

Viksit Bharat 2047 Initiatives and the Transformative Role of Libraries: An Analytical Study of Amrit Peedhi, PM eVIDYA, SWAYAM, SWAYAM PRABHA, SIDH, DIKSHA, PMKVY 4.0 and PM-SETU

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Peer Review Information	Abstract
Type: Article Received: 10 May 2026 Revised: 22 June 2026 Accepted: 19 July 2026 Published: 13 Aug 2026	For Viksit Bharat 2047, instead of separate digital services, public education and skill services need to be integrated as public digital assets. This paper analyses Amrit Peedhi, PM eVIDYA, SWAYAM, SWAYAM PRABHA, Skill India Digital Hub (SIDH), DIKSHA, PMKVY 4.0, and PM-SETU and explores the roles of libraries as implementation intermediaries. From a quantitative, descriptive, and analytical standpoint, this study uses secondary data, UDISE+ school infrastructure data for 2022-2023 to 2024-2025, and PMKVY 4.0 data as provided by the States/UTs as of 9 January 2025. The Library-Enabled Digital Readiness Index (LEDRI) combines provision of school libraries/reading, digital libraries, pedagogical computers, and internet connectivity. A coding policy framework for the eight programs was conducted. From a national standpoint, the rapid increase in the availability of computers and internet services was not accompanied by an increase in digital libraries, which remained under 8 percent. PMKVY 4.0 recorded 2.81 million enrollments and 1.32 million certifications. Out of 34 jurisdictions, LEDRI and certification yield were positively correlated, $r = .412$, $p = .015$; and in a robust regression, had a positive coefficient, $B = 3.52$, $p = .020$. Causal claims are not possible due to mixed group tests and ecological constraints. The outcome of the study places libraries as trusted discovery and device centers, multilingual and accessible mediation, digital and AI literacy, supported study and credential navigation, and community referral centers. A 6-stage, library-led implementation cycle is also proposed. The study also aims to establish a targetable baseline for public policy, library funding, and program assessment through further research.
	Keywords: Viksit Bharat 2047; libraries; digital inclusion; PM eVIDYA; SWAYAM; DIKSHA; SIDH; PMKVY 4.0; PM-SETU; lifelong learning

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Introduction

Viksit Bharat 2047 envisions India's 100 years of independence as an opportunity for holistic growth, advanced technology, and governance that is both accountable and agile. In this context, the knowledge economy's productive infrastructure is the education and skills of the workforce. The "Amrit Peedhi" focus considers youth to be the beneficiaries and the change agents of the process, and the Voice of Youth initiative interlinks the nation's goals and active participation (Ministry of Finance, 2023; MyGov, 2023; Prime Minister's Office, 2023). NEP 2020 also associates equity with a comprehensive and multidisciplinary pedagogy, coupled with education technology, vocational training, research, and lifelong learning (Ministry of Education, 2020).

The delivery system is decentralized. PM eVIDYA fuses online, TV and radio integrated schooling; DIKSHA provides teaching resources and services linked to the curriculum; SWAYAM offers a range of online courses and creditable learning; SWAYAM PRABHA alleviates the need for uninterrupted broadband. SIDH manages the skills continuum, PMKVY 4.0 provides training and certification, and PM-SETU creates hub-and-spoke partnerships to improve Industrial Training Institutes. While an emerging public learning infrastructure, these offer various target populations and models, and differing credentialing and administrative frameworks (Ministry of Education, 2025b, 2025c; Press Information Bureau, 2024a, 2025a, 2025b; Ministry of Skill Development and Entrepreneurship, 2023, 2025).

Just because something is formally available does not mean it is accessible. For learners, effective access requires the discovery of relevant opportunities along with the procurement of digital devices, connectivity, an understanding of the prerequisites, the ability to sustain, and the utilization of available study formats and methods. Digital inequity can also be a result of low confidence, language barriers, long-term disabilities, fears for personal safety, and the absence of social support networks (Beaunoyer et al., 2020; Lythreath et al., 2022). Libraries are a fusion of public space, organized information, professional staffing, and social validation of a community. For these reasons this study links program design, school infrastructure, and skill certification, to evaluate whether library-enabled program readiness relates to program throughput, placing all findings from a State as exploratory and not causal. For this reason, the institutional mediation of multiple services becomes a policy focal point, rather than a marginal supportive activity for learners.

Table 1. Policy scope, delivery mechanism and proposed library interface

Initiative	Primary mechanism	Transformative library role	Latest verified indicator / status
Amrit Peedhi	Youth-centred development frame and participation	Civic information, deliberation, youth idea labs	Budget and Voice of Youth framing from 2023–24
PM eVIDYA	Multimodal school learning umbrella	Discovery, device access, supervised broadcast and inclusion	Designed to benefit nearly 25 crore school-going children
SWAYAM	MOOCs, examinations and credit-bearing study	Course mapping, study support, examination and credit clinics	5.15 crore+ enrolments; 16,530+ courses; 388 credit-transfer universities
SWAYAM PRABHA	Direct-to-home television and scheduled content	Shared viewing, timetable curation and local facilitation	School channels expanded from 12 to 200; 92,147 videos in 30 languages
DIKSHA	Curriculum-linked digital resources and teacher services	QR-linked curation, language and accessibility mediation	All States/UTs onboarded; 1,500+ micro-courses; 5 billion+ sessions
SIDH	Digital public infrastructure for the skill lifecycle	Registration, course discovery, e-KYC and credential guidance	88 lakh registrations and 752 online courses reported for June 2024
PMKVY 4.0	Short-term training, RPL and special projects	Enrolment, study, assessment and certification support	2.81 million enrolled and 1.32 million certified by 9 January 2025
PM-SETU	Hub-and-spoke upgrade of government ITIs	ITI knowledge hubs, digital learning and employer referral	₹60,000 crore; 1,000 ITIs; target of 20 lakh youth over five years

Note. Programme descriptions and indicators were compiled from official sources (Ministry of Finance, 2023, 2024a, 2024b; MyGov, 2023; Prime Minister’s Office, 2023, 2025; Ministry of Education, 2024b, 2024c, 2025c; Press Information Bureau, 2024a, 2025a, 2025b, 2025c; Ministry of Skill Development and Entrepreneurship, 2023, 2025). Amrit Peedhi is treated as a policy frame, not a single operational scheme.

From emergency multimodal access to an integrated learning-and-skilling architecture

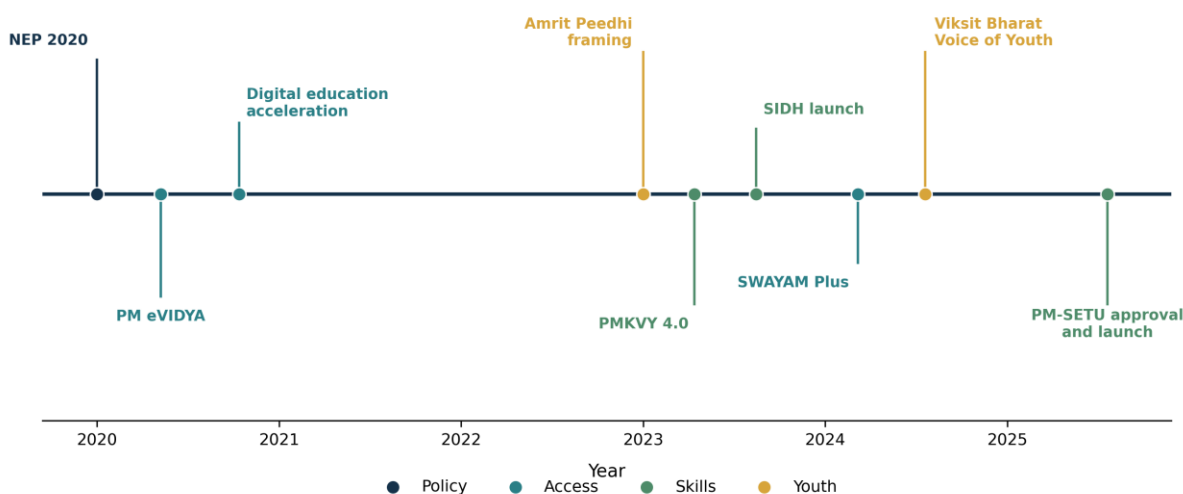


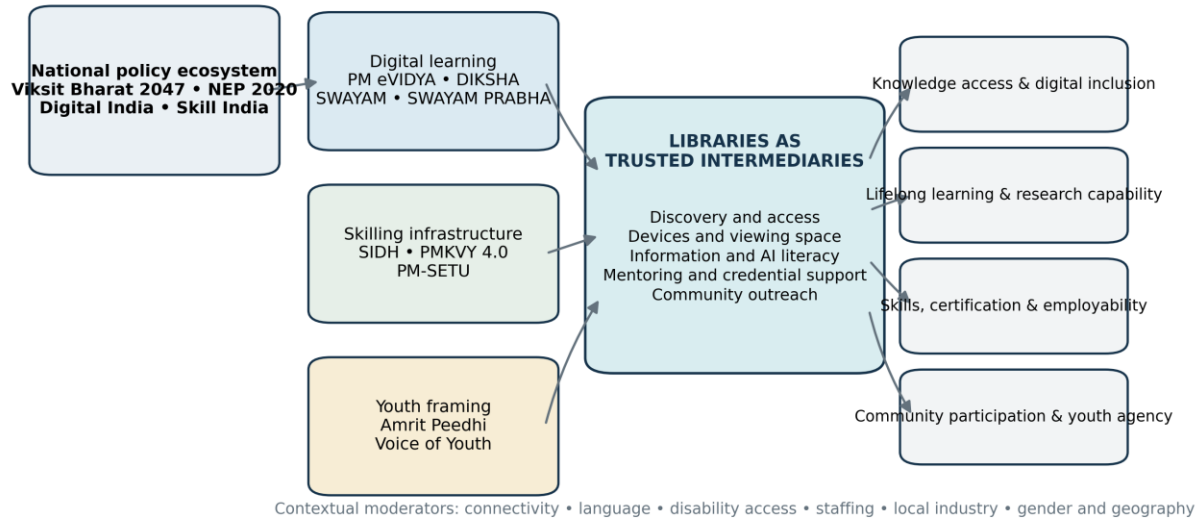
Fig. 1. Policy and programme milestones from emergency multimodal access to integrated learning and skilling

Note. Timeline synthesised from official launch, regulatory and budget documents (Ministry of Education, 2020, 2021; University Grants Commission, 2021; Ministry of Finance, 2023, 2024a; Prime Minister’s Office, 2023, 2025; Press Information Bureau, 2025b).

Policy and conceptual framework

India's modern framework for digital learning integrates emergency response practices with reform. Learning during this period was supported by various media, as described in the India Report Digital Education, PRAGYATA and the Students’ Learning Enhancement Guidelines (Department of School Education and Literacy, 2020a, 2020b; National Council of Educational Research and Training, 2020). The SARTHAQ plans and the NEP focused on the accessibility of learning, the development of teachers and the frameworks of the NDEAR, which described registries and services with standards and interoperability (Department of School Education and Literacy, 2021a, 2021c, 2021d; Ministry of Education, 2021).

The eight Initiatives have different, but interrelated domains. Amrit Peedhi is a frame for youth development, while a multimodal school umbrella is described by PM eVIDYA. DIKSHA is focused on school curriculum and teacher resources and SWAYAM supports courses of higher education and lifelong learning. SWAYAM PRABHA is designed for limited bandwidth. SIDH integrates identity, courses, enrollment and certification. PMKVY 4.0 supports short-term training and the projects of training with an integration of RPL, while infrastructure and industry training for governance design is supported by PM-SETU. The National Skills Qualification Framework and SWAYAM credit guidelines integrate learning outcomes and recognition (National Council for Vocational Education and Training, 2023; University Grants Commission, 2021).

Analytical framework: libraries convert platforms into usable public capabilities**Fig. 2.** Analytical framework: libraries convert national platforms into usable public capabilities

Note. Author's synthesis informed by NEP 2020, lifelong-learning, public-library and digital-education frameworks (Ministry of Education, 2020; IFLA & UNESCO, 2022; International Commission on the Futures of Education, 2020, 2021; UNESCO Institute for Lifelong Learning, 2020; OECD, 2023).

The analytical framework treats libraries as capability intermediaries across six linked functions: discovery, access, literacy, learning support, credential navigation and community connection. Technology remains subordinate to educational purpose. UNESCO and OECD frameworks emphasise appropriateness, inclusion, evidence, human agency and responsible artificial intelligence rather than technology adoption alone (Global Education Monitoring Report Team, 2023; Miao & Holmes, 2023; OECD, 2021, 2023; UNESCO, 2024a, 2024b). Libraries operationalise these principles through curated resources, accessible interfaces, professional guidance, trusted local space and referral networks. Credit portability and interoperable records can connect fragmented learning episodes across institutions and life stages. However, meaningful interoperability still depends on understandable interfaces, local assistance, accessible content and accountable governance at every delivery point.

Table 2. Researcher-coded comparative capability matrix (0 = absent, 1 = supporting, 2 = core)

Initiative	Onl.	Bcast.	Cred.	Multi.	Educ.	Skill	Data	Lib.
Amrit Peedhi	0	0	0	1	1	2	0	1
PM eVIDYA	2	2	0	2	2	1	1	2
SWAYAM	2	0	2	1	1	2	1	2
SWAYAM PRABHA	1	2	0	2	1	1	0	2
SIDH	2	0	2	1	1	2	2	2
DIKSHA	2	1	1	2	2	1	2	2
PMKVY 4.0	1	0	2	1	1	2	2	2
PM-SETU	1	0	2	1	2	2	1	2

Note. Onl. = online platform; Bcast. = broadcast/offline; Cred. = credential/credit; Multi. = multilingual/accessibility; Educ. = educator support; Skill = skills/employability; Data = data/analytics; Lib. = library mediation. Coding is a transparent policy-content interpretation based on official programme documents; it is not a performance score.

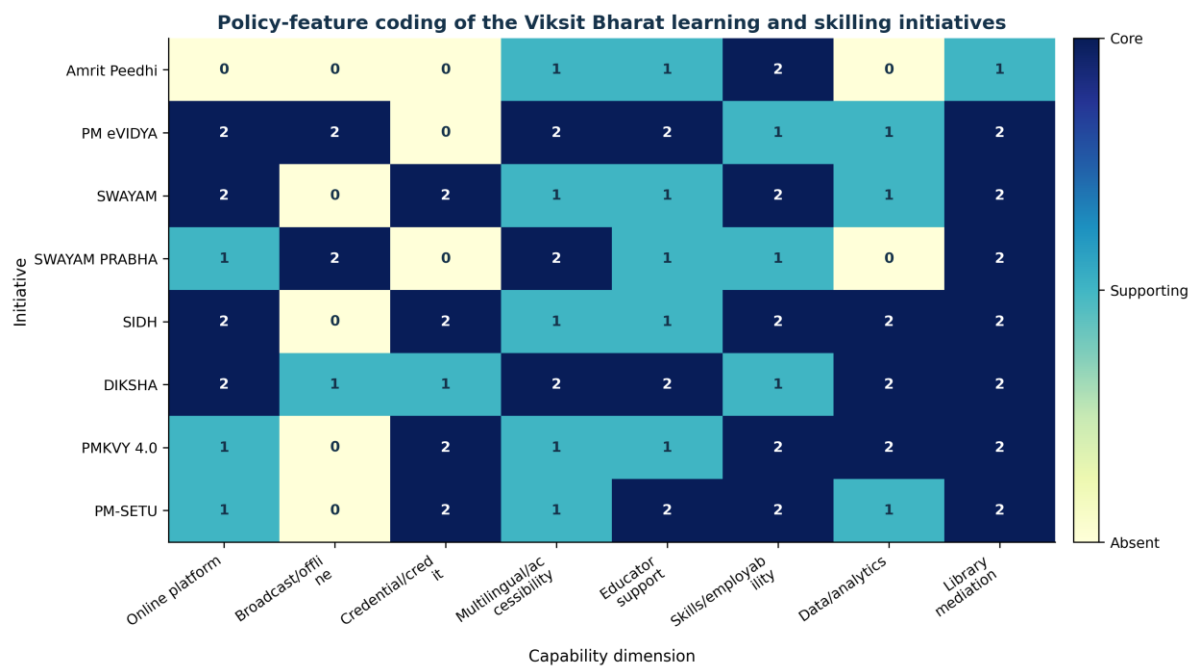


Fig. 3. Heat map of policy-feature coding across the eight initiatives

Note. Visualisation of Table 2. Official programme descriptions include PM eVIDYA, DIKSHA, SWAYAM, SWAYAM PRABHA, SIDH, PMKVY 4.0 and PM-SETU (Ministry of Education, 2025c; Press Information Bureau, 2024a, 2025a, 2025b, 2025c; Ministry of Skill Development and Entrepreneurship, 2023).

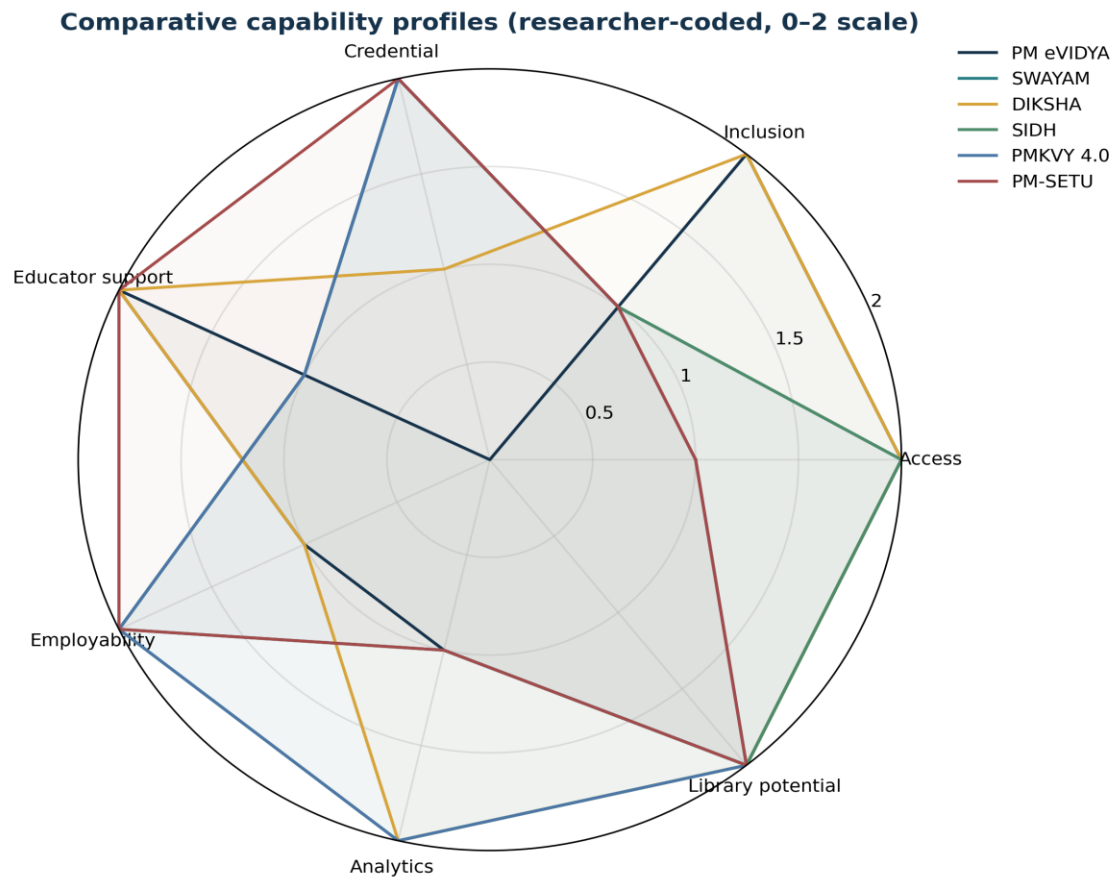


Fig. 4. Selected capability profiles on a researcher-coded 0–2 scale

Note. The radar chart is descriptive and highlights complementarity; it should not be interpreted as a causal or outcome ranking.

Transformative role of libraries

Integrating SWAYAM Courses into subject guides offers additional support for online examinations and links learners to the National Digital Library of India. Credit-transfer policies can be integrated into research consultations. Additional topics can include copyright, artificial intelligence, and openness. There is evidence that library support works best in conjunction with a MOOC when there is an element of orientation and a sustained focus on the learners (Anand Shankar Raja & Kallarakal, 2021; Bordoloi et al., 2020; Kaushik, 2021; Rafiq et al., 2021).

School libraries can link print collections to DIKSHA QR resources through PM eVIDYA and SWAYAM PRABHA. Resources will support digitization pathways, and will be complemented by extended resources and workshops to support families and educators. Public libraries may extend this support to rural populations, job seekers, and individuals displaced from education. Mobile libraries can bring devices, and offer facilitated sessions to low connectivity areas. Community Knowledge Centers may host PMKVY course exploration, SIDH registration, and practice assessments.

Transformation hinges on unique service design and measurable criteria. Libraries should track the number of active users and sessions supported, the accessibility of resources, the number of users completing a course and earning course credits, and the number of users referred and successful. This is an improvement over simply tracking the number of library holdings or the number of devices. Librarians need skills related to the digital pedagogy, mediation in several languages, privacy issues and cyber safety, and accessibility and AI literacy. The public library's mandate on information, culture, and lifelong learning supports an expanded public librarian role. Meanwhile, school library and PM SHRI direction focuses on the improvement of education (Department of School Education and Literacy, 2021b; IFLA & UNESCO, 2022; Ministry of Education, 2022a, 2022b). Knowledge resource centers in modernized ITIs could collect safe trade standards, trade safety, and the information on apprenticeships. Mobile and community services could provide local feedback on missing courses and assessment services, providing justification for evidence-based district integration. Libraries are accountable learning network nodes, not passive spaces.

Research Questions, Objectives, and Hypotheses

The six questions focus on the alignment of policies, variations in skills and capabilities, trends in infrastructure, the connection of LEDRI certification, and the differences in readiness groups and the impact of program scope. The related objectives focus on mapping the connections among initiatives, identifying and coding the eight capabilities, measuring the changes in UDISE+, developing the LEDRI, and analyzing correlations, regressions, and group differences. The following hypotheses are presented: H1 knowledge becomes more accessible, H2 the LEDRI coefficient shifts positively, H3 there is an increase in the culture of lifelong learning, H4 differences emerge within the readiness groups, H5 a positive correlation is found between readiness above the median and certification, and H6 a positive enrollment intensity is found. The scaffolding for hypotheses H1 and H3 is provided in the documentation across India; however, individual-level analysis is not provided.

Table 3. Research questions, measurable objectives and hypotheses

ID	Research question	Measurable objective	Hypothesis
RQ1	How do the eight initiatives align with Viksit Bharat 2047?	Map policy purposes and institutional linkages	H1: infrastructure and digital initiatives support knowledge accessibility
RQ2	How do their delivery capabilities differ?	Code eight programme capability dimensions	H1 and H3: complementarity supports access and lifelong learning
RQ3	How did school library and digital infrastructure change?	Quantify 2022–23 to 2024–25 UDISE+ trends	H1: readiness expands over time, with unequal components
RQ4	Is LEDRI associated with PMKVY certification yield?	Test correlation and robust regression	H2: LEDRI has a positive coefficient
RQ5	Do readiness groups differ in certification performance?	Apply t-test, ANOVA and effect sizes	H4: mean yield differs across readiness groups/quartiles
RQ6	Are above-median readiness and certification associated, and does scale predict yield?	Apply chi-square and controlled regression	H5: median categories are associated; H6: enrolment intensity is positive

Note. H3 is assessed through policy-literature triangulation because no individual lifelong-learning measure is available. H1 is partly descriptive; H2, H4, H5 and H6 are statistically tested.

Methodology

This study adopted a quantitative, analytical, descriptive framework supported by secondary data. Infrastructure data were taken from the official UDISE+ reports for the years 2022–23, 2023–24, and 2024–25 (Ministry of Education, 2023, 2024a, 2025a). PMKVY 4.0 State/Union Territory enrolment, training, active participation, assessment, and certification data were sourced from the Ministry of Skill Development and Entrepreneurship Annual Report 2024–25, as of 9 January 2025. The total of training-types and definitions of the National Program were cross-checked with PMKVY and previous annual reports (Ministry of Skill Development and Entrepreneurship, 2023, 2024, 2025). No invented survey responses were reported.

The unit of analysis was State or Union Territory. Reporting geography dictated the combination of Dadra and Nagar Haveli and Daman and Diu. Descriptive analysis considered all 36 jurisdictions, whilst 34 jurisdictions, with a minimum of 1,000 PMKVY enrollments, were considered for inferential analysis. Goa and Lakshadweep were excluded due to unstable enrollments. Certification yield was calculated as the percentage of participants who were certified, out of total PMKVY enrollment. Placement was not included due to PMKVY 4.0 severing the linkage with Placement, thus making certification a process outcome.

The four UDISE+ indicators assessed the existence of a school library, a digital library, a pedagogical computer, and internet access. The indicators were standardized and averaged, along with ongoing share and log enrollment per 1,000 schools, to create the LEDRI index. Cronbach's alpha was employed to assess the internal consistency of the infrastructure composite, not the composite of the questionnaires. A policy matrix coded (0) absence, (1) support, and (2) core presence of online, broadcast/offline, credential, multilingual/accessibility, educator, analytics, and library mediation capabilities. This was done using official program documents.

Studies utilized Shapiro–Wilk tests, Welch's independent t-test, one-way ANOVA, and Yates-corrected chi-square to analyze data and performed HC3 robust multiple regression to assess multiple variables simultaneously. Analysis included means, standard deviations, and effect sizes. Cohen's d, eta-squared, and phi also were computed. The regression aimed to predict certification yield based on variables of LEDRI, ongoing share, and log intensive enrollments. Statistical significance was determined at $p < .05$. However, effect sizes, confidence intervals, and the consistency of results across tests were considered for the analysis. The assessed share variable was not included in the regression because this variable is, by its nature, placed prior to certification. Data transformations relied on Python and supported packages, notably Pandas and StatsModels. The described ecological design is inherently unable to isolate specific factors and to directly measure satisfaction, library usage, the persistence of lifelong learning, or employability. Data extraction was done in a way to honor and protect official report dates, definitions, and denominators. All rates, reported subsequent to the official report, were done based on the published counts with no estimation for missing data. A sensitivity analysis was performed to assess the impact of using median in place of mean when addressing the problem of heteroskedasticity. The design of the study in question aimed to minimize the risk of transcription errors through the consultation of the relevant administrative data prior to the analysis

Table 4. Secondary data sources, operational variables and analytical use

Source	Coverage	Variables / evidence	Use and limitation
UDISE+ 2022–23, 2023–24, 2024–25	36 States/UTs; school counts and facilities	Library, digital library, functional pedagogical computer, internet	National trend and LEDRI; reported availability, not observed quality
MSDE Annual Report 2024–25	PMKVY 4.0 State/UT counts to 9 January 2025	Enrolled, trained, ongoing, assessed, certified	Certification yield and pipeline rates; placement not tracked
PMKVY 4.0 guidelines and MSDE 2023–24 report	Scheme design and national component totals	Training types, governance, funding and SIDH integration	Triangulation of programme definitions
Official platform, budget and policy documents	Eight initiatives, 2020–2025	Modalities, credentials, accessibility, skills, analytics	Researcher-coded capability matrix
Recent peer-reviewed and institutional literature	2020–2025	Digital inequality, MOOCs, library services, AI literacy	Interpretation and policy comparison

Note. The source architecture also reflects NDEAR interoperability, the National Credit Framework and the National Skills Qualification Framework (Ministry of Education, 2021; University Grants Commission, 2023; National Council for Vocational Education and Training, 2023). All analyses use aggregate public data; no human-participant survey was fabricated or inferred.

Results

The capability analysis showed complementarity rather than interchangeability. PM eVIDYA had the broadest multimodal-access profile; DIKSHA combined curriculum, educator support and analytics; SWAYAM had the strongest higher-education credential function; and SWAYAM PRABHA remained important where continuous internet or personal devices were unavailable. SIDH, PMKVY 4.0 and PM-SETU concentrated on skills, credentials and labour-market linkage. All initiatives showed high potential for library mediation because users may require discovery, registration, accessible formats, study support and verification. Amrit Peedhi operated as a participation frame rather than a delivery platform.

UDISE+ recorded clear progress but an unresolved conversion gap. Schools reporting a library, book bank or reading corner increased from 88.28% in 2022–23 to 89.50% in 2024–25. Functional pedagogical computers rose from 43.41% to 57.95%, and internet access from 49.66% to 63.47%. Digital-library coverage moved from 7.36% to 7.53% before falling to 6.90%. In 2024–25, 1,316,991 of 1,471,473 schools reported a basic library-related facility, but only 101,505 reported a digital library. Connectivity therefore expanded faster than curated, discoverable and supported digital collections.

Table 5. National school infrastructure trends from UDISE+

Year	Library / reading facility	Digital library	Functional computer	Internet
2022–23	88.28%	7.36%	43.41%	49.66%
2023–24	89.02%	7.53%	50.88%	53.88%
2024–25	89.50%	6.90%	57.95%	63.47%

Note. Percentages are author calculations from official UDISE+ school counts (Ministry of Education, 2023, 2024a, 2025a). “Library” includes library, book bank or reading corner; “functional computer” refers to pedagogical use.

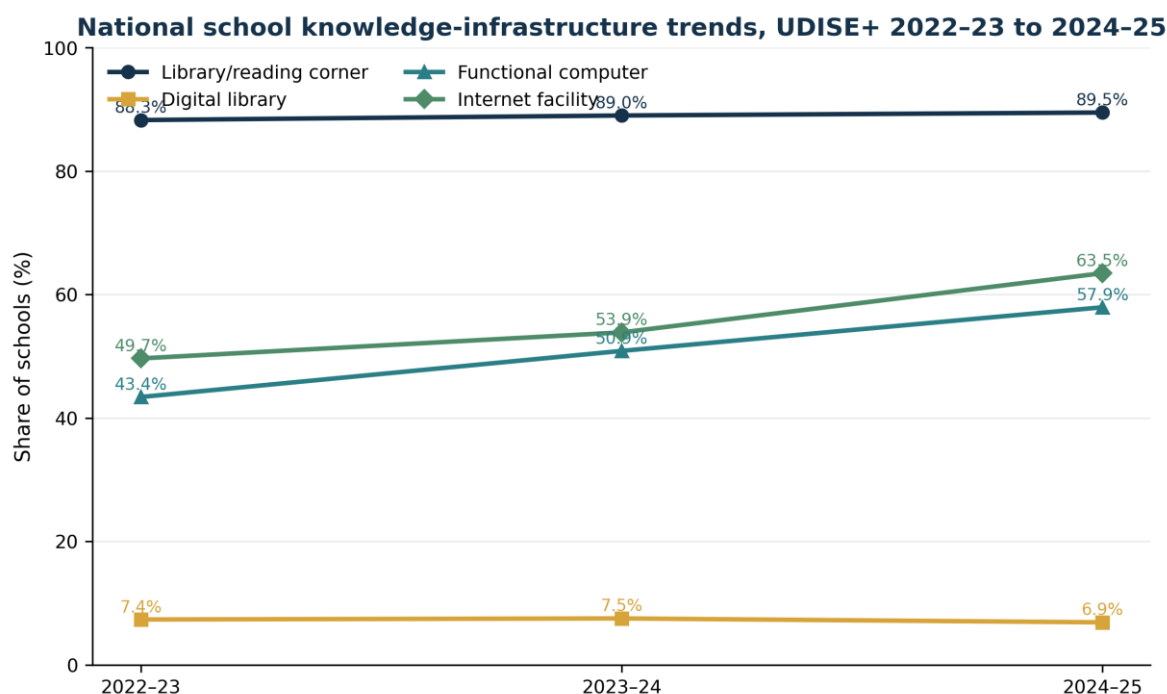


Fig. 5. National change in school library and digital infrastructure, 2022–23 to 2024–25

Note. Source: Author calculations from UDISE+ reports (Ministry of Education, 2023, 2024a, 2025a).

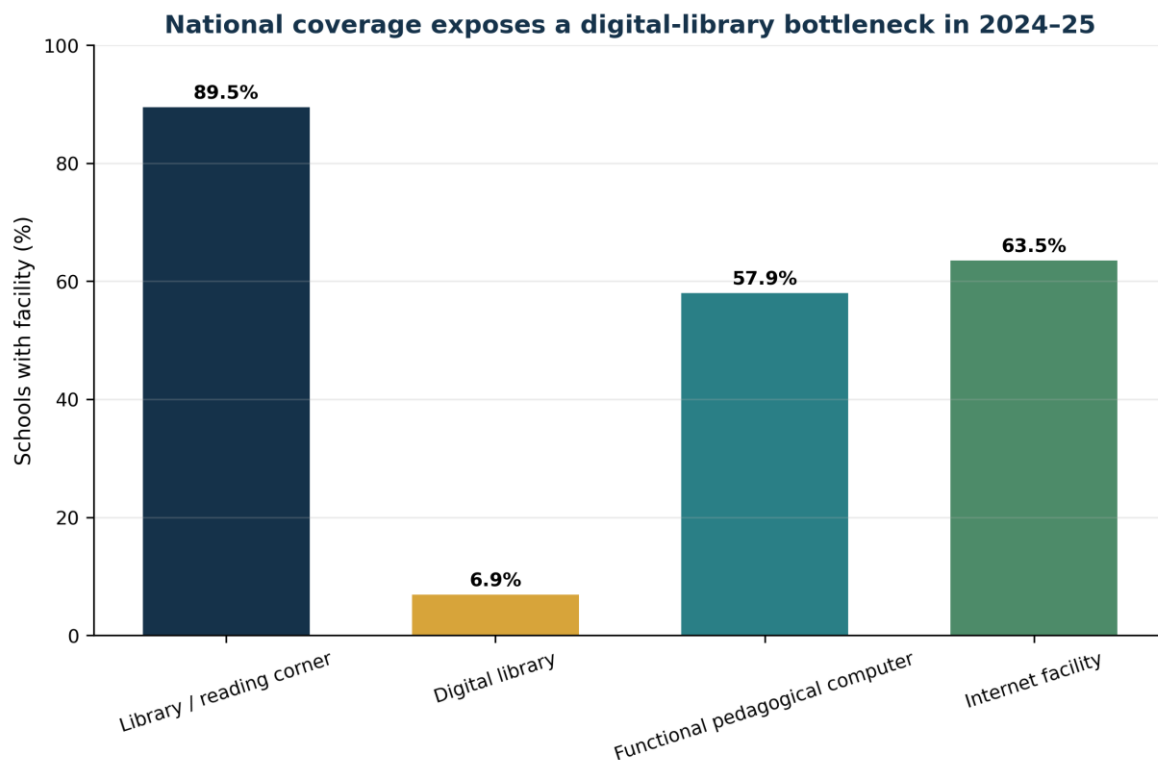


Fig. 6. National coverage of selected school facilities in 2024–25

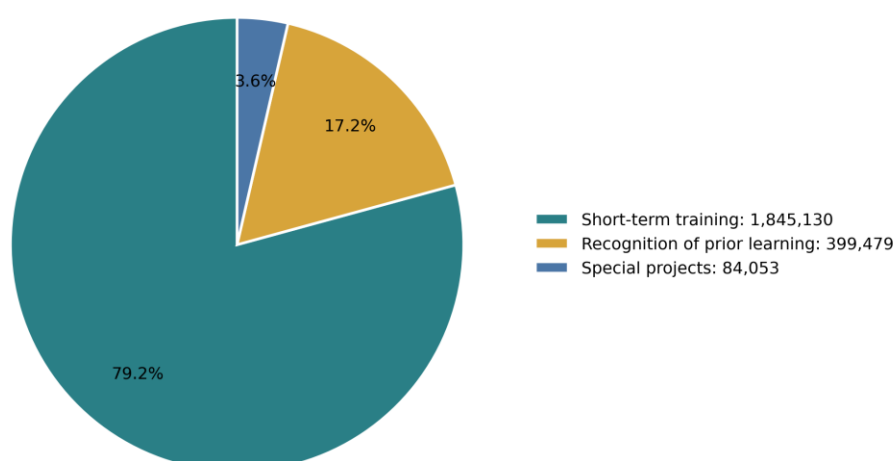
Note. Source: UDISE+ 2024–25. Counts use 1,471,473 reported schools (Ministry of Education, 2025a).

PMKVY 4.0 recorded 2,811,469 enrolments, 2,328,662 trained participants, 252,744 ongoing participants, 1,449,006 assessed participants and 1,319,810 certifications. These represented 82.83% trained, 8.99% ongoing, 51.54% assessed and 46.94% certified relative to enrolment; 91.08% of assessed participants were certified. Short-term training accounted for 1,845,130 participants, recognition of prior learning for 399,479 and special projects for 84,053. The funnel indicates substantial scale, but attrition occurred mainly before assessment rather than during assessed-to-certified conversion. Libraries cannot remove every administrative constraint, although orientation, learning materials, scheduling and assessment information may reduce avoidable loss.

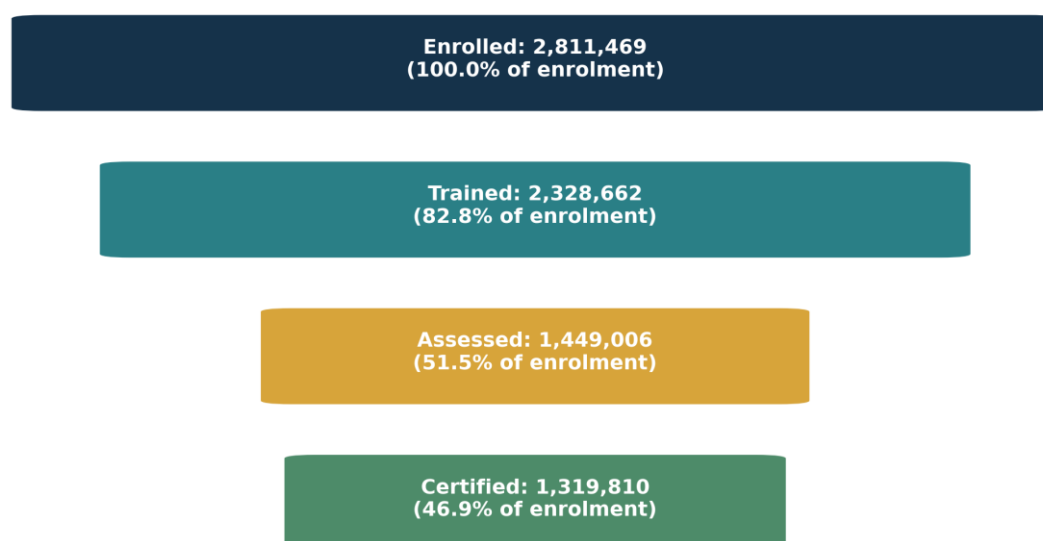
Table 6. PMKVY 4.0 national participation and training profile

Panel	Measure	Count	Rate / interpretation
Pipeline	Enrolled	2,811,469	100.00% of enrolment
Pipeline	Trained	2,328,662	82.83% of enrolment
Pipeline	Ongoing	252,744	8.99% of enrolment
Pipeline	Assessed	1,449,006	51.54% of enrolment
Pipeline	Certified	1,319,810	46.94% of enrolment; 91.08% of assessed
Training mix	Short-term training	1,845,130	79.24% of trained
Training mix	Recognition of prior learning	399,479	17.15% of trained
Training mix	Special projects	84,053	3.61% of trained

Note. State-wise pipeline counts are reported to 9 January 2025; training-type totals are reported to 31 December 2024 (Ministry of Skill Development and Entrepreneurship, 2025). Placement is not inferred because PMKVY 4.0 delinked mandatory placement tracking.

PMKVY 4.0 trained candidates by intervention type (to 31 December 2024)**Fig. 7.** Composition of PMKVY 4.0 trained participants by training type

Note. Source: Ministry of Skill Development and Entrepreneurship Annual Report 2024–25.

PMKVY 4.0 national participation-to-certification funnel (9 January 2025)**Fig. 8.** PMKVY 4.0 national enrolment-to-certification funnel

Note. Percentages are calculated against enrolment. Assessed-to-certified conversion equals 91.08%.

Across 36 jurisdictions, mean school coverage was 88.24% for a library-related facility, 7.00% for a digital library, 68.06% for functional computers and 69.20% for internet. Standard deviations were 19.06, 14.31, 25.11 and 23.46 percentage points respectively, indicating substantial inequality. Telangana's digital-library reporting made it a high outlier, while several north-eastern and large low-resource States recorded negative LEDRI values. In the 34-jurisdiction inferential sample, mean certification yield was 45.31% (SD = 8.04), ranging from 25.66% to 59.89%.

Table 7. State/UT descriptive statistics

Variable	n	Mean	SD	Minimum	Maximum
Library / reading facility (%)	36	88.24	19.06	27.99	100.00
Digital library (%)	36	7.00	14.31	0.13	85.70
Functional computer (%)	36	68.06	25.11	17.50	99.95

Internet (%)	36	69.20	23.46	18.61	100.00
LEDRI (standardised)	34	-0.03	0.77	-1.88	1.55
Trained / enrolled (%)	34	82.99	7.20	61.83	96.66
Ongoing / enrolled (%)	34	7.37	5.03	0.00	24.85
Certification yield (%)	34	45.31	8.04	25.66	59.89

Note. Infrastructure descriptions use all 36 jurisdictions. Inferential variables use 34 jurisdictions with at least 1,000 PMKVY enrolments. Goa and Lakshadweep were excluded only from inferential analysis.

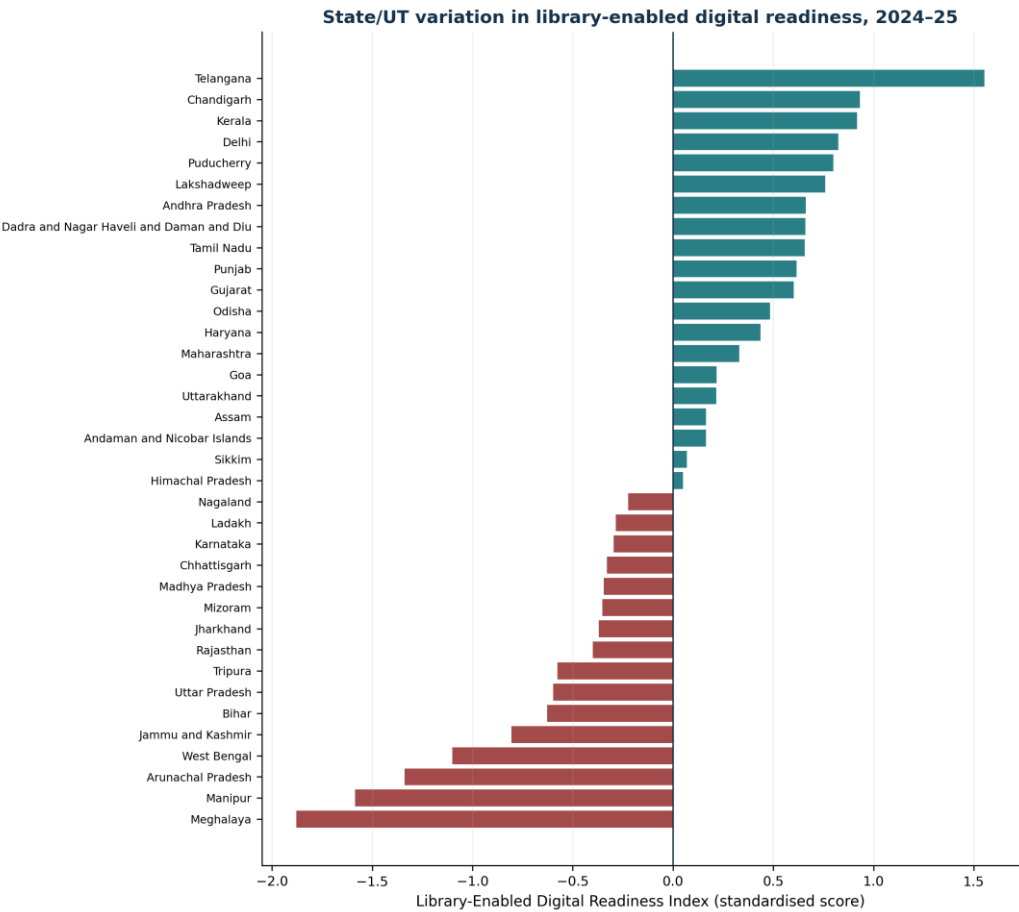


Fig. 9. State/UT variation in the Library-Enabled Digital Readiness Index

Note. LEDRI is the mean of four standardised UDISE+ percentages: library/reading facility, digital library, functional pedagogical computer and internet.

The four LEDRI components produced Cronbach’s alpha of .773, supporting acceptable coherence for an exploratory infrastructure index. Shapiro–Wilk tests indicated approximate normality for LEDRI, $W = .971$, $p = .502$, and certification yield, $W = .985$, $p = .901$. Trained share, ongoing share and enrolment intensity were non-normal, justifying robust standard errors and Welch’s test. Assessed-to-certified conversion was also non-normal because one jurisdiction had unusually low conversion despite high assessment coverage. These diagnostics support cautious inferential use without implying that all distributional assumptions were fully satisfied.

Table 8. Reliability and distributional diagnostics

Variable / scale	Test	Statistic	Interpretation
LEDRI components	Cronbach’s alpha	.773	Acceptable coherence for an exploratory infrastructure composite
LEDRI	Shapiro–Wilk	$W = 0.971$; $p = 0.502$	Approx. normal
Trained rate	Shapiro–Wilk	$W = 0.934$; $p = 0.042$	Non-normal

Ongoing rate	Shapiro–Wilk	W = 0.872; p < .001	Non-normal
Assessed rate	Shapiro–Wilk	W = 0.978; p = 0.722	Approx. normal
Certification yield	Shapiro–Wilk	W = 0.985; p = 0.901	Approx. normal
Certified/assessed	Shapiro–Wilk	W = 0.691; p < .001	Non-normal
Enrolment intensity	Shapiro–Wilk	W = 0.907; p = 0.007	Non-normal

Note. Cronbach's alpha evaluates coherence of infrastructure indicators, not psychometric reliability of a questionnaire. Robust standard errors and Welch's test were used where distributional assumptions were uncertain.

Certification yield correlated positively with the basic library indicator, $r = .446$, $p = .008$; internet coverage, $r = .428$, $p = .012$; and LEDRI, $r = .412$, $p = .015$. Functional-computer coverage was positive but non-significant, $r = .282$, $p = .107$, whereas digital-library coverage alone was weak, $r = .095$, $p = .594$. Ongoing share correlated negatively with yield, $r = -.384$, $p = .025$. Assessed share correlated strongly, $r = .944$, $p < .001$, but this largely reflects the programme pipeline and was not treated as an independent explanatory result.

Table 9. Pearson correlations with PMKVY 4.0 certification yield ($n = 34$)

Predictor	r	p	Decision at .05
Library/reading facility	0.446	0.008	Significant
Digital library	0.095	0.594	Not significant
Functional computer	0.282	0.107	Not significant
Internet	0.428	0.012	Significant
LEDRI	0.412	0.015	Significant
Ongoing rate	-0.384	0.025	Significant
Trained rate	0.311	0.074	Not significant
Assessed rate	0.944	< .001	Significant

Note. The assessed-rate correlation is mechanically related to certification and is reported descriptively rather than treated as an independent explanatory variable.

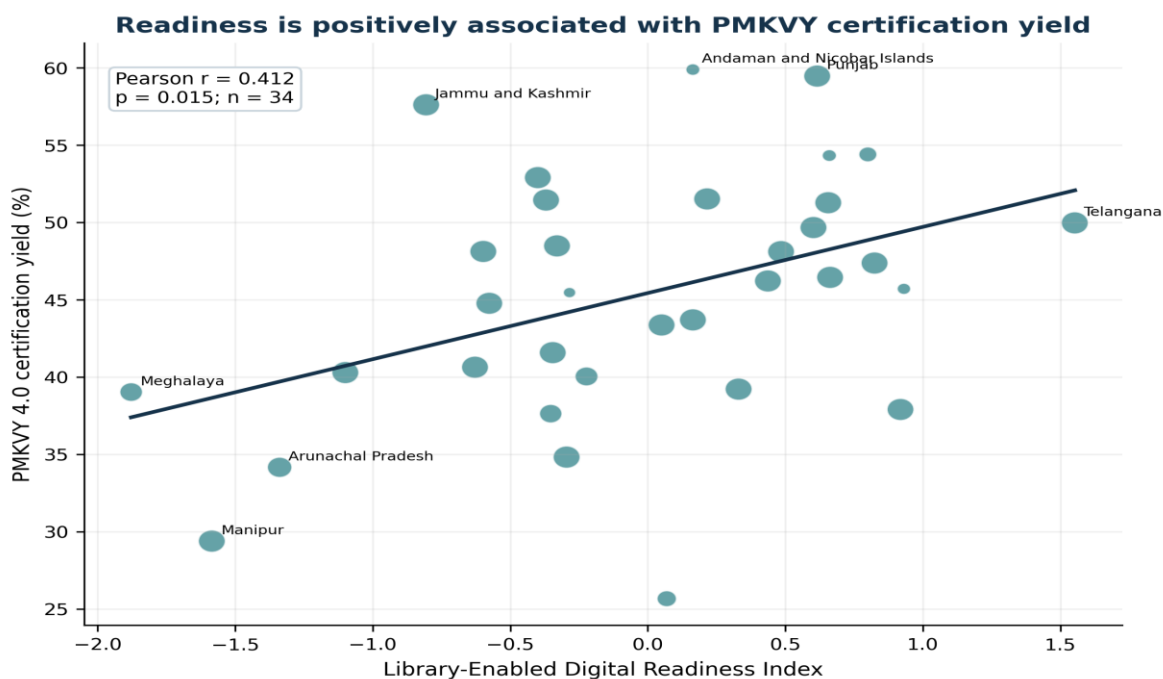


Fig. 10. Association between LEDRI and PMKVY 4.0 certification yield

Note. Bubble size represents enrolment. The fitted line is descriptive; the ecological association does not establish individual-level causation.

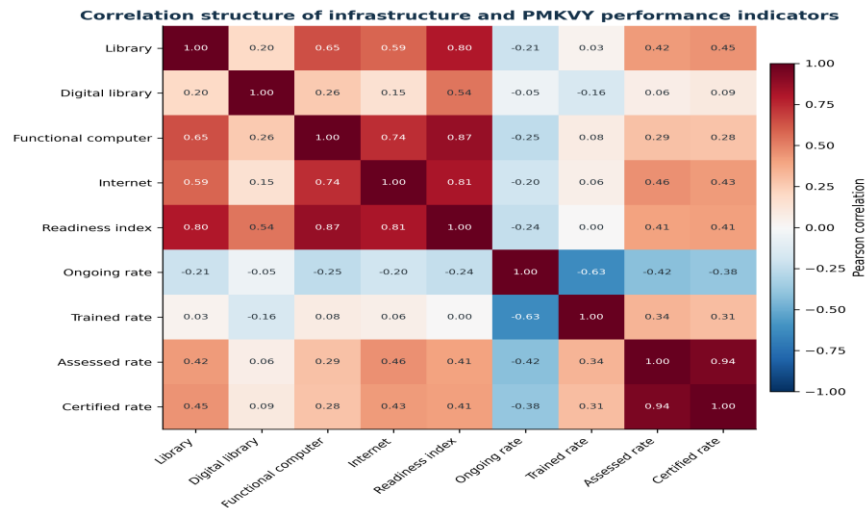


Fig. 11. Correlation structure of infrastructure and PMKVY performance indicators

Note. Pearson coefficients are based on the 34-jurisdiction inferential sample.

The HC3 regression was jointly significant, robust $F = 4.324$, $p = .012$, with $R^2 = .258$ and adjusted $R^2 = .184$. Holding ongoing share and enrolment intensity constant, a one-standard-unit LEDRI increase was associated with a 3.52-percentage-point rise in certification yield, robust $SE = 1.51$, $p = .020$, 95% CI [0.55, 6.48]. Ongoing share was negative but non-significant, $B = -0.49$, $p = .103$; log enrolment intensity was negligible, $B = 0.30$, $p = .866$. Enabling infrastructure was therefore associated with throughput, although most variance remained unexplained.

Table 10. HC3 robust multiple regression predicting certification yield

Term	B	Robust SE	z	p	95% CI
Intercept	46.674	11.674	3.998	< .001	[23.793, 69.555]
LEDRI	3.518	1.512	2.327	0.020	[0.554, 6.482]
Ongoing share (%)	-0.485	0.298	-1.630	0.103	[-1.069, 0.098]
Log enrolment intensity	0.300	1.784	0.168	0.866	[-3.197, 3.797]

Note. $n = 34$; $R^2 = .258$; adjusted $R^2 = .184$; robust $F = 4.324$, $p = .012$. Outcome = certified/enrolled $\times 100$. The coefficient is an ecological association and should not be interpreted causally.

Group tests produced mixed evidence. High-readiness jurisdictions averaged 47.70% certification against 42.92% for low-readiness jurisdictions. Welch's $t = 1.788$, $p = .083$, was non-significant, although Cohen's $d = .613$ indicated a medium difference. Quartile ANOVA was also non-significant, $F(3, 30) = 1.431$, $p = .253$, eta-squared = .125. Conversely, the median-split association was significant, chi-square(1) = 4.235, $p = .040$, phi = .353. Correlation and regression support H2; t-test and ANOVA do not support H4; chi-square supports H5; and enrolment intensity does not support H6. H1 and H3 receive descriptive, triangulated support only.

Table 11. Group tests, effect sizes and hypothesis decisions

Test / proposition	Result	p	Effect interpretation /	Decision
Welch t-test: high vs low LEDRI	47.70% vs 42.92%; $t = 1.788$	.083	Cohen's $d = .613$	H4 not supported at .05; medium effect
ANOVA: LEDRI quartiles	$F(3,30) = 1.431$	.253	$\eta^2 = .125$	H4 not supported
Chi-square: high readiness $\times$ high certification	$\chi^2(1) = 4.235$	.040	$\phi = .353$	H5 supported

Regression: LEDRI	B = 3.518; 95% CI [0.554, 6.482]	.020	Positive adjusted association	H2 supported
Regression: enrolment intensity	B = 0.300	.866	Negligible	H6 not supported
Policy/data triangulation	Multimodal access and library mediation	—	Descriptive evidence	H1 and H3 partially supported

Note. Decisions are not based on p values alone. Continuous and categorical tests provide convergent but not identical evidence; confidence intervals, effect sizes and the ecological design constrain inference.

Taken together, the descriptive and inferential results identify a two-part implementation problem. First, national systems have achieved substantial reach, but access infrastructure remains uneven and digital-library provision is especially thin. Second, jurisdictions with stronger combined readiness tended to report better certification throughput, although categorical tests were not uniformly significant. The evidence therefore favours targeted service strengthening over undifferentiated expansion. It also indicates that future monitoring should separate registration, active participation, assessment readiness, certification and post-certification progression, while recording whether library mediation was available and actually used.

Discussion

The findings indicate that India's educational and skilling frameworks consist of several multimodal layers, with public value relying primarily on institutional conversion. Various schemes contribute to different stages of skill development and the building of training infrastructure. Existing libraries can integrate the components of these frameworks and allow for more structured skill development. This is corroborated by findings that, while the availability of online content made learning more flexible, many issues surrounding interaction, self-regulation, assessment, and availability of devices and internet connectivity persisted (Agarwal & Kaushik, 2020; Chakraborty et al., 2021; Nambiar, 2020; Rizvi & Nabi, 2021). The currently active configuration is therefore a combination of Platform, Place, and Professional support.

The UDISE+ trend is noteworthy. While internet access and the availability of functional computers increased significantly, the provision of digital libraries remained below 8% and decreased in the last reported year. A digital library is not simply a room with internet access. It is a collection of a legitimate resources, research assistance, authentication, user friendly interfaces, digital preservation and curation. The weak digital library and certification bivariate relationship may describe uncommonly reported libraries with differing definitions. Basic libraries and internet connectivity exhibit stronger relationships. Focus should be on supported sessions, user statistics, accessibility, and the presence of a skilled workforce dedicated to the library.

A likely ecologically valid phenomenon would be suggested by a positive LEDRI coefficient. More prepared jurisdictions may have more robust administration and more complex urbanization and education systems, more developed exam and an extensive labor market. It is important to note the enabling conditions for education systems certification processes, as the findings suggest that better prepared jurisdictions have greater numbers of certified jurisdictions. Intensive enrollment produced no predictions and made the scale of evaluation more difficult. Expanding systems and leaving guidance and support for readiness and completion out of the equation may increase participation, but will not change the proportional success rate. The same phenomenon can be seen in research of MOOCs, where there is a tradeoff between mass participation and persistent participation (Anand Shankar Raja & Kallarakal, 2021; Bordoloi et al., 2020; Kaur et al., 2022).

This interpretation is further supported by the result of Mixed group testing. A medium Cohen's d suggests a readiness gap that may be meaningful, but a small number of jurisdictions that practice Mixed group testing diminished the measurement. Non-significant ANOVA recognized that there is no simple outcome that is linear and graduated. A chi-square test showed clustering, leaving a void of the necessary infrastructure. Libraries fall in the context of a large implementation system. Availability of quality courses, trainers, languages, inclusion of persons with disabilities, scheduling of tests, credit recognition and connections with employment impact outcomes. These factors demonstrate that the rapid technological expansion libraries experience (and other services) can co-exist with unequal outcomes.

The findings suggest potential pathways for NEP 2020 for local progressive implementation throughout multiple educational levels. Libraries may enact NCQF by utilizing course mapping and credit clinics, resource integration, and room allocation for critical inquiry. Such initiatives will likely be applicable in the context of AI. Users will be required to perform critical evaluations of the credibility, bias, and privacy of AI tools and generated outputs. In regard to AI, UNESCO advocates for the implementation of these skills, providing a framework for accountability for libraries and educational partners. Libraries present a network of skilled personnel to aid in this area. (Miao & Holmes, 2023; UNESCO, 2024a, 2024b).

Resources and services vary by library type. School libraries help sustain connections to resources and reading, while academic libraries help facilitate credit recognition and SWAYAM. Public and community libraries help reach different patrons, while mobile libraries help reach less populated areas. ITI knowledge centers may aim to link PMKVY and PM-SETU learners with assessment opportunities as well as job and apprenticeship offerings. This approach meets varying levels of digital opportunity and successful remote learning (Beaunoyer et al., 2020; Bond et al., 2021; Lythreathis et al., 2022; Williamson et al., 2020). Most importantly, this approach remains aligned with the traditional purpose of libraries: reading, a shared culture, and collective knowledge.

Data governance innovations are triggered by new services expansions. Libraries intervene and blend identity verification, enrollment, and credentialing with SIDH, DIKSHA, and credit systems. More digitized footprints from these systems require dashboards that break apart reach and completion data by gender, disability, rurality, socio-economic status, and more, while upholding the need to protect the identities of data subjects. Privacy by design and minimum data collection, secure workstations, and informed consent will be the new modus operandi. IndiaAI extends the national computing grid. Equitable benefits of IndiaAI at the community level will require functional understanding of AI, cyber hygiene, basic digital literacy, critical thinking, and algorithms, along with fraud (Press Information Bureau, 2024b). Out of control digitization can quickly erode trust and deepen exclusion, especially without adequate protections.

Be cautious of employment claims. The India Employment Report outlines the difficult school to work transitions and the fragmented nature of youth employment (International Labour Organization & Institute for Human Development, 2024). Lack of mandatory placement tracking in PMKVY 4.0 means that employability cannot be measured. While important, PMKVY certification does not guarantee employment or even adequate work. Future dashboards should use privacy-preserving linkages to measure the continuum of training, certification, apprenticeships, employment, and wages. Libraries may offer career services and connect users to alumni, but should be measured against a reasonable combination of education, inclusion, and employment metrics, as opposed to placement metrics.

Public libraries are experiencing a major shift from housing a “collection” to a “public capability” infrastructure. The COVID-19 pandemic laid bare the precarious juggling act of several public services, including libraries, education, and other resources. Managed appropriately, the Viksit Bharat 2047 project will standardize and implement new ideas to address the inequities of those left behind. Libraries are perhaps the only public services that can implement a completely integrated, nationwide policy, advanced public mediation, and retain public trust.

Implementation and Recommendations

As a first step, libraries should identify and close the gaps for access and skills on the local level. They should then begin public mediation to create pathways for learners to engage with employ and education opportunities, as well as connect to public libraries; and to define learning pathways and equitable user outcome frameworks and metrics. Services should be sustained to achieve these goals.

At a minimum, the Viksit Bharat should implement adequate staffing, appropriate service hours, and ensure physical and digital services are accessible and safe; as well as offer privacy and multilingual resources. The heads of State Libraries and education departments should create district coordination centers. Libraries and library education should include digital Pedagogy, skills navigation, data literacy, and responsible AI. Readiness within jurisdictions should be prioritized, including mobile libraries and shared services.

Local discretion is needed when striving for national interoperability. A centralized catalog might show metadata of verified programs in library systems alongside their prerequisites as well as info regarding language, duration, assessments, credits, and accessibility. The States will add local courses, mentors, and employers. Multi-year grants will be needed to fund the upkeep, licensing and professional development. Equity, completion, and privacy should be measured by balance dashboards. Evaluation should be done independently and the methods should be disclosed. To offer trusted help to the disconnected, the least served, and the most digitally underserved, the best option will be to use traditional methods of communication. They should be used in the schools, panchayats, self-help groups and youth clubs.

The implementation agreements must also include data ownership, grievance interoperability, and accessibility standards along with the mandate for regular audits. Regarding localized content that poorly meets the needs of women and people with disabilities, slow participation, few assessment opportunities, and the lack of testing centers, the absences should be the main focus of the quarterly evaluations.

Table 12. Library transformation and policy recommendation matrix

Library type	Priority initiative linkage	Core transformative services	Suggested outcome indicators
School library	DIKSHA, PM eVIDYA, SWAYAM	QR-linked curation, reading-to-	Active users, accessible

	PRABHA	digital pathways, teacher support	resources, supported sessions
Academic / university library	SWAYAM, NDLI, NCrF	Course mapping, credit clinics, research and AI literacy	Course completion, credits recognised, research consultations
Public library	SIDH, PMKVY 4.0, e-Pustakalaya	Registration, career information, study groups, civic access	New digital users, repeat use, certification referrals
Community library	Amrit Peedhi, local skill programmes	Youth deliberation, local-language mediation, peer learning	Participation diversity and locally defined outcomes
Mobile library	Offline DIKSHA/DTH resources	Devices, downloaded content and facilitated outreach	Settlements reached, sessions and completed referrals
Digital library	NDLI, SWAYAM, institutional repositories	Federated discovery, metadata, accessibility and preservation	Search success, accessible formats, resource reuse
ITI knowledge resource centre	SIDH, PMKVY 4.0, PM-SETU	Assessment preparation, trainer resources, employer linkage	Completion, certification, apprenticeship and follow-up

Note. The service matrix synthesises recent evidence on digital inequality, online learning, institutional mediation and library response (Ali, 2020; Anderson & Rivera-Vargas, 2020; Beaunoyer et al., 2020; Bond et al., 2021; Kapasia et al., 2020; Kaushik, 2021; Kaur et al., 2022; Mariya et al., 2022; Muthuprasad et al., 2021; Rafiq et al., 2021; Williamson et al., 2020). Curriculum and discovery context is informed by the National Council of Educational Research and Training (2022, 2023) and National Digital Library of India (2025). Connectivity and national service indicators are informed by International Telecommunication Union (2024), Ministry of Education (2024d), National Statistical Office (2024) and NITI Aayog (2024).

Proposed library implementation cycle for Viksit Bharat 2047

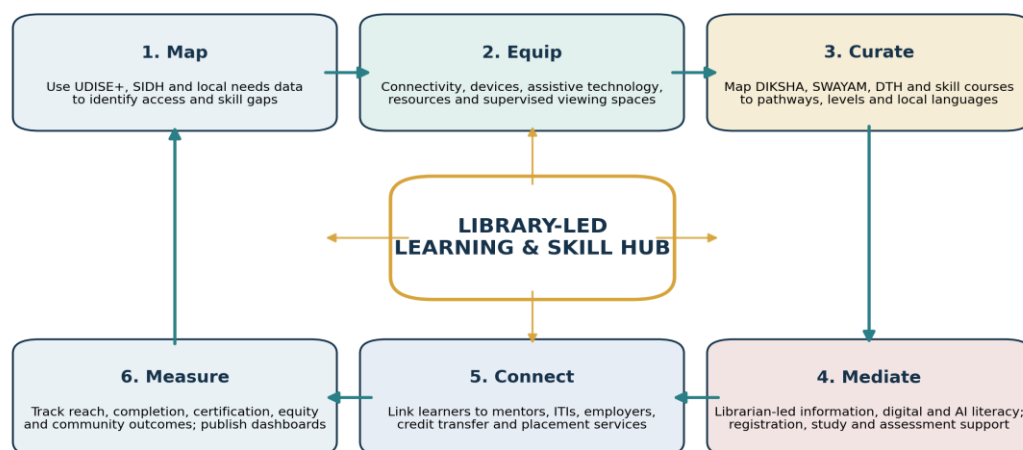


Fig. 12. Proposed six-stage library implementation cycle for Viksit Bharat 2047

Note. Author's implementation framework: map, equip, curate, mediate, connect and measure. The cycle combines national interoperability with locally accountable service delivery.

Limitations and Future Research

Administrative datasets serve various objectives and are compiled at different points in time. UDISE+ indicators show availability, but UDISE+ does not measure quality or usefulness. The LEDRI framework is based on equal weights. However, at the State level, the relationships are susceptible to the ecological fallacy. Certification yield is not the same as employment. The effects of PM-SETU cannot be evaluated at this point. There is also a lack of data on awareness, satisfaction and other lifelong learning and community engagement indicators. There is no clear guidance, and so, policy feature coding is based on the discretion of the researcher. Small sample size, especially for quartiles, unmeasured policy mixing, and inconsistencies in other reporting limit the framework's scope. The LEDRI

framework needs to be implemented with adjusted weights and exclusions, lag specifications, and replicated before it is used for funding and performance purposes.

Validation of LEDRI with actual services, real district and rural-urban service learning and library user panels, equity of learning and library services, and learning and library landscapes among others, should be prioritized. These would be a basis to develop program theories and causal frameworks as opposed to the ecological correlations that the field currently relies upon.

Conclusion

For Viksit Bharat 2047, the flexible, adaptable, integrative education, and training systems are indispensable. The eight initiatives build integrated systems. The Amrit Peedhi initiative develops a youth-centric system, PM eVIDYA, DIKSHA, SWAYAM and SWAYAM PRABHA modify the learning systems, and SIDH and PMKVY 4.0 integrate participatory skills and certification. PM-SETU builds place-based vocational institutes. The initiatives attain their true nature when citizens are able to locate, access, understand, complete, and utilize them.

PMKVY 4.0 had good participation and offered good levels of certification. There were no significant observations with regard to motivation to get certified as a majority of the participants did not complete the assessment. Several state studies noted a positive relationship between LEDRI and the certification outcome, but there were no significant observations on the level of enrollment. It was stated that a particular level of readiness was more important.

Access is better represented as a mediated capability than a tally of the number of platforms. In addition to the collaboration and coordination of fragmented systems, academic libraries provide credit-based teaching and learning activities. School libraries integrate DIKSHA and other online and broadcast resources. Various outreach services, including mobile libraries, community libraries, and public libraries, assist learners who are outside the realm of formal education. Vocational training institutes connect training with assessment and placement in the industry. In all of these, librarianship is inclined toward access and integration of digital and AI literacy, credentialing, privacy, outcome and engagement metrics.

Stable financing is a necessity for libraries. Policies must establish baseline funding, continuing education for staff, and service level and library service metrics for education and skills dashboards. Resources must fill existing voids in library service and internet infrastructure. Evaluations should be directed to a level below the State, focusing on the individual, and be designed with separate streams for certification, employment, and income. Though libraries cannot offer the employment and course opportunities, nor the quality of trainers and assessments, or the quality of jobs, they can the social and digital barriers to services. Libraries are a unique service and civil infrastructure. Libraries provide access to information and evidence in a civil service and constructive way, to narrow the service gap the State seeks to provide and the resources its citizens offer. Library services should focus on improving the quality of library use and learning, not the costs or expenditures. The reliable funding and ongoing support for library services and local accountability with improved interoperability, will enable library services to sustainably transform. These will empower national library services to meet the needs of users who have been historically left behind.

Declarations

Ethics statement: The study analyses publicly available aggregate administrative data and did not involve human participants or personally identifiable information.

Data availability: All source datasets are available through the official reports cited. Derived variables, formulas and inclusion rules are fully documented in the methodology and tables.

Funding: No external funding was received for this study.

Conflict of interest: The author declares no conflict of interest.

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