

INDIAN INSTITUTIONAL REPOSITORIES: TECHNOLOGICAL INNOVATIONS, GREEN ACCESS MODELS AND POLICY ALIGNMENT IN NEP 2020

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Abstract

The paper has discussed the technological advancements in the light of the Institutional Repositories (IRs) in India in the context of both green open access practices and in keeping up with the National Education Policy (NEP) 2020. They found out that IRs were emerging as a more important digital infrastructure to store and share institutions-based academic products of the nature of theses, dissertations and research publications. In the research, the methodology followed was descriptive-analytical in which secondary sources like research literature, repository and policy document reports were employed. These were the main parameters considered like repository platforms, Web 2.0, Dublin Core and metadata practices, Knowledge Organisation Systems (KOS), user interface and discoverability, integration with national platforms (e.g., NDLI and OER systems), and its relevance to NEP 2020. Results further showed uneven technology maturity in institutions: basic search and browsing and metadata structures were also widespread, but advanced alternatives amongst others, such as interactive Web 2.0 tools, more customized metadata, and user-centered design were not common. The research paper also noted that IRs were able to assist in ensuring green open access by the use of self archiving that helped to increase visibility and lowered barriers to accessibility. The paper concluded that the IRs need to operate with greater standardization, capacity building as well as policy-oriented implementation in order to emerge as sustainable digital knowledge hubs in Indian higher education.

Keywords: Institutional Repositories, Open access, Green open access, NEP 2020, Dublin core, Knowledge organisation systems, Web 2.0 Digital libraries.

1. INTRODUCTION

Institutional Repositories (IRs): These are gaining importance as a critical digital infrastructure in India for collecting, preserving and disseminating the scholarly output of an institution - such as theses, dissertations, research articles, conference papers, reports and other academic documents - to increase open access, institutional visibility and

facilitate a long-term digital preservation. The effectiveness and impact of an IR however, does not only depend on the amount of content that is hosted but also on the technological robustness of its content, especially standardisation of metadata, user-friendly interface design and appropriate Knowledge Organisation Systems (KOS) that enhance searching, browsing, filtering and overall discoverability of resources (Pradhan & Maharana, 2022). Evidence also suggests that the repositories are slowly evolving towards more interactive and user-oriented repositories, however, the integration of Web 2.0 applications is rather patchy suggesting a need for systematic planning for improving user engagement, connectivity and participatory access mechanisms (Khan, Loan, & Andrabi, 2022). So, along with technological innovation, IRs also play a critical role in contributing to the Green Open Access model by encouraging self-archiving practices, which mitigates access barriers and provides an affordable alternative to expensive subscription-based publishing systems, ultimately leading to boosting research reach, collaboration opportunities and academic impact. (Mishra & Kumar, 2023) India's wider open knowledge ecosystem is further bolstered by national digital learning repositories and open education resources (OER) platforms, particularly those maintained in the context of initiatives linked to INFLIBNET, that enhance access to a wide range of educational content and raise awareness of possibilities and challenges in relation to issues surrounding awareness, usability, and quality assurance (Chakrabarti and Maharana, 2025). On the same note, OERs nationals such as NROER are bearing witness to the scale up of open educational resources and how such repositories can contribute to digital learning and development of digital libraries (Bhattacharyya, 2022). Besides, the National Education Policy (NEP) 2020 has placed much emphasis on digital infrastructure, research culture and digital literacy placing the libraries, and by extension, institutional repositories as an important enabler in ensuring equitable access to and academic innovation in the sector of higher education (Jayamma, Mahesh, and Kotur, 2023). In this framework, which is technology intensive and policy driven, the present research paper studies institutional repositories in India. Using a combined viewpoint that embraces the technological innovations, green offerings of access to academic information and creation of a superior knowledge society, the paper postulates institutional repositories as strategic tools to enhance scholarly communication. The research also takes into account that they contribute to the creation of digital learning environments and the development of a more inclusive knowledge society.

Figure 1. Conceptual Framework of Institutional Repository Ecosystem in India



2. REVIEW OF LITERATURE

The current field of literature demonstrates an increasing academic interest in the technological, access-related, and policy aspects of institutional repositories (IRs) throughout India and even beyond. The research on repository development and functional aspects concentrates on the significance of user interface characteristics, and on Knowledge Organisation Systems (KOS). Pradhan and Maharana (2022) studied IRs of Centrally Funded Technical Institutions in India and found out that much of the repositories have some simple search and browsing and incorporate structured metadata and controlled vocabulary tools to boost discoverability and interoperability. On the same note, studies of the integration of Web 2.0 have indicated that there has been an uneven implementation of interactive tools in repositories. Khan, Loan, and Andrabi (2022) discovered that a small fraction of Asian social science repositories have Web 2.0 functionality, which leaves room to enhance user interaction and participatory access processes. The other theme in the literature is the Green Open Access model. According to Mishra and Kumar (2023), institutional repositories have been characterized as viable measures of fostering self-archiving, lowering the amounts of money, and increase research publicity, which makes IRs a cheaper alternative to the publishing systems of subscription. In further support of an influence, national digital learning repositories managed by INFLIBNET, including Shodhganga and e-PG Pathshala, widen the availability of scholarly and educational materials and struggle with issues and obstacles of awareness and usability to adherence (Chakrabarti and Maharana, 2025). On a larger scale, Bhattacharyya (2022) emphasizes the importance of the National Repository of Open Educational Resources (NROER) on enhancing online education and online library, participating in extensive access to OER. The literature written towards policies also links repositories with national educational reforms. According to Jayamma, Mahesh, and Kotur (2023), libraries can also be instrumental in the implementation of NEP 2020 by facilitating digital literacy and a better digital access to digital resources, which programs indirectly support the target policies of institutional repositories. Collectively, these studies highlight technological advancement, green access practices, national digital repository initiatives, and policy alignment as central dimensions of IR development. However, an integrated evaluation combining all these aspects within the Indian context remains limited, thereby necessitating the present study.

Recently published literature indicates the increasing scholarly interest in the technological, access-related and policy aspects of Institutional Repositories (IRs) in India and elsewhere. Studies directed toward design and functionality of repositories have highlighted the importance of user interface capabilities and Knowledge Organisation Systems (KOS). Pradhan and Maharana (2022) have worked with IRs in Centrally Funded Technical Institutions in India and found that most of the repositories offer basic search and browsing functionality while incorporating structured metadata and controlled vocabulary tools to increase discoverability and interoperability. Similarly, studies of integration in the Web 2.0 show uneven adoption of interactive tools in repositories. Khan, Loan, and Andrabi (2022) found that only few percentage of Asian social science repositories use Web 2.0 features so there is a scope for bettering the user engagement and mechanism for participation. Another theme which runs through the literature is the Green Open Access model. Mishra and Kumar (2023) call institutional repositories as sustainable mechanisms that encourage self-archiving, lower financial barriers, and increase research visibility that make IRs an inexpensive alternative for subscription-based publishing systems. Complementing this perspective, there are national digital

learning repositories sustained by INFLIBNET, such as Shodhganga and e-PG Pathshala, that expand open access to scholarly as well as educational content with challenges related to adoption due to awareness and usability barriers (Chakrabarti & Maharana, 2025). At a larger level, Bhattacharyya (2022) points to the role that the National Repository of Open Educational Resources (NROER) plays in enhancing the digital learning and digital library services through wide OER availabilities. Policy-oriented literature makes another connection between repositories and national educational reform. Jayamma, Mahesh, and Kotur (2023) claim that libraries are central in ensuring the implementation of NEP 2020 in ensuring digital literacy and ensure digital resource accessibility in an indirect manner, which indirectly reinforces the strategic relevance of institutional repositories in achieving the policy goals. Collectively, these studies point to technological development, green access practices, national digital repository programs, and aligning policies as key dimensions of IR development. However, an integrated evaluation incorporating all of these aspects in Indian context is limited and therefore the need for follow the current evaluation.

3. RESEARCH METHODOLOGY

This study adopts descriptive & analytical research design to study the status of Institutional Repositories (IRs) in India with specific reference to technological innovations, green access practices and coherent with NEP 2020. The methodology is designed to incorporate technological, policy as well as access aspects in a rational manner:

3.1. Research Design

The study itself is grounded on a qualitative cum analytical approach, with secondary data analysis to support it. It brings together the themes of document analysis, repository feature evaluation, and comparative synthesis of extant scholarly studies in order to arrive at an integrated understanding of IR development in India.

3.2. Data Sources

- The study is based on the mainly secondary data sources which include:
- Published Research Articles relating to Institutional Repositories
- Studies on adoption of Web 2.0 in Repositories
- Research on Green Open Access practices.
- Reports of national digital repositories (ex: NDLI, INFLIBNET projects)
- The National Education Policy 2020 Policy documents.

Systematic review of these sources was done to outline repetitive patterns, technological trends, and policy inferences.

3.3. Selection Criteria

- Institutional repositories that were considered in the analysis were chosen based on the following criteria:
- Repositories on the Indian scaled universities, centrally funded bodies and national research bodies.

- Repositories had to be built on known open-source platforms, e.g. DSpace or EPrints.
- Repositories organized in a detectively way encourage the free availability of quality academic outputs.
- Remote connected or accessed repositories, including those that are interoperable with national or international discovery networks, should be incorporated with or interoperable to national or international discovery systems, including adherence to OAI-PMH.

3.4. Parameters for Evaluation

To guarantee the structured analysis, the following parameters of the evaluation have been determined:

- Technological Infrastructure
(Platform used /Was it OAI-PMH compliant/ System configuration)
- Metadata Standards
(Use of Dublin Core, use of metadata completeness, interoperability)
- Knowledge Organisation Systems (KOS)
(Subject browsing - indexing - authority control - classification support)
- Web 2.0 Integration
(RSS feeds, tools of social sharing, interactive services)
- User Interface & Discoverability Capabilities
(Search functionality, filtering, browsing mechanisms, usability).
- Green Access Practices
(Self-archiving policy, open access policies, copyright policies)
- National Integration
(Linkage with repositories of NDLI, INFLIBNET, repositories, OER platforms).
- Policy Alignment
(Relevance to objectives of NEP 2020 - e.g. digital literacy, visibility of research, equitable access)

3.5. Data Analysis Procedure

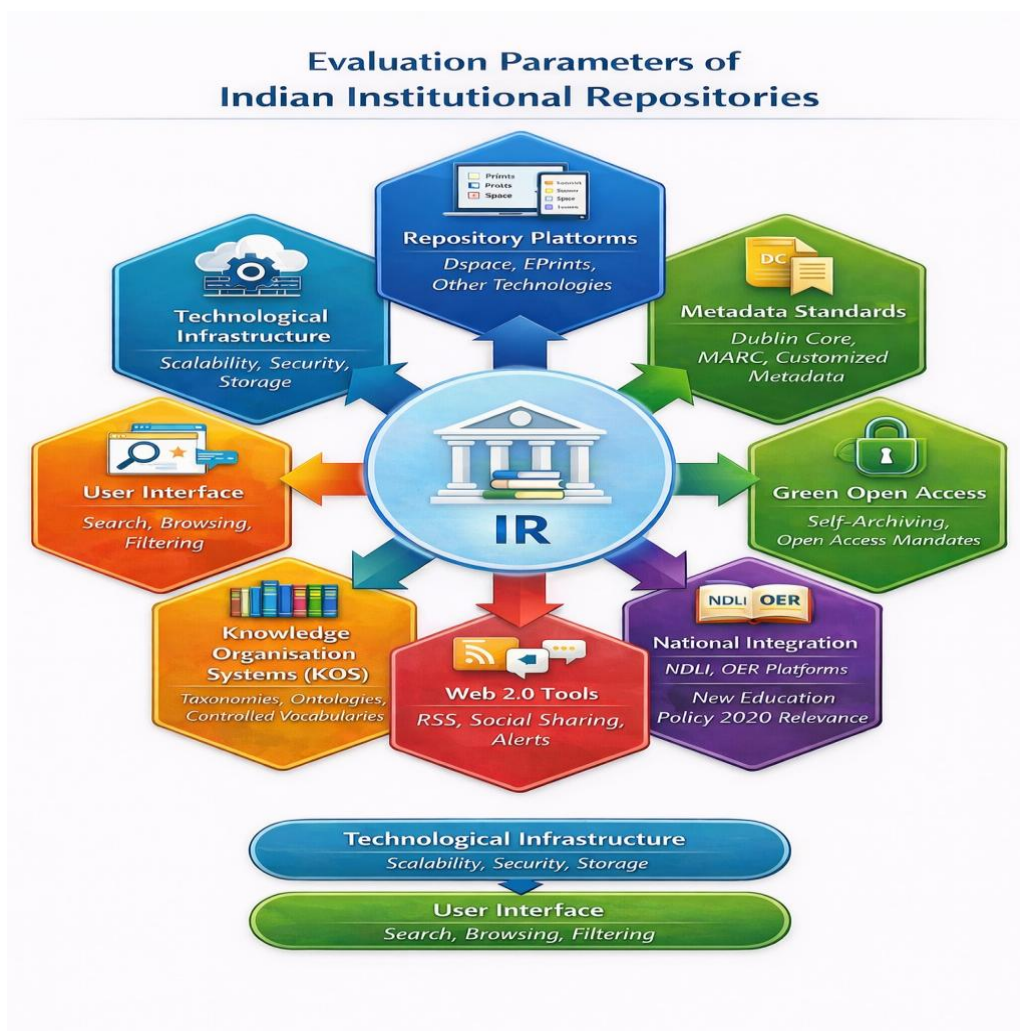
The analysis of the reviewed studies was based on the extraction of data which was thematically divided based on the mentioned parameters. The strengths, gaps, and emerging trends were made out by comparing them. Where the quantitative data were present such as the percentage of Web 2.0 technology adoption; the same were included in the analysis tables.

The results of the study were generalized, and a holistic system was obtained, which connects technological change, green access systems, and policy congruence with the Indian institutional repository ecosystem.

3.6. Scope and Limitations

The study is limited to analysis of the published literature and documented repository features. Primary data collection (e.g. survey or interview with repository manager(s)) was not performed. Therefore, conclusions reflect documented evidence and may not reflect current unpublished technological developments.

Figure 2: Evaluation Parameters of Institutional Repositories in India



4. ANALYSIS AND DISCUSSION

The analysis of institutional repositories in India is divided into various technological, access-related and policy dimensions. This section looks at the state of the art of IR development today in terms of infrastructure, innovation, and connection to national digital activities. The discussion starts with an overview on the general status and growth of institutional repositories in the country.

4.1. Status of Institutional Repositories in India

Institutional repositories in India are primarily hosted by universities, centrally funded technical institutions, and national research bodies. Most repositories are developed using open-source platforms such as DSpace and EPrints. Studies indicate that repositories generally support open access policies and provide structured access to theses, dissertations, and research publications.

Table 1: Operational Status of Institutional Repositories (Indicative Pattern)

PARAMETER	OBSERVATION
Platform Used	DSpace / EPrints
Type of Content	Theses, Dissertations, Articles
Access Type	Predominantly Open Access
OAI-PMH Compliance	Present in Majority
National Integration	Many linked with NDLI

4.2. Adoption of Web 2.0 Tools

The adoption of Web 2.0 features in institutional repositories enhances user engagement and information dissemination. Khan, Loan, and Andrabi (2022) reported that among 101 social science repositories studied in Asia, only 31.60% were Web 2.0 enabled, while 69.40% lacked such features.

Table 2: Web 2.0 Adoption in Asian Institutional Repositories

Repository Status	Number	Percentage
Operational Repositories	92	100%
Web 2.0 Enabled	30	31.60%
Not Web 2.0 Enabled	62	69.40%

As revealed, India is among the countries with comparatively low Web 2.0 penetration thus highlighting the need to integrate technology.

4.3. Metadata Standards and Dublin Core Usage

Metadata standardization facilitates interoperability and discovery. Repositories in the Indian environment are primarily using the Dublin Core metadata schema, which is a result of its conformity with open-source repository software and harvesting standards.

Table 3: Metadata Practices in Institutional Repositories

METADATA FEATURE	LEVEL OF ADOPTION
Dublin Core Schema	High
Structured Fields (Title, Author, Subject)	High
Authority Control	Moderate
Metadata Harvesting (OAI-PMH)	High
Extended Metadata Customization	Limited

The predominance of Dublin Core facilitates integration with NDLI and other discovery services.

4.4 Knowledge Organisation Systems (KOS) Implementation

Knowledge Organisation Systems shall be used to provide better search accuracy and browsing. According to a study by Pradhan and Maharana (2022), repositories combine subject browsing and author indexing, but more sophisticated semantic functionality has yet to be developed.

Table 4: KOS Features in Indian IRs

KOS Component	Implementation Status
Subject Browsing	Widely Implemented
Author Indexing	Widely Implemented
Controlled Vocabulary	Partially Implemented
Thesaurus Integration	Limited
Semantic Linking	Emerging

4.5 User Interface and Discoverability Features

User interface quality significantly influences repository usability. Most repositories provide keyword-based search, basic filtering, and browsing options. However, personalization and analytics features remain underdeveloped.

Table 5: Common UI Features in IRs

UI FEATURE	AVAILABILITY
Basic Keyword Search	High
Advanced Search Filters	Moderate
Faceted Browsing	Moderate
Usage Statistics	Limited
Mobile Optimization	Emerging

4.6 Green Access Practices

The green open access is a relevant strength of institutional depositories. Mishra and Kumar (2023) highlight institutional repositories as one of the most effective methods to promote self-archiving, influence the reduction of financial barriers as well as the promotion of research findings.

Table 6: Impact of Green Access Model

DIMENSION	OBSERVED IMPACT
Cost Reduction	High
Research Visibility	High
Institutional Reputation	Moderate–High
Long-term Preservation	High

4.7 Integration with NDLI and OER Platforms

National platforms are increasingly being incorporated in institutional repositories. Empirical research denotes that more IRs are developing connections with NDLI and other services offered by INFLIBNET. The NROER is one of the national OER initiatives that contribute significantly to the growth of digital resources in India. Online collections that are backed by INFLIBNET support increased access to research products as well as education.

4.8 Policy Alignment with NEP 2020

The National Education Policy 2020 lays a lot of stress on the digital infrastructure, research promotion, and the inclusive access. Jayamma, Mahesh, and Kotur (2023) Libraries are postulated to be of the key in the formation of digital literacy, as well as the creation of access to scholarly sources.

These policy goals are comparable to institutional repositories as they help improve open access, promote spreading of research, and foster digital scholarship.

Table 7: Alignment of IR Functions with NEP 2020 Goals

NEP OBJECTIVE	REPOSITORY CONTRIBUTION
Digital Access Expansion	Open Repository Platforms
Research Promotion	Archiving & Visibility
Digital Literacy	Structured Access & Retrieval
Equity in Education	Free Access to Research

The current discussion supports the assertion that Indian institutional repositories have brought measurable progress in the technological field, green presupposition, and national integration. However, more improvements are justified in the usage of Web 2.0 technologies, in high level of metadata customization, and in the architecture of user

friendly interfaces to unlock their full potential in the developing digital knowledge ecosystem of India.

5. FINDINGS

The discussion of institutional repositories in India and the analysis with particular attention devoted to technological innovations, green access models, national integration, and policy alignment makes several findings that can be viewed as practical and research-related. These results are typical of trends in repositories and show development and aspects that need systematic reinforcement.

- Indian Institutional repositories are becoming more and more core academic infrastructure as opposed to optional digital projects, particularly in institutions of higher education and research.
- Repository developments: expansion of repositories can be determined by the increase of the number of repositories, as well as the diversification of content types, such as theses, dissertations, faculty publications, conference papers, reports, and learning materials.
- There is also an unequal technological maturity within different institutions; some repositories have high structures and are user friendly whereas many are still in limited features and rudimentary settings.
- Metadata quality is a major source of difference: repositories whose metadata is consistent and complete will be more discoverable, whereas an otherwise strongly-content repositories will still be less useful due to poor metadata.
- Base metadata standards such as Dublin Core are either common, although, extended metadata practices and more descriptive elements are not that much standardized.
- There are usually knowledge organisation mechanisms (subject categorisation, author indexing, browsing structures) but more sophisticated systems are restricted in the majority of the repositories (controlled vocabularies, authority control, semantic linking).
- Web 2.0 and user-engagement tools (notifications, feeds, sharing services, social connection) are not very accepted yet, which means that most repositories remain to be more of a static archive than an active scholarly resource.
- Basic search and navigation is common on repository user interfaces, whereas more sophisticated capabilities, such as facet filtering, personalization, analytics dashboards, and mobile-friendly access, are available inconsistently.
- Self-archiving Green open access practices are becoming a significant path to better access and visibility especially where subscription fees hinder access to scholarly materials.
- The integration at the national level is gaining more significance; repositories, which are connected to large discovery and aggregation systems, become more visible and helpful to end users.
- The conceptual preparedness to align with NEP 2020 is quite high since repositories enable the facilitation of digital learning, research visibility, and equitable access, yet the realization of institutional level and policy-based standardization is yet to be enhanced.
- Capacity building: This is a very important need: in metadata management, content curation, copyright awareness, and user support, the knowledge and skills of the librarian are essential to repository performance.

- Sustainability problems are still being experienced such as inconsistencies in updating content, lack of staff, poor technical maintenance, and lack of proper institutional repository policies in some institutions.
- Indian institutional repositories hold a great opportunity to be strategic means of digital scholarship and policy objectives, yet they need to be properly standardized, more user-focused in their design, and systematically connected to national digital strategies in order to achieve the most.

6. CONCLUSION

Institutional repositories in India seem to be gradually becoming an integral part of India's academic digital infrastructure. They are no longer just "storage spaces" for theses and papers many of our institutions are using them to enhance the visibility, access and long-term preservation of their research output. This work demonstrates that although most repositories have the basic elements in place to realize an open data vision, including structured records and searchable content, and standard metadata, the quality and capability of the repositories generally vary considerably from one institution to another. Some repositories are well-organized and easy to use, but there are still many limited repositories with basic functions and few capabilities to make the discovery faster and more user-friendly, such as better filters, clean navigation, advanced indexing, usage analytics, and interactive tools.

From the access and policy angle, institutional repositories provide a huge service in support of the green open access approach by encouraging self-archiving and removing barriers that are created by expensive subscription based publishing. They also become more valuable not least because they are better linked to bigger national platforms and open learning systems, since that means that more learners and researchers are likely to find the content easily and discover it. NEP 2020 has clearly advocated this direction as it emphasized digital infrastructure, research culture, fair access to knowledge, which also aligns perfectly with what repositories are designed to do. Still, if repositories are going to provide their full benefit, institutions must have clearer policies, content-updating, staff training, and improved technical planning. Overall, the study concludes that the institutional repositories in India have good potential and with standards and better design and institutional support, they can be a dependable learning and knowledge and repository that aids in research and broader access in accordance with NEP 2020.

7. RECOMMENDATIONS

To improve on the effectiveness and sustainability of the institutional repository in India, the following are some of the recommendations put forward:

- To enhance interoperability, discoverability and easy integration with national and international digital platforms there should be standardized and uniform metadata practices across repositories.
- To be more user-friendly and interactive, repositories should add enhanced search filters, RSS feeds, content notifications, mobile-based design, and simple analytic tools to stimulate user interaction and exposure.
- Institutions like universities and research centers should establish clear institutional policies of repository including submission policies, self-archiving

policies, copyright policies, access control policies, and long-term preservation digital strategies.

- Constant capacity building and professional training activities must be arranged among librarians and those in charge of the repository to further enhance professional skills in metadata management, digital management, copyright and technical maintenance.

The institutional repositories must be viewed as a strategic aspect of NEP 2020, as they need to be integrated into institutional digital strategies, be easier to promote research visibility, assist with digital literacy, and be more proactive in cooperation with national digital and open knowledge platforms.

These initiatives can make institutional repositories become robust, sustainable, and policy-oriented digital knowledge systems in the Indian higher education system.

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