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New Areas of Skill Development and Infrastructure in India

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Abstract: India is the largest populated country in the world now .It has the largest working population in the age group (14-59). It is a challenge to the government to provide jobs over 50 crore population in this age group. Various government programs started to provide employment and self-employment to youth of the country. But these programs less success and temporary nature can't fulfill the life time earnings for the youth. Economic reforms started from 1991 after that the size of manufacturing and service sector growth exponentially seen in India. Increasing various jobs requirements of different skills now is very essential in organized and unorganized sector and they are giving good salary and opportunities for life long earning. But these jobs opportunities require specific skills according to requirement of industries and service sector. But the large population of youth is not skilled in India. Govt. of India identifies this gap and developed national skill policy and other initiatives to skill the youth according the requirement. This research paper is the effort to analysis various skill development program and strategy towards providing lifelong earning by skilling the youth of India. Various secondary data's uses to analysis the present scenario. Analysis the national skill framework, infrastructure, various policy, Skill University, internship etc.
Keywords- National skill framework, Skill structure Govt policies, Skill jobs, Evaluation.

Introduction - India's demographic transition has placed it at a unique historical juncture. With a median age of 28.4 years and over 65% of its population in the working-age bracket (14–59 years), the country possesses a potential labor force of approximately 520 million (World Bank, 2025). Unlike aging economies in Europe, Japan, or North America, India has a window of roughly three decades to harness this dividend before its dependency ratio rises. However, this demographic opportunity can quickly become a demographic liability if the working population remains unemployed, underemployed, or engaged in low-productivity informal work.

The economic liberalization of 1991 transformed India from a predominantly agrarian economy to one driven by services and manufacturing. Yet, the growth in Gross State Domestic Product (GSDP) and Gross Value Added (GVA) has not been matched by proportionate growth in formal, skilled employment. The Periodic Labour Force Survey (PLFS) 2023-24 indicates that while the unemployment rate has moderated, the quality of employment—characterized by wage stagnation, contractualization, and lack of social security—remains precarious. Over 90% of India's workforce is still in the unorganized sector, where skill recognition is minimal and lifelong earnings are uncertain. The central economic problem, therefore, is not merely the absence of jobs but a profound *skill gap*: the mismatch between what the industry requires and what the labor force possesses. The Government of India (GoI) has responded through the National Skill Development Mission, Pradhan Mantri Kaushal Vikas Yojana (PMKVY), Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY), and the establishment of Skill Universities and Indian Institute of Skills. However, evaluations by the Comptroller and Auditor General (CAG) and NITI Aayog have repeatedly highlighted issues of low placement rates, poor infrastructure, and the temporary nature of skill-based employment.

This research paper addresses the following critical questions:

1. What is the current state of skill infrastructure in India, and how does it align with new areas of economic growth (green jobs, AI, logistics, care economy)?
2. How effective have government skill policies been in transforming short-term placements into lifetime earnings trajectories?
3. What economic and institutional barriers prevent the National Skill Framework from achieving its objectives?
4. What novel policy and infrastructure interventions can bridge the skill-employment-lifelong earning continuum?

The paper is organized into six sections. Following the introduction, Section II reviews theoretical underpinnings

linking skill development to lifetime earnings. Section III outlines the research methodology based on secondary data analysis. Section IV presents a detailed evaluation of India's skill infrastructure and new skill areas. Section V discusses key economic challenges and evaluation findings. Section VI concludes with policy recommendations.

Theoretical Framework: Skill, Earnings, and Lifetime Income: To understand the necessity of skill development, one must invoke human capital theory, originally formalized by Gary Becker (1964) and Jacob Mincer (1974). Human capital theory posits that education and training are investments that yield returns over an individual's lifetime in the form of higher wages. However, in developing economies like India, this theory requires two crucial modifications:

1. **Signaling vs. Productivity:** Spence's job market signaling model suggests that without credible skill certification, employers rely on proxies (e.g., general education degrees), which fail to capture vocational competence. Skill development programs, therefore, must provide *verifiable, portable credentials*.
2. **Lifetime Earnings Trajectory:** Unlike one-time placements, *lifetime earnings* depend on skill upgradation, adaptability, and experience. Temporary, low-skill jobs without a career progression pathway lead to flat earnings profiles, trapping workers in a low-level equilibrium.

Furthermore, the **Dual Labor Market Theory** (Doeringer & Piore, 1971) explains why skill programs often fail. In India, a primary sector (formal, high-wage, skilled) and a secondary sector (informal, low-wage, unskilled) exist with limited mobility. Most government skill programs, despite training, channel graduates into the secondary market due to lack of industry linkages, infrastructure, or because they train in saturated skills (e.g., basic stitching, computer literacy) rather than emerging areas.

New Areas of Skill Development must be understood through the lens of *structural transformation* (Lewis, 1954). As India shifts from agriculture to services and Industry 4.0, skill demand moves from general laborers to techno-functional specialists. New areas include:

1. **Green Skills:** Solar PV installation, e-waste management, climate-resilient agriculture.
2. **Digital Skills:** AI-ML basics, cybersecurity, cloud computing support, data annotation.
3. **Care Economy Skills:** Geriatric care, early childhood education, mental health first aid.
4. **Logistics and Supply Chain:** Warehouse automation, cold chain management, last-mile delivery optimization.

Without corresponding physical and digital infrastructure—training centers, high-speed internet, assessment labs, and apprenticeship hubs—these new skill areas remain inaccessible to the rural and semi-urban youth, perpetuating regional and class-based inequalities in lifelong earnings.

Research Methodology: This study employs a qualitative, exploratory research design based on the analysis of secondary data. Given the macroeconomic scope of the topic—covering national policies, infrastructure, and outcomes across 28 states and 8 union territories—primary data collection would be logistically prohibitive within the scope of this paper. The methodology comprises:

Data Sources:

Government Reports: Ministry of Skill Development and Entrepreneurship (MSDE) annual reports (2019–2025); National Skill Development Corporation (NSDC) performance dashboards; CAG audit reports on PMKVY; NITI Aayog's "India's Skill Development Journey" (2024); RBI's KLEMS database for sectoral employment.

International Databases: ILO's World Employment and Social Outlook; World Bank's SKILLS dataset.

Academic Literature: Peer-reviewed articles from JSTOR, Scopus, and EconLit (2015–2025) on skill development, labor economics, and infrastructure planning.

Policy Documents: National Skill Development Policy (2009, 2015); National Education Policy (NEP) 2020 (section on vocational education); State Skill Development Missions (selected states: Gujarat, Kerala, Tamil Nadu, Bihar).

Analytical Framework:

Infrastructure Mapping: Assessment of physical (ITIs, Skill Centers, Skill Universities) and digital infrastructure (Skill India Portal, e-Skill India).

Policy Evaluation Matrix: Using criteria from the World Bank's SABER (Systems Approach for Better Education Results) – workforce development framework: governance, financing, quality assurance, articulation pathways, and labor market alignment.

Indicator Analysis: Placement rates, wage outcomes (short-term vs. 3-year follow-up), certification validity, employer satisfaction, and gender/regional inclusion.

Limitations: Secondary data limitations include reporting biases, non-standardized metrics across states, and a lag in real-time data. Furthermore, most evaluations measure *initial placement* rather than true *lifetime earnings*. This paper addresses this by critically examining tracer study evidence where available.

Analysis of Skill Development Infrastructure and New Areas

The National Skill Framework: Structure and Gaps: The National Skill Qualifications Framework (NSQF), launched in 2012, organizes qualifications according to a series of levels (1 to 10) based on knowledge, skills, and aptitude. It is a laudable attempt to create parity between general education and vocational training. However, empirical evaluation reveals three critical gaps:

1. **Vertical Mobility Illusion:** While NSQF theoretically allows a Level 4 electrician to gain credits for a polytechnic diploma, in practice, articulation is rare. Only 12% of vocational trainees have successfully transferred credits into formal degree programs (UGC, 2024). Consequently, skill training remains a "dead end" rather than a pathway to

lifelong earning.

2. **Infrastructure Deficit:** As of 2025, India has approximately 14,000 Industrial Training Institutes (ITIs) and over 2,500 Pradhan Mantri Kaushal Kendras (PMKKs). However, only 45% of PMKKs have functioning advanced simulators or equipment aligned with Industry 4.0. Rural district skill centers lack even basic internet connectivity, limiting access to online training modules.

3. **Trainer Shortage:** The MSDE estimates a deficiency of over 1.2 million accredited trainers. Most existing trainers themselves have outdated skills, particularly in emerging areas like robotics or renewable energy.

New Areas of Skill Development: Based on sectoral growth projections (NITI Aayog, 2025; RBI, 2024), four new skill areas are critical for lifelong earnings:

Table 1 (see in last page)

Evidence: The Logistics Skill Council reports that trained candidates in cold chain management earn 62% higher lifetime income (over 10 years) compared to untrained warehouse workers. Similarly, green skill certification under Suryamitra (solar PV) shows a wage premium of 45% in the first job, but retention at 3 years drops to 54% due to lack of career progression – highlighting the *lifetime earnings* problem.

Skill Universities and Internship Infrastructure

The establishment of Skill Universities (e.g., Delhi Skill and Entrepreneurship University, Haryana Vishwakarma Skill University) represents a novel infrastructure intervention. These universities offer degree programs integrated with NSQF levels 5-8. Early evaluation (NSDC, 2025) shows:

- **Success:** On-the-job training (OJT) embedded in curriculum; industry-designed capstone projects.
- **Challenge:** Only 6 operational skill universities exist against a target of 25 by 2025. Moreover, internship infrastructure (hostels, transport, stipend mechanisms) is weak, resulting in only 40% of enrolled students completing mandatory industry internships.

The National Apprenticeship Promotion Scheme (NAPS) increased apprentices from 0.3 million (2016) to 1.1 million (2025), but this is still minuscule compared to 500 million working-age population. Additionally, 73% of apprenticeships are concentrated in manufacturing (automotive, textiles), with negligible presence in new skill areas like AI or care economy.

Evaluation of Government Policies and Economic Outcomes

Macroeconomic Impact Assessment: Using a simple pre-post analysis (2014-2025), the share of formally skilled youth (with at least NSQF Level 4 certification) rose from 4% to 27% of the labor force. However, the employment elasticity of skill training remains low: a 1% increase in skill certification leads to only 0.3% increase in formal employment (NITI Aayog, 2024). The reasons are structural:

For PMKVY (flagship short-term training):

1. **Placement rates:** Officially 58% (MSDE, 2025). Independent studies (e.g., Azim Premji University, 2024) place it at 34% after 12 months.
2. **Wage outcomes:** Median monthly wage for PMKVY trained youth is Rs. 9,000-12,000 ($110-145), barely above the minimum wage. After 3 years, wages increase only 7% (inflation-adjusted) because most jobs are in low productivity services (retail, security, hospitality).
3. **Lifetime earnings projection:** A PMKVY-trained retail associate earning Rs.10,000/month with 3% annual real growth will earn a cumulative Rs. 1.68 million over 20 years. In contrast, a degree-holding (or advanced skill-certified) AI data assistant starting at Rs. 25,000/month with 6% growth will earn Rs. 9.2 million. The divergence represents the *skill penalty*.
4. **For DDU-GKY (rural youth):** Stronger placement focus (mandatory 75% placement within 6 months). However, placements are often in high-turnover sectors (security guards, sales promoters). The average job tenure is 11 months. Consequently, *lifetime earnings* are interrupted by frequent unemployment spells.

Infrastructure Evaluation: Digital and Physical: The Skill India Portal (SIP) claims 35 million registered candidates. However, only 12 million have completed any assessment. The e-Skill India digital platform offers 500+ courses, but completion rates are <18% (similar to global MOOC averages). Without proctored assessment centers and offline infrastructure (PMKK libraries, simulation labs), digital skilling excludes rural youth with poor digital literacy.

Regional disparity: Southern and western states (Kerala, Tamil Nadu, Karnataka, Maharashtra) account for 62% of advanced skill infrastructure (Skill Universities, Centers of Excellence). Northern and eastern states (Uttar Pradesh, Bihar, Jharkhand, Odisha) have 25% of the infrastructure but 48% of the working-age population. This infrastructural maldistribution perpetuates internal migration and spatial inequality in earnings.

Institutional Barriers to Lifelong Earnings

1. **Fragmented Governance:** Skill development is divided among MSDE, Ministry of Education (vocational in schools), Ministry of Labour (apprenticeships), and various line ministries (e.g., Ministry of New and Renewable Energy for green jobs). Coordination failures lead to duplicate training, wasted infrastructure, and inconsistent standards.
2. **Financing Mismatch:** Total public expenditure on skill development is 0.1% of GDP, compared to 0.6% in Germany and 0.5% in South Korea. Moreover, 85% of funds are allocated to *supply-side* training (running courses) rather than *demand-side* infrastructure (industry-sponsored internships, wage subsidies for lifelong learning accounts).
3. **Assessment and Certification Weakness:** The majority of assessments are conducted by the same training providers (conflict of interest). Employer trust in NSQF certifications is low (only 44% of employers accept them as equivalent to formal degrees; FICCI-EY survey, 2025).

Discussion: From Short-Term Placement to Lifelong

Earnings: The central argument emerging from this analysis is that India's skill development ecosystem remains *placement-centric* rather than *lifetime earnings-centric*. The political economy favors easily measurable outputs (number trained, short-term placed) over harder-to-measure outcomes (wage progression over 10 years, career switches, upskilling cycles).

To transition to lifelong earnings, three paradigm shifts are needed:

1. **From Static to Dynamic Infrastructure:** Instead of physical PMKKs, India needs "Skill Hubs" co-located with industrial clusters (e.g., automobile, electronics, pharmaceutical zones). These hubs should offer multi-entry, multi-exit pathways, evening and weekend modules for the already employed, and digital credential wallets (secured on a blockchain-like system) that accumulate lifelong learning credits.
2. **From Subsidized Training to Co-financed Lifelong Learning Accounts (LLAs):** Based on Singapore's SkillsFuture model, every Indian youth should receive a government-seeded LLA (e.g., Rs. 50,000) that they can draw upon for re-skilling every 5 years, supplemented by employer contributions. This shifts ownership from government to individual and incentivizes quality training providers to compete for LLA withdrawals.
3. **Mandatory Internship Infrastructure:** The NEP 2020 recommends internships from Grade 6 onwards. This must be extended to all skill training programs with a legal mandate: no skill certificate without a verified industry internship of at least 200 hours. Infrastructure for this includes a national internship exchange portal, transport and risk insurance for interns, and tax credits for SMEs offering internships in new skill areas.

Furthermore, the National Skill Framework must integrate micro-credentials—short, stackable modules in new areas (e.g., "EV two-wheeler repair Level 1") that can be combined into a full qualification. This allows workers to adapt to technological change without starting from zero, protecting lifetime earnings.

Conclusion and Policy Recommendations: India's skill development challenge is not merely about numbers. With over 500 million youth, the government has initiated a robust policy framework (NSQF, PMKVY, Skill Universities, NAPS). However, the gap between training infrastructure and new-area industry requirements remains wide. Short-term placements in low-productivity jobs do not translate into *lifelong earnings*, which require career progression, continuous upskilling, and credible certification.

The demographic dividend will be realized only if skill infrastructure shifts from rural-centric low-level training to industry-integrated, digital-first, regionally balanced centers of excellence. The current evaluation metrics—trained, placed—must be replaced by a 10-year earnings trajectory index.

Key Policy Recommendations:

1. **Establish a National Skill Infrastructure Finance Corporation (SIFC)** with a corpus of Rs. 50,000 crore to fund district-level "Skill Parks" with dynamic labs, hostels for internships, and fiber-optic connectivity.
2. **Enact the Lifelong Learning Account (LLA) Act,** providing every youth (18-35) a government-seeded account for upskilling, requiring co-investment from employers for employees earning above a threshold.
3. **Mandate 8-10% of CSR funds** be directed to skill infrastructure in new areas (green, digital, care economy) with a specific focus on aspirational districts.
4. **Create an independent National Skill Assessment Authority (NSAA)** separate from training providers, using AI-proctored and simulation-based assessments to enhance employer trust.
5. **Integrate skill credits into formal education** by mandating that all universities accept up to 30% NSQF credits for undergraduate degrees, enabling vertical mobility for vocational trainees.

India stands at a crossroads. With appropriate, adaptive, and lifelong-oriented skill infrastructure, the largest working population can become the world's most productive asset. Without it, the same population may fuel unemployment, social unrest, and economic stagnation. The economics are clear: every rupee invested in quality skill infrastructure yields a lifetime earnings return of 8-10, compared to 2-3 for unskilled work. The policy imperative is urgent.

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Table 1

New Skill Area	Projected Job Growth (2025-2030)	Key Infrastructure Needed	Current Penetration (States with dedicated policy)
Green Energy & E-mobility	3.4 million	Solar parks, EV charging station training labs	Gujarat, Rajasthan, Tamil Nadu, Maharashtra
AI & Data Services	1.5 million	Cloud labs, AI sandboxes, high-speed broadband	Karnataka, Telangana, Delhi-NCR, Kerala
Care Economy (Elderly/Child)	2.8 million	Simulation centers for caregiving, mobile assessment vans	Kerala, Tamil Nadu, Punjab, West Bengal
Logistics, Warehousing & Cold Chain	4.1 million	Multi-modal logistics parks, virtual reality (VR) training for forklift/cranes	Gujarat, Haryana, Maharashtra, Assam (NE corridor)

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