protected area. The central challenge is to protect a fragile ecological system while addressing the livelihood, development and federal concerns of States and local communities.

This makes the issue important not only for biodiversity conservation, but also for cooperative federalism, disaster risk reduction and sustainable development.



b. Significance of the Western Ghats

Biodiversity Hotspot

- The Western Ghats form a mountain chain of about 1,500 kilometres along India's western coast. They are recognised as one of the world's eight major biodiversity hotspots and include several areas listed under the UNESCO World Heritage framework.

The region is home to thousands of endemic plant and animal species.

Source of Major Rivers

The ecological value of the Western Ghats extends far beyond wildlife conservation. They are the source of several major peninsular rivers, including:

- Godavari,
- Krishna,
- Cauvery,
- Periyar.

These rivers sustain agriculture, drinking water supply, hydropower and livelihoods across large parts of peninsular India.

Climate and Watershed Functions

The Western Ghats influence the southwest monsoon, support groundwater recharge and strengthen climate resilience.

Forests, wetlands and hill ecosystems in this region help:

- regulate floods,
- prevent soil erosion,
- reduce landslide risks,
- moderate local climate,
- reduce the impact of extreme weather events.

Thus, conservation of the Western Ghats is essential for both ecological security and human development.

c. Background of the ESA Proposal

Need for ESA Framework

- The demand for a formal Ecologically Sensitive Area framework arose from concerns over mining, quarrying, deforestation, unplanned construction and ecological degradation in the Western Ghats.

Gadgil Committee Report

The Western Ghats Ecology Expert Panel, chaired by Madhav Gadgil in 2011, recommended that the entire Western Ghats region should be treated as an Ecologically Sensitive Area.

It favoured:

- strong restrictions on environmentally damaging activities,
- decentralised conservation,
- community-based decision-making,
- ecological caution in land-use planning.

The Gadgil approach gave significant importance to local participation and ecological sensitivity.

Kasturirangan Committee Report

In 2013, the High-Level Working Group chaired by K. Kasturirangan adopted a more moderated approach.

It distinguished between:

- natural landscapes, which referred largely to relatively undisturbed ecological areas,
- cultural landscapes, which included areas with long-standing human settlements, plantations and livelihood activities.

Proposed ESA Area

The Kasturirangan Committee recommended that about 60,000 square kilometres of natural landscape should be notified as an Ecologically Sensitive Area.

It proposed restrictions on:

- mining,
- quarrying,
- thermal power plants,
- highly polluting industries,
- large construction projects.

The Centre later issued draft notifications covering about 56,825 square kilometres after modifying the recommendations based on inputs from States.

The background shows that the debate is not about conservation versus development alone. It is about choosing the right model of conservation for a lived-in ecological landscape.

d. Why Consensus Has Been Difficult

Involvement of Six States

Consensus has been difficult because the proposed notification affects six States:

- Gujarat,
- Maharashtra,
- Goa,
- Karnataka,
- Kerala,
- Tamil Nadu.

State-Level Concerns

These States have raised concerns over the inclusion of inhabited villages, plantations, agricultural lands and economically active areas within the proposed Ecologically Sensitive Area.

State governments are also concerned about the possible impact on:

- mining,
- industries,
- infrastructure projects,
- local revenue,
- land-use flexibility.

Livelihood Concerns of Communities

In several areas, communities fear that environmental restrictions may affect:

- housing,
- farming,
- plantations,
- road construction,
- everyday livelihood needs.

Demand for Boundary Reduction

- Some States have sought further reduction in the proposed Ecologically Sensitive Area boundaries. The issue has become a test of cooperative federalism because ecological protection requires national commitment, while land-use regulation and local development concerns are deeply connected with State and local governance.

Therefore, any final framework must be ecologically sound, federally acceptable and socially legitimate.

e. Analysis/ Observations

Significance of the Notification

The notification is important because it can help conserve one of India's richest biodiversity regions.

It can:

- protect critical watersheds,
- reduce ecological degradation,
- prevent irreversible damage from mining,
- regulate unplanned development,
- strengthen disaster resilience.

Developmental Importance

The Western Ghats provide ecosystem services that are central to agriculture, water security and disaster mitigation.

Forest conservation in this region helps:

- maintain river flows,
- reduce landslide risks,
- regulate local climate,
- strengthen resilience against extreme weather events.

Therefore, protecting the Western Ghats is not merely an environmental concern. It is also a developmental necessity.

Livelihood Challenge

- The first major challenge is balancing conservation with livelihood concerns. The Western Ghats are not empty wilderness. They include villages, farms, plantations, roads and local economies that have existed for generations.

A rigid conservation model may generate resistance if it ignores these realities.

Federal Coordination Challenge

- The second challenge is federal coordination. The Union government may frame environmental regulations, but States have practical responsibility over land use, local administration and development planning.

Without State cooperation, even a scientifically sound notification may remain weak in implementation.

Economic Dependence

- The third challenge is economic dependence on activities such as plantations, quarrying, tourism and infrastructure development. If restrictions are imposed without alternatives, affected communities may view conservation as a burden rather than a shared responsibility.

Compensation Gap

- The absence of adequate compensation for ecosystem protection is another concern. States and local communities that conserve forests often bear opportunity costs, while the benefits of conservation are enjoyed by wider regions.

This imbalance must be corrected through financial and institutional incentives.

Thus, the success of the ESA framework will depend on balancing ecological urgency with social justice and federal cooperation.

f. Way Forward

Scientific Ground Verification

- The final notification should be based on scientific, village-level ground verification. Satellite mapping must be supplemented with local ecological assessment so that genuinely critical areas are protected without unnecessarily including settled cultural landscapes.

Participatory Conservation

- A participatory approach is essential. Local communities, panchayats, State governments, scientists and civil society organisations should be involved in the demarcation and implementation process.

Conservation will be more durable when communities understand its purpose and have a role in decision-making.

Differentiated Zoning

- The framework should differentiate clearly between ecologically critical zones and long-settled cultural landscapes.
- Activities that damage ecosystems, such as mining in fragile zones and highly polluting industries, should be restricted. At the same time, sustainable agriculture, plantations with ecological safeguards, eco-tourism and nature-based livelihoods should be encouraged.

Payments for Ecosystem Services

- Payments for ecosystem services can help address livelihood and federal concerns. States and local communities that protect forests, watersheds and biodiversity should receive financial incentives.

Such a mechanism would recognise that conservation produces public benefits beyond local boundaries.

Transparent Monitoring

- Transparent monitoring and periodic review are necessary. Ecologically Sensitive Area boundaries and restrictions should be reviewed on the basis of ecological evidence, disaster vulnerability and local feedback.
- This will make the framework both scientifically credible and socially acceptable.

These steps can help convert the ESA notification from a contested restriction into a cooperative conservation framework.

Conclusion

The Western Ghats are indispensable for India's biodiversity, water security and climate resilience. The central question is not whether they should be conserved, but how conservation can be reconciled with the developmental aspirations of local communities.

A successful Ecologically Sensitive Area framework must combine scientific assessment, cooperative federalism, community participation and sustainable land-use planning. Such an approach can protect the Western Ghats while ensuring that conservation remains inclusive, practical and developmentally just.

GS Paper III: Science and Technology

2. India's Digital Sovereignty Challenge

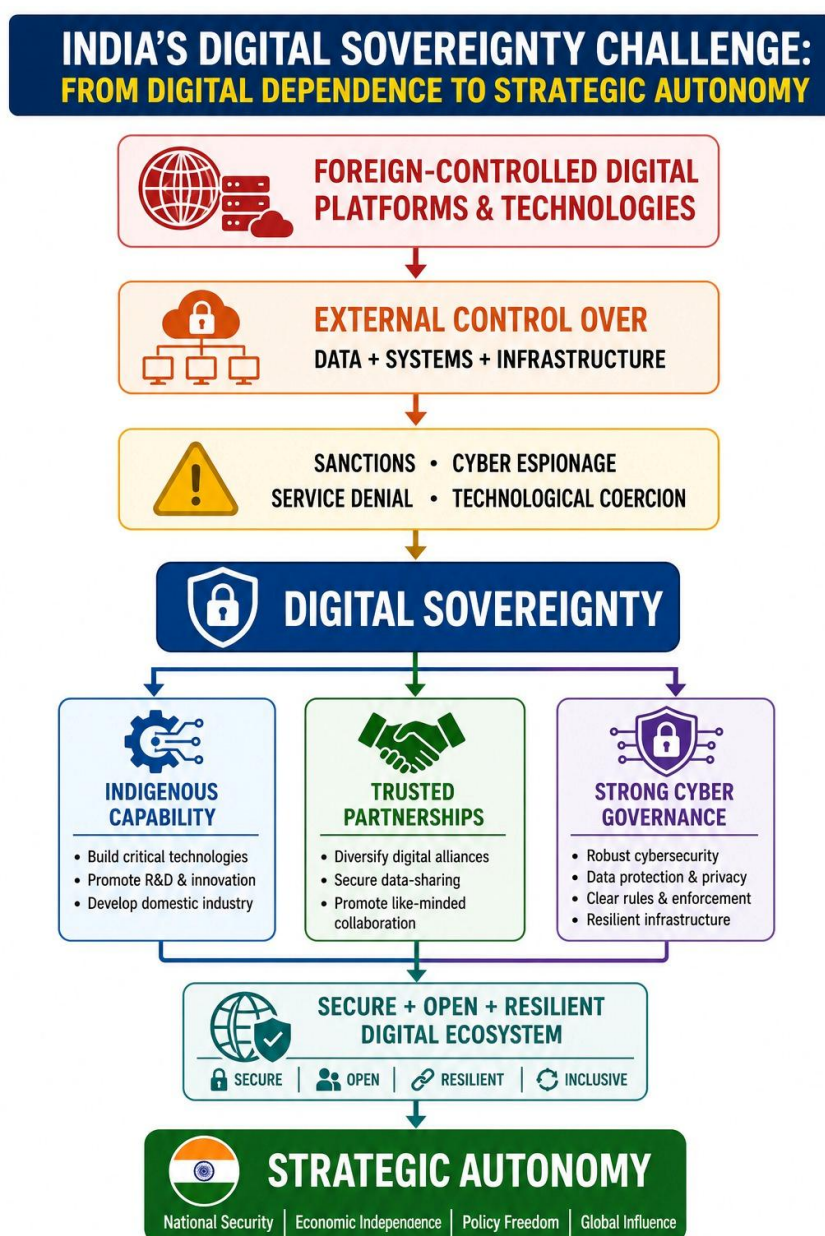
a. Introduction

Digital infrastructure has become the foundation on which modern commerce, governance and national security operate. Cloud platforms, email systems, digital payments, authentication tools, surveillance networks, artificial intelligence systems and defence technologies now form the invisible architecture of state capacity.

In such a context, dependence on foreign-controlled digital infrastructure can create serious strategic vulnerability.

Recent reports of compromised Indian CCTV networks and the denial of digital services to Nayara Energy by Microsoft due to European Union sanctions have revived concerns over India's digital dependence. These incidents show that even when operations are located within India, effective control may still lie with foreign corporations and foreign legal systems.

Digital sovereignty has therefore become a central issue in India's pursuit of strategic autonomy.



b. Key Issue

India's economy and state systems increasingly depend on digital platforms that are owned, controlled or regulated outside India.

These include:

- cloud services,
- productivity tools,
- authentication systems,
- operating systems,
- surveillance equipment,
- communication platforms,
- defence technologies.

This dependence creates a structural vulnerability. Even if data is stored within India, the company managing that data may be subject to the laws, sanctions or political pressures of another country.

In such a situation, Indian businesses and public institutions may lose operational control during geopolitical tensions, sanctions, cyber incidents or conflict.

The challenge is therefore not only about data localisation. It is about effective control over critical digital systems.

c. Meaning and Importance of Digital Sovereignty

Meaning

- Digital sovereignty means the ability of a country to control its critical digital infrastructure, data, platforms and technologies in accordance with its national interests.
- It does not necessarily mean isolation from global technology. Rather, it means ensuring that essential systems cannot be externally disabled, manipulated or exploited.

Strategic Importance

Digital sovereignty is important because foreign-controlled systems can:

- disrupt government and business operations,
- expose sensitive defence, industrial and security data,
- enable cyber espionage through compromised hardware or software,
- weaken defence capabilities during conflict situations,
- create dependence on external legal and commercial decisions.

Kargil Lesson

- The 1999 Kargil conflict, when India faced limitations in access to precise Global Positioning System support, remains an important reminder of the risks of technological dependence.
- In a crisis, access to critical digital and technological systems cannot be left entirely to external discretion.

Thus, digital sovereignty is an essential condition for strategic autonomy in the twenty-first century.

d. Global Context

- Digital sovereignty is now a global strategic concern. Several countries are trying to reduce dependence on foreign digital platforms in sensitive sectors.

European Efforts

- France has explored sovereign alternatives for government communication platforms. European countries are examining domestic substitutes for United States-based software and cloud services. The European Union is working towards more independent cloud and information technology infrastructure.

Türkiye's Approach

- Türkiye has also attempted to reduce reliance on foreign technologies in strategic sectors.

Wider Lesson

- These developments show that the search for digital sovereignty is not unique to India. Even advanced economies that are deeply integrated with global markets are trying to secure greater control over critical digital systems.

The global trend shows that digital sovereignty is now becoming a core element of national security planning.

e. India's Vulnerabilities

- India's position is especially sensitive because it is a rising power seeking strategic autonomy in a contested geopolitical environment.

Dependence on Foreign Platforms

India's dependence on foreign cloud platforms, email services, surveillance systems and imported defence technologies creates multiple vulnerabilities.

- Foreign CCTV networks and surveillance software can expose sensitive locations to cyber espionage.
- Dependence on foreign cloud and email platforms can disrupt official and corporate operations if access is denied.
- Imported defence technologies may create constraints in maintenance, upgrades, spare parts, software access and wartime reliability.

Semiconductor and Electronics Weakness

- India faces structural weaknesses in semiconductor manufacturing, advanced electronics, high-end defence innovation and research and development.
- India's research and development expenditure averaged only about 0.74 per cent of gross domestic product during 2000 to 2020, much lower than the global average of around 2.07 per cent. This limits the country's ability to build deep technological capability.

Limited Private-Sector Role

- Another challenge is the limited role of the private sector in high-end defence and strategic technology innovation.
- In advanced technology ecosystems, governments often provide research funding and assured procurement, while private firms develop frontier capabilities. India has begun moving in this direction, but the ecosystem remains underdeveloped.

Therefore, India's vulnerability is not only external dependence. It is also the domestic capacity gap in strategic technologies.

f. Positive Developments

India has already demonstrated that technological self-reliance is possible when public policy, market scale and innovation align.

- **Digital Public Infrastructure:** Unified Payments Interface and RuPay reduced dependence on foreign payment networks and created strong domestic digital payment infrastructure.
- **Navigation Capability:** NavIC, India's regional navigation satellite system, emerged from the recognition that dependence on foreign navigation systems can be risky. It reflects India's effort to build sovereign capability in an area critical for civilian, commercial and security applications.
- **Domestic Digital Platforms:** Some ministries and institutions have begun shifting to domestic digital platforms such as Zoho.
- **Semiconductor Ecosystem:** India is strengthening its semiconductor ecosystem through projects such as Micron's assembly, testing, marking and packaging facility in Gujarat.
- **Trusted Technology Partnerships:** Trusted technology partnerships, including initiatives such as Pax Silica, reflect the attempt to build secure supply chains with like-minded partners.
- **Defence Technology Participation:** In defence technology, greater private participation is being encouraged through programmes such as the Advanced Medium Combat Aircraft.

These developments suggest that India is moving from pure import dependence towards a more mixed model of indigenous capability, private innovation and trusted partnerships.

g. Analysis/ Observations

Strategic Significance

Digital sovereignty is essential for national security and strategic autonomy. In the twenty-first century, sovereignty is not limited to territorial control.

It also includes control over:

- data,
- networks,
- digital platforms,
- cyber systems,
- critical technological supply chains.

Security Benefits

- Greater digital sovereignty can reduce vulnerability to sanctions, cyber espionage and technological coercion. It can also support secure governance because public services increasingly depend on digital systems.

Economic Benefits

Digital sovereignty can strengthen India's economic competitiveness by encouraging domestic innovation in:

- cloud computing,
- artificial intelligence,
- semiconductors,
- cybersecurity,
- defence electronics.

Avoiding Isolationism

- Digital sovereignty must not be confused with technological isolation. Complete autarky is neither feasible nor desirable.
- Modern technology is built through global supply chains, shared standards, research collaboration and international markets. India must therefore pursue strategic autonomy without cutting itself off from global innovation.

Quality of Indigenous Alternatives

- The quality of indigenous alternatives is another concern. Domestic products must match global standards of reliability, security, scale and user experience.
- If domestic procurement is driven only by protectionism and not by quality, it may weaken rather than strengthen national capability.

Research and Development Constraint

- India's low research and development spending remains a serious constraint. Public-sector-led technology development has often faced delays, while private innovation requires predictable demand, patient capital, skilled talent and regulatory clarity.

Trusted Partnerships

- Trusted partnerships are necessary, but they should be structured carefully. Replacing one form of dependence with another will not solve the problem.
- The objective should be mutual dependence, diversified supply chains and domestic capacity-building.

Thus, India's digital sovereignty strategy must combine self-reliance, openness, quality and strategic diversification.

h. Way Forward

Identify Critical Digital Infrastructure

India should begin by identifying critical digital infrastructure that requires sovereign or trusted control.

This includes:

- government cloud systems,
- defence communication networks,
- authentication platforms,
- surveillance infrastructure,
- cybersecurity systems,
- artificial intelligence infrastructure,
- sensitive data repositories.

Build Indigenous Capacity

Indigenous capacity must be built in:

- cloud computing,
- cybersecurity,
- semiconductors,
- artificial intelligence,
- operating systems,
- secure communication,
- authentication technologies.

This requires higher research and development spending, stronger university-industry collaboration, public procurement support and incentives for private-sector innovation.

Strengthen Cyber Audits

- Cyber audits of CCTV networks, Internet of Things devices and surveillance infrastructure should be strengthened. Sensitive installations must avoid insecure hardware and software supply chains.

Create Procurement Security Standards

- Clear security standards should be created for procurement in government, defence and critical infrastructure sectors.

Regulate Foreign Cloud Providers

India should frame clear data governance norms for foreign cloud providers operating in the country.

These norms should address:

- access control,
- legal jurisdiction,
- encryption,
- auditability,
- continuity of service,
- obligations during sanctions or geopolitical disputes.

Promote Quality-Based Domestic Procurement

- Domestic procurement should be encouraged in strategic sectors, but without compromising quality. Indian firms must be supported to compete globally, not merely protected domestically.

Use Trusted Partnerships Strategically

- Trusted international partnerships should be pursued where they bring technology transfer, co-development and supply-chain resilience.

These steps can help India build digital sovereignty without retreating from global technology ecosystems.

Conclusion

Digital sovereignty is no longer a narrow technology issue. It is central to India's economic security, cyber resilience and strategic autonomy.

India must avoid both excessive dependence and isolationism. The appropriate path lies in combining indigenous capability, trusted partnerships, private-sector innovation, stronger cyber governance and higher research and development investment.

A digitally sovereign India will be better placed to protect its national interests in an increasingly technology-driven world.

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