

Skills Development and Vocational Education in Viksit Bharat 2047

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Abstract: *India's vision of Viksit Bharat 2047 places human-capital development, employability, technological readiness, entrepreneurship, and productive youth participation at the centre of its transformation into a developed economy. In this context, skill development and vocational education are critical for reducing the gap between formal education and labour-market requirements. India has a demographic advantage, with more than 65% of its population below the age of 35 years; however, employability gaps, uneven access to vocational training, digital skill deficiencies, and differences between industry requirements and educational outcomes remain major concerns. The present study examines the role of skill development and vocational education in achieving the objectives of Viksit Bharat 2047 through a review-based and quantitative secondary-data approach.*

The study reviews approximately 50 research papers, policy reports, government documents, and institutional publications published primarily during 2015–2026. The review framework classifies the literature into five major dimensions: employability and industry readiness (30%), vocational education and training (24%), digital and emerging-technology skills (18%), entrepreneurship and self-employment (16%), and inclusion and accessibility of skill programmes (12%). The reviewed evidence indicates that greater integration of vocational education with mainstream education, industry-linked training, apprenticeships, digital competencies, and competency-based curricula can substantially improve workforce preparedness. The analysis further suggests that increasing vocational exposure at school and higher-education levels, strengthening industry–institution partnerships, and expanding training opportunities in areas such as Artificial Intelligence, data analytics, green technologies, advanced manufacturing, healthcare, and digital services will be essential for meeting the changing occupational structure of the Indian economy.

The study concludes that achieving Viksit Bharat 2047 will require a transition from qualification-oriented education towards a skill-, competency-, and employment-oriented learning ecosystem. A coordinated framework involving educational institutions, government agencies, industry, training providers, and local communities can improve employability, entrepreneurship, productivity, and inclusive economic participation. Skill development and vocational education should therefore be viewed not merely as employment

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interventions but as strategic pillars for developing a technologically capable, innovative, productive, and globally competitive workforce by 2047.

Keywords: Viksit Bharat in 2047, Vocational skills, Vocational Education, Sustainable Development, NEP-2020, Skill education and training.

Introduction

India's aspiration to become a developed nation by 2047, when the country completes 100 years of independence, is widely articulated through the vision of Viksit Bharat 2047. The achievement of this vision will depend not only on the expansion of infrastructure, industrialisation and technological advancement, but also on the capacity of the country to create a skilled, employable, innovative and adaptable workforce. India possesses a major demographic advantage because approximately 65% of its population is below the age of 35 years. This large young population can become a powerful source of economic growth, innovation and productivity; however, the demographic dividend can produce sustainable outcomes only when young people possess skills that are aligned with emerging occupational and industrial requirements. The Government of India has therefore increasingly positioned skill development, vocational education, apprenticeships, reskilling and upskilling as essential components of the Viksit Bharat journey.

The magnitude of the skill-development challenge becomes clearer when the available vocational-training data are considered. According to the Economic Survey 2024–25, based on the Periodic Labour Force Survey 2023–24, around 65.3% of persons in the 15–59 age group had not received any form of vocational or technical training. Only 4.1% had received formal vocational training, while 11.6% acquired skills through hereditary sources, 9.3% through learning on the job, 7.1% through self-learning and approximately 2.5% through other sources. These figures indicate that although India has a large working-age population, formal vocational education still reaches only a small proportion of potential workers. More recent official estimates for 2025 similarly reported that only 4.2% of persons aged 15–59 had received or were receiving formal vocational or technical training, while the corresponding proportion among the 15–29 age group was about 5.0%. Therefore, increasing the coverage, quality and relevance of formal skill training remains central to the development agenda.

The problem is not limited to access to training; it also involves the relationship between educational qualifications and actual employment opportunities. The Economic Survey 2024–25 noted considerable mismatches between educational attainment and occupational roles, reporting that more than 53% of graduates and around 36% of postgraduates were employed in occupations below their educational qualifications. This highlights an important distinction between being educated and being employable. Conventional academic qualifications may improve theoretical knowledge, but changing labour markets increasingly require technical competence, digital literacy, communication skills, problem-solving ability, adaptability, entrepreneurial capability and practical occupational experience. Consequently, Viksit Bharat

2047 requires the education system to progress beyond degree-oriented learning towards competency-based and industry-connected learning.

Recognising this need, the National Education Policy 2020 proposed the systematic integration of vocational education with mainstream schooling and higher education. One of its most significant objectives was that at least 50% of learners in school and higher education should receive exposure to vocational education by 2025. The policy also emphasised that every child should learn at least one vocation and gain exposure to several others. It proposed collaboration among secondary schools, Industrial Training Institutes, polytechnics, local industries and higher educational institutions, together with the development of skill laboratories under a hub-and-spoke model. Although the scale of formal vocational participation shows that substantial work remains to be done, the NEP framework represents an important structural shift by treating vocational education not as a separate or inferior educational pathway but as an integral component of holistic education.

The expansion of government skill-development schemes provides another numerical indication of the scale at which India is attempting to address the skill gap. Under the Pradhan Mantri Kaushal Vikas Yojana, approximately 1.64 crore candidates had been trained or oriented between the inception of the scheme in 2015 and December 2025, of whom approximately 1.29 crore had been certified. Among candidates certified under the Short-Term Training component of PMKVY 1.0, 2.0 and 3.0, around 24.3 lakh out of 56.89 lakh certified candidates were reported as placed, representing a placement rate of approximately 42.8%. The size of these numbers demonstrates the scale of public intervention in skill creation, but the placement proportion also reinforces the importance of connecting training programmes more directly with employment demand, industry participation and measurable labour-market outcomes.

The wider Skill India institutional ecosystem has also grown considerably. By June 2025, PMKVY had recorded approximately 1.64 crore trainees and 1.29 crore certifications; Jan Shikshan Sansthan had trained about 31.43 lakh candidates; approximately 40.81 lakh apprentices had been engaged under the National Apprenticeship Promotion Scheme; and around 92.66 lakh learners had been enrolled under the Craftsmen Training Scheme through Industrial Training Institutes. At that time, the national training ecosystem included approximately 12,838 PMKVY 4.0 training centres, 289 Jan Shikshan Sansthans, 51,895 establishments participating in NAPS and 14,615 ITIs. These figures indicate that India already possesses a substantial institutional base for vocational education and skill formation. The major policy challenge is therefore to strengthen training quality, occupational relevance, certification credibility, employer acceptance and geographical accessibility.

Recent annual data further demonstrate continuing investments in skill development. During 2024–25, approximately 20.38 lakh persons were trained or oriented under PMKVY, about 5.00 lakh under Jan Shikshan Sansthan and nearly 9.85 lakh apprentices were engaged through NAPS. Taken together, these three components accounted for more than 35 lakh training, orientation or apprenticeship engagements in a single financial year. Such scale is significant because a developed India will require continuous skill formation rather than one-time

educational qualification. Workers entering the labour market today will experience multiple technological and occupational changes before 2047; hence, lifelong learning, reskilling and upskilling must become regular features of the education and employment ecosystem.

Another critical dimension of Viksit Bharat 2047 is the movement from conventional vocational occupations towards future-oriented and emerging skills. Artificial Intelligence, machine learning, robotics, data analytics, cybersecurity, cloud computing, semiconductor technologies, electric vehicles, renewable energy, green hydrogen, advanced manufacturing, healthcare technology and digital financial services are likely to generate entirely new categories of employment. Skill development programmes have consequently begun to integrate green and emerging occupations. For example, under PMKVY 4.0, 4,907 candidates were enrolled for solar-panel-related training, of whom 3,962 were trained in installation, maintenance and operations. Under skill initiatives aligned with the National Green Hydrogen Mission, 3,509 candidates were enrolled and 1,507 had received training in hydrogen-energy-related job roles. These initiatives illustrate the gradual alignment of vocational training with India's energy transition and future industrial structure.

Industry acceptance is equally important because skill programmes cannot contribute to Viksit Bharat if certification fails to translate into employment value. An official statement in March 2026, referring to a NITI Aayog evaluation undertaken in October 2025, reported that approximately 94% of surveyed employers expressed willingness to hire additional PMKVY-trained candidates. Furthermore, around 52% of candidates who had obtained employment or received Recognition of Prior Learning certification reported either higher salaries or expectations of improved earnings compared with uncertified workers. Such evidence suggests that recognised skill certification can contribute to labour-market mobility and employer confidence, although stronger outcome tracking remains necessary to examine the sustainability, wages and quality of employment obtained by trained candidates.

The employment context also underlines why skills must remain at the centre of the 2047 development framework. The unemployment rate for persons aged 15 years and above, based on usual status, declined from approximately 6.0% in 2017–18 to 3.2% in 2023–24. Nevertheless, low unemployment alone does not necessarily imply high-quality or productive employment, particularly when considerable portions of the workforce lack formal vocational training. In addition, national statistics for 2025 estimated that approximately 61.6 crore persons aged 15 years and above were employed, including around 41.6 crore males and 20.0 crore females. At the same time, approximately 25% of persons aged 15–29 were estimated to be outside employment, education or training. This presents an important policy concern because a substantial proportion of young people who are neither studying nor employed represents underutilised human capital that could otherwise contribute to economic development.

Vocational education can play a particularly important role in addressing this challenge because it connects learning with occupational application. Unlike purely theoretical educational models, vocational education provides learners with job-specific competencies, practical exposure, workplace experience and pathways towards entrepreneurship. The NEP 2020

framework seeks to reduce the long-standing social hierarchy between academic and vocational streams and proposes integrating vocational exposure throughout education. Such integration is especially important in India because students often perceive vocational programmes as secondary alternatives to conventional university degrees. For Viksit Bharat 2047, this perception must change from “vocational education as an alternative” to “vocational competence as an essential component of education.”

Apprenticeships constitute another important bridge between educational institutions and workplaces. They allow learners to acquire practical knowledge within real organisational environments while helping employers develop workers according to actual occupational requirements. The engagement of more than 40 lakh apprentices under NAPS by June 2025 and the participation of more than 51,000 establishments indicate an expanding apprenticeship ecosystem. However, given the scale of the Indian labour force, apprenticeships have considerable further potential. Expansion into MSMEs, service sectors, emerging technologies, healthcare, logistics, tourism, digital services and green industries can significantly enhance school-to-work and college-to-work transitions.

An important transformation is also required in the definition of “skill” itself. Skill development in the context of Viksit Bharat should not be restricted to mechanical or trade-based competencies. A future-ready worker will require a combination of technical, cognitive, digital and behavioural competencies. Communication, critical thinking, creativity, teamwork, problem-solving, leadership, financial literacy, digital literacy, Artificial Intelligence literacy and entrepreneurial orientation will increasingly complement occupational skills. The Ministry of Skill Development and Entrepreneurship has similarly emphasised that skilling needs to become demand-driven, market-aligned and outcome-oriented rather than functioning merely as a supply-side training activity. This transition is essential because rapidly changing technologies may make specific technical skills obsolete while transferable competencies enable workers to adapt to new employment environments.

Inclusive access must also remain a central component of vocational development. The vision of a developed India cannot be achieved if opportunities are concentrated among urban, highly educated or already advantaged populations. Skill policies must therefore extend to rural youth, women, economically weaker groups, school dropouts, tribal communities and workers in the informal economy. PMKVY 4.0 has begun convergence with programmes targeted at specific social groups. For example, its linkage with Project VIKALP was designed as a pilot across 27 districts in 19 States and Union Territories, targeting around 3,850 adolescent girls for skill and enterprise development. Such initiatives indicate that vocational education can simultaneously promote economic participation and social inclusion when programmes are appropriately targeted.

The evidence therefore reveals a paradox that makes the study of skill development especially important. On one side, India has one of the world’s largest young populations, approximately 1.64 crore candidates have already been trained or oriented under PMKVY, thousands of training centres and ITIs are operating, and skill development is formally embedded in national educational and economic policy. On the other side, only around 4–5% of the relevant age

groups report formal vocational or technical training, and 65.3% of the 15–59 population had received no vocational or technical training according to PLFS 2023–24. Thus, the central challenge is no longer merely the creation of skill-development schemes; it is the achievement of scale, relevance, quality, inclusion and measurable employment outcomes.

Against this background, skill development and vocational education must be understood as strategic foundations of Viksit Bharat 2047. India's transformation into a high-income, technologically advanced and globally competitive economy will require millions of workers capable of adapting to Industry 4.0, digitalisation, green transitions and evolving service-sector requirements. Education institutions, industries, skill councils, ITIs, polytechnics, universities, MSMEs and government agencies therefore need to operate as interconnected components of a national human-capital ecosystem. The quantitative evidence reviewed above demonstrates both substantial progress and persistent gaps. Consequently, the present study examines how vocational education and skill-development initiatives can contribute to employability, productivity, entrepreneurship, technology readiness and inclusive economic growth, while identifying the structural reforms required to transform India's demographic potential into the skilled human capital necessary for achieving Viksit Bharat by 2047.

Review of Literature

Ghosh, Ray Chaudhury and Sinha (2026) examined whether vocational education and training acts as a safety net in the Indian labour market. Using recent Indian labour-market evidence, the researchers analysed whether individuals possessing vocational training experienced lower risks of unemployment and better access to regular or casual employment. The findings indicated that vocational education significantly influences labour-market participation and employment outcomes, although its effect varies according to the nature of employment and worker characteristics. The study argued that VET should not merely increase the number of trained candidates but should improve the quality and labour-market relevance of training. The findings are particularly significant for Viksit Bharat 2047 because they establish that vocational education can serve as an employment-protection mechanism when training is appropriately aligned with labour demand.

Kharel, Dahal and Joshi (2026) conducted a systematic review and bibliometric analysis of vocational education and training programme design and employability outcomes. The study synthesised international research published during 2015–2025 and examined the role of programme design in facilitating the transition of learners from education to sustainable employment. The review found that employer involvement, workplace-based learning, competency-oriented curricula and industry exposure substantially improve employment outcomes. It further highlighted that simply providing vocational certification does not guarantee employment unless programmes incorporate labour-market information and practical experience. These findings support the requirement for a more industry-connected skill-development ecosystem under Viksit Bharat 2047.

Srivastava, Bhavya, Surbhi, Avani and Manish (2025) investigated vocational training and employability with reference to skill-development programmes in Gujarat, India. Their

research evaluated how participation in vocational training affected the employment preparedness of trainees. The study emphasised that employability is shaped not only by technical training but also by the relevance of course content, quality of instruction and linkages between training institutions and employers. The authors identified a continuing need to align vocational curricula with changing industrial requirements and improve post-training employment support. Their findings suggest that regional skill programmes can contribute more effectively to national development when training is demand-driven rather than supply-oriented.

Chaurasia and Punnam (2025) examined skill-development opportunities and their influence on the employability of students. Using a structured questionnaire administered to students and administrators, the researchers applied descriptive statistical techniques to understand learners' perceptions, expectations and satisfaction with available skill-development programmes. The study reported that appropriate skill acquisition enhances employment readiness by narrowing the gap between academic education and workplace requirements. However, it also observed that programme effectiveness depends heavily on the relevance and practical orientation of the training provided. The study recommended expanding student access to skill programmes and strengthening their association with actual employment opportunities.

Sharma and Mehrotra (2025) critically examined the performance of India's skill-development and vocational-training system. Their analysis highlighted the rapid expansion of short-term training programmes but questioned whether enrolment and certification figures consistently translate into sustainable employment. They noted that India had progressively expanded its skill-development architecture through schemes such as PMKVY, DDU-GKY and NAPS, yet challenges persisted in employment outcomes, training quality and reporting of placements. The study therefore argued for stronger outcome measurement, greater apprenticeship participation and a shift from numerical training targets to sustainable employment outcomes. This perspective is highly relevant for evaluating the contribution of Skill India to Viksit Bharat 2047.

Schneider and Pilz (2024) analysed India's labour-market challenges from both the demand and supply perspectives of youth employability. Their study emphasised that although India possesses one of the world's largest working-age populations, employers continue to experience shortages of adequately skilled workers while many young people struggle to secure suitable employment. The authors observed that the quantitative role of formal vocational education and training in India remains comparatively limited. They concluded that skill shortages cannot be addressed merely by increasing the number of training institutions; the quality, relevance and employer orientation of training are equally important. The study directly supports the argument that India's demographic dividend can become an economic dividend only through stronger skill matching.

Choudhury, Mallick and Kumar (2024) investigated the relationship between vocational education, skill training and self-employment in India's non-farm sector using nationally representative household survey data. Their findings showed that vocationally trained individuals demonstrated a higher likelihood of participation in self-employment activities

compared with wage employment in certain contexts. However, significant differences were found across gender, caste, educational and socioeconomic categories. The study therefore established that vocational training is important not only for wage employment but also for entrepreneurial and self-employment opportunities. For Viksit Bharat 2047, this finding is particularly important because future skill policies need to create both job seekers and job creators.

Dutta (2024) analysed the alignment between vocational education and employment opportunities in India across sectors such as manufacturing, healthcare, retail, information technology and agriculture. The study identified a persistent mismatch between the skills taught in training centres and the skills demanded by employers. Lack of practical experience, inadequate technical competencies, weak communication and teamwork skills and outdated curricula emerged as major constraints on employability. Dutta concluded that vocational education must become more practical, industry-oriented and future-ready. Stronger industry partnerships and regular curriculum revision were recommended to improve the labour-market relevance of vocational education.

Saharia and Mazumdar (2024) critically examined vocational education in the context of the National Education Policy 2020. The researchers highlighted the low historical participation of Indian youth in formal vocational education compared with countries such as Germany, the United States and South Korea. They analysed the innovative provisions of NEP 2020 aimed at integrating vocational education with mainstream schooling and reducing the traditional separation between academic and vocational pathways. The study concluded that early vocational exposure, practical learning, flexible curricula and stronger educational-industry collaboration can increase the attractiveness and effectiveness of vocational education in India.

Singh and Gunasekaran (2024) conducted a policy analysis of vocational education in India and examined the implementation of NEP 2020 through a case study of Skill Enhancement Courses at the University of Delhi. The researchers found that despite repeated policy recognition, vocational education has historically remained insufficiently integrated with mainstream academic education. This separation has limited the employability and entrepreneurial capabilities of graduates. The study argued that NEP 2020 offers an opportunity to bridge this divide through multidisciplinary education and structured skill-enhancement courses. It recommended strengthening institutional implementation and linking university-level skill courses more closely with employers and entrepreneurship opportunities.

Pramod and Ramachandran (2023) reviewed youth employment and inclusive growth with special reference to India. The researchers argued that a large youth population can either accelerate economic development or intensify unemployment depending on the quality of education, entrepreneurship opportunities and skill development available to young people. Their conceptual analysis linked youth employment with inclusive growth and identified skill development and youth entrepreneurship as major mechanisms for tackling unemployment. The study suggested that skill policies should be designed not merely around employment numbers but around sustainable and productive participation in economic activity. This

approach closely corresponds with the inclusive-development orientation of Viksit Bharat 2047.

Singh (2023) examined skill development and employment opportunities for Indian youth and emphasised the interdependence of education, skills and career guidance. The study concluded that formal education without employability skills is insufficient, while job creation without an adequately skilled labour force cannot produce sustainable outcomes. Technical competencies therefore need to be accompanied by transferable skills such as communication, adaptability and problem-solving. The author advocated an integrated model in which basic education, vocational training and career counselling operate simultaneously. This finding supports the emerging view that future-ready skill development needs a combination of technical and behavioural competencies.

Singh, Aggarwal and Gupta (2023/2021) reviewed the effectiveness of selected skill-development programmes in India, with particular reference to Haryana. Their analysis of five nationwide programmes found that the structure and penetration mechanisms of skill initiatives required modification to achieve expected results. The researchers emphasised that identical programme designs may not generate equivalent outcomes across different states due to variations in industrial structure, labour-market conditions and demographic profiles. They recommended state-specific customization of skill programmes and stronger evaluation mechanisms. The study has particular relevance for Viksit Bharat because it demonstrates the necessity of decentralised and locally responsive skill-development planning.

Kataria and Seval (2022) examined the status and structure of vocational education and training in India in the context of demographic transition. The authors identified skill development as a critical policy issue because a rapidly expanding working-age population needs corresponding employment and vocational opportunities. Their study reviewed the development of vocational education, technical education institutions, skill-development mechanisms and the role of bodies such as the All India Council for Technical Education. They concluded that a strong vocational-training system contributes directly to economic development by equipping individuals with occupation-specific capabilities. They further stressed the need to strengthen vocational institutions and align training with changing occupations.

Ganie (2022) critically examined the challenges and possible solutions associated with vocational education and training under NEP 2020. The study highlighted the policy target of exposing at least 50% of learners to vocational education and analysed whether the proposed structural reforms could address longstanding VET challenges. Through a detailed review of policy provisions and institutional information, the author identified problems relating to infrastructure, social perception, implementation capacity, availability of trained personnel and industry linkages. The study concluded that policy aspirations must be accompanied by adequate institutional capacity and systematic implementation if vocational education is to become genuinely mainstream.

Dagar (2022) studied vocational education and training for indigenous women in India through a participatory planning perspective. The research examined skill-training interventions among indigenous women belonging to different communities and geographical locations. It demonstrated that vocational training can contribute to livelihood enhancement and economic participation but may generate limited benefits when programmes fail to reflect local knowledge, cultural conditions and the actual livelihood aspirations of women. The author recommended participatory planning and context-specific training instead of a uniform top-down approach. This study contributes an important inclusion dimension to Viksit Bharat 2047 by showing that skill development needs to reach disadvantaged communities in ways suited to their socioeconomic circumstances.

Pilz and Regel (2021) provided a systematic overview of the prospects and challenges of vocational education and training in India. They observed that rapid economic growth and shortages of skilled workers had led the Indian government to place skill development prominently on the policy agenda. Despite multiple schemes and institutional reforms, however, the VET system continued to experience quantitative and qualitative constraints. The researchers highlighted issues related to the structure of the system, institutional coordination, training quality and labour-market responsiveness. They concluded that reform should address the vocational ecosystem as a whole instead of relying on isolated programmes. Their analysis remains important for understanding why institutional integration is essential for India's long-term skill strategy.

Schneider and Pilz (2019) investigated the function and institutional embeddedness of polytechnics in India's education and vocational-training system. The study found that polytechnics occupy an important intermediary position between general education, technical learning and labour-market preparation but have received relatively limited research and policy attention. The authors analysed how different actors perceive the role of polytechnics and highlighted their potential contribution to skill formation. They suggested that stronger institutional recognition and links with the wider VET system could improve their contribution to technical manpower development. This is significant for Viksit Bharat because middle-level technical skills will be essential for manufacturing, infrastructure and technology-driven expansion.

Objective of the Study

Objective 1: To examine the role of vocational skills and vocational education in achieving the vision of Viksit Bharat 2047.

The first objective is to analyse how vocational education can contribute to the creation of the skilled human capital required for India to become a developed, self-reliant and globally competitive economy by 2047. Vocational education connects academic learning with practical occupational competencies and can improve the ability of learners to participate productively in manufacturing, services, agriculture, healthcare, construction, tourism, logistics and emerging technology sectors. NEP 2020 specifically proposes the integration of vocational education into mainstream education, collaboration between secondary schools, ITIs, polytechnics and local industries, and vocational exposure from the school level onward

(Ministry of Education, 2020). The scale of expansion is already considerable: vocational education increased from only 960 schools in 2014 to 29,342 schools in 2024, representing more than a thirty-fold increase, while enrolment rose to over 30.8 lakh students. The study therefore examines whether such expansion can support Viksit Bharat through improvements in workforce productivity, occupational preparedness, innovation and human-capital development.

Objective 2: To assess the importance of vocational education in improving employability, entrepreneurship and industry readiness among youth.

The second objective focuses on the relationship between vocational skills and the economic participation of young people. Vocational education is particularly important because it combines technical competence with workplace-oriented abilities such as communication, teamwork, digital literacy, problem-solving and adaptability. The Government's school vocationalisation initiative explicitly aims to enhance both employability and entrepreneurial capabilities while exposing students to actual work environments. Under Samagra Shiksha, vocational education has also been diversified across sectors; by June 2022 the scheme covered 88 job roles across 22 sectors, including agriculture, automotive, banking and financial services, construction, healthcare, IT/ITeS, retail, telecom, tourism, transportation and logistics. This diversity indicates that vocational education can provide multiple employment and entrepreneurship pathways rather than preparing students for a narrow range of traditional trades. The objective therefore examines how industry-aligned vocational training can reduce skill mismatch, improve school-to-work transition and enable young people to become both employment seekers and employment creators.

Objective 3: To analyse the contribution of vocational skills and education to sustainable development and the emerging green economy.

The third objective examines vocational education from the perspective of environmental sustainability and green economic transformation. Achieving Viksit Bharat 2047 requires economic growth to be accompanied by efficient resource utilisation, renewable energy adoption, climate-responsive production and environmentally sustainable employment. Consequently, vocational education needs to prepare workers for green occupations such as solar installation, electric-vehicle maintenance, energy-efficient construction, waste management and green hydrogen. The Ministry of Skill Development and Entrepreneurship reported that under PMKVY 4.0, 4,907 candidates were enrolled for solar-panel-related training and 3,962 were trained in installation, maintenance and operations. Under skill initiatives linked with the National Green Hydrogen Mission, 3,509 candidates were enrolled and 1,507 were trained for hydrogen-energy-related job roles. These figures demonstrate that green skills are already becoming part of India's vocational architecture. The objective therefore evaluates vocational education as an instrument not only for employment creation but also for building the skilled workforce required for India's transition towards a low-carbon and environmentally sustainable economy.

Objective 4: To study the significance of digital, technological and future-oriented vocational skills for the workforce requirements of Viksit Bharat 2047.

The fourth objective is concerned with the changing meaning of vocational competence in the age of Artificial Intelligence, automation and Industry 4.0. Future employment will increasingly require competencies in Artificial Intelligence, Internet of Things, robotics, drones, electric vehicles, additive manufacturing, cybersecurity, application development and other digital technologies. The Ministry of Skill Development and Entrepreneurship has accordingly expanded PMKVY 4.0 into job roles such as AI Data Engineer, AI-Machine Learning Engineer, Telecom Technician for IoT Devices/Systems, Drone Manufacturing and Assembly Technician, Additive Manufacturing Technician, Electric Vehicle Service Technician and Kisan Drone Operator. Approximately 3.80 lakh candidates had been enrolled in new-age and futuristic job roles during an eight-month period reported by the Ministry. The programme has also involved institutions such as IITs and NITs, while 1,254 schools, including Kendriya Vidyalayas and Jawahar Navodaya Vidyalayas, were implementing PMKVY 4.0 programmes. Thus, the study examines whether technological vocational education can strengthen digital readiness, adaptability and competitiveness of India's future workforce.

Objective 5: To identify the challenges and suggest measures for strengthening vocational education for inclusive and sustainable development by 2047.

The fifth objective is to identify the structural and implementation challenges that may restrict the contribution of vocational education to Viksit Bharat 2047. Although substantial expansion has taken place, challenges relating to social perception, quality of training, infrastructure, accessibility, industry linkages, geographical inequality and integration with mainstream education remain significant. NEP 2020 itself acknowledged that vocational education had historically been perceived as inferior to mainstream academic education and therefore called for the removal of this social-status hierarchy through complete integration of vocational programmes with regular education. Inclusion is equally important. PMKVY 4.0 has, for example, been integrated with PM-JANMAN for tribal youth and Project VIKALP for adolescent girls; the latter was designed as a pilot covering 27 districts across 19 States/Union Territories with a target of approximately 3,850 beneficiaries. This objective therefore seeks to identify measures through which vocational education can become more accessible to women, rural youth, disadvantaged communities and learners from different socioeconomic backgrounds while simultaneously improving training quality and labour-market relevance.

Role of Vocational Skills in Human Capital Development

Vocational skills play a significant role in human capital development because they convert general education into practical ability, productive capacity and employable competence. Human capital refers to the knowledge, skills, abilities, health, values and productive potential of people that contribute directly to economic and social development. In the context of Viksit Bharat 2047, India's progress will depend not only on the number of educated people but also on the quality, relevance and adaptability of their skills. The National Education Policy 2020 therefore places strong emphasis on integrating vocational education with mainstream education and envisages that at least 50% of learners in school and higher education should receive exposure to vocational education (Ministry of Education, 2020). This policy direction reflects the recognition that a large educated population can become an effective development

resource only when academic learning is supported by practical, technical and occupational competencies.

Vocational skills contribute to human capital formation by providing learners with job-oriented training, technical knowledge, hands-on experience, digital competence, problem-solving ability, communication skills and professional discipline. These qualities improve an individual's capacity to perform productive work and adapt to changing occupational requirements. The importance of this process is particularly evident in India, where approximately 65% of the population is below the age of 35 years, creating a substantial demographic opportunity for economic growth. However, this demographic advantage can be fully realised only when young people possess employable and industry-relevant skills. Official labour-market evidence has also shown that formal vocational or technical training continues to cover only a relatively small proportion of the working-age population, highlighting the need to substantially expand structured skill development across the country.

In a developing economy like India, many young people complete formal education but still face difficulty in obtaining suitable employment because educational qualifications do not always correspond with actual workplace requirements. The Economic Survey 2024–25 highlighted the continuing mismatch between educational attainment and occupational outcomes, indicating that a considerable proportion of graduates and postgraduates were employed in occupations below their qualification levels. Vocational education helps to reduce this gap by connecting classroom learning with practical workplace requirements. Skills related to computer operations, electrical work, plumbing, healthcare assistance, food processing, tailoring, automobile repair, beauty and wellness, agricultural technology, hospitality, logistics and renewable energy can provide learners with direct pathways into employment and self-employment.

The contribution of vocational training to human capital development is also visible in the scale of national skill initiatives. Under the Pradhan Mantri Kaushal Vikas Yojana, approximately 1.64 crore candidates had been trained or oriented by the end of 2025, while around 1.29 crore had received certification. In addition, more than 40 lakh apprentices had been engaged under the National Apprenticeship Promotion Scheme, and approximately 92.66 lakh learners had participated in the Craftsmen Training Scheme by mid-2025. These figures demonstrate that vocational training has become an important component of India's human-capital strategy. However, the long-term value of these programmes will depend on training quality, industry relevance, employment outcomes, wage improvement and the capacity of trained individuals to adapt to technological change.

Vocational skills also strengthen human capital by promoting independence, entrepreneurship and productive participation in local economies. Individuals who acquire marketable skills are not restricted only to salaried employment; they can also establish micro-enterprises, provide specialised services and participate in self-employment. This is particularly important in rural and semi-urban areas, where opportunities in agriculture technology, food processing, repair services, handicrafts, logistics, renewable energy and local services can generate income without requiring migration to large cities. Recent skill-development initiatives have also

expanded into future-oriented areas such as Artificial Intelligence, drones, electric vehicles, solar energy and green hydrogen, showing that vocational education is gradually adapting to the changing structure of the economy. Therefore, vocational skills should be viewed as a strategic instrument for building a capable, productive, innovative and self-reliant human capital base capable of supporting the broader goals of Viksit Bharat 2047.

Vocational Education as a Driver of Employability and Entrepreneurship

Employability is one of the most important outcomes of vocational education because it connects formal learning with practical workplace requirements. Schneider and Pilz (2024) observed that India continues to face a mismatch between the skills possessed by young people and the competencies demanded by employers, even though the country has a very large working-age population. Vocational education helps to reduce this gap by developing communication ability, digital literacy, problem-solving, teamwork, technical operation, customer handling, safety practices and work discipline. Dutta (2024) similarly reported that inadequate practical exposure and outdated skill sets are major barriers to employment and argued that vocational programmes should be more closely aligned with industry requirements. When learners receive practical and occupation-oriented training, they become better prepared for employment in industries, offices, hospitals, workshops, service centres, agriculture-based enterprises and digital platforms.

Vocational education also promotes entrepreneurship by encouraging young people to become job creators rather than remaining dependent only on salaried employment. Choudhury, Mallick and Kumar (2024) found that vocational training can positively influence participation in self-employment, particularly in the non-farm sector. Training in tailoring, food processing, computer services, mobile repairing, electrical work, beauty and wellness, dairy farming, organic farming, tourism, hospitality, handicrafts and small manufacturing can provide youth with practical opportunities to establish micro-enterprises. Pramod and Ramachandran (2023) also highlighted the close relationship between skill development, entrepreneurship and inclusive growth, arguing that youth employment strategies should combine vocational competence with entrepreneurial opportunities. Thus, vocational education can strengthen both employability and enterprise creation.



Along with technical skills, vocational education can develop business-related competencies such as planning, marketing, financial management, customer service, communication and innovation. These abilities are especially important for the growth of micro, small and medium enterprises in rural and semi-urban regions. Dagar (2022) demonstrated that appropriately designed vocational programmes can improve livelihood opportunities among disadvantaged communities, particularly when training reflects local economic conditions and community needs. Similarly, Singh and Gunasekaran (2024) emphasised that vocational education should be integrated with mainstream education and entrepreneurship-oriented learning so that students are equipped not only to obtain jobs but also to establish and manage enterprises. Such an approach can help convert vocational learning into productive economic activity.

In the context of Viksit Bharat 2047, entrepreneurship has particular significance for local economic development, self-reliance and employment generation. Skilled entrepreneurs can use local resources, introduce new services, create employment for others and contribute to regional as well as national economic growth. Mehrotra, Kalaiyarasan, Kumra and Ravi Raman (2015) had earlier argued that stronger industry involvement and workplace-oriented skill development were essential for improving the quality and relevance of vocational training in India. More recent studies, including Kharel, Dahal and Joshi (2026), have reinforced this view by showing that employer participation, workplace learning and competency-based curricula are closely associated with stronger employability outcomes. Therefore, entrepreneurship-oriented vocational education can become a major mechanism for translating skills into sustainable livelihoods.

Vocational education is also important for inclusion because it can provide pathways to economic participation for women, rural youth, school dropouts and economically weaker groups. Ganie (2022) noted that the success of vocational education under NEP 2020 depends on overcoming barriers related to accessibility, infrastructure, social perception and institutional capacity. Dagar (2022) further showed that vocational training can support financial independence when programmes are adapted to the needs of specific communities. Therefore, vocational education should not be viewed merely as a mechanism for employment placement; it is also a powerful instrument for self-employment, entrepreneurship, innovation

and inclusive development. By strengthening employability, enterprise creation and local economic participation, vocational education can make India's youth active contributors to the broader objective of achieving Viksit Bharat by 2047.

Contribution of Skill-Based Education to Viksit Bharat 2047

Skill-based education has a major contribution in achieving the vision of Viksit Bharat 2047 because it prepares individuals for practical life, employment, productivity and national development. A developed India requires a population that is educated as well as skilled. Only theoretical knowledge cannot fulfil the needs of modern industries, services, agriculture, technology and entrepreneurship. Skill-based education connects learning with real work situations and helps students develop practical abilities, technical knowledge, digital literacy, problem-solving capacity and professional confidence.

In the vision of Viksit Bharat 2047, India aims to become economically strong, socially inclusive, technologically advanced and globally competitive. Skill-based education supports this vision by creating a workforce that can contribute to different sectors such as manufacturing, healthcare, construction, renewable energy, information technology, tourism, logistics, agriculture, food processing and small enterprises. When people are trained according to the needs of these sectors, they become more employable and productive. This improves industrial growth, service quality, innovation and national income.

Result and Discussion

The results of the study indicate that India has created a substantial institutional base for skill development, but the penetration of formal vocational education continues to remain limited in relation to the size of the working-age population. The reviewed evidence shows that nearly 65.3% of persons in the 15–59 years age group had not received any vocational or technical training, whereas only about 4.1% had received formal vocational training. A further 11.6% acquired skills through hereditary sources, 9.3% through on-the-job learning, 7.1% through self-learning and approximately 2.5% through other informal mechanisms. These figures reveal a major structural gap between the availability of India's large youth population and their participation in organised skill-development systems. The finding is particularly significant for Viksit Bharat 2047 because India has nearly 65% of its population below the age of 35 years. Therefore, the demographic advantage can contribute to national development only when a substantially larger proportion of young people is brought within formal, recognised and industry-relevant vocational training. The results suggest that India must move from limited formal skill coverage of around 4–5% towards a much wider vocational participation base during the coming two decades.

The analysis also demonstrates that government skill-development programmes have achieved considerable numerical scale. Under the Pradhan Mantri Kaushal Vikas Yojana, approximately 1.64 crore candidates had been trained or oriented by the end of 2025, while nearly 1.29 crore candidates had received certification. However, employment outcomes reveal an important difference between training participation and actual labour-market absorption. Among

approximately 56.89 lakh candidates certified under the Short-Term Training components of the earlier phases of PMKVY, nearly 24.3 lakh were reported as placed, producing an approximate placement proportion of 42.8%. This means that around 57.2% of certified candidates were not reflected in recorded placement outcomes. The result should not necessarily be interpreted as complete programme failure because several candidates may have entered self-employment, further education or informal occupations, but the numerical difference clearly highlights the need for stronger post-training tracking. Thus, the discussion suggests that future skill policy under Viksit Bharat 2047 should measure programme success not merely through enrolment and certification figures but through placement rates, wage improvement, job retention, career progression and entrepreneurial outcomes.

The broader institutional data further indicate that India possesses the capacity to expand vocational learning rapidly. By mid-2025, approximately 31.43 lakh candidates had received training through Jan Shikshan Sansthan, around 40.81 lakh apprentices had been engaged under the National Apprenticeship Promotion Scheme and approximately 92.66 lakh learners had been enrolled through the Craftsmen Training Scheme. The skill ecosystem included nearly 12,838 PMKVY 4.0 training centres, 289 Jan Shikshan Sansthans, about 51,895 apprenticeship establishments and nearly 14,615 Industrial Training Institutes. In 2024–25 alone, around 20.38 lakh people were trained or oriented under PMKVY, approximately 5 lakh under Jan Shikshan Sansthan and nearly 9.85 lakh were engaged as apprentices, resulting in more than 35 lakh training or apprenticeship engagements within one financial year. These results demonstrate that India does not lack institutional initiatives; rather, the challenge lies in improving coordination, capacity utilisation, geographic accessibility and industry alignment. The discussion therefore supports the need for converting the existing large-scale training infrastructure into an integrated national skill network linked with schools, higher education institutions, MSMEs and emerging industrial clusters.

A significant result emerging from the reviewed evidence is the growing importance of future-oriented skills. Traditional vocational education alone may not be sufficient for the economic requirements of 2047 because the labour market is increasingly influenced by Artificial Intelligence, automation, renewable energy, electric mobility, data analytics, cybersecurity and advanced manufacturing. Under PMKVY 4.0, for example, approximately 4,907 candidates were enrolled in solar-panel-related skill programmes and about 3,962 completed training in installation, operation and maintenance. Similarly, skill initiatives linked with the National Green Hydrogen Mission recorded around 3,509 enrolments, of which approximately 1,507 candidates had been trained in hydrogen-energy-related job roles. This represents a training completion proportion of about 80.7% in the solar-related programmes and nearly 42.9% in the hydrogen-related programmes. Such figures show that India has begun integrating emerging sectors into vocational education, although the scale remains relatively small compared with the expected future demand. The results therefore indicate that the Viksit Bharat 2047 strategy must substantially expand training in AI, robotics, green technologies, semiconductors, healthcare technology, cloud computing and other high-growth sectors while simultaneously strengthening foundational digital and behavioural competencies.

The findings finally reveal that the effectiveness of skill development must be assessed in terms of employability, quality of employment and social inclusion. Recent evidence suggested that approximately 94% of surveyed employers were willing to hire additional PMKVY-trained candidates, while nearly 52% of candidates who obtained employment or Recognition of Prior Learning certification reported higher salaries or expected improved earnings compared with uncertified workers. At the same time, approximately 25% of individuals aged 15–29 years were estimated to be outside employment, education or training, indicating that a substantial section of young people still remains disconnected from productive economic participation. The coexistence of high employer willingness and a large youth population outside education and employment demonstrates that the central issue is not simply the absence of opportunities but the mismatch between skills, accessibility and labour-market requirements. Consequently, the study concludes that skill development and vocational education can become one of the strongest pillars of Viksit Bharat 2047 only when the system simultaneously improves formal vocational participation, increases placement and wage outcomes, strengthens apprenticeship-based learning, expands future-oriented skills and ensures greater inclusion of women, rural youth and disadvantaged groups. Numerically, the movement from the present formal training coverage of approximately 4–5% towards substantially broader participation will be essential for transforming India's demographic potential into productive human capital by 2047.

Conclusion

The study concludes that skill development and vocational education will be among the most important foundations for achieving the vision of Viksit Bharat 2047. India has a considerable demographic advantage, with nearly 65% of its population below the age of 35 years, but this advantage can contribute to national development only when young people possess relevant, practical and future-oriented skills. The reviewed evidence shows that nearly 65.3% of persons aged 15–59 years had not received vocational or technical training, while formal vocational training remained limited to approximately 4–5% of the population in this age group. This gap clearly indicates that the expansion of formal skill education must become a national priority during the coming two decades.

At the same time, India has already established a large skill-development ecosystem through initiatives such as PMKVY, Jan Shikshan Sansthan, NAPS and the Craftsmen Training Scheme. Around 1.64 crore candidates had been trained or oriented under PMKVY, while nearly 1.29 crore had received certification. More than 40 lakh apprentices had also been engaged under NAPS, and approximately 92.66 lakh learners had participated in the Craftsmen Training Scheme. These figures demonstrate significant institutional progress, but the study also finds that training numbers alone cannot be treated as the final indicator of success. Placement rates, income improvement, job retention, entrepreneurship, employer satisfaction and career progression must become equally important measures of programme effectiveness. The findings further suggest that vocational education must move beyond traditional trades and become closely connected with emerging sectors such as Artificial Intelligence, data analytics, renewable energy, green hydrogen, robotics, cybersecurity, electric mobility, healthcare technology and advanced manufacturing. India's future workforce will require a combination of technical, digital and behavioural competencies. Therefore, industry-linked curricula,

apprenticeships, practical training, entrepreneurship education and continuous reskilling should become integral components of school, college and university education. The successful integration of vocational education with mainstream education, as envisaged under NEP 2020, can significantly improve employability and reduce the existing gap between educational qualifications and labour-market requirements.

Overall, Viksit Bharat 2047 requires a shift from qualification-based education to competency-based and employment-oriented learning. Government institutions, industries, educational organisations, ITIs, polytechnics, universities and MSMEs must work together to create an inclusive and responsive national skill ecosystem. Special attention should also be given to women, rural youth, disadvantaged groups and individuals outside employment, education or training. If formal vocational participation is significantly expanded beyond the present 4–5% level and training is consistently linked with sustainable employment and emerging economic opportunities, skill development can transform India's demographic strength into productive human capital. Thus, vocational education should be recognised not merely as an alternative educational pathway, but as a strategic instrument for productivity, innovation, entrepreneurship, social inclusion and the achievement of a developed India by 2047.

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