ASSESSING RESEARCH SUPPORT SERVICES IN SELECTED INDIAN HIGHER EDUCATION INSTITUTIONS: A COMPARATIVE STUDY OF USER SATISFACTION

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ABSTRACT

This comparative empirical study assesses research support services (RSS) and user satisfaction at the Indian Institute of Management Udaipur (IIMU) and the Motilal Nehru National Institute of Technology Prayagraj (MNNIT). The study utilizes a framework derived from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) to examine infrastructure, service delivery, and ICT training over a three-year period. Surveys of 100 users from each institution, librarian questionnaires, and institutional technical reports were used to collect the data. The study shows that libraries are strong in plagiarism detection services but do not utilize advanced tools such as bibliometrics and research data management (RDM) to their full potential.

IIMU has invested substantially in paid databases and licensed research tools, while MNNIT has larger physical collections and more computers but comparatively fewer licensed electronic resources. User satisfaction, particularly among postgraduate students, is significantly affected by the effectiveness of training programmes and the robustness of ICT and economic/payment infrastructure.

The findings indicate that libraries must transition from passive resource providers to proactive research collaborators. The study highlights strategic policy implications for the Ministry of Education (India) alongside institutional improvements. It proposes the establishment of a national "AI-Research Support Consortium" to enhance accessibility to costly licensed tools and recommends the formal inclusion of AI literacy within the National Higher Education Qualifications Framework (NHEQF). To boost global research productivity and academic satisfaction in Indian higher education, there is a need to strengthen economic infrastructure, leverage librarians' expertise, and standardise evaluation of research support services across institutions.

Keywords: Research support services; User satisfaction; Academic libraries; ICT infrastructure; TAM; UTAUT; Artificial intelligence

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1. INTRODUCTION

Indian higher education institutions (HEIs) are rapidly adopting digital technologies due to intensified research requirements, national initiatives to strengthen digital infrastructure, and the emergence of AI-powered tools.

In this context, academic libraries are shifting from document provision to complex research support services that span discovery, data, impact, and publishing workflows.

Institutes of National Importance, such as Indian Institutes of Management (IIMs) and National Institutes of Technology (NITs), serve as crucial testbeds as their libraries support intensive research and innovation in management and STEM fields.

Recent evidence indicates that Indian academic libraries are still in the early stages of implementing comprehensive research support services (RSS), despite their strategic importance.

This is evident in uneven coverage of data management, bibliometrics, open science, and AI-enabled services. TAM and UTAUT have been widely applied to digital and mobile library services and consistently show that perceived usefulness, ease of use, and facilitating conditions are key determinants of adoption and satisfaction.

However, there is limited understanding of how these constructs operate in the specific context of research support services in Indian HEIs, particularly when AI tools and economic/payment infrastructures add further complexity.

This study addresses this gap by comparing research support services and user satisfaction at IIM Udaipur (IIMU) and Motilal Nehru National Institute of

Technology Prayagraj (MNNIT). IIMU is a relatively young, research-oriented management institution with a predominantly digital, database-driven library. MNNIT is an older engineering institution with a large print collection, a campus-wide ICT backbone, and substantial research and development activity. By comparing these institutions, the study examines how disciplinary focus, funding patterns, and ICT configurations shape research support portfolios and user experiences.

The study is guided by four broad questions:

- To map the range and intensity of research support services and ICT infrastructure in both libraries.
- To assess user awareness, usage, and satisfaction with these services.
- To analyse the role of training and facilitating conditions, including economic/payment infrastructure and AI availability, in shaping adoption.
- To extend TAM/UTAUT to model these relationships in a research support context.

The results are intended to inform policy-level decisions in Indian higher education and support academic libraries seeking to realign their services more closely with research workflows.

2. LITERATURE REVIEW

Cao (2026), Haq and Jan (2025) and Riady et al. (2025) collectively argue that research support services (RSS) are an interconnected socio-technical framework where the interaction of user acceptance, system quality and perceived usefulness together determine ongoing usage and benefits achieved. Cao (2026) indicates that the intention to continue using self-service systems is affected by a number of factors including technology design, service quality and user motivation. Riady et al. (2025) meanwhile investigate similar mechanisms within the integrated TAM and IS Success frameworks to connect digital library usage to satisfaction and net benefits. Haq and Jan (2025) present a systematic review that summarizes the roles and gaps of RSS, arguing that mature services must incorporate training, tools and liaison roles to produce measurable research outcomes. Recent Indian studies, on this basis, chart local practice and readiness. Singh, Raj and Madalli (2024) paint a picture of varied availability and uneven uptake of RSS across Indian academic libraries, attributing shortfalls to staffing, skills and coordination. Duragannavar et al. (2023) and Duragannavar and colleagues' NEP-focused work (2023) highlight policy-driven imperatives for knowledge management that push libraries toward more proactive research engagement. The discussion expands to address literature on AI and automation (Kisilowska-Szurmińska, 2025; Patil, 2024; Bairagi & Lihitkar, 2025; Jha, 2023; Choudhari, 2023), framing artificial intelligence as both an enabler of personalized discovery, metadata enrichment, and automation of research workflows and a domain requiring new skills and ethical oversight. Kisilowska-Szurmińska (2025) and Patil (2024) caution that AI adoption alters professional roles and necessitates critical governance, while Bairagi and Lihitkar (2025) and Jha (2023) articulate practical potentials and challenges of AI deployment in Indian engineering and academic contexts. The trajectory from early data services to more integrated, maturity-focused models is established in foundational RDM and infrastructure scholarship (Cox et al., 2017; Tenopir et al., 2017; Brown et al., 2018; Pinfield et al., 2014) where core infrastructure, training, and liaison expertise underpin reliable RSS. These studies collectively show how service evolution depends on institutional drivers, researcher demand, and cross-functional collaboration. Complementary, practice-oriented Indian studies (Anilkumar, 2018; Tripathi et al., 2017; Matonkar & Dhuri, 2021) document user behaviors, data management awareness, and use patterns that influence RSS design. Library resource use and satisfaction evaluations (Samant & Gadhvi, 2025; Mohindra & Kumar, 2015; Krishna & Singh, 2015) highlight ongoing gaps between existing services and researcher expectations. The methodological development of the corpus moves from descriptive case studies and surveys to mixed-method approaches that integrate behavioral models (TAM/IS Success) and service maturity perspectives. This shift implies that future research support services (RSS) research should be directed to longitudinal studies of researcher outcomes, the development of staff capabilities, and the governance of emerging AI tools. Taken together, these research streams suggest that effective RSS are not merely assemblages of tools but instead are dynamic, policy-sensitive ecosystems. Such ecosystems require aligned infrastructure, trained staff and technology uptake under ethical guidance to translate investments in libraries into measurable research outcomes (Brown et al., 2018; Cox et al., 2017; Kisilowska-Szurmińska, 2025).

2.1 Research Support Services in Academic Libraries

Research support services now encompass research guides, consultative support, impact measurement, recommendation of research tools, research data management (RDM), scholarly communication, and curation of research outputs. Corrall et al. (2012) note a shift in academic libraries towards research-focused service models. Systematic reviews report growing attention to citation management, data curation, bibliometric analysis, and open access publishing support, while highlighting persistent constraints related to staffing, technology, and skills. Studies emphasise the centrality of ICT infrastructure in enabling use of these services, with institutional repositories and research analytics tools enhancing research

visibility. Tenopir et al. (2011) identify research data management as an increasingly important responsibility for academic libraries.

In India, research shows that RSS implementation remains nascent, with limited user awareness of advanced services and minimal formal RDM support even in many Institutes of National Importance. Most libraries concentrate on providing access to e-resources and recommending basic research tools, while structured services for data management, impact analytics, and workflow integration are less frequently institutionalised. These patterns align with broader concerns about resource constraints, fragmented ICT infrastructures, and insufficient professional development for librarians in research-intensive roles. Cox et al. (2011) underline the importance of targeted training for effective research support services. Indian case studies, such as Panjab University, show high satisfaction with core library services but uneven uptake of specialised RSS and underutilisation of staff expertise in advanced areas. Cooke et al. (2011) and Brewerton (2012) emphasise the role of liaison librarians and researcher training programmes in enhancing research productivity.

2.2 TAM, UTAUT and User Satisfaction in Library Contexts

The Technology Acceptance Model (TAM) posits that perceived usefulness and perceived ease of use influence user attitudes and intention to adopt information systems, a relationship validated extensively in digital and mobile library contexts. In academic libraries, perceived utility, interactivity, and interface quality of digital services significantly affect satisfaction and continuance intention. User satisfaction often emerges as a strong predictor of behavioural intention, underscoring the importance of experience quality. The Unified Theory of Acceptance and Use of Technology (UTAUT) extends TAM by incorporating performance expectancy, effort expectancy, social influence, and facilitating conditions, along with moderating demographic and usage factors. Studies on smart libraries and self-service systems show that system characteristics, technological readiness, accessibility, and personal attributes influence continuance intentions. Integrations of TAM and UTAUT demonstrate strong explanatory power for complex library technologies. However, many library-focused TAM/UTAUT studies conceptualise facilitating conditions narrowly, limiting them to technical infrastructure or organisational support, and give limited attention to economic/payment infrastructures that underpin licensed tools and AI services. Training is frequently treated as an external factor or control variable rather than as a mediating mechanism that converts awareness and perceived usefulness into sustained usage, especially for sophisticated research support services.

2.3 AI in Academic Libraries and Emerging Facilitating Conditions

AI is increasingly recognised as a transformative force in academic libraries, supporting intelligent discovery, chatbots, predictive analytics for collection development, and personalised recommendations. Global and Indian studies highlight both the potential of AI to strengthen research support and the challenges of skills, ethics, sustainability, and standardisation. Delphi and survey-based studies with librarians describe ambivalent attitudes towards AI as tool, collaborator, and potential adversary, reflecting excitement about innovation alongside concerns about job roles, quality control, and institutional readiness. Within Indian HEIs, AI-enabled library services largely remain at pilot or nascent stages.

Many institutions depend on free or freemium AI tools accessed individually by users, rather than formally integrated platforms. This foregrounds economic/payment infrastructure—budget allocations, subscription models, and institutional policies—as a crucial yet under-theorised dimension of facilitating conditions in TAM/UTAUT applications to RSS. AI literacy and training for librarians and users emerge as central prerequisites for effective and ethical deployment. Recent discussions have shifted from basic AI adoption to complex ethical governance. Patil (2024) argues for urgent institutional policies on data privacy and algorithmic bias as Indian libraries adopt AI. Kisilowska-Szurmińska (2025) characterises AI as both collaborator and adversary and warns that absent ethical frameworks can contribute to filter bubbles in research discovery. Studies from Southern Indian engineering colleges suggest that the digital divide is increasingly being replaced by an AI-literacy divide, calling for action to promote ethical AI-based prompting and citation practices led by librarians.

3. IDENTIFIED GAPS

The literature review highlights three primary gaps.

- First, there is a lack of comparative studies on research support services across different Indian Institutes of National Importance, such as IIMs and NITs, which differ markedly in disciplinary focus, funding models, and ICT histories.
- Second, although TAM and UTAUT are widely used to study digital and mobile library services, they have not been adequately employed to model usage and satisfaction with research support services, particularly when training and payment infrastructures are significant.
- Third, few empirical studies explicitly incorporate AI-related services and practices within library research support frameworks, especially in the Indian context.

This study addresses these gaps by focusing on IIMU and MNNIT, integrating TAM/UTAUT constructs with training as a mediating factor and

economic/payment infrastructure as an extended facilitating condition, while explicitly examining the role of AI tools.

4. GOALS OF THE STUDY

The study has the following specific goals:

- To chart and contrast the ICT infrastructure and research support services at the libraries of IIMU and MNNIT, including print and electronic collections, databases, research tools, and AI-enhanced services.
- To evaluate and compare user awareness, usage trends, and satisfaction levels regarding research support services at both institutions, using samples of 100 users from each library.
- To identify and rank research support services by user satisfaction, highlighting strengths and weaknesses at each institution.
- To examine relationships among awareness, training participation, ICT-related facilitating conditions, and user satisfaction using chi-square tests, correlation analysis, ANOVA, and regression, with particular emphasis on training as a mediating variable.
- To interpret quantitative results through librarian-level qualitative insights and annual report data on funding and research orientation, thereby contextualising service gaps and opportunities.
- To extend TAM/UTAUT for library research support services by including training as a mediating variable and economic/payment infrastructure and AI integration as additional components of facilitating conditions.

5. HYPOTHESIS

The empirical analysis is guided by the following hypotheses:

- **H1 (Institutional difference—awareness):** There is a significant association between institution type (IIMU vs MNNIT) and level of user awareness of research support services, reflecting differences in service portfolios and communication practices.
- **H2 (Awareness–usage linkage):** User awareness of research support services is positively correlated with usage frequency of those services in both institutions.
- **H3 (User category differences):** Mean satisfaction with research support services differs significantly across user categories (faculty, research scholars, postgraduate students), with postgraduate students expected to report lower satisfaction due to higher dependence and weaker skills.
- **H4 (Training–satisfaction effect):** Participation in training programmes has a positive effect on user satisfaction with research support services, after controlling for awareness and ICT-related facilitating conditions.
- **H5 (Training as mediator):** Training mediates the relationship between awareness of services and their actual usage, thereby influencing satisfaction in line with extended TAM/UTAUT expectations.
- **H6 (Infrastructure–satisfaction relationship):** Better ICT and economic/payment facilitating conditions—such as availability of licensed research tools, remote access, and AI-enabled services—are positively associated with user satisfaction with research support services.

6. METHODOLOGY

6.1 Research Design and Setting

The study adopts a comparative, empirical design involving one IIM (IIM Udaipur) and one NIT (MNNIT Prayagraj), both designated as Institutes of National Importance with substantial research and postgraduate teaching activity.

IIMU represents a relatively young but rapidly ascending management institute, whose library is oriented towards e-resources, company and industry databases, and specialised research tools. MNNIT is a mature technical institution whose central library combines a large legacy print collection with campus-wide ICT and consortia-based e-resource access.

6.2 Data Sources and Sample

Three sources of data are integrated.

- First, primary user survey data were collected from 100 respondents in each institution using a structured questionnaire covering awareness, usage, perceptions, problems, and satisfaction regarding research support services; responses were coded and standardised for analysis. At IIMU, the sample is dominated by faculty (60 per cent), followed by research scholars (30 per cent) and postgraduate students (10 per cent). At MNNIT, faculty constitute 40 per cent, research scholars 35 per cent, and postgraduate students 25 per cent, with an overall male majority of 65 per cent.
- Second, librarian-level profiles capture detailed information on library collections, ICT infrastructure, staff strength, service menus, consortia participation, and perceived challenges and user satisfaction. These instruments document, for example, the number of PCs, subscribed databases, provision of digital literacy, bibliographic services, and AI-enabled tools, as well as perceptions of user awareness and service demand.
- Third, institutional annual reports for the last three years provide contextual data on research funding, consultancy income, R&D projects, and narrative descriptions of library infrastructure and services, including lists of major databases and research support tools.

Together, these data sources allow quantitative analysis and qualitative interpretation of the research support ecology at each institution. The dataset used in this study is available from the corresponding author upon reasonable request.

6.3 Reliability and Validity

Reliability analysis using Cronbach's alpha was conducted to ensure consistent performance of the survey instruments across both institutions. The tool

was divided into two main themes: user satisfaction and awareness/usage frequency.

Cronbach's alpha was 0.89 for the satisfaction scale and 0.84 for the combined awareness and usage constructs. These values exceed the widely accepted 0.70 threshold (Nunnally & Bernstein, 1994), indicating high internal consistency and robust measurement of the research variables. This level of statistical rigour supports the use of the data for regression modelling and comparative analysis.

6.4 Measurement and Coding

The user survey employed five-point Likert scales (1 = strongly disagree to 5 = strongly agree) to measure awareness, perceptions, and satisfaction. Usage frequency was captured using ordinal scales (1 = never to 5 = daily), while demographic and user categories were recorded as categorical variables. A four-point scale (1 = never to 4 = regular) was used to assess frequency of use of AI tools, Google Scholar, reference managers (Mendeley/Zotero), plagiarism detection tools (Turnitin/Urkund), and institutional repositories.

At IIMU, the highest mean awareness scores are for plagiarism detection services (4.6), e-resources (4.5), and citation support (4.3), while research data management (3.8) and bibliometrics (3.5) record lower awareness levels. Usage scores show high use of e-resources (mean 4.1) alongside more moderate library visit frequency (3.2) and relatively low participation in training programmes (2.5). Users report high satisfaction with library staff (4.4) and overall resources (4.3), but lower satisfaction with training programmes (3.6) and access to specialised tools (3.5).

Narrative analysis at MNNIT indicates that approximately 75 per cent of respondents utilise e-resources and 70 per cent frequently visit the library, while only 48 per cent engage in training. Users are very familiar with Google Scholar and plagiarism detection tools but show less engagement with institutional repositories and advanced bibliometric services. Major problems reported include weak communication about research support options, limited awareness of advanced services, and constrained training opportunities.

6.5 Statistical Techniques

Descriptive statistics such as means and percentages are used to summarise awareness, usage, and satisfaction indicators for each institution.

Chi-square tests analyse relationships between institution type and awareness levels, and between user categories and satisfaction ratings.

Correlation analyses examine interrelationships among awareness, training participation, ICT-related perceptions, and satisfaction.

One-way ANOVA is utilised to explore variations in satisfaction across user categories and services, while multiple regression models assess the influence of awareness, training, and facilitating conditions on satisfaction, operationalising the extended TAM/UTAUT framework.

Given the interpretive focus, results are reported in terms of direction and significance patterns rather than detailed test statistics.

7. RESULTS AND DISCUSSION

7.1 ICT Infrastructure and Resource Availability

IIMU's library demonstrates a strong digital orientation, with 6,078 print books and more than 200,000 e-books, around 45 online databases, and approximately 13,000 e-journals, alongside major company, industry, and macroeconomic data platforms. Annual reports list a rich suite of research support tools including Grammarly, MATLAB, Qualtrics, SAS, SSRN, Overleaf, and authentication via OpenAthens, supplemented by membership in the e-ShodhSindhu consortium. Budget allocations over three years show substantial and rising investment in e-databases (3.5–5.0 crore rupees), e-journals (2.0–2.4 crore rupees), and dedicated lines for research support services and ICT/automation.

MNNIT's central library maintains a very large print collection of 97,555 books and 20,363 e-books, along with 17,656 current journals, 1,043 bound journals, 21,708 theses, and 644 CD-ROMs, supported by around 30 PCs and campus-wide high-speed network connectivity. The annual report describes the campus as fully networked, with 1.25 Gbps internet connectivity and a central computer centre supporting departments, while the library participates in consortia such as UGC-INFLIBNET for e-resources. Librarian responses, however, highlight constrained budgets earmarked for research support and indicate that accessibility of paid tools is a major issue for users. From a TAM/UTAUT perspective, both institutions provide strong performance expectancy through access to relevant digital and print resources, but differ in the breadth of specialised databases and licensed tools forming the economic/payment infrastructure.

IIMU's concentration of high-value databases and research tools reduces search and discovery costs for management researchers, while MNNIT's leaner paid-tool environment results in greater reliance on free web resources and consortial offerings.

7.2 Research Support Service Portfolios

Librarian surveys report a broad range of research support services at both libraries, including orientation programmes, literature search and bibliographic assistance, citation and referencing support, plagiarism checking, institutional repository management, and workshops on tools such as Zotero, Mendeley, EndNote, and SPSS.

Both libraries provide internet and Wi-Fi access, remote access to e-resources, and access to AI-enabled tools such as ChatGPT and Semantic Scholar, though the level of integration of these tools within library systems varies. IIMU's annual report positions research support as central to its mission,

describing the library as "an essential resource" for achieving leadership in management research and highlighting discovery services (ProQuest Summon), large databases, and specialised tools. MNNIT's annual report situates the central library within a broader network of institutional facilities, emphasising support for a large population of undergraduate and postgraduate students, with research support embedded within general reference and digital services.

Taken together, the service portfolios at both institutions converge around core RSS but diverge in the intensity and specialisation of offerings, particularly in data-intensive and impact-oriented areas such as bibliometrics, RDM, and advanced analytics.

This is consistent with national-level findings that RDM and comprehensive impact services remain underdeveloped in Indian academic libraries, including research-intensive institutions.

7.3 Service Usage Patterns

User survey data indicate strong engagement with digital resources at both institutions.

At IIMU, e-resource usage attains a high mean score (4.1), with 88 per cent of respondents reporting regular use of Google Scholar, 72 per cent regular use of Mendeley/Zotero, 68 per cent regular use of Turnitin, and 62 per cent regular use of AI tools. Library visit frequency records a moderate mean of 3.2, reflecting the availability of remote access and digital-first services, while participation in training programmes is relatively low (mean 2.5).

At MNNIT, approximately 75 per cent of respondents report high e-resource usage and 70 per cent report frequent physical library visits, but only 48 per cent report participation in training activities. Institutional repositories and formal bibliometric services are underutilised, with users heavily depending on Google Scholar and generic AI tools, and relying less on structured institutional platforms. These patterns support H2 by indicating a positive but incomplete link between awareness and usage. Awareness of core services such as e-resources, plagiarism tools, and citation assistance is high, but actual use of advanced, training-intensive services such as RDM, bibliometrics, and institutional repositories remains limited. From an extended TAM/UTAUT viewpoint, perceived usefulness is strong for basic services, but perceived ease of use and facilitating conditions (including training and tool integration) constrain uptake of more complex offerings.

7.4 User Satisfaction and Rankings of Services

The highest satisfaction scores at both institutions relate to human-mediated and resource-based dimensions.

At IIMU, users report very high satisfaction with library staff (mean 4.4) and overall resources (4.3), but lower satisfaction with training programmes (3.6) and access to specialised tools (3.5). Narrative evidence from MNNIT indicates that users perceive staff as helpful and core resources as adequate but are only moderately satisfied with formal training services and less satisfied with access to paid tools.

Based on combined results, service-wise satisfaction rankings for both institutions can be outlined as follows:

- Human support (librarian assistance, responsiveness, reliability)
- Access to key e-resources (e-books, e-journals, databases)
- Citation support and plagiarism checking
- Basic digital literacy and orientation programmes
- Advanced training (reference managers, data analysis software, impact metrics)
- Institutional access to paid, specialised tools and AI services

The decline in satisfaction from basic resources and staff support to advanced training and specialised tools aligns with user-reported concerns about limited training, remote access constraints, and affordability, particularly at MNNIT.

Table 1. Satisfaction Ranking Across Institutions

Service Area	IIM Udaipur (IIMU)	MNNIT Prayagraj (MNNIT)
Library staff	Very high	High
E-resources	Very high	High
Plagiarism services	High	Moderate
Training programmes	Moderate	Moderate
Research data management	Low	Low
Bibliometric services	Moderate	Low
AI tools	Moderate	Low

7.5 Service-Wise Awareness and Usage

Service-wise analysis indicates that awareness and usage patterns are uneven across different components of RSS.

At IIMU, awareness is highest for plagiarism services, e-resources, and citation help, and lower for RDM and bibliometrics.

At MNNIT, narrative data suggest high use of e-resources and plagiarism tools but moderate to low familiarity with RDM and bibliometric services.

These patterns can be summarised in a structured awareness and usage table.

Table 2. Service-wise Awareness and Usage Indicators

Service Area	IIMU – Awareness (Mean, 1–5)	IIMU – Usage Indicator	MNNIT – Qualitative Trend / Usage
Plagiarism services	4.6	Widely used (Turnitin, Urkund)	High; mandatory for PhD
E-resources	4.5	High usage (mean 4.1)	Highest usage (~75% users)
Citation help	4.3	Positive use and perceptions	Positive perception
Research data management	3.8	Moderate awareness, low usage	Moderate to low
Bibliometrics	3.5	Moderate awareness, low usage	Moderate to low
Training programmes	–	Low participation (mean 2.5)	48% participation
AI tools	–	62% regular users	High but largely individual use
Library visits	–	Mean frequency 3.2	~70% frequent visitors

The data reveal a clear "awareness–usage gap".

At IIMU, awareness of plagiarism services is nearly universal (mean 4.6), but participation in formal library training is low (mean 2.5).

MNNIT exhibits a similar pattern, with strong engagement with e-resources and visits, but less than half of respondents participating in training.

7.6 Institutional Comparison and Hypotheses Testing

Chi-square analyses show a significant association between institution type and high awareness of advanced research support services, with IIMU users more likely to report familiarity with bibliometric and data management services than MNNIT users. This reflects stronger visibility and integration of advanced services in IIMU's digital ecosystem and supports H1. Correlation analysis across both datasets reveals positive relationships among awareness, training participation, and satisfaction, with the strongest correlations between training participation and satisfaction, supporting H4. Regression models incorporating awareness, training, and ICT-related facilitating conditions indicate that training retains a significant independent effect on satisfaction even after controlling for other variables, confirming its role as a mediating construct in the extended TAM/UTAUT framework and supporting H5.

ANOVA tests by user category support H3 by indicating significant differences in satisfaction, with faculty generally reporting higher satisfaction than research scholars and postgraduate students. Qualitative comments and librarian perceptions corroborate that postgraduate students face the greatest difficulties in navigating advanced research services, particularly at MNNIT, where structured training opportunities are fewer.

Comparative analysis of infrastructure indicators and satisfaction lends support to H6.

IIMU's more extensive and integrated digital infrastructure—comprising high-end databases, specialised research tools, remote access via OpenAthens, and discovery services—coincides with stronger satisfaction scores for resources and tools access, despite relatively low training participation. At MNNIT, larger print holdings and more PCs coexist with reported constraints in paid-tool access and user concerns about affordability and subscription stability, which depress satisfaction with advanced ICT-based services despite generally positive views of core resources and staff support. These results can be summarised in a hypothesis testing table.

Table 3. Hypothesis Testing Summary

Hypothesis	Focus	Primary Test(s)	Result / Evidence Summary
H1	Institutional differences in awareness	Chi-square	Supported: Significant association between institution type and awareness of advanced RSS
H2	Awareness–usage linkage	Correlation, narrative	Supported: Positive relationship; awareness high, but usage of advanced services lags
H3	User category differences in	ANOVA	Supported: Faculty more satisfied than

	satisfaction		research scholars and postgraduate students
H4	Training–satisfaction effect	Correlation, regression	Supported: Training participation strongly related to higher satisfaction
H5	Training as mediator	Regression (extended TAM/UTAUT)	Supported: Training retains significant independent effect after controlling other factors
H6	Infrastructure–satisfaction relationship	Comparative analysis, regression	Supported: Better ICT and economic/payment conditions associated with higher satisfaction

7.7 Discussion: Bridging Empirical Data and 2026 Trends

The IIMU and MNNIT cases illustrate a broader phenomenon of "bottom-up AI adoption versus top-down institutional lag". Although 62 per cent of IIMU users and a large proportion of MNNIT researchers use AI tools in their everyday work, this usage often occurs outside formal institutional frameworks, circumventing governance structures. This aligns with 2026 international trends in which shadow AI use in scholarship poses risks to data sovereignty and scholarly integrity.

7.7.1 Economic Infrastructure as a Facilitating Condition

The dissatisfaction at MNNIT with "paid tool access" points to a shift in the meaning of "facilitating conditions" in 2026. In a "SaaS-heavy" research environment, economic/payment infrastructure—budget lines, licensing models, and subscription strategies—becomes as important as technical connectivity. At IIMU, separate budget lines for licensed research tools and authentication infrastructure are directly linked to higher faculty satisfaction, supporting H6.

7.7.2 Training as an Intermediary for AI-Savvy Research

Training emerges as the most reliable predictor of whether awareness leads to advanced usage, in line with H5. In 2026, research support increasingly concerns evaluation and synthesis of AI-generated information rather than basic information retrieval. The low participation in library-led training (around 25 per cent at IIMU and 48 per cent at MNNIT) suggests that traditional workshop formats are not keeping pace with rapidly evolving AI tools and researcher expectations.

7.7.3 Policy Consequences for Higher Education

The findings support a move towards a federated national research support model. Instead of individual institutions such as MNNIT negotiating expensive subscriptions alone, the Ministry of Education could leverage IIM/NIT networks to negotiate "National AI-Research Licenses". Such arrangements would promote equitable access to modern research tools for postgraduate students, currently among the least satisfied user groups.

7.8 Implications

7.8.1 Policy Implications (India-Focused)

The study stresses to Indian policymakers and funding bodies the need to prioritise research support services in Institutes of National Importance and other HEIs. National consortia and schemes could be used not only for e-journals and databases but also to share access to AI-enabled research support platforms, bibliometric tools, and RDM infrastructures. HEIs should treat expenditure on library-based research support and training as core investments in research excellence rather than optional overheads in their incentive and evaluation frameworks.

7.8.2 Practical Implications for Libraries

For academic libraries, the following practical steps are indicated:

- Elevate research support to a central mission with appropriate budgets and personnel allocations.
- Conduct audits of existing services to evaluate alignment with user needs, particularly in less-developed areas such as RDM, bibliometrics, and AI integration.
- Design tiered training programmes that embed research support into disciplinary teaching, research methodology courses, and graduate orientation, with modules tailored to different user groups.
- Formulate policies and guidance on the use of AI for research support, specifying preferred tools, standards, and ethical considerations, and integrate these into training and advisory services.
- Strengthen communication channels between libraries and patrons via departmental liaison roles, research workshops, and online platforms, addressing the communication gaps noted especially at MNNIT.

Implementing these measures would help convert current resource investments into more equitable and satisfying research support experiences.

8. CONCLUSION

8.1 Overall Conclusion

The comparison between IIMU and MNNIT shows that both institutions have made notable progress in developing research support services and ICT infrastructure, yet significant gaps remain in

advanced services, training, and AI integration, which constrain user satisfaction and service effectiveness.

By incorporating training as a mediating factor and economic/payment infrastructure and AI integration as key facilitating conditions, the study provides a more nuanced understanding of the adoption and utilisation of research support services.

The findings point to the need for a reorientation of academic library missions through policy formulation, targeted funding, and systematic training of staff in AI-related and advanced research support functions. Libraries must evolve from passive resource providers into active partners in the research lifecycle, aligning their strategies with institutional research agendas and emerging AI-driven scholarly practices.

8.2 RECOMMENDATIONS

The study recommends that libraries adopt a Hybrid AI-Library Framework that moves beyond incremental service improvement.

This framework proposes incorporating an "AI middleware" layer into the library portal that provides a single interface for licensed AI solutions (such as Semantic Scholar and institutional subscriptions to advanced AI tools) under secure institutional authentication.

Such a portal should include:

- Curated AI prompt libraries, offering discipline-specific prompt templates for literature synthesis and research tasks.
- Real-time ethics checking functions to verify AI-generated content against institutional plagiarism policies and data-sharing guidelines.
- Automated skill pathways that unlock advanced tools as users complete AI-literacy certification modules.

Adopting this framework can help bridge the gap between AI awareness and ethical, productive use.

Upgrading economic infrastructure, integrating librarians more deeply into the research lifecycle, and standardising service assessment are crucial to enhancing research productivity in Indian HEIs.

8.3 Limitations

The study is limited to a single IIM and a single NIT, with cross-sectional survey data from 100 users at each institution.

This restricts the generalisability of the findings and does not allow detailed longitudinal analysis of evolving practices.

Certain statistical results are presented in aggregate form without detailed effect sizes, reflecting a primary emphasis on pattern identification and theoretical extension rather than precise parameter estimation.

Librarian insights and annual reports provide rich contextualisation but may reflect institutional self-representation and subjective perceptions.

These sources would benefit from triangulation with observational data or usage-log analytics in future work.

8.4 Future Research Directions

Several avenues for future research emerge from this study. Multi-institutional studies involving a broader range of IIMs, NITs, central universities, and private universities would enable deeper analysis of how governance models, funding frameworks, and disciplinary mixes influence research support services and their effectiveness. Longitudinal designs could track the impacts of rapidly evolving AI tools and national digital policies on library research support and user behaviour over time. Methodologically, combining survey data with usage analytics from discovery systems, repositories, and AI platforms would provide more robust insights into actual user behaviour beyond self-reported measures. Experimental evaluations of alternative training interventions or AI-driven service prototypes could yield stronger evidence on the causal effects of training and technology design on satisfaction and research outcomes. Qualitative research with faculty, research scholars, and librarians could further illuminate disciplinary and cultural factors shaping perceptions of AI, data sharing, and collaborative research support, thereby enriching extended TAM/UTAUT models in this domain.

9. AUTHOR CONTRIBUTION

Varsha Chaudhary: Data collection, data analysis, and manuscript writing.
Prof. Ashok Kumar Upadhyay: Conceptualization, supervision, review, and editing.

10. REFERENCES

1. Cao, K., Wang, P., Zhang, C., & Zhao, J. (2026). Multidimensional factors influencing continuance usage intention of university library self-service systems. PLoS One, 21(3), e0346014.
2. B V, N., & Duragannavar, G. F. (2025). SWAYAM E-Learning Utilization in Higher Education: A Case Study of Bangalore University. International Journal of Research in Library Science, 11(1), 266–274.
3. Bairagi, M., & Lihitkar, S. R. (2025). AI-driven library services in Southern Indian engineering colleges: Opportunities and challenges. College Libraries, 40(2), 72–82.
4. Dyamanagoudr, S., et al. (2025). Library Services for The Digital Age: Redefining the Role of Librarians. International Journal of Environmental Sciences, 2630–2645.
5. Haq, A., & Jan, R. (2025). Assessing research support services in academic libraries: A systematic literature review. Annals of Library and Information Studies, 72(3), 280–297.
6. Kisilowska-Szurmińska, M. (2025). Artificial intelligence in academic libraries – a tool, a collaborator, an adversary? The Journal of Academic Librarianship, 51(5), Article 103114.
7. Riady, Y., et al. (2025). TAM and IS success model on digital library use, user satisfaction and net benefits. Library Management, 46(1-2), 173–188.
8. Samant, M. A., & Gadhvi, G. G. (2025). Review of Literature on Utilization of College Library Resources of Mumbai City. International Journal of Research in Library Science, 11(4), 424–437.
9. Patil, M. A. (2024). Integration of artificial intelligence in the academic libraries in India and abroad. Library Progress International, 44(4), 3122–3130.
10. Singh, R., Raj, R., & Madalli, D. (2024). Investigation of research support services (RSS) in academic libraries of India. Journal of Librarianship and Information Science. https://doi.org/10.1177/09610006241245714
11. Choudhari, V. M. (2023). A case study on application artificial intelligence need in libraries of higher education system in India. International Journal for Advanced Research in Science & Technology, 13(8), 237–246.
12. Duragannavar, G., et al. (2023). A study of Information Seeking Behaviour of research scholars of Science and Arts faculty in Bangalore University.
13. Dyamanagoudr, S., Duragannavar, G., & Narayanaswamy, B. V. (2023). Transformative Challenges in Knowledge Management: NEP 2020 Perspective. International Journal of Creative Research Thoughts, 11.
14. Jha, S. K. (2023). Application of artificial intelligence in libraries and information centres services: prospects and challenges. Library Hi Tech News, 40(7), 1–5. https://doi.org/10.1108/LHTN-06-2023-0102
15. Sharma, R., et al. (2023). Library research support and services: A case study of Panjab University Library. Library Philosophy and Practice (e-journal), Article 7740.
16. Kennette, L. N., & McIntosh, E. (2022). Your Information Literacy Practices (YILP): Information Literacy and Resourcefulness. Partnership, 17(2), 1–22. https://doi.org/10.21083/partnership.v17i2.6680
17. Kropocheva, N. (2021). Repositories of Higher Pedagogical Education Institutions: New Opportunities for Scientific Libraries. Humanities Science Current Issues, 2(39), 186–195. https://doi.org/10.24919/2308-4863/39-2-32
18. Matonkar, P., & Dhuri, K. (2021). The Evaluation of Usage of Library Resources and Services: An Exclusive Study on Users of Academic College Libraries.
19. Tzanova, S. (2020). Changes in Academic Libraries in the Era of Open Science. Education for Information, 36(3), 281–299. https://doi.org/10.3233/EFI-190259
20. Hovorukha, V. B., et al. (2019). Networking Information Technologies as a Method Innovative Changes in Academic Libraries. University Library at a New Stage of Social Communications Development, (4), 110–116. https://doi.org/10.15802/unilib/2019_187420
21. Anilkumar, N. (2018). Research Data Management in India: A Pilot Study. EPJ Web of Conferences, 186, 03002. https://doi.org/10.1051/epjconf/201818603002
22. Borghi, J., et al. (2018). Support Your Data: A Research Data Management Guide for Researchers. Research Ideas and Outcomes, 4, e26439. https://doi.org/10.3897/rio.4.e26439
23. Brown, S., et al. (2018). Evolution of Research Support Services at an Academic Library: Specialist Knowledge Linked by Core Infrastructure. New Review of Academic Librarianship, 24(3–4), 337–348. https://doi.org/10.1080/13614533.2018.1473259
24. Cox, A. M., et al. (2017). Developments in Research Data Management in Academic Libraries: Towards an Understanding of Research Data Service Maturity. Journal of the Association for Information Science and Technology, 68(9), 2182–2200. https://doi.org/10.1002/asi.23781
25. Koltay, T. (2017). Research 2.0 and Research Data Services in Academic and Research Libraries: Priority Issues. Library Management, 38(6/7), 345–353. https://doi.org/10.1108/LM-11-2016-0082
26. Naraanaswamy, B. V., & Kumar, K. D. (2017). Knowledge and Utilisation of ICT and Open Source Software's among the Library Professionals of

Karnataka. Pearl, 11(3), 230. https://doi.org/10.5958/0975-6922.2017.00031.6
27. Southall, J., & Scutt, C. (2017). Training for Research Data Management at the Bodleian Libraries. New Review of Academic Librarianship, 23, 303-322.
28. Tenopir, C., et al. (2017). Research Data Services in European Academic Research Libraries. LIBER QUARTERLY, 27(1), 23–44. https://doi.org/10.18352/lq.10180.
29. Tripathi, M., et al. (2017). Research Data Management Practices in University Libraries: A Study. DESIDOC Journal of Library & Information Technology, 37(6), 417. https://doi.org/10.14429/djlit.37.6.11336
30. Deepa, P. K., & Abdul Azeez, T. A. (2016). Use of Web-Based Information Resources and Services by Research Scholars: A Case Study of the University of Calicut. Pearl, 10(1), 1. https://doi.org/10.5958/0975-6922.2016.00001.2
31. Patel, D. (2016). Research Data Management: A Conceptual Framework. Library Review, 65(4/5), 226–241. https://doi.org/10.1108/LR-01-2016-0001
32. Yoon, H. (2016). User Acceptance of Mobile Library Applications in Academic Libraries: An Application of the Technology Acceptance Model. The Journal of Academic Librarianship, 42. https://doi.org/10.1016/j.acalib.2016.08.003
33. Hoppenfeld, J., & Malafi, E. (2015). Engaging with Entrepreneurs in Academic and Public Libraries. Reference Services Review, 43(3), 379–399. https://doi.org/10.1108/RSR-02-2015-0011
34. Keller, A. (2015). Research Support in Australian University Libraries: An Outsider View. Australian Academic & Research Libraries, 46(2), 73–85. https://doi.org/10.1080/00048623.2015.1009528
35. Koffel, J. B. (2015). Use of Recommended Search Strategies in Systematic Reviews and the Impact of Librarian Involvement. PLOS ONE, 10(5), e0125931. https://doi.org/10.1371/journal.pone.0125931
36. Krishna, K. M., & Singh, A. (2015). Library E-Resource Services and Its Impacts on Research Scholars of University of Allahabad. Library Progress (International), 35(2), 139. https://doi.org/10.5958/2320-317X.2015.00012.4
37. Mohindra, R., & Kumar, A. (2015). User Satisfaction Regarding Quality of Library Services of A.C. Joshi Library, Panjab University, Chandigarh. DESIDOC Journal of Library & Information Technology, 35(1), 54–60. https://doi.org/10.14429/djlit.35.1.8072
38. Rethlefsen, M. L., et al. (2015). Librarian Co-Authors Correlated with Higher Quality Reported Search Strategies in General Internal Medicine Systematic Reviews. Journal of Clinical Epidemiology, 68(6), 617–26. https://doi.org/10.1016/j.jclinepi.2014.11.025
39. University of Tennessee, Knoxville, et al. (2015). Research Data Services in Academic Libraries: Data Intensive Roles for the Future? Journal of eScience Librarianship, 4(2), e1085. https://doi.org/10.7191/jeslib.2015.1085
40. Cox, A. M., & Pinfield, S. (2014). Research Data Management and Libraries: Current Activities and Future Priorities. Journal of Librarianship and Information Science, 46(4), 299–316. https://doi.org/10.1177/0961000613492542
41. Pinfield, S., et al. (2014). Research Data Management and Libraries: Relationships, Activities, Drivers and Influences. PLoS ONE, 9(12), e114734. https://doi.org/10.1371/journal.pone.0114734
42. Raju, R., & Schoombee, L. (2014). Research Support through the Lens of Transformation in Academic Libraries with Reference to the Case of Stellenbosch University Libraries. South African Journal of Libraries and Information Science, 79(2). https://doi.org/10.7553/79-2-155
43. Castagne, M. (2013). Institutional repositories software comparison. Open Access Library Journal, 1(3), 1–10. https://doi.org/10.4236/oalib.1100486
44. Ciobanu, A. (2013). The Role of Student Services in the Improving of Student Experience in Higher Education. Procedia - Social and Behavioural Sciences, 92, 169–173. https://doi.org/10.1016/j.sbspro.2013.08.654
45. Corrall, S., et al. (2013). Bibliometrics and Research Data Management Services: Emerging Trends in Library Support for Research. Library Trends, 61(3), 636–674. https://doi.org/10.1353/lib.2013.0005
46. Brewerton, A. (2012). Re-Skilling for Research: Investigating the Needs of Researchers and How Library Staff Can Best Support Them. New Review of Academic Librarianship, 18(1), 96–110. https://doi.org/10.1080/13614533.2012.665718
47. Corrall, S., Kennan, M., & Afzal, W. (2012). Changes in academic libraries: Evolution and innovation in research support services. Journal of Librarianship and Information Science.
48. Jantz, R. C. (2012). A Framework for Studying Organizational Innovation in Research Libraries. College & Research Libraries, 73(6), 525–541. https://doi.org/10.5860/crl-302
49. Kumar, D. (2012). User Satisfaction and Service Quality of the University Libraries in Kerala. International Journal of Information Dissemination and Technology, 2, 24-30.
50. Madhusudhan, M., & Nagabhushanam, V. (2012). Web-based Library Services in University Libraries in India: An Analysis of Librarians' Perspective. The Electronic Library, 30(5), 569–588. https://doi.org/10.1108/02640471211275657
51. Massis, B. E. (2012). Local Newspapers and the Library: A "Community Asset". New Library World, 113(11/12), 614–618. https://doi.org/10.1108/03074801211282966
52. Razzak, F. (2012). Spamming the Internet of Things: A Possibility and Its Probable Solution. Procedia

Computer Science, 10, 658–665. https://doi.org/10.1016/j.procs.2012.06.084
53. Thomsett-Scott, B., & Reese, P. E. (2012). Academic Libraries and Discovery Tools: A Survey of the Literature. College & Undergraduate Libraries, 19(2–4), 123–143. https://doi.org/10.1080/10691316.2012.697009
54. Cooke, L., et al. (2011). Evaluating the Impact of Academic Liaison Librarians on Their User Community: A Review and Case Study. New Review of Academic Librarianship, 17(1), 5–30. https://doi.org/10.1080/13614533.2011.539096
55. Cox, A. M., Verbaan, E., & Sen, B. (2011). Upskilling liaison librarians for research data management. Ariadne, 67.
56. Hart, G., & Kleinveldt, L. (2011). The role of an academic library in research: Researchers' perspectives at a South African University of Technology. South African Journal of Libraries and Information Science, 77(1), 37–50.
57. Tenopir, C., et al. (2011). Data sharing by scientists: Practices and perceptions. PLoS ONE, 6(6), e21101. https://doi.org/10.1371/journal.pone.0021101
58. McKnight, S. (Ed.). (2010). Envisioning Future Academic Library Services: Initiatives, Ideas and Challenges (1st ed.). Facet. https://doi.org/10.29085/9781856048750
59. Witt, M. (2008). Institutional Repositories and Research Data Curation in a Distributed Environment. Library Trends, 57(2), 191–201. https://doi.org/10.1353/lib.0.0029
60. Beverley, C. A., et al. (2003). The Role of the Information Specialist in the Systematic Review Process: A Health Information Case Study. Health Information & Libraries Journal, 20(2), 65–74. https://doi.org/10.1046/j.1471-1842.2003.00411.x
61. Gallagher, P., Promnitz, J., & Germain, C. (2002). Categories of student support services in higher education institutions. Journal of Student Affairs Research and Practice, 39(2), 112–125.
62. Nunnally, J. C., & Bernstein, I. H. (1994). Psychometric theory (3rd ed.). McGraw-Hill.