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A Case Study on Library Automation in Indian Academic Libraries of Universities in Maharashtra

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Abstract

The automation of academic libraries in Maharashtra represents a significant chapter in the broader narrative of India's higher education digital transformation. This case study provides a comprehensive, longitudinal analysis of library automation across universities in Maharashtra—India's third-largest state by area and second-largest by population, with a higher education network comprising over 20 state universities, 300+ affiliated colleges, and several centrally funded institutions including IIT Bombay and NIT Surathkal. Spanning the period from 2000 to 2023, the study examines the evolution from manual, card-catalog-based systems to integrated library management systems (ILS/LMS), digital repositories, consortia-based e-resource access, and emerging smart technologies such as RFID and cloud-based platforms. The research synthesizes evidence from multiple case studies and survey-based investigations conducted across Maharashtra's academic libraries, including: (i) the pioneering automation of Shivaji University, Kolhapur's Barr. Balasaheb Khardekar Library (documented in SRELS Journal of Information Management, 2011), which details the phase-wise implementation of automation—retrospective conversion, barcode ID generation, member ID generation, and housekeeping operations—within the challenging context of a rural, semi-urban environment with weak IT infrastructure and limited skilled human resources; (ii) the assessment of KOHA Open-LMS implementation across 13 higher educational institute libraries within the Maharshi Karve Stree Shikshan Samstha (MKSSS) in Pune (2022 study), which evaluates customization options, integration capabilities, user experience, technical support, and cost considerations, revealing that KOHA is highly valued for its cost-effectiveness, accessibility, cloud-based hosting, and Union Catalogue feature, with Circulation and OPAC modules being the most frequently utilized; (iii) the study of library automation status across Marathwada Shikshan Prasarak Mandal's college libraries in the Aurangabad region (2018), which surveyed 21 colleges (17 responses) to assess available library services and resources, digital library infrastructure, and means for improvement, revealing significant variation in automation levels and persistent infrastructure gaps; (iv) the analysis of UGC-Infonet Digital Library Consortium usage at Rashtrasant Tukdoji Maharaj Nagpur University and Sant Gadge Baba Amravati University (2017), examining how consortia-based access to electronic journals transformed scholarly communication and information access for faculty, research scholars, and post-graduate students.

Key findings demonstrate: (1) The automation journey in Maharashtra's university libraries began in earnest during the early 2000s, catalyzed by INFLIBNET's initiatives including the development of SOUL (Software for University Libraries), which was first released during CALIBER 2000 and received its first installation at North Maharashtra University, Jalgaon—marking a significant milestone for the state; (2) The adoption patterns varied significantly across institutional types: centrally funded institutions (IIT Bombay) achieved early and comprehensive automation; state universities (Shivaji University, Kolhapur; University of Mumbai; University of Pune; Nagpur University; Amravati University) adopted automation in phases, with varying degrees of success; affiliated colleges demonstrated the most uneven adoption, with some achieving full automation (e.g., MKSSS

group libraries in Pune) while others remained partially or un-automated; (3) The choice of library management software evolved over the period: proprietary systems including LibSys and SOUL (developed by INFLIBNET) dominated early adoption, while the 2010s witnessed significant growth in open source systems, particularly KOHA, driven by cost considerations, flexibility, and active community support; (4) Retrospective conversion (retrocon) of legacy collections—converting manual card catalog records into machine-readable MARC format—emerged as the most resource-intensive and challenging phase of automation, requiring significant investment in skilled manpower, data entry infrastructure, and quality control mechanisms; (5) The adoption of RFID technology for library automation gained momentum in the late 2010s and early 2020s, with recent tenders (e.g., Maharashtra National Law University, Aurangabad, May 2023) indicating continued investment in smart library infrastructure; (6) Consortia-based e-resource access through UGC-Infonet transformed the information landscape, providing access to thousands of peer-reviewed journals and enabling faculty and researchers in Maharashtra's universities to engage with global scholarship; (7) Despite significant progress, persistent challenges remain: inadequate IT infrastructure in rural and semi-urban institutions, shortage of trained library professionals with ICT skills, financial constraints for smaller colleges, and the need for ongoing technical support and maintenance.

The research methodology integrates: (i) Systematic case study analysis of documented automation projects at specific Maharashtra institutions (Shivaji University, Kolhapur; MKSSS Pune colleges; Marathwada colleges); (ii) Survey-based studies of automation status across multiple institutions (Marathwada region study, 2018; MKSSS study, 2023); (iii) Policy and infrastructure analysis examining the role of INFLIBNET, UGC-Infonet, and state-level initiatives; (iv) Technology adoption analysis tracking the evolution from SOUL to KOHA and RFID; (v) Comparative institutional analysis across institutional tiers (central universities, state universities, affiliated colleges); (vi) SWOT analysis evaluating strengths (policy support, INFLIBNET infrastructure, growing ICT literacy), weaknesses (infrastructure gaps, skills shortages, financial constraints), opportunities (open source systems, cloud computing, RFID expansion), and threats (technological obsolescence, vendor dependency, sustainability concerns).

Strong points of this study include: (1) The first comprehensive case study focused specifically on library automation in Maharashtra's academic libraries across the critical period 2000–2023; (2) Integration of diverse case study evidence from peer-reviewed journals (SRELS Journal, College Libraries, IP Indian Journal of Library Science) providing methodological triangulation; (3) Coverage of all major university types—central, state, and affiliated colleges—enabling comparative analysis; (4) Inclusion of both proprietary and open source software adoption patterns; (5) Longitudinal perspective capturing evolution from early automation (2000s) through RFID adoption (2023). Weak points include: (1) Limited availability of detailed documentation for some institutions, particularly for the early 2000s period; (2) Variation in survey methodologies across studies, complicating direct comparison; (3) Underrepresentation of certain geographic regions within Maharashtra (e.g., Vidarbha, Western Maharashtra, Konkan); (4) Reliance on published studies with potential publication bias toward successful implementations.

Current trends emerging from the 2018–2023 period include: increasing adoption of open source KOHA over proprietary systems; cloud-based hosting and software-as-a-service (SaaS) models for library management; integration of RFID for self-checkout, inventory management, and security; consortia-based e-resource access as standard practice; growing emphasis on digital repositories and institutional archives; and the emergence of next-generation discovery platforms.

Historical context traces library automation in Maharashtra through three phases: Phase 1 (2000–2008)—Initial automation with SOUL and LibSys, retrospective conversion projects, establishment of INFLIBNET connectivity; Phase 2 (2009–2015)—Expansion of automation to affiliated colleges, adoption of open source systems (KOHA), UGC-Infonet consortia access matures; Phase 3 (2016–2023)—RFID adoption, cloud-based systems, focus on smart libraries, post-COVID acceleration of digital services.

The discussion interprets findings through the lens of INFLIBNET's catalytic role, the rural-urban divide in infrastructure and skills, the economic constraints driving open source adoption, and the transformative impact of consortia-based e-resource access. Results confirm that Maharashtra has emerged as a leader in library automation among Indian states, with pioneering institutions (Shivaji University, IIT Bombay, University of Pune) setting benchmarks, yet significant disparities persist between well-resourced and under-resourced institutions, and between urban and rural locations.

The conclusion recommends a multi-pronged strategy for consolidating and advancing library automation in Maharashtra: (1) Strengthening state-level coordination through a Maharashtra Academic Library Consortium to share resources, expertise, and best practices; (2) Accelerating open source adoption (KOHA, DSpace) to reduce costs and increase flexibility; (3) Investing in continuing education and skill development for library professionals, particularly in AI/ML, data analytics, and digital preservation; (4) Expanding RFID and smart library technologies to more institutions, leveraging recent government initiatives; (5) Developing shared digital repositories for regional cultural and scholarly heritage; (6) Establishing quality benchmarks and certification programs for library automation.

Keywords: Library automation; academic libraries; Maharashtra; university libraries; INFLIBNET; SOUL software; KOHA open source; RFID technology; UGC-Infonet; retrospective conversion; case study; Shivaji University Kolhapur; MKSSS Pune; Marathwada colleges; Nagpur University; Amravati University; integrated library management system (ILMS); digital libraries; consortia-based e-resources; open source software; library management system (LMS); higher education; India.

1. Introduction

1.1 Maharashtra's Higher Education Landscape

Maharashtra, India's third-largest state by area (307,713 square kilometers) and second-largest by population (approximately 124 million as of 2023), possesses one of the nation's most extensive and diverse higher education systems. The state's academic infrastructure includes:

1. Over 20 state universities (including University of Mumbai, University of Pune, Shivaji University Kolhapur, Rashtrasant Tukdoji Maharaj Nagpur University, Sant Gadge Baba Amravati University, North Maharashtra University Jalgaon, Dr. Babasaheb Ambedkar Marathwada University Aurangabad, Swami Ramanand Teerth Marathwada University Nanded, and others)
2. Centrally funded institutions: Indian Institute of Technology (IIT) Bombay, National Institute of Technology (NIT) Surathkal, Tata Institute of Social Sciences (TISS) Mumbai, and others
3. More than 300 affiliated colleges spanning arts, science, commerce, engineering, medicine, law, and management disciplines
4. Numerous autonomous colleges and research institutions

The academic libraries serving these institutions—ranging from the technologically advanced central library of IIT Bombay to the resource-constrained college libraries in rural Marathwada and Vidarbha regions—form a complex ecosystem characterized by significant diversity in resources, infrastructure, staffing, and technological readiness.

1.2 The Imperative for Library Automation

Library automation—the application of information and communication technologies (ICT) to library operations and services—emerged as a critical priority for Maharashtra's academic libraries during the 1990s and 2000s. The drivers for automation included:

1. **Growing collections**: University libraries accumulated vast print collections (often hundreds of thousands of volumes) that were increasingly difficult to manage through manual cataloging and card catalogs

2. **User expectations**: Students and faculty accustomed to digital information access demanded modern, efficient library services
3. **Resource sharing**: Automation enabled union catalogs and inter-library loans, maximizing utilization of limited resources
4. **Scholarly communication**: The shift to electronic journals and digital resources required integrated discovery systems
5. **National mandates**: UGC and INFLIBNET policies encouraged and supported library automation across Indian universities

1.3 The Role of INFLIBNET

The INFLIBNET (Information and Library Network) Centre, established as an Inter-University Centre (IUC) of the UGC in May 1996, has been the primary catalyst for library automation in Maharashtra and across India . INFLIBNET's key initiatives relevant to Maharashtra include:

1. **SOUL (Software for University Libraries)**: Indigenous library management software first released during CALIBER 2000 . SOUL 2.0 was released in January 2009, compliant with international standards including MARC 21, Unicode, SIP/N-SIP for RFID compliance, and FRBR
2. **Retrospective conversion projects**: Financial and technical support for converting legacy card catalogs into machine-readable MARC format
3. **UGC-Infonet Digital Library Consortium**: Access to e-journals and databases for subscribing universities
4. **Training and capacity building**: Workshops on bibliographic standards, data input sheet preparation, AACR2, and Library of Congress subject headings

The first installation of SOUL took place at North Maharashtra University, Jalgaon—a significant milestone for Maharashtra's automation journey .

1.4 Scope of This Case Study

This case study provides a comprehensive, longitudinal analysis of library automation in Maharashtra's academic libraries from 2000 to 2023. It examines:

1. **Phase-wise evolution** of automation technologies and practices
2. **Institutional case studies** of pioneering libraries (Shivaji University Kolhapur, MKSSS Pune colleges, Marathwada region colleges)
3. **Software adoption patterns** from proprietary SOUL to open source KOHA
4. **Emerging technologies** including RFID and cloud-based systems
5. **Challenges and success factors** across institutional types
6. **Lessons learned** for future automation initiatives

2. Definitions

1. **Library Automation**: The application of information and communication technologies (ICT) to library operations including acquisition, cataloging, circulation, serials management, and user services, replacing manual or partially automated processes .
2. **Integrated Library Management System (ILMS) / Library Management System (LMS)** : Software platforms that manage core library operations—acquisitions (ordering and receiving materials), cataloging (creating bibliographic records), circulation (check-in/check-out, patron management), serials management (periodicals), and OPAC (public access catalog). Examples include SOUL, LibSys, and KOHA .
3. **SOUL (Software for University Libraries)** : Indigenous integrated library management software designed and developed by INFLIBNET Centre based on requirements of colleges, universities, and

other academic libraries. First version released during CALIBER 2000; SOUL 2.0 released in January 2009. Compliant with MARC 21, Unicode, SIP/N-SIP for RFID, and FRBR standards .

4. **KOHA**: An enterprise-class, open source integrated library system (ILS) used worldwide. First deployed in 1999 in New Zealand, KOHA gained significant adoption in Indian academic libraries during the 2010s due to its zero licensing cost, active community support, and comprehensive feature set .
5. **Retrospective Conversion (Retrocon)** : The process of converting manually created card catalog records into machine-readable MARC (Machine-Readable Cataloging) format within an automated library system. This is often the most resource-intensive phase of library automation, requiring skilled manpower and quality control .
6. **OPAC (Online Public Access Catalog)** : A digital interface allowing library users to search the library's collection of books, journals, and other materials. Modern OPACs incorporate features such as keyword searching, Boolean operators, relevance ranking, and personalization.
7. **UGC-Infonet Digital Library Consortium**: A national initiative providing subscribing universities with access to electronic journals and databases from major publishers (Elsevier, Springer, Wiley, Taylor & Francis, etc.) through consortia-based licensing .
8. **INFLIBNET Centre**: The Information and Library Network Centre, established as an Inter-University Centre (IUC) of the University Grants Commission (UGC) in May 1996. Serves as the nodal agency for networking of libraries in universities and higher education institutions in India .
9. **RFID (Radio Frequency Identification) in Libraries**: A wireless technology using electromagnetic fields to identify and track tags attached to library items. RFID enables self-checkout kiosks, automated sorting, inventory management, and security detection. Recent tenders (e.g., Maharashtra National Law University, Aurangabad, 2023) indicate continued investment in RFID-based automation .
10. **Union Catalogue**: A combined catalog listing the holdings of multiple libraries, enabling resource sharing and inter-library loans. INFLIBNET has facilitated the creation of union databases of resources available in academic libraries .
11. **MARC 21 (Machine-Readable Cataloging)** : A standard format for the representation and communication of bibliographic and related information in machine-readable form. SOUL 2.0 and other modern ILS are compliant with MARC 21 to facilitate data transfer and exchange .

3. Need for the Case Study

1. **Maharashtra's leadership role in Indian higher education**: As one of India's most economically and educationally advanced states, Maharashtra's experience with library automation offers valuable lessons for other states and for national policy.
2. **Diversity of institutions**: Maharashtra's academic landscape includes central universities (IIT Bombay), state universities (Mumbai, Pune, Nagpur, Shivaji, Amravati, etc.), grant-in-aid colleges, and unaided private colleges—providing a comprehensive picture of automation challenges across institutional types .
3. **Documentation of pioneering efforts**: Maharashtra institutions have been at the forefront of library automation in India. The first installation of SOUL at North Maharashtra University, Jalgaon; the comprehensive automation documented at Shivaji University, Kolhapur; and the KOHA adoption across MKSSS Pune colleges require systematic documentation .
4. **The urban-rural divide within a single state**: Maharashtra presents sharp contrasts between the well-resourced libraries of Mumbai, Pune, and Nagpur and the resource-constrained libraries in rural Marathwada and Vidarbha regions—enabling analysis of factors driving success .
5. **Open source vs. proprietary software adoption**: The state's experience with both SOUL (proprietary, developed by INFLIBNET) and KOHA (open source) provides valuable comparative insights for automation planning across India .

6. **RFID and smart library infrastructure**: Recent investments in RFID-based automation (e.g., Maharashtra National Law University, Aurangabad tender, May 2023) represent the next frontier of library technology .
7. **Policy implications for UGC and INFLIBNET**: Understanding the effectiveness of national initiatives (SOUL software, UGC-Infonet consortia, training programs) in the Maharashtra context informs future policy design .
8. **Professional development insights**: The automation journey highlights the critical importance of skilled manpower—a major challenge documented in the Shivaji University case study, which noted "weak IT base both in terms of skilled human resource and services" in rural, semi-urban environments .
9. **Foundation for future smart libraries**: The lessons from 2000–2023 provide essential guidance for the next phase of library transformation, including AI integration, cloud services, and advanced analytics.
10. **Comparative analysis framework**: This case study establishes a baseline for comparing Maharashtra's automation trajectory with other Indian states, enabling best-practice sharing and policy coordination.

4. Aims

The primary aims of this case study are:

1. To provide a comprehensive, longitudinal analysis of library automation in Maharashtra's academic libraries across the period 2000–2023, tracing the evolution from manual to automated to smart library systems.
2. To document and analyze the automation journeys of specific institutions—including Shivaji University, Kolhapur; MKSSS group libraries, Pune; Marathwada Shikshan Prasarak Mandal's colleges; Nagpur University; Amravati University; and others.
3. To examine the adoption patterns of library management software—from SOUL (proprietary) to KOHA (open source) and emerging RFID technologies.
4. To analyze the role of INFLIBNET, UGC-Infonet, and national consortia in catalyzing automation in Maharashtra.
5. To identify and analyze challenges—technical, human resource, financial, and infrastructure—that impeded or delayed automation across institutional types.
6. To identify success factors and best practices from pioneering institutions.
7. To conduct comparative analysis across institutional tiers (central universities, state universities, affiliated colleges) to understand differential adoption patterns.
8. To assess the current state of automation (as of 2023) and identify gaps requiring future attention.
9. To synthesize lessons learned for the benefit of library professionals, administrators, and policymakers.
10. To develop actionable recommendations for consolidating and advancing library automation in Maharashtra and similar contexts.

5. Objectives

1. **Objective 1 (Historical Periodization)** : To periodize the automation journey in Maharashtra's academic libraries across three phases:
    1. Phase 1 (2000–2008): Initial automation with SOUL and LibSys, retrospective conversion projects
    2. Phase 2 (2009–2015): Expansion of automation to affiliated colleges, open source adoption (KOHA), UGC-Infonet maturation
    3. Phase 3 (2016–2023): RFID adoption, cloud-based systems, smart libraries, post-COVID digital acceleration

2. **Objective 2 (INFLIBNET Role Analysis)** : To analyze the catalytic role of INFLIBNET in Maharashtra's automation through:
    1. SOUL software development and deployment (first installation at North Maharashtra University, Jalgaon)
    2. Retrospective conversion workshops and guidelines (May 2000 workshop)
    3. Training programs on bibliographic standards and data preparation
    4. Union catalog development and resource sharing facilitation
3. **Objective 3 (Institutional Case Study: Shivaji University, Kolhapur)** : To analyze the automation of Barr. Balasaheb Khardekar Library, Shivaji University, Kolhapur, documented in SRELS Journal of Information Management (2011), focusing on:
    1. Phase-wise automation implementation
    2. Retrospective conversion process
    3. Barcode ID and member ID generation
    4. Housekeeping operations
    5. Challenges in rural, semi-urban environment with weak IT infrastructure
4. **Objective 4 (Institutional Case Study: MKSSS Pune Libraries)** : To assess KOHA Open-LMS implementation across 13 higher educational institute libraries within Maharshi Karve Stree Shikshan Samstha (MKSSS), Pune (2022 study), evaluating:
    1. Customization options for KOHA
    2. Integration capabilities
    3. User experience and technical support
    4. Cost considerations and cost-effectiveness
    5. Usage patterns of different modules (Circulation, OPAC, etc.)
5. **Objective 5 (Regional Analysis: Marathwada Colleges)** : To analyze the status of library automation in Marathwada Shikshan Prasarak Mandal's college libraries in the Aurangabad region (2018 study), examining:
    1. Available library services and resources
    2. Status of library automation across 21 colleges (17 responses)
    3. Digital library infrastructure
    4. Means and ways for improvement
6. **Objective 6 (Consortia Access Analysis)** : To analyze the usage of UGC-Infonet Digital Library Consortium at Nagpur University and Amravati University (2017 study), examining:
    1. Access patterns and usage statistics
    2. Impact on faculty, research scholars, and post-graduate students
    3. Challenges in consortia usage
    4. Transformation of scholarly communication
7. **Objective 7 (RFID Technology Adoption)** : To examine the adoption of RFID technology for library automation in Maharashtra, including recent tenders (e.g., Maharashtra National Law University, Aurangabad, May 2023) .
8. **Objective 8 (Software Adoption Evolution)** : To trace the evolution of library management software adoption from proprietary systems (SOUL, LibSys) to open source systems (KOHA) and analyze drivers of this transition.
9. **Objective 9 (Comparative Institutional Analysis)** : To compare automation status, challenges, and success factors across institutional tiers:
    1. Central universities and elite institutions (IIT Bombay)
    2. State universities (Shivaji, Nagpur, Amravati, Pune, Mumbai)

3. Affiliated colleges (MKSSS Pune, Marathwada colleges)

10. **Objective 10 (SWOT Analysis)** : To conduct SWOT analysis of library automation in Maharashtra during 2000–2023.
11. **Objective 11 (Lesson Synthesis and Recommendations)** : To synthesize lessons from 2000–2023 and formulate actionable recommendations for future automation initiatives.
12. **Objective 12 (Future Directions)** : To identify emerging trends and future directions for library automation in Maharashtra beyond 2023.

6. Hypothesis

Primary Hypothesis (H1 – Evolutionary Progression) : *Library automation in Maharashtra's academic libraries evolved through three distinct phases during 2000–2023: Phase 1 (2000–2008) focused on basic automation using SOUL and LibSys with retrospective conversion; Phase 2 (2009–2015) witnessed expansion to affiliated colleges and adoption of open source systems (KOHA); Phase 3 (2016–2023) saw the emergence of RFID, cloud-based systems, and smart library technologies. This progression was driven by INFLIBNET initiatives, falling technology costs, and growing ICT literacy among library professionals.*

Secondary Hypothesis (H2 – Institutional Variation) : *Significant variation exists in automation across Maharashtra's academic libraries, forming a three-tier spectrum: Tier 1 (central universities and elite institutions) achieved comprehensive automation with advanced features (RFID, digital repositories, federated search); Tier 2 (state universities) achieved core automation (ILS, OPAC, consortia access) but with variable implementation depth; Tier 3 (affiliated colleges) demonstrate uneven automation, with some (e.g., MKSSS Pune) achieving full automation through open source systems, while others remain partially or un-automated due to resource constraints.*

Tertiary Hypothesis (H3 – SOUL as Entry Point) : *SOUL (Software for University Libraries) served as the primary entry point for library automation in Maharashtra's state universities, with the first installation at North Maharashtra University, Jalgaon marking a significant milestone. INFLIBNET's role in developing, distributing, and training on SOUL was catalytic for automation adoption .*

Quaternary Hypothesis (H4 – Open Source Advantage) : *The transition from proprietary systems (SOUL, LibSys) to open source systems (KOHA) during the 2010s was driven by cost considerations (zero licensing fees), flexibility (ability to customize), and active community support. Resource-constrained colleges in Maharashtra increasingly adopted KOHA, enabling automation that would otherwise be financially unviable .*

Quinary Hypothesis (H5 – Rural-Urban Divide) : *A significant automation divide exists between urban-based institutions (Mumbai, Pune, Nagpur) and rural/semi-urban institutions (Marathwada, Vidarbha, rural Western Maharashtra). The Shivaji University, Kolhapur case study explicitly notes challenges of "rural ambience" and "weak IT base both in terms of skilled human resource and services" . The Marathwada colleges study further confirms persistent infrastructure and skill gaps .*

Sixth Hypothesis (H6 – Consortia as Transformative) : *The UGC-Infonet Digital Library Consortium transformed scholarly information access in Maharashtra's universities, providing access to thousands of peer-reviewed journals to faculty and researchers who previously had limited access. The Nagpur and Amravati universities study confirms the positive impact on scholarly communication .*

7. Literature Search

7.1 Databases Accessed

1. SRELS Journal of Information Management (for Shivaji University case study)
2. College Libraries journal (for MKSSS KOHA study)
3. IP Indian Journal of Library Science and Information Technology (for Marathwada colleges study)
4. Zenodo (for UGC-Infonet Nagpur/Amravati study)

5. INFLIBNET E-Books platform (for INFLIBNET overview)
6. INFLIBNET IR (for retrospective conversion documentation)

7.2 Key Search Strings

1. "Shivaji University" AND "library automation" AND "Kolhapur"
2. "Maharashtra" AND "academic libraries" AND "automation"
3. "KOHA" AND "Pune" AND "library"
4. "Marathwada" AND "college libraries" AND "automation"
5. "SOUL software" AND "Maharashtra" AND "INFLIBNET"
6. "UGC-Infonet" AND "Nagpur University" OR "Amravati University"
7. "RFID" AND "Maharashtra" AND "university library"

7.3 Key References

Study/Source	Year	Focus	Key Findings/Relevance
Birje, S. R., Khamkar, R. D., Gurav, D. S., & Mahajan, S. D. "Library Automation: a Case Study of Barr. Balasaheb Khardekar Library, Shivaji University, Kolhapur" (SRELS Journal of Information and Knowledge)	2011	Phase-wise automation in rural university context	Details retro conversion, barcode ID generation, member ID generation, housekeeping operations; challenges of "rural ambience" and "weak IT base"
Moghe, G., Nagarkar, S., & Pradhan, A. "Assessment of KOHA Open-LMS at MKSSS Group Libraries: A Critical Study" (College Libraries)	2022	KOHA implementation across 13 Pune libraries	KOHA valued for cost-effectiveness, accessibility, cloud-based hosting, Union Catalogue; Circulation and OPAC modules most used
Pagore, R. B. "Marathwada Shikshan Prasarak Mandal's college library automation: A study" (IP Indian Journal of Library Science and Information Technology)	2018	Automation status in Marathwada region	Survey of 21 colleges (17 responses); examines library services, resources, automation status, digital infrastructure
Dalve, D. B. "USE OF UGC-INFONET CONSORTIUM IN RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY AND SANT GADGE BABA AMRAVATI UNIVERSITY" (Zenodo)	2017	Consortia usage in Vidarbha universities	Examines access patterns, usage by faculty and research scholars; impact on scholarly communication
Kruti T & Arora, Jagdish. "Library Networks in India: Case Study:	—	INFLIBNET overview and SOUL software	SOUL development history (SOUL 1.0 at CALIBER 2000; SOUL 2.0 January 2009);

Study/Source	Year	Focus	Key Findings/Relevance
INFLIBNET" (INFLIBNET e-Adhyayan)			standards compliance (MARC 21, Unicode, SIP/N-SIP, FRBR)
INFLIBNET Newsletter (2000)	2000	SOUL first installation	First installation at North Maharashtra University, Jalgaon; CALIBER 2000; Demo of SOUL beta version

7.4 Inclusion Criteria

1. Case studies and survey-based research on Maharashtra academic libraries
2. Peer-reviewed journal articles and conference proceedings (2000–2023)
3. Studies documenting automation status, challenges, and outcomes
4. English-language sources
5. Both proprietary and open source software studies included

7.5 Exclusion Criteria

1. Studies focused exclusively on K-12 school libraries
2. Non-Maharashtra institutional studies (except for contextual comparison)
3. Purely theoretical papers without empirical data
4. Vendor marketing materials without independent analysis

8. Research Methodology

8.1 Overview: Multi-Case, Mixed-Methods Approach

This study employs a qualitative, multi-case methodology integrating case study analysis, survey synthesis, and policy analysis. The methodology triangulates evidence from multiple published studies to provide a comprehensive picture of library automation in Maharashtra (2000–2023).

8.2 Phase 1: Institutional Case Study Analysis

Case Study 1: Shivaji University, Kolhapur

1. Source: Birje et al. (2011), SRELS Journal of Information and Knowledge
2. Focus: Phase-wise automation implementation, retro conversion, barcode generation
3. Key themes: Rural context challenges, weak IT infrastructure, skilled human resource gaps

Case Study 2: MKSSS Group Libraries, Pune

1. Source: Moghe et al. (2022), College Libraries
2. Focus: KOHA Open-LMS assessment across 13 libraries
3. Key themes: Open source adoption, cost-effectiveness, cloud hosting, Union Catalogue

Case Study 3: Marathwada Colleges

1. Source: Pagore (2018), IP Indian Journal of Library Science
2. Focus: Automation status across 21 colleges (17 responses)
3. Key themes: Regional disparities, infrastructure gaps, digital library development

Case Study 4: Nagpur and Amravati Universities

1. Source: Dalve (2017), Zenodo
2. Focus: UGC-Infonet consortia usage
3. Key themes: E-journal access, scholarly communication transformation, user patterns

8.3 Phase 2: Policy and Infrastructure Analysis

Analysis of:

1. INFLIBNET Centre role and initiatives
2. SOUL software development and deployment
3. UGC-Infonet consortium framework
4. RFID tender documentation (Maharashtra National Law University, Aurangabad, 2023)

8.4 Phase 3: Technology Adoption Evolution Tracking

Tracking adoption of:

1. SOUL (proprietary, INFLIBNET-developed)
2. LibSys (proprietary)
3. KOHA (open source)
4. RFID technology
5. Cloud-based and SaaS models

8.5 Phase 4: Comparative Institutional Analysis

Comparison across:

Tier 1: Central/elite institutions (IIT Bombay, NIT Surathkal)

Tier 2: State universities (Shivaji, Nagpur, Amravati, Pune, Mumbai)

Tier 3: Affiliated colleges (MKSSS Pune, Marathwada colleges)

8.6 Phase 5: SWOT Analysis

SWOT analysis across dimensions:

1. Strengths: Policy support, INFLIBNET infrastructure, SOUL software, consortia access
2. Weaknesses: Infrastructure gaps, skills shortages, financial constraints, rural-urban divide
3. Opportunities: Open source software, cloud computing, RFID expansion, digital repositories
4. Threats: Technological obsolescence, vendor dependency, sustainability concerns, skill obsolescence

8.7 Phase 6: Temporal Periodization

Periodization into three phases:

Phase 1 (2000–2008): Initial automation (SOUL, LibSys, retrocon)

Phase 2 (2009–2015): Expansion (KOHA, consortia maturity)

Phase 3 (2016–2023): Smart libraries (RFID, cloud, post-COVID acceleration)

9. Strong Points (Advantages of This Study)

1. **Comprehensive state-level focus**: First study specifically focused on library automation across Maharashtra's academic libraries over a 23-year period.
2. **Multi-case triangulation**: Integration of evidence from Shivaji University, MKSSS Pune, Marathwada colleges, and Nagpur/Amravati universities provides methodological triangulation.
3. **Longitudinal perspective**: Coverage from 2000 (SOUL first installation) to 2023 (RFID tenders) captures the complete automation evolution.
4. **Diverse institutional coverage**: Includes central universities (IIT Bombay), state universities (Shivaji, Nagpur, Amravati), and affiliated colleges (MKSSS, Marathwada)—providing comprehensive representation.
5. **Both proprietary and open source analysis**: Examines both SOUL (proprietary, INFLIBNET-developed) and KOHA (open source) adoption patterns.
6. **Rural-urban divide analysis**: Explicit attention to challenges in rural and semi-urban contexts (Shivaji University, Marathwada colleges).
7. **Policy-institutional linkage**: Analyzes the catalytic role of INFLIBNET and national consortia in enabling local automation.

8. **Recent data inclusion**: Includes 2022 KOHA study and 2023 RFID tender, ensuring contemporary relevance.
9. **Peer-reviewed sources**: All major case studies are from peer-reviewed journals, ensuring academic rigor.
10. **Actionable insights**: Findings directly applicable to automation planning for similar institutions.

10. Weak Points (Limitations)

1. **Geographic gaps within Maharashtra**: Underrepresentation of certain regions—Vidarbha (beyond Nagpur/Amravati), Western Maharashtra (beyond Pune/Kolhapur), Konkan, and Khandesh.
2. **Limited central university analysis**: IIT Bombay and NIT Surathkal are mentioned but lack detailed case study documentation comparable to state universities.
3. **Variation in study methodologies**: The included studies use different survey instruments and data collection methods, complicating direct comparison.
4. **Potential publication bias**: Published studies may over-represent successful implementations; failed or partial automation projects may be under-documented.
5. **Temporal data asymmetry**: More documentation available for the 2010s and 2020s than for the early 2000s period.
6. **Reliance on secondary sources**: This study synthesizes published research rather than collecting primary data, inheriting limitations of the source studies.
7. **Affiliated college coverage gaps**: Representation of grant-in-aid and unaided private colleges is limited beyond the MKSSS and Marathwada studies.
8. **Non-English sources exclusion**: Some relevant Marathi-language documentation may have been excluded due to language constraints.
9. **COVID-19 impact variability**: Post-2020 period includes pandemic-related disruptions and accelerated digital adoption that may not be fully captured.
10. **Emerging AI integration**: Automation beyond 2023 (AI, ML, advanced analytics) is beyond the scope of this historical study.

11. Current Trends (2018–2023)

1. **Open source dominance in resource-constrained institutions**: The MKSSS Pune study (2022) confirms that KOHA is "highly valued for its cost-effectiveness, accessibility, and cloud-based hosting" .
2. **RFID adoption acceleration**: Recent tenders (Maharashtra National Law University, Aurangabad, May 2023) indicate growing investment in RFID-based automation .
3. **Cloud-based library management**: Shift from on-premise to cloud hosting, as noted in the MKSSS study ("cloud-based hosting" among KOHA's valued features) .
4. **Union Catalogue development**: KOHA's Union Catalogue feature enables resource sharing across multiple libraries within a consortium .
5. **Continued consortia reliance**: UGC-Infonet remains the primary source of e-journal access for state universities .
6. **Post-COVID digital acceleration**: The pandemic accelerated digital library services, remote access, and online resources.
7. **Integration with institutional repositories**: Growing emphasis on digital repositories for theses, dissertations, and institutional scholarship.
8. **Skill development focus**: Recognition of the need for ongoing training for library professionals (noted as a challenge in Shivaji University case study) .

12. History

12.1 Phase 1: Initial Automation (2000–2008)

Year	Event	Significance for Maharashtra
1996	INFLIBNET Centre established as UGC Inter-University Centre	Foundation for national library networking
1998–1999	INFLIBNET Centre website, work on SOUL begins	Development of indigenous ILS
2000	SOUL 1.0 released during CALIBER 2000	Indigenous ILS available for Indian universities
2000	First installation of SOUL at North Maharashtra University, Jalgaon	Major milestone for Maharashtra
2000	INFLIBNET retrocon workshop (May 15-25, 2000)	Training for retrospective conversion
2003	UGC-Infonet Digital Library Consortium launched	Access to e-journals for subscribing universities
2005	National Knowledge Commission recommendations	Policy push for library modernization
2008	National Mission on Education through ICT (NMEICT)	Technology mandate for higher education

12.2 Phase 2: Expansion and Open Source (2009–2015)

Year	Event	Significance
2009	SOUL 2.0 released (January)	MARC 21, Unicode, RFID compliance
2011	Shivaji University, Kolhapur automation case study published	Documents rural university challenges
2012	UGC-Infonet Phase II	Enhanced digital resource access
2013–2015	KOHA adoption gains momentum in Maharashtra colleges	Open source alternative to proprietary systems
2015	UGC regulations for library automation	Mandates for automation and digitization

12.3 Phase 3: Smart Libraries and RFID (2016–2023)

Year	Event	Significance
2017	Nagpur/Amravati UGC-Infonet study published	Consortia usage documentation
2018	Marathwada colleges automation study published	Regional analysis of automation status
2019–2021	COVID-19 pandemic accelerates digital services	Remote access, online resources
2023	RFID tender at Maharashtra National Law University, Aurangabad	Continued investment in smart library tech
2023	MKSSS Pune KOHA assessment published	Open source adoption success

13. Discussion

13.1 The Catalytic Role of INFLIBNET and SOUL

INFLIBNET's role as the catalyst for library automation in Maharashtra cannot be overstated. The establishment of the INFLIBNET Centre in 1996 as an Inter-University Centre of UGC provided the institutional framework for nationwide library networking . For Maharashtra, this translated into:

1. **SOUL software availability**: The indigenous development of SOUL (Software for University Libraries) provided a standardized, affordable ILS option for state universities. SOUL 1.0 released during CALIBER 2000, with the first installation at North Maharashtra University, Jalgaon .
2. **Technical standards**: SOUL 2.0 (January 2009) compliance with MARC 21, Unicode, SIP/N-SIP for RFID, and FRBR ensured interoperability and future-readiness .
3. **Training infrastructure**: INFLIBNET's workshop on "Bibliographic Standards and Formats" (May 15-25, 2000) provided crucial training for librarians from five major libraries on AACR2, LC subject headings, data input sheet preparation, and SOUL operation .

13.2 The Shivaji University, Kolhapur Model: Automation in Rural Context

The Barr. Balasaheb Khardekar Library at Shivaji University, Kolhapur, provides the most detailed documentation of automation implementation in a rural, semi-urban environment .

Key challenges identified:

1. "Rural ambience in the backdrop of the rural ambience and with the weak IT base both in terms of skilled human resource and services"
2. Need for phase-wise implementation given resource constraints
3. Retrospective conversion as the most resource-intensive phase

Phase-wise implementation:

1. Retrospective conversion of legacy collections
2. Barcode ID generation for library materials
3. Member ID generation for patrons
4. Housekeeping operations (circulation, cataloging, acquisition, serials control)

Lessons learned:

1. Automation in rural contexts requires significantly more investment in training and infrastructure than urban institutions

2. Phased implementation, starting with high-priority modules (circulation, cataloging), is essential for success
3. Ongoing technical support and maintenance are critical

13.3 Open Source Revolution: KOHA at MKSSS Pune

The Maharshi Karve Stree Shikshan Samstha (MKSSS) group libraries in Pune represent a successful open source automation model .

KOHA implementation across 13 libraries:

1. Comprehensive assessment using questionnaires, focus group meetings, and empirical data collection
2. Evaluation of customization options, integration capabilities, user experience, technical support, and cost considerations

Key findings:

1. KOHA "highly valued for its cost-effectiveness, accessibility, and cloud-based hosting"
2. Union Catalogue feature enables resource sharing across the 13 libraries
3. Circulation and OPAC modules were the most frequently used
4. Zero licensing cost makes KOHA attractive for resource-constrained institutions

Implications:

1. Open source systems are viable alternatives to proprietary systems for college libraries
2. Cloud-based hosting reduces local infrastructure requirements
3. Union Catalogue functionality enables consortia-style resource sharing without vendor lock-in

13.4 Regional Disparities: Marathwada Colleges

The Marathwada Shikshan Prasarak Mandal's college libraries study (2018) reveals significant regional disparities within Maharashtra .

Methodology: Questionnaire survey of 21 colleges, 17 responses

Findings:

1. Significant variation in automation levels across colleges
2. Digital library infrastructure gaps persist
3. Need for improvement in library services, resources, and infrastructure

Explanatory factors:

1. Geographic remoteness from urban centers (Mumbai, Pune)
2. Limited financial resources compared to urban institutions
3. Shortage of trained library professionals with ICT skills

13.5 Consortia-Based E-Resource Access: Nagpur and Amravati Universities

The UGC-Infonet consortium study at Rashtrasant Tukdoji Maharaj Nagpur University and Sant Gadge Baba Amravati University (2017) documents the transformation in scholarly information access .

Key observations:

1. "Electronic journals bring new challenges for the library and information professionals to give full text access of scholarly publications in electronic version to its end users"
2. UGC-Infonet provides "access to large number of scholarly journals"
3. Assumption: "broader, faster, better access makes more use of information"

Impact:

1. Faculty members, research scholars, and post-graduate students gained access to thousands of peer-reviewed journals
2. Transformed scholarly communication and research capacity
3. Reduced dependency on physical journal collections and inter-library loans

13.6 Technology Evolution: From SOUL to KOHA to RFID

Maharashtra's automation journey reflects broader technology trends in Indian libraries:

SOUL Era (2000–2010) :

1. INFLIBNET-developed proprietary software
2. First installation at North Maharashtra University, Jalgaon
3. Standardized approach across state universities
4. Compliance with international standards (MARC 21, Unicode)

KOHA Era (2010–present) :

1. Open source, zero licensing cost
2. Cloud-based hosting options
3. Active community support and regular updates
4. Union Catalogue feature for consortia

RFID Era (late 2010s–present) :

1. Self-checkout kiosks
2. Automated inventory management
3. Security detection
4. Recent tender at Maharashtra National Law University, Aurangabad (May 2023) indicates continued investment

13.7 The Rural-Urban Divide

A persistent theme across the case studies is the automation divide between urban and rural/semi-urban institutions:

Dimension	Urban (Mumbai, Pune, Nagpur)	Rural/Semi-Urban (Kolhapur, Marathwada)
IT infrastructure	Robust	Weak
Skilled manpower	Available	Limited
Financial resources	Higher	Constrained
Automation status	Advanced	Partial/incomplete
Consortia access	Yes (UGC-Infonet)	Yes (through affiliation)

The Shivaji University case study explicitly notes these challenges: "weak IT base both in terms of skilled human resource and services" in the "rural ambience" . The Marathwada colleges study confirms persistent gaps .

13.8 Success Factors and Challenges

Success factors:

1. INFLIBNET policy support and SOUL software
2. UGC-Infonet consortia access
3. Open source adoption (KOHA) reducing costs
4. Leadership commitment at institutional level
5. Phased implementation strategies

Challenges:

1. Retrospective conversion resource intensity
2. Skilled manpower shortages
3. Infrastructure gaps in rural areas

4. Financial constraints for smaller colleges
5. Ongoing technical support and maintenance
6. Keeping pace with technological change

14. Results (Synthesized Findings)

14.1 Phase-Wise Automation Summary

Phase	Period	Key Technologies	Maharashtra Milestones	Adoption Scale
Phase 1	2000–2008	SOUL 1.0, LibSys, barcode, retrocon	First SOUL installation at NMU Jalgaon ; INFLIBNET retrocon workshop	State universities (partial)
Phase 2	2009–2015	SOUL 2.0, KOHA, DSpace, UGC-Infonet	SOUL 2.0 release (Jan 2009) ; Shivaji University automation	State universities (comprehensive); some colleges
Phase 3	2016–2023	KOHA (cloud), RFID, discovery platforms	MKSSS KOHA implementation ; Marathwada survey ; MNLU RFID tender (2023)	Mixed: central/state advanced; colleges variable

14.2 Institutional Tier Comparison

Dimension	Tier 1 (Central/Elite: IIT Bombay)	Tier 2 (State Universities: Shivaji, Nagpur, Amravati)	Tier 3 (Affiliated Colleges: MKSSS, Marathwada)
ILS/LMS	Advanced (proprietary + open source)	SOUL (majority); some KOHA transition	KOHA (dominant); some SOUL
Automation status	Comprehensive	Core modules operational	Variable: MKSSS comprehensive ; Marathwada partial
Retrocon completion	Completed	Completed (major collections)	Partial/in progress
OPAC availability	Yes (advanced)	Yes (basic)	MKSSS: Yes; others: Limited
RFID adoption	Yes	Limited	Very limited (MNLU tender 2023 emerging)

Dimension	Tier 1 (Central/Elite: IIT Bombay)	Tier 2 (State Universities: Shivaji, Nagpur, Amravati)	Tier 3 (Affiliated Colleges: MKSSS, Marathwada)
UGC-Infonet access	Yes (direct)	Yes	Through parent university
Digital repository	Yes (DSpace, EPrints)	Emerging	Limited

14.3 Software Adoption Evolution

Period	Dominant Software	Adoption Drivers	Key Maharashtra Institutions
2000–2010	SOUL 1.0, LibSys	INFLIBNET support, standardization, training	NMU Jalgaon ; Shivaji University
2010–2020	SOUL 2.0, KOHA (emerging)	SOUL upgrade to standards ; KOHA cost benefits	Multiple state universities; MKSSS transition
2020–2023	KOHA (dominant in colleges), SOUL (universities)	Zero licensing cost, cloud hosting, Union Catalogue	MKSSS (13 libraries) ; emerging college adoptions

14.4 Consortia Usage Summary (Nagpur & Amravati Universities)

Parameter	Finding
Consortium	UGC-Infonet Digital Library Consortium
User groups	Faculty members, research scholars, PG students
Primary benefit	Access to large number of scholarly journals
Transformation	Shift from print to electronic access
Challenge	Need for librarian training on electronic resource management

14.5 SWOT Analysis Summary

Strengths	Weaknesses
INFLIBNET policy support and SOUL software	Infrastructure gaps in rural areas
UGC-Infonet consortia access	Skilled manpower shortages
Indigenous software development (SOUL)	Financial constraints for smaller colleges
Open source alternatives (KOHA)	Retrospective conversion resource intensity
Growing ICT literacy among librarians	Variation in automation across institutions

Opportunities	Threats
RFID and smart library expansion	Technological obsolescence
Cloud-based hosting reducing infrastructure costs	Vendor dependency for proprietary systems
Union Catalogue for consortia resource sharing	Sustainability of open source support
Integration with institutional repositories	Skill obsolescence among librarians
Post-COVID digital acceleration	Competing institutional priorities

14.6 Key Milestones Timeline (Maharashtra)

Year	Milestone	Institution/Location
2000	First SOUL installation	North Maharashtra University, Jalgaon
2000	INFLIBNET retrocon workshop	INFLIBNET Centre
2009	SOUL 2.0 release	National (including Maharashtra)
2011	Automation case study published	Shivaji University, Kolhapur
2017	UGC-Infonet usage study	Nagpur and Amravati Universities
2018	Marathwada automation survey	Marathwada region colleges

Year	Milestone	Institution/Location
2023	RFID tender	Maharashtra National Law University, Aurangabad
2023	KOHA assessment published	MKSSS, Pune (13 libraries)

15. Conclusion

The period 2000–2023 witnessed a remarkable transformation in the automation of academic libraries across Maharashtra. From the manual card-catalog era of the late 1990s to the RFID-enabled, cloud-hosted smart libraries of 2023, the state's university and college libraries have undergone a fundamental technological evolution.

Key conclusions:

1. **INFLIBNET as primary catalyst**: The INFLIBNET Centre, through its development of SOUL software, training programs, and policy support, served as the primary catalyst for library automation in Maharashtra. The first installation of SOUL at North Maharashtra University, Jalgaon, marked the beginning of this journey .
2. **Three-phase evolution**: Automation progressed through three phases: Phase 1 (2000–2008) initial automation with SOUL/LibSys and retrospective conversion; Phase 2 (2009–2015) expansion and open source adoption; Phase 3 (2016–2023) smart library technologies (RFID, cloud) .
3. **Institutional variation**: Significant disparities persist across institutional tiers. Elite institutions (IIT Bombay) achieved comprehensive automation; state universities (Shivaji, Nagpur, Amravati) achieved core automation with variable depth; affiliated colleges demonstrate uneven automation—some (MKSSS Pune) achieving full automation through open source, others remaining partially automated .
4. **Open source revolution**: KOHA's adoption, particularly among college libraries, democratized automation by eliminating licensing costs. The MKSSS Pune case study confirms KOHA's cost-effectiveness, cloud hosting benefits, and Union Catalogue functionality .
5. **Rural-urban divide**: Automation success correlates strongly with geographic location. Rural and semi-urban institutions (Shivaji University, Marathwada colleges) face significantly greater challenges: weak IT infrastructure, skilled manpower shortages, and financial constraints .
6. **Retrospective conversion as critical challenge**: Converting legacy card catalog records into MARC format emerged as the most resource-intensive automation phase, requiring significant investment in skilled manpower and quality control .
7. **Consortia as transformative**: The UGC-Infonet Digital Library Consortium transformed scholarly information access for faculty and researchers in state universities (Nagpur, Amravati), providing access to thousands of peer-reviewed journals .
8. **RFID as emerging trend**: Recent investments (MNLU Aurangabad tender, May 2023) indicate continued movement toward RFID-based smart libraries in Maharashtra .

Final assessment:

Maharashtra has emerged as a leader in library automation among Indian states, with pioneering institutions (North Maharashtra University Jalgaon, Shivaji University Kolhapur, MKSSS Pune, IIT Bombay, and others) setting benchmarks for the nation. However, the automation journey is far from complete. The digital divide between well-resourced and under-resourced institutions, between urban and rural locations, and between

universities and colleges remains significant. Open source systems (KOHA) offer a promising pathway for resource-constrained institutions, but require ongoing technical support and training that may not be locally available.

The lessons from Maharashtra's automation experience—both successes and challenges—provide essential guidance for library automation planning across India. As the state moves toward AI-integrated, smart library systems, the foundational work of 2000–2023 will determine who benefits and who is left behind.

16. Suggestions and Recommendations

16.1 For Library Professionals and Administrators

1. **Phase-wise implementation with prioritization**: Following Shivaji University's model, implement automation in phases, starting with high-priority modules (circulation, cataloging) .
2. **Invest in retrocon quality control**: Allocate adequate resources for retrospective conversion, including multiple quality checks and skilled manpower .
3. **Consider open source options**: For resource-constrained institutions, evaluate KOHA's cost-effectiveness, customization capabilities, and cloud hosting options .
4. **Leverage Union Catalogue functionality**: Use KOHA's Union Catalogue feature for resource sharing across multiple libraries within a consortium .
5. **Pursue cloud-based hosting**: Reduce local infrastructure requirements by adopting cloud-based library management systems .
6. **Engage with consortia**: Ensure UGC-Infonet and other consortia access is fully utilized by faculty and research scholars .

16.2 For INFLIBNET and Policymakers

1. **Continue SOUL support and updates**: Maintain and update SOUL software to remain compatible with emerging technologies and standards .
2. **Strengthen training programs**: Expand training on bibliographic standards, data conversion, and ILS operation, particularly targeting rural institutions .
3. **Support open source adoption**: Provide technical support and training for KOHA adoption, especially for colleges unable to afford proprietary systems.
4. **Bridge the rural-urban divide**: Targeted funding and technical assistance for rural and semi-urban institutions, addressing infrastructure and skill gaps.
5. **RFID standards and guidelines**: Develop standardized guidelines for RFID adoption in academic libraries, ensuring interoperability .
6. **Facilitate Union Catalogue expansion**: Support the development of regional and state-level union catalogs for resource sharing.

16.3 For UGC and Government

1. **Mandate automation benchmarks**: Establish minimum automation standards for university and college libraries, with compliance deadlines.
2. **Provide automation grants**: Allocate dedicated funds for library automation, with higher allocations for rural and resource-constrained institutions.
3. **Strengthen consortia access**: Expand UGC-Infonet coverage to include more colleges and additional publisher packages .
4. **Support digital repository development**: Fund institutional repository initiatives for universities and colleges.
5. **Incentivize open source adoption**: Provide technical and financial support for KOHA implementation, including migration from proprietary systems.

16.4 For LIS Educators

1. **Update curriculum**: Include practical training on ILS (both SOUL and KOHA), RFID systems, and digital repository platforms.
2. **Emphasize retrocon skills**: Train students in MARC standards, data conversion, and quality control .
3. **Offer continuing education**: Provide short-term certificate programs for practicing librarians on emerging automation technologies.
4. **Collaborate with INFLIBNET**: Partner with INFLIBNET for training programs and curriculum development .

17. Future Scope

1. **AI integration in Maharashtra libraries**: Beyond 2023, the integration of artificial intelligence (AI) for intelligent discovery, chatbots, automated metadata generation, and predictive analytics for collection management represents the next frontier.
2. **RFID expansion and smart libraries**: The MNLU Aurangabad RFID tender (2023) indicates growing adoption; future research should track RFID implementation outcomes across more Maharashtra institutions.
3. **Post-COVID digital transformation**: The pandemic accelerated digital library services; longitudinal studies on post-COVID automation trajectories are needed.
4. **Comparative studies with other states**: Compare Maharashtra's automation trajectory with Gujarat, Tamil Nadu, Karnataka, and other states to identify best practices.
5. **Impact assessment of consortia access**: Quantitative research on the impact of UGC-Infonet on research output and scholarly communication in Maharashtra universities.
6. **Evaluation of open source sustainability**: Long-term studies on the sustainability of KOHA implementations, including community support and maintenance .
7. **Digital repository development**: Research on the adoption of DSpace, EPrints, and other repository platforms for institutional scholarship preservation.
8. **User satisfaction studies**: Research on user (student and faculty) satisfaction with automated library services across institutional types.
9. **Technical support models**: Investigation of effective technical support models for rural and resource-constrained institutions.
10. **Cloud migration patterns**: Study of the transition from on-premise to cloud-based library management systems in Maharashtra institutions .

18. References

[1] Tendersniper. (2023). Supply, Installation and Commissioning of The project titled Library Automation using RFID Technology at Maharashtra National Law University, Aurangabad. Tender ID: 73599293. Published 20 May 2023.

[2] Vengan, R., & Ganesan, S. (2001). DIGITISATION OF RESOURCES AT MADRAS UNIVERSITY LIBRARY (MUL) USING THE "SOUL". INFLIBNET Centre.

[3] Birje, S. R., Khamkar, R. D., Gurav, D. S., & Mahajan, S. D. (2011). Library Automation: a Case Study of Barr. Balasaheb Khardekar Library, Shivaji University, Kolhapur. *Journal of Information and Knowledge*, 48(2), 131–145. https://doi.org/10.17821/srels/2011/v48i2/43946

[4] INFLIBNET. (2000). CALIBER 2000 and SOUL release. INFLIBNET Newsletter.

[5] Dalve, D. B. (2017). USE OF UGC-INFONET CONSORTIUM IN RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY AND SANT GADGE BABA AMRAVATI UNIVERSITY. Zenodo. https://zenodo.org/records/6915713

[6] Moghe, G., Nagarkar, S., & Pradhan, A. (2022). Assessment of KOHA Open-LMS at MKSSS Group Libraries: A Critical Study. *College Libraries*, 39(4), 53–61. http://collegelibraries.in/index.php/CL/article/view/180
[7] Pagore, R. B. (2018). Marathwada Shikshan Prasarak Mandal's college library automation: A study. *IP Indian Journal of Library Science and Information Technology*, 3(1), 56-60.
[8] Kruti T, & Arora, Jagdish. (n.d.). Library Networks in India: Case Study: INFLIBNET. INFLIBNET e-Adhyayan. https://ebooks.inflibnet.ac.in/lisp5/chapter/library-networks-in-india-case-study-inflibnet/
[9] Chandra, P., & Ramesh, D. B. (2009). Library automation in Indian universities: Issues and challenges. *DESIDOC Journal of Library & Information Technology*, 29(2), 45-51.
[10] Harinarayana, N. S., & Raju, N. V. (Eds.). (2015). *Library Automation and Networking*. Concept Publishing.
[11] INFLIBNET Centre. (2000-2023). Annual Reports. INFLIBNET, Ahmedabad.
[12] Kaul, H. K. (2001). *Library Automation and Networking*. DELNET.
[13] Kumar, S. (2015). Koha in Indian libraries: A study of adoption and implementation. *International Journal of Library and Information Science*, 7(6), 112-120.
[14] Murthy, T. A. V., Cholin, V. S., & Rajyalakshmi, D. (2006). UGC-Infonet digital library consortium: An overview. *Annals of Library and Information Studies*, 53(3), 121-130.
[15] Patil, S. K., & Kumbar, B. D. (2013). Library automation in Maharashtra: A study. *SRELS Journal of Information Management*, 50(4), 521-528.
[16] Sahu, N. K. (2019). Recommender systems in digital libraries: A study of Indian institutional repositories. *Library Philosophy and Practice*, 2019.
[17] Singh, M. (2016). DSpace implementation in Indian academic libraries: A study. *DESIDOC Journal of Library & Information Technology*, 36(5), 275-282.