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Future Workforce Skills in India (2025-2047): Bridging the Employability Gap through an Integrated Skill Stack Model

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Abstract

*India's demographic advantage positions it as a potential global talent hub; however, the challenge lies in ensuring workforce employability in a rapidly evolving economic and technological landscape. This study integrates conceptual frameworks of future workforce skills with empirical insights derived from a primary dataset ("Skills for Future Workforce" survey). The findings reveal a critical gap between foundational digital and communication competencies and higher-order cognitive, technological, and industry-specific skills. While respondents demonstrate strong proficiency in basic digital tools and interpersonal communication, significant deficiencies are observed in cyber-security awareness, systems thinking, decision-making under uncertainty, and Industry 4.0 readiness. The study proposes an **Integrated Skill Stack Model** viz., digital, cognitive, human, and adaptive skills as a pathway to future employability. Policy and educational recommendations emphasize experiential learning, interdisciplinary integration, and industry-aligned training systems.*

Keywords: Future workforce, employability, skill gap, Industry 4.0, digital skills, cognitive skills, India, skill stack model, workforce development

Introduction

India stands at a pivotal moment in its economic trajectory, driven by one of the youngest populations globally. While this demographic dividend offers immense potential, the transformation into a productive workforce depends on the acquisition of relevant skills aligned with future labour market demands. Traditional education systems, focused on theoretical knowledge, are increasingly inadequate in preparing individuals for complex, technology-driven environments. The concept of employability has evolved beyond mere academic qualifications to encompass a multidimensional skill framework. This study builds upon the "Skill Stack Model," which integrates digital, cognitive, human, and adaptive skills, and examines its relevance through empirical evidence. By combining theoretical insights with survey-based analysis, this paper aims to identify critical skill gaps and propose actionable strategies for workforce transformation in India.

Literature Review

Existing literature highlights the growing importance of hybrid skill sets in the future of work. Studies on Industry 4.0 emphasize the convergence of automation, artificial intelligence, and data-driven decision-making, requiring workers to possess both technical and cognitive capabilities. Research on employability in emerging economies suggests that while digital literacy is increasing, higher-order skills such as critical thinking, systems thinking, and adaptability remain underdeveloped. Additionally, global reports underscore the importance of soft skills, including communication, emotional intelligence, and collaboration, as key differentiators in automated environments. However, a gap persists between policy frameworks and actual workforce readiness, particularly in developing countries like India. This study contributes to the literature by integrating empirical survey data with conceptual models to provide a grounded understanding of skill readiness.

Key Skill Domains Shaping India's Future Workforce

1 Digital & Technology Skills: The Foundational Layer

- Digital skills are no longer optional—they are the backbone of modern employment. From IT services to agriculture, technology integration is universal.

Key Competencies Include: Data literacy and analytics; Artificial Intelligence (AI) and Machine Learning (ML); Cloud computing platforms (AWS, Azure); Programming (Python, SQL, JavaScript); Digital tools like Power BI and Tableau.

Example: A farmer in Tamil Nadu using AI-based weather prediction tools to optimize crop cycles demonstrates how digital literacy is transforming even traditional sectors.

India Context: Cities like Bengaluru, Hyderabad, and Chennai are already global IT hubs, and initiatives such as Digital India are accelerating digital adoption across governance and business.

2 Cognitive & Analytical Skills: The Decision-Making Core

- Automation can process data, but human intelligence is required to interpret it and make decisions.

Core skills include: Critical thinking; Problem-solving; Systems thinking; Policy analysis.

Example: An IAS officer designing a district-level healthcare intervention must analyse data, identify systemic gaps, and make decisions under uncertainty. These skills are particularly crucial in governance, corporate strategy, and development planning.

3 Human & Behavioural Skills: The Irreplaceable Edge

- In an age of automation, human skills differentiate individuals.

Important competencies: Communication; Emotional intelligence; Leadership; Conflict resolution; Cultural sensitivity.

Example: A project manager handling a multilingual team across Tamil Nadu must navigate cultural differences while ensuring productivity.

Indian Relevance: India's diversity makes interpersonal skills essential for both governance and business environments.

4 Entrepreneurial & Innovation Skills: Driving Economic Growth

- India's future economy will be powered by startups and MSMEs.

Key skills: Business model design, financial literacy; Risk-taking and resilience; Design thinking.

Example: Startups like fintech platforms or agritech ventures rely on innovative thinking and strong financial understanding.

Policy Driver: Government initiatives such as Startup India are encouraging innovation-led growth.

5. Sector-Specific Emerging Skills: Future Growth Engines

a) Green Economy Skills: Renewable energy systems; Climate risk analysis; Sustainable agriculture.

Example: Solar energy technicians in rural India supporting decentralized power systems.

b) Healthcare & Biotechnology: Telemedicine; Health data analytics; Public health management.

Example: Digital health platforms providing remote diagnosis in underserved regions.

c) Advanced Manufacturing: Robotics, IoT, 3D printing; Industry 4.0 systems.

Example: Automated factories in Tamil Nadu's industrial corridors using smart manufacturing technologies.

6 Adaptive & Lifelong Learning Skills: The Meta-Skill

- Perhaps the most critical skill is the ability to continuously learn.

Key Aspects: Learning agility; Up-skilling and reskilling; Curiosity and adaptability.

Example: An IT professional transitioning from basic coding to AI/ML specialization through online platforms.

7 Financial & Economic Literacy: Empowering Individuals

- Understanding money and the economy is essential for both personal and national growth.

Skills Include: Budgeting and savings; Investment knowledge; Understanding inflation and GDP.

Example: A gig worker investing in mutual funds to secure long-term financial stability.

8 Civic & Governance Skills: Strengthening Democracy

- India requires citizens and administrators who understand governance systems.

Key Skills: Policy literacy, Legal awareness; Ethics and integrity; Stakeholder engagement.

Example: Local government officials implementing welfare schemes effectively through community participation.

9 Global & Cross-Cultural Skills: Competing Internationally

- India is deeply integrated into the global economy.

Skills Include: English proficiency and foreign languages; Global market awareness; Remote collaboration.

Example: Indian professionals working with international teams in remote-first organizations.

10 Creativity & Interdisciplinary Thinking: The Future of Innovation

- Future jobs will not belong to single disciplines but to those who can integrate multiple fields.

Skills Include: Creative problem solving; Storytelling; Cross-domain expertise.

Example: A professional combining technology; policy, and business knowledge to design smart city solutions.

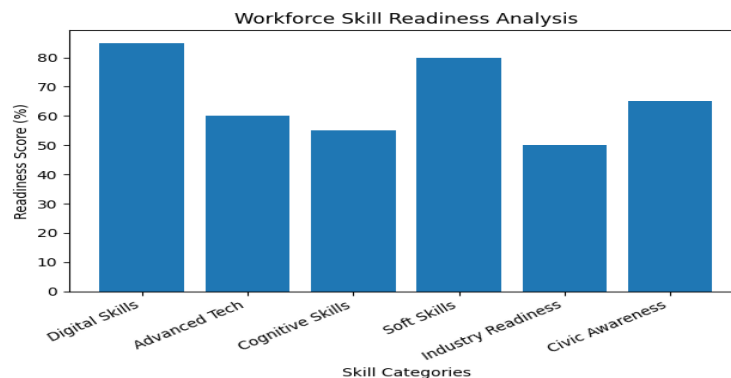
Methodology

1 Data Source: The study is based on a primary dataset titled “Skills for Future Workforce (Responses)”, consisting of:

- **120 respondents, 34 skill variables;** demographically balanced age groups.

Results and Discussion

Figure 1: Analysis of Skill Categories



Digital & Technological Skills

The findings indicate strong foundational digital competencies: 100% proficiency in data analysis; High familiarity with coding and digital tools. **However, critical gaps are evident:** 83% lack cyber-security awareness; Limited understanding of AI/ML applications.

Interpretation: The workforce is digitally literate but lacks depth in advanced and secure technology usage.

Cognitive & Analytical Skills

- While 75% of respondents demonstrate critical thinking ability, deficiencies are observed in: Decision-making under uncertainty (67%

4.2 Analytical Approach: A descriptive and diagnostic analytical framework was adopted: Frequency distribution analysis; Skill category mapping; Gap identification across domains.

4.3 Skill Categories Examined

- Digital & technological skills; Cognitive & analytical skills; Human & behavioural skills; Industry-specific skills; Civic and global competencies; Innovation and interdisciplinary skills

weak); Systems thinking (67% weak); Complex problem-solving (50% weak).

Interpretation: The ability to handle complexity and ambiguity remains underdeveloped.

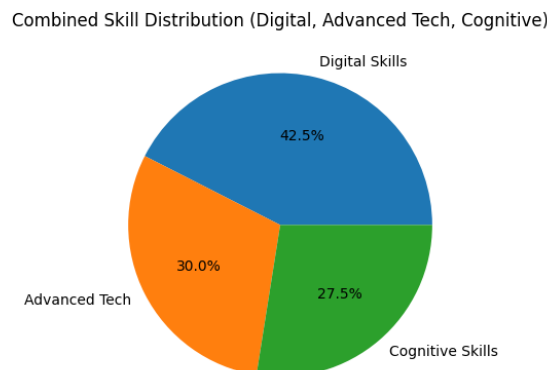
Industry 4.0 and Sector-Specific Skills

The Analysis Reveals: Low awareness of automation and robotics; Limited readiness for Industry 4.0 environments.

Conversely: High awareness of sustainability and digital healthcare.

Interpretation: There is a mismatch between awareness and technical capability in emerging sectors.

Figure 2: Analysis of Cognitive, Advanced Tech, Digital Skills



Key Insight from the Chart: Digital Skills (~42.5%) dominate; **Advanced Tech (~30%)** is moderate; **Cognitive Skills (~27.5%)** are the weakest.

Interpretation: This clearly shows: The workforce is **digitally strong but lacks deeper thinking and advanced tech capability**.

4 Human & Behavioural Skills

Strong Competencies Include: Communication (92%); Emotional intelligence (83%).

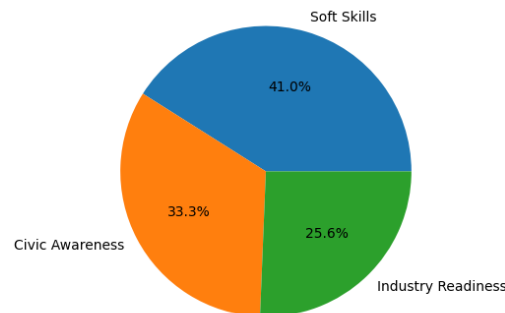
However: Conflict resolution and cultural adaptability show mixed results.

Interpretation: Interpersonal skills are present but lack depth in collaborative and leadership contexts.

Civic and Global Skills

Figure 3: Analysis of Soft Skills, Civic Awareness, Industry Readiness

Combined Skill Distribution (Soft Skills, Civic Awareness, Industry Readiness)



Key Insight from the Chart: Soft Skills (~41%) are the strongest; **Civic Awareness (~33%)** is moderate; **Industry Readiness (~26%)** is the weakest.

Interpretation: The workforce is **strong in interpersonal capabilities**, but **struggles significantly with practical industry preparedness**. This reinforces the core finding: **“Good communicators, but not fully job-ready.”**

Key Findings

Strong foundation in digital and communication skills; 2. Significant gaps in cyber-security and advanced technologies; 3. Weak higher-order cognitive skills (systems thinking, decision-making); 4. Limited Industry 4.0 readiness; 5. Low civic engagement despite high awareness; 6. Creativity not supported by interdisciplinary capabilities.

The Skill Stack Model: A Framework for Employability

- The study validates the need for an integrated skill model: **Skill Stack = Digital + Cognitive + Human + Adaptive Skills**

This model emphasizes: Technical proficiency, Analytical thinking, Interpersonal effectiveness, Continuous learning.

Respondents Exhibit: Strong ethical and legal awareness; Low civic engagement (75% weak).

Global Skills: Strong communication and remote collaboration; Limited global economic understanding.

Interpretation: A gap exists between awareness and active participation at both civic and global levels.

Creativity and Innovation: While creativity levels are high (83%); interdisciplinary thinking is weak (50%).

Interpretation: Innovation is constrained by a lack of cross-domain integration.

Implication: Employability depends not on isolated skills but on their integration.

Policy and Strategic Recommendations

- Education Reform:** Integrate experiential and case-based learning; Introduce AI, cyber-security, and Industry 4.0 modules.
- Skill Development Initiatives:** Focus on systems thinking and decision-making; Promote interdisciplinary learning
- Industry Collaboration:** Strengthen apprenticeship programs; Align curriculum with industry needs.
- Governance and Civic Engagement:** Encourage community-based learning; Enhance policy literacy programs.
- Global Competitiveness:** Promote cross-cultural training; Expand international academic collaborations.

Future Research: Large-scale national surveys; Sector-specific skill gap analysis; longitudinal studies on skill development.

Conclusion

India's workforce transformation requires a shift from **skill acquisition to skill application**. While foundational competencies are strong, the lack of advanced cognitive, technological, and

interdisciplinary skills poses a significant challenge to future employability. The integration of empirical findings with the Skill Stack Model underscores the need for systemic reforms in education, policy, and industry collaboration. By fostering a culture of continuous learning, adaptability, and innovation, India can effectively convert its demographic advantage into a sustainable economic dividend.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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