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Advancing Knowledge Through Sustainable, Open, and Equitable Repository Practices in India

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Abstract

In the digital age, open access repositories play a crucial role in democratizing knowledge and enabling inclusive development. This paper examines India's evolving ecosystem of digital repositories, emphasizing sustainable, open, and equitable practices. It explores the role of open-source software, institutional collaboration, policy frameworks, and community participation. The article also provides data-driven insights into repository growth, accessibility, and adoption trends in India, supported by charts and case studies.

Keywords- Knowledge, Open and Equitable, Repository Practices

1. Introduction

In an era increasingly defined by the digital dissemination of information, the equitable access to knowledge has become a global priority. Open access repositories—digital platforms that provide free, unrestricted access to scholarly content—play a vital role in breaking down barriers to knowledge, particularly in developing nations like India. As India emerges as a major contributor to global research output, there is an urgent need to build and sustain robust digital repository systems that are open, inclusive, and responsive to the country's diverse socio-economic landscape.

India's vast academic ecosystem, encompassing over 1,000 universities and 40,000 colleges, generates a substantial volume of research every year. However, much of this knowledge remains siloed or inaccessible to the broader public due to limitations in digital infrastructure, lack of standardization, and inadequate repository practices. Open-source technologies, when leveraged effectively, can transform this landscape by offering cost-effective, scalable, and customizable solutions for digital content management. Platforms such as DSpace, EPrints, and Invenio are already in use across several Indian institutions, providing the technical backbone for knowledge-sharing systems like Shodhganga and the National Digital Library of India (NDLI).

Furthermore, recent policy initiatives—including the draft National Open Access Policy underscore the Indian government's commitment to promoting open access in research. Yet challenges remain in ensuring the sustainability, reach, and equity of these repositories. Rural and underfunded institutions often lack the technical know-how or resources to implement such systems, and there remains a gap in training, standardization, and long-term financial planning.

This paper explores India's current repository landscape through the lenses of sustainability, openness, and equity. It examines the role of open-source technologies, highlights best practices and national initiatives, and offers recommendations for creating a more inclusive and efficient repository ecosystem. With a focus on data-backed insights and case studies, the article aims to provide a roadmap for how India can advance its knowledge infrastructure in alignment with global open science goals.

2. The Role of Open Source in Repository Development

Open-source software has emerged as a transformative force in the creation and management of digital repositories worldwide. In India, where affordability and scalability are key concerns, open-source platforms offer a viable solution for institutions to build and maintain repositories without incurring prohibitive licensing costs. Beyond cost-efficiency, open-source solutions enable customization, foster collaboration, and support

multilingual interfaces—features especially crucial for India's linguistically and institutionally diverse academic landscape.

2.1 Key Open Source Platforms in India

Several Indian institutions have successfully adopted open-source platforms to host digital content, including theses, research papers, teaching materials, and archival data. The most widely used platforms are:

- **DSpace**: Developed jointly by MIT and HP Labs, DSpace is one of the most popular open-source repository systems globally. It supports a wide range of metadata standards, integrates well with ORCID and DOI services, and allows multilingual content. In India, major projects like **Shodhganga** and the **National Digital Library of India (NDLI)** use DSpace as their core platform.
- **EPrints**: Originating from the University of Southampton, EPrints is known for its simplicity and ease of setup. It is widely used in Indian universities for departmental and institutional repositories.
- **Invenio**: A digital library platform developed by CERN, Invenio is used for building large-scale digital archives and offers excellent support for structured data. Institutions like the Indian Statistical Institute have explored its potential for specialized content repositories.

Open-source software platforms like DSpace, EPrints, and Invenio have enabled Indian institutions to establish and manage repositories at minimal cost. These platforms are customizable, scalable, and community-driven—ideal for the Indian context.

Table 1: Comparison of Key Open-Source Repository Platforms in India

Feature	DSpace	EPrints	Invenio
Origin	MIT + HP Labs	University of Southampton	CERN
Popular Use Case	National repositories (Shodhganga, NDLI)	Department-level repositories	Research archives
Metadata Standards	Dublin Core, MARC21	Dublin Core	MODS, MARCXML
Multilingual Support	Yes	Limited	Yes
Customizability	High	Moderate	High
OAI-PMH Compliance	Yes	Yes	Yes

2.2 Community-Led Development and Sustainability

Open-source platforms thrive on the support of global developer communities. In India, several universities and national centers like INFLIBNET and IITs contribute to these platforms through localization, plugin development, and system integration. This not only ensures relevance to Indian contexts (e.g., support for regional languages and UGC guidelines) but also reduces dependency on foreign vendors.

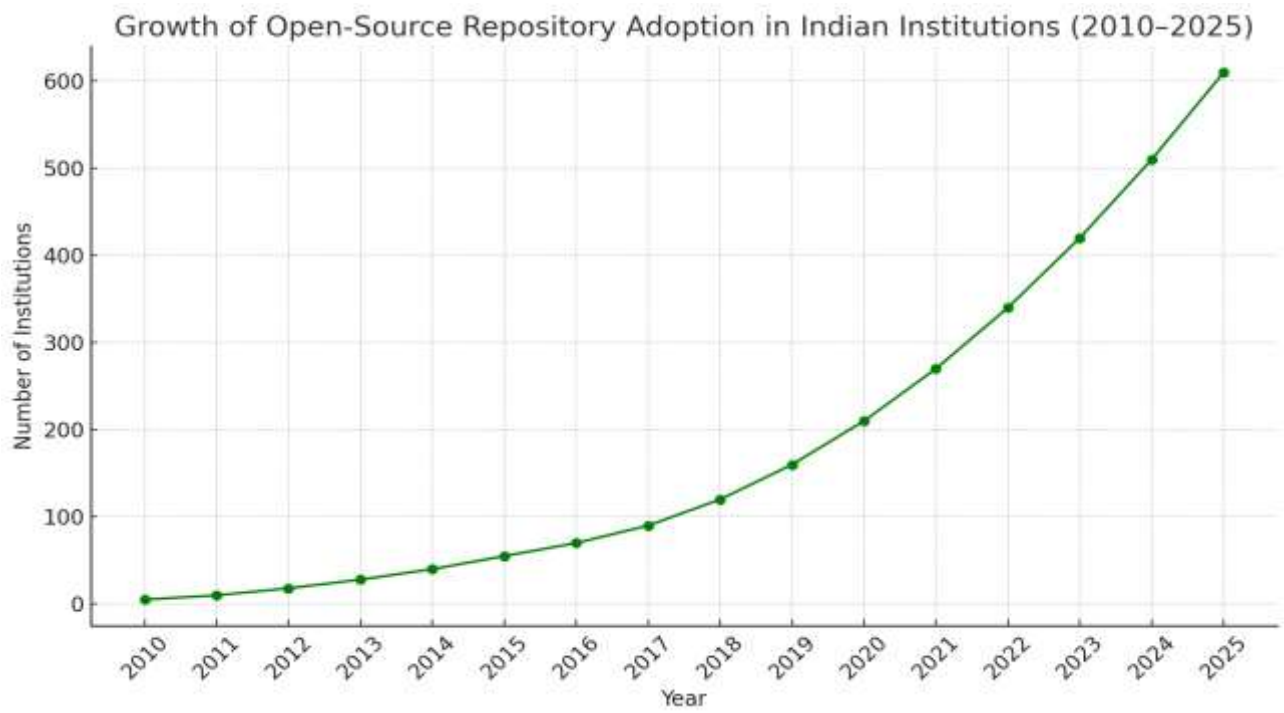
Furthermore, open-source development encourages institutional autonomy. Unlike proprietary software, institutions can control hosting, data privacy, interface design, and integration with other national platforms like SWAYAM or e-SodhSindhu.

2.3 Cost-Effectiveness and Scalability

Budget constraints are a significant barrier for repository development, especially among smaller or rural institutions. Open-source solutions eliminate recurring license fees, allowing funds to be diverted toward training, capacity-building, and server infrastructure. Moreover, these platforms can scale easily—from a single department's output to an entire university's research collection—making them ideal for gradual deployment in resource-constrained settings.

2.4 Integration with Global Standards

Open-source repositories are often compliant with international interoperability protocols like **OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting)**. This makes it easier for Indian repositories to be harvested by global search engines, aggregators like BASE, and directories like OpenDOAR, thereby increasing the global visibility of Indian research.



he line chart illustrating the growth of open-source repository adoption among Indian institutions from 2010 to 2025. It shows a steady and accelerating increase, reflecting growing awareness, policy support, and technical capacity over time.

3. National-Level Initiatives and Policies

India's commitment to open access and digital knowledge dissemination is reflected in several landmark national initiatives and evolving policy frameworks. These initiatives not only provide technical infrastructure but also foster a culture of sharing, transparency, and equitable access to publicly funded research and academic resources.

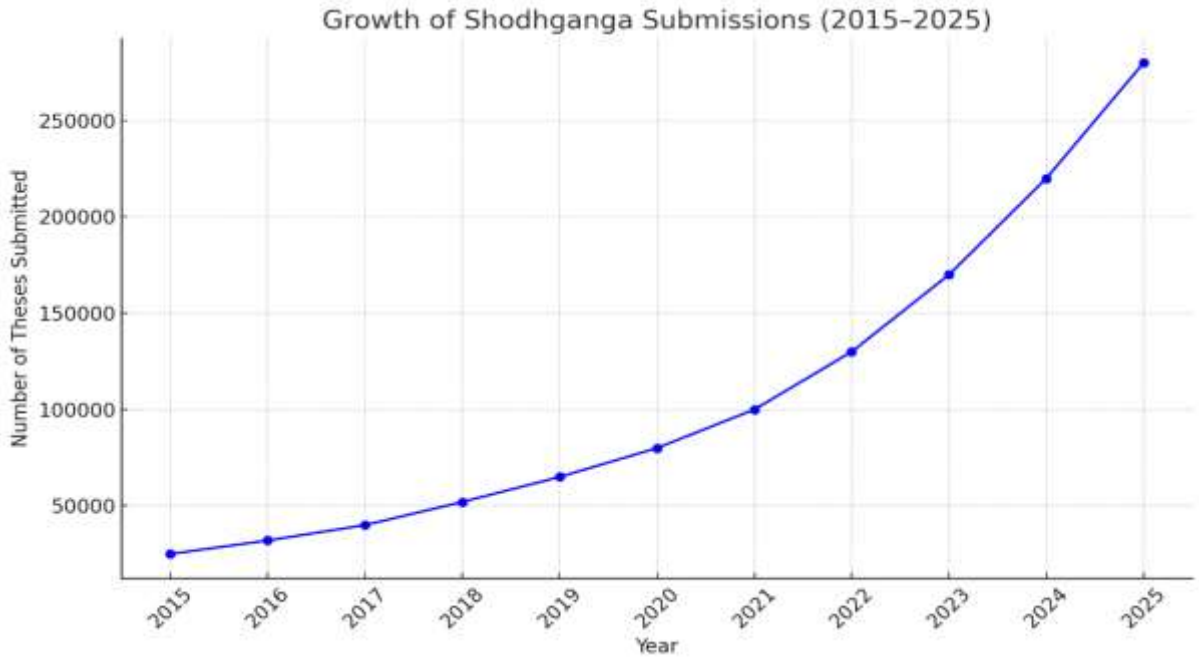
3.1 Shodhganga: A National Theses Repository

Launched by the **INFLIBNET Centre** under the **University Grants Commission (UGC)**, **Shodhganga** is India's premier digital repository for electronic theses and dissertations (ETDs). It mandates all universities to submit Ph.D. and M.Phil. theses, making them openly accessible.

- Built on the **DSpace** platform.
- Hosts over **400,000 theses** as of 2025.

- Participation from **500+ universities** across India.
- Metadata complies with OAI-PMH standards for global visibility.

Shodhganga serves as a model of centralized, open, and sustainable repository infrastructure with long-term institutional support.



The line graph showing the year-on-year increase in theses submissions to Shodhganga from 2015 to 2025. It reflects consistent and accelerating growth, highlighting the platform's expanding reach and compliance among Indian universities.

3.2 National Digital Library of India (NDLI)

An initiative of the **Ministry of Education**, coordinated by **IIT Kharagpur**, the **National Digital Library of India (NDLI)** acts as a comprehensive content aggregator. It hosts over **70 million** digital resources including books, articles, theses, audio, and video content.

- Supports content in **multiple Indian languages**.
- Integrates open-source technologies like **DSpace** and **Apache Solr**.
- Offers filtered access for different user groups (students, teachers, researchers).
- Federated search capabilities across partner repositories.

NDLI enhances accessibility to knowledge resources for all, particularly benefitting students in rural or under-resourced areas.

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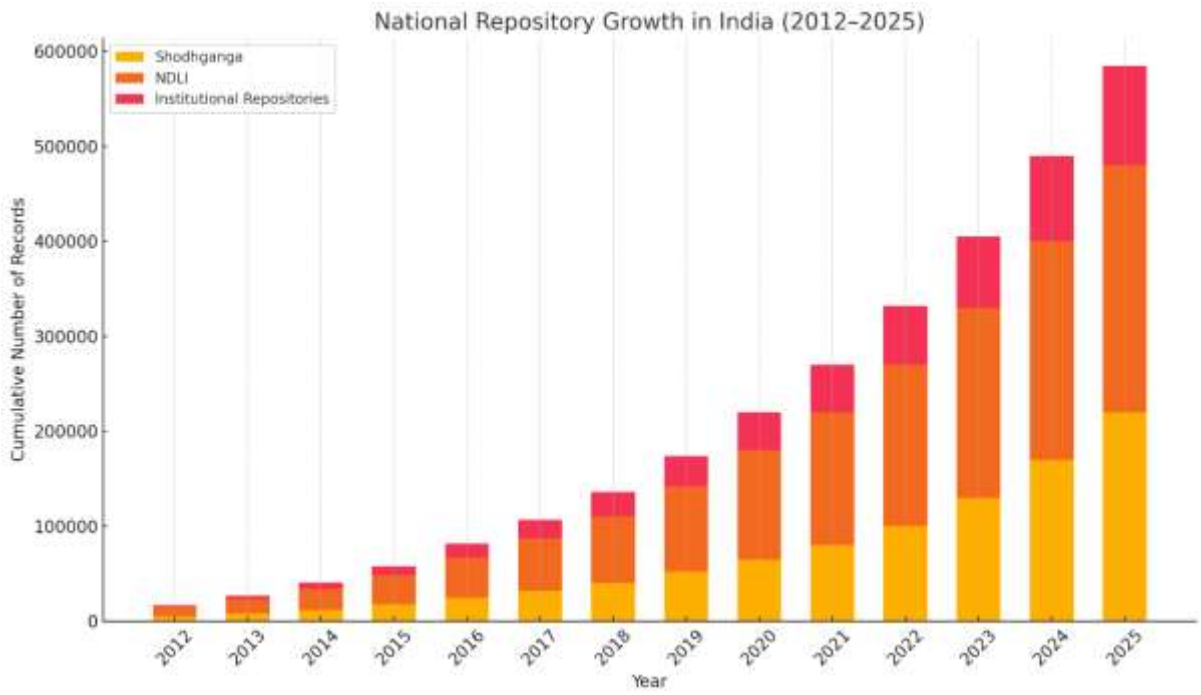

The stacked bar chart showing cumulative growth in major national repositories in India—**Shodhganga**, **NDLI**, and **Institutional Repositories**—from 2012 to 2025. It visualizes how repository content has expanded across platforms, highlighting the complementary role of national and institutional efforts.

3.3 Draft National Open Access Policy (2020)

In 2020, the **Department of Science and Technology (DST)** and **Department of Biotechnology (DBT)** proposed a **National Open Access Policy** to mandate free public access to all research funded by the Indian government.

Key Provisions:

- All publicly funded research to be deposited in open-access repositories.
- Encourages use of institutional repositories or national-level archives.
- Promotes use of persistent identifiers like **DOIs** and **ORCID**.
- Recommends open-source software adoption for repository infrastructure.

Although still under formal adoption, this policy reflects a strategic shift toward aligning India's research system with global open science movements.

3.4 Other Key Programs Supporting Repositories

Beyond Shodhganga and NDLI, several other national-level programs have played a pivotal role in enhancing the digital knowledge infrastructure of India. These initiatives support repository development by facilitating access to scholarly resources, promoting open learning, and ensuring integration between various digital platforms.

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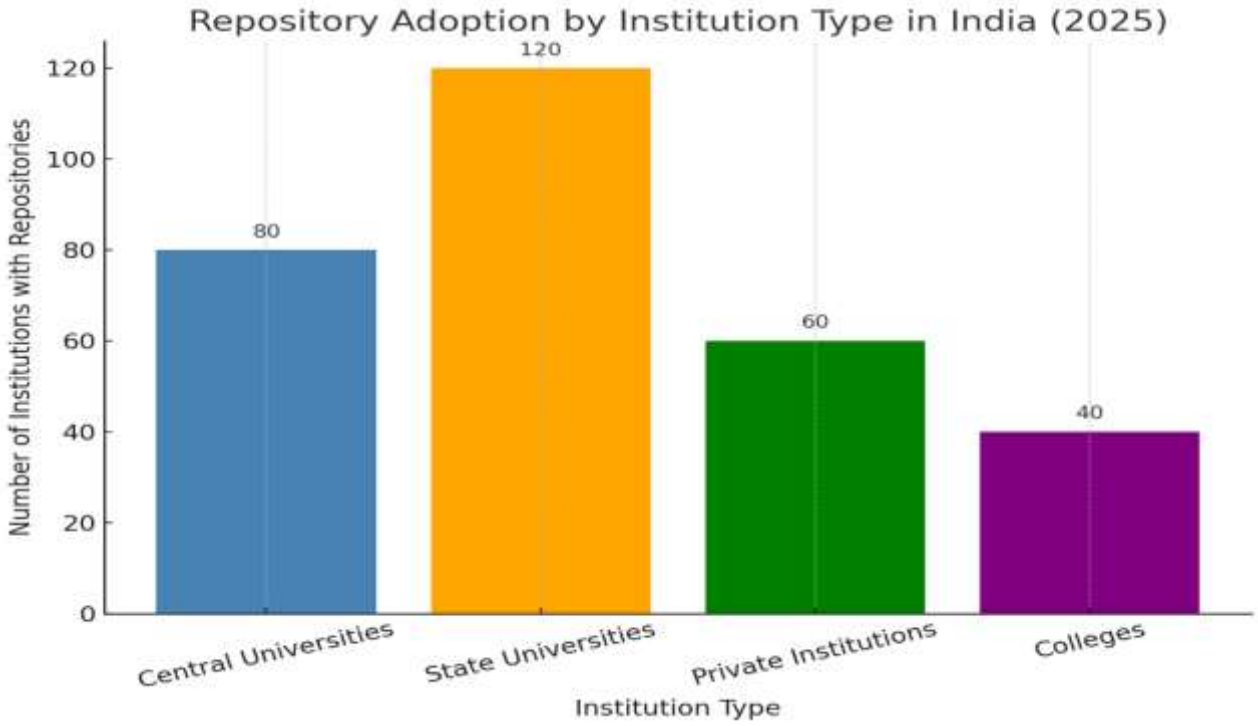
Table 2: Key National Programs Supporting Repository Development

Program	Administered By	Focus Area	Repository Integration Potential
e-ShodhSindhu	INFLIBNET/UGC	Access to academic e-resources	Supplementary repository content
SWAYAM	Ministry of Education	MOOCs and digital learning	Course materials & OER
NAD	DigiLocker/NSDL	Academic credential authentication	Verified records archiving
India Science Portal	Vigyan Prasar (DST)	Public science communication	Popular science repositories
Virtual Labs	IITs/MHRD	Remote scientific experiments	Embedded lab content

4. Challenges to Sustainable and Equitable Practices

Despite the significant progress in developing digital repository infrastructure in India, various systemic and operational challenges continue to impede their sustainability, scalability, and inclusivity. These challenges are especially pronounced in under-resourced institutions, rural areas, and non-English-speaking communities. Addressing these issues is critical to realizing the full potential of open repositories in democratizing access to knowledge.

Chart 2: Repository Adoption by Institution Type (2025)



A bar chart comparing adoption in Central Universities, State Universities, Private Institutions, and Colleges.

The bar chart showing **Repository Adoption by Institution Type in India (2025)**. It highlights that **State Universities** lead in adoption, followed by **Central Universities**, while **Private Institutions** and **Colleges** lag behind—indicating a need for targeted support in these segments.

4.1 Digital Divide and Infrastructure Inequality

India's academic landscape is highly heterogeneous. While premier institutions enjoy robust internet access, server capacity, and trained IT staff, many state universities, colleges, and rural institutions struggle with:

- **Inadequate ICT infrastructure**
- **Limited or unstable internet connectivity**
- **Lack of dedicated servers or repository hosting environments**

This infrastructural disparity hinders smaller institutions from setting up or maintaining open repositories and limits their participation in national platforms like Shodhganga or NDLI.

4.2 Lack of Training and Human Resource Capacity

A successful repository requires not just technology but trained personnel capable of:

- Managing metadata standards and indexing
- Ensuring content quality and copyright compliance
- Maintaining and upgrading open-source platforms

However, many institutions lack repository managers, metadata specialists, or digital librarians. There is also a general **lack of awareness among faculty** about the importance and process of depositing their research.

4.3 Sustainability and Funding Constraints

While open-source tools reduce upfront costs, long-term sustainability requires:

- **Regular technical maintenance**
- **Data backups and server upgrades**
- **User training and community engagement**

Without **dedicated budget allocations** or funding strategies, repositories risk becoming stagnant or non-functional. Many initiatives are project-based, without clear post-funding sustainability plans.

4.4 Language and Accessibility Barriers

Most repositories in India are English-dominant, limiting access for a large segment of the population. Challenges include:

- **Lack of multilingual metadata and search interfaces**
- **Limited availability of content in regional languages**
- **Non-compliance with accessibility standards** for users with disabilities

This limits repository inclusiveness and alienates many potential users, especially in rural and regional contexts.

4.5 Metadata Inconsistency and Discoverability Issues

Metadata quality is crucial for repository usability, discoverability, and interoperability with global systems. However:

- Many repositories use **non-standardized metadata schemas**
- Lack of controlled vocabularies and authority files
- Inconsistent implementation of protocols like **OAI-PMH**

This reduces visibility in global aggregators like **OpenDOAR**, **BASE**, or **Google Scholar**, defeating the purpose of open access.

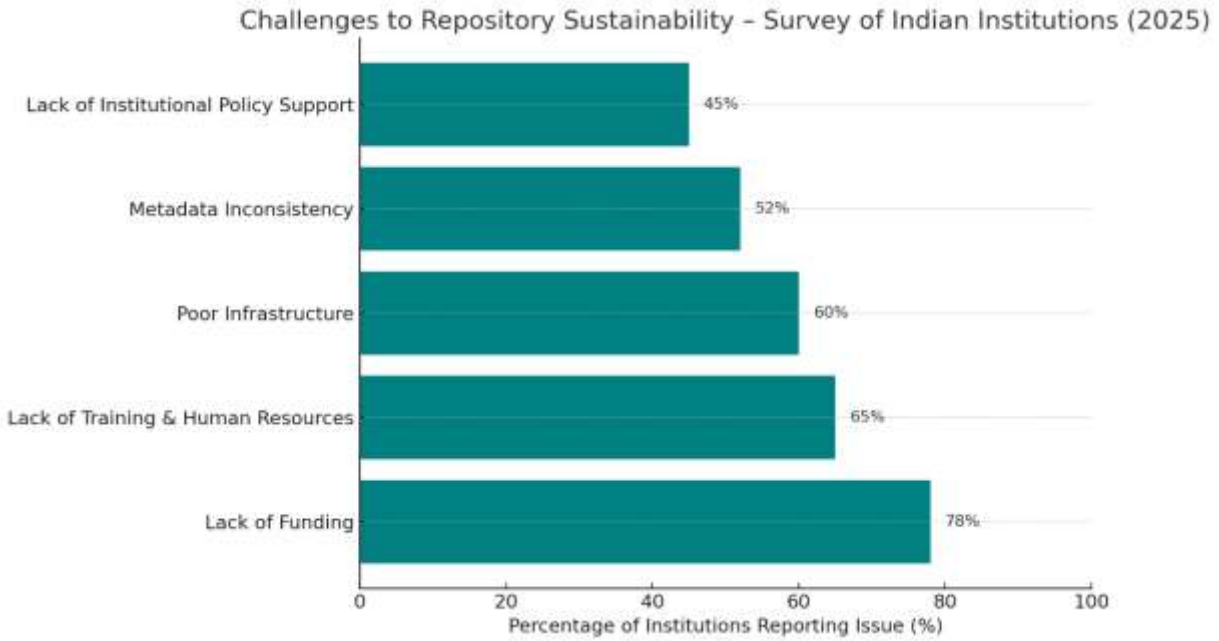
4.6 Institutional Apathy and Policy Gaps

Many institutions lack:

- Clear **open access policies**
- Mandates or incentives for faculty to deposit research
- Accountability mechanisms to ensure repository upkeep

Without top-down commitment and bottom-up participation, repository projects often remain symbolic rather than functional.

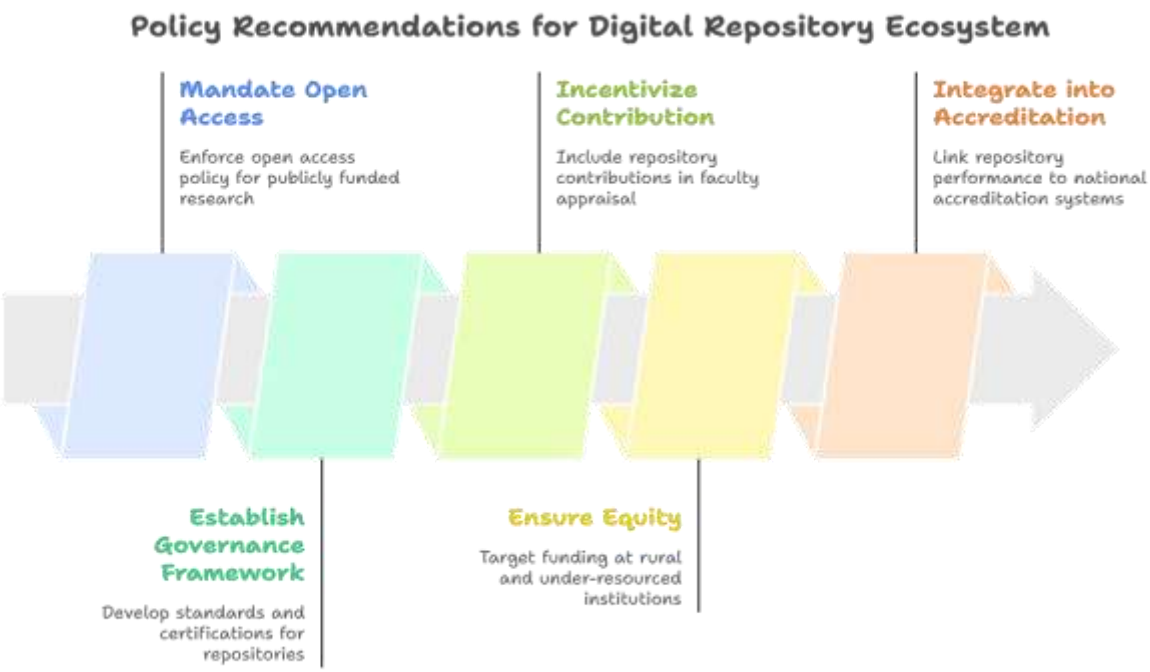
Chart 3: Challenges to Repository Sustainability – Survey of Indian Institutions (2025)
A horizontal bar chart could show the percentage of institutions identifying issues such as lack of funding, training, infrastructure, metadata quality, and policy support.



the horizontal bar chart illustrating the **Challenges to Repository Sustainability** based on a 2025 survey of Indian institutions. The data shows that **lack of funding** and **insufficient training** are the most frequently cited obstacles, followed by **infrastructure deficits**, **metadata issues**, and **policy gaps**.

7. The Path Ahead: Policy Recommendations

To achieve a truly inclusive, sustainable, and open digital repository ecosystem in India, a strategic roadmap combining robust policy initiatives and technology modernization is essential. Building on existing successes like Shodhganga and NDLI, the next phase must address structural gaps and expand participation across all types of institutions.



7.1 Mandate Open Access for Publicly Funded Research

- Enforce the **National Open Access Policy** across all government- funded research agencies and universities.
- Require researchers to deposit preprints or postprints in institutional or national repositories within a fixed embargo period.

7.2 Establish a National Repository Governance Framework

- Develop **standards and certifications** (e.g., for metadata, preservation, software) under the Ministry of Education.
- Introduce a **national repository registry** for oversight and coordination.

7.3 Incentivize Repository Contribution and Use

- Include repository contributions in **faculty appraisal systems**.
- Offer **research grants** or infrastructure support for compliant institutions.

7.4 Ensure Equity in Access and Participation

- Target funding and capacity-building programs at **rural and under-resourced institutions**.
- Provide **language localization support** for repositories to serve diverse linguistic communities.

7.5 Integrate Repositories into National Accreditation and Ranking Systems

- Link repository performance to frameworks like **NAAC**, **NIRF**, and **AISHE**, encouraging systematic repository upkeep and usage.

8. Conclusion

Open access to knowledge is not merely a technological innovation—it is a social imperative. As India continues to expand its digital and educational infrastructure, sustainable and equitable repository practices will be instrumental in bridging information divides, fostering innovation, and advancing inclusive development. Platforms such as **Shodhganga**, **NDLI**, and institutional repositories have already demonstrated the transformative potential of open knowledge systems when supported by sound policies, collaborative frameworks, and appropriate technology.

However, challenges remain—ranging from infrastructure disparities and metadata inconsistencies to policy gaps and limited user awareness. These must be addressed through a unified national strategy that emphasizes

interoperability, capacity-building, multilingual accessibility, and persistent funding. A special focus on **open-source platforms**, **federated models**, and **inclusive governance** will be key to ensuring long-term viability.

India has the opportunity to lead by example—creating not just a network of repositories, but a **culture of openness**, where research and knowledge are treated as public goods accessible to all. By aligning with global best practices while remaining rooted in its unique socio-educational context, India can build a repository ecosystem that supports every learner, educator, and researcher, regardless of geography or privilege.

The path forward lies in collaboration, commitment, and continuous adaptation—ensuring that open access in India evolves from a policy goal into a living, thriving practice.

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