Green Economic Transition and Green Skills: A Pathway for Sustainable Development

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Abstract
The sustainable development goal of climate action calls for urgent actions to combat climate change and emphasizes climate mitigation and adaptation. Many global agreements have been signed to discuss the climate change issue and reports on climate action agree that the World should shift to a 'Green Economic Growth' model. A green economy is low-carbon, resource-efficient, and socially inclusive. A green economy growth process advocates a sustainable growth strategy with investments in green employment and skills. Climate change and human capital are deeply interconnected and investing in human capital is essential. Human capital—the knowledge, skills, and good health—is needed to deal with climate change. A 'green skilled' population is essential to develop innovative climate solutions for a green economy. Green transition requires green skills - knowledge, and abilities to live in and develop a sustainable green economy. Green human capital is a foundational requirement to ensure that people do not become passive victims of climate change. The green transition measures have affected the existing job profiles and created new job opportunities. Green skills gaps imply that the skills of the existing workforce are inadequate for performing the green job efficiently. Skills shortages and gaps are major impediments to green transition. Skills must be revised to build foundational knowledge, research, and innovation in green economy-related fields. Greening Technical and Vocational Educational Training (TVET) institutions to promote green skills to cater to the demand of green technology industries is the need of the hour. This research paper explores integrating green skills in education as a strategy for climate action.

Keywords: Sustainable Development, Green Economy, Green Transition, Green Skills

The world is witnessing a widespread shift in global weather patterns and an average rise in temperatures in the past century. Scientists have interpreted this change as an impact of global warming and warned that the world is heading towards catastrophic 'climate change'. Earth's temperature has risen by an average of 0.11° Fahrenheit (0.06° Celsius) per decade since 1850 (Lindsey and Dahlman). Nations worldwide realize the critical importance of decreasing global warming through economic, social, and environmental, strategies and making development sustainable. The Stockholm Declaration of 1972 was the first document, presented at the United Nations Conference on Human Environment that stated that "the protection of the environment is a major issue and the environmental policies of all States should enhance rather than adversely affect the present or future development potential of developing countries nor should they hamper the attainment of better living conditions for all" (*Report of the United Nations Conference on the Human Environment*). The Brundtland Report, "Our Common Future" 1987, raised the call for 'Sustainable Development' as a process "that meets the needs of the present, without compromising the ability of future generations to meet their own needs" (United Nations: *Our Common Future*). 154 countries at The United Nations Framework Convention on Climate Change (UNFCCC) decided to control 'dangerous human interference with the climate system' (UNFCCC).

The 2030 Agenda for Sustainable Development adopted in 2015 stated the seventeen Sustainable Development Goals (SDGs) of which Goal 13: Climate Action asks governments to "take urgent actions to combat climate change and its impacts" (*Sustainable Development Goals*) and it connects the achievement of all other SDGs to climate mitigation and adaptation. Subsequently, many global agreements have been signed to discuss the climate change issue, initiate climate action, and monitor its progress. Most studies and reports on climate action agree that climate mitigation and adaptation need a strategy to shift the current economic growth model to a 'Green Economic Growth' model. A green economy is low-carbon, resource-efficient, and socially inclusive (*Green Economy*). A green economy growth process advocates a sustainable economic growth strategy with investments, green employment, and skills (Duflo). The advocates of a green economy believe that climate change and human capital are deeply interconnected and that investing in human capital is essential for better climate outcomes (Caruso et al.). Climate change impacts society by affecting health, nutrition, learning, skills, and employment outcomes (UNIDO). Therefore, climate action is necessary to address global warming through climate mitigation and adaptation.

Climate mitigation, which aims at reducing the negative impacts of climate change on the economy and human capital, has been the focus of economists and scientists. Climate mitigation and interventions for reducing the net amount of greenhouse gases (GHGs) emitted into the atmosphere are being discussed and applied globally.

Climate adaptation is the adjustment process in societies to protect people, livelihoods, and ecosystems from the current impacts and expected impacts of climatic change. Adaptation actions seek to moderate or prevent harm or take advantage of beneficial opportunities (Caruso et al.). A balanced climate action, focusing on climate mitigation and adaptation simultaneously, is needed as a long-term global policy on climate change.

Human capital—knowledge, skills, and good health—is critical to deal with climate change. A healthier, better-educated, skilled population is necessary to develop innovative climate solutions for a green economy. Skilled human capital is resilient to global warming issues that endanger the world. The transition to an environmentally sustainable economy requires the development of green skills. Green skills are, "the knowledge, abilities, values, and attitudes needed to live in, develop, and support a sustainable and resource-efficient society" (UNIDO). Green skills are necessary to increase the adaptive capacity of society to face climate hazards and to protect economic resources. Green human capital is a foundational requirement to ensure that people do not become passive victims of climate change. 'Education is the single strongest predictor of climate change awareness' (Sabarwal et al.).

Review of Literature

With increasing emphasis on climate action for sustainable development, climate mitigation, and climate adaptation issues have become the focus of government policies. Climate adaptation recognizes the integration of green skills into the educational system. In their research analysis, Caruso et al., study the interlinkages of climate change with human capital. They conclude that climate change has severely impacted humanity and we are witnessing increasing episodes of extreme weather shocks and consequent damage to resources and causalities. Climate action is necessary for both climate mitigation and climate adaptation. Human capital plays a vital role in making development sustainable. (Filho et al.) advocate that education must include knowledge of all aspects of environmental issues and should develop a change perspective toward the environment and conservation of natural resources. The emphasis should be on transformation in learning for sustainability. Green education must be adopted to increase societal awareness of sustainable development challenges and the measures to tackle them. (Ruiz-Mallén and Heras) study the sustainability discourses of global and regional higher education institutions and conclude that a major trend observed is a 'greening' discourse i.e. curriculum change and innovation to include sustainability issues and the teaching of skills needed for achieving sustainability goals. They emphasize in their study the role of higher education in promoting a green

economy. (Avanjali) states that the education system of the economy plays a critical role in sustainable development. 'Greening' of school education does not solely imply developing a green infrastructure rather more importantly, it means 'greening of the curriculum' to develop knowledge, skills, and green practices needed for sustainable development. (Kamble) presents a view that the green economy is a remedy for environmental sustainability and analyses the state of the green economy in India and its linkages with sustainable development goals. The statistical analysis of indicators of economic transition towards a green economy reveals that multifaceted planned efforts are necessary to attain a green economy. In their research, (Vona et al.) find that increasing emphasis on transition to a green economy for sustainable development has created new occupations or 'green jobs'. This has led to a demand for 'green skills' i.e. knowledge, skills, and attitudes for environmentally sustainable modes of production, management, organization, and monitoring. (Bala) discusses the different aspects of green economy and green skills crucial for the transition to a green economy. According to her study, 'green jobs' are growing, and India's economic transition depends on green skills. Up-skilling will help India achieve the SDGs targets by developing sectors where green jobs exist and can be generated.

The above review reveals various dimensions of research studies on the present research topic. Today, green skills are recognised as an important tool for changing the mindset of the youth and hence there is an urgent need to make an in-depth study on the topic. A research analysis must examine the strategy for developing green skills in India.

Statement of the Problem

India has developed a comprehensive climate action policy and has adopted a National Action Plan for Climate Change to achieve sustainable development goals. The success of these policy measures requires effective implementation. A linkage between the education system and the green economy targets is important. The green economy requires youth with green skills. However, integrating green skills into education has not picked up the pace necessary. This study discusses the concept of green skills, analyses green skills in India, discusses the challenges in promoting them, and suggests ways to improve its sustainability benefits.

Objectives of the Study

Higher learning institutions, especially Technical and Vocational Education and Training (TVET), must integrate into the skill curriculum the emerging green skills for a green transition. The objectives of this study are to:

- Understand the concept of and the need for a green economy model;
- To understand why green transition demands green skills;
- To analyze the various green skills that are needed for green transition;
- To analyze the global policy approach for imparting green skills;
- To analyze India's Green Skills approach and the challenges ahead;

Research Methodology

An in-depth analysis of documents relevant to the present study was made to analyze the needs of a green economy for climate action and sustainable development and the role of green skills for transition. Various published articles and technical reports related to the issues of climate action, green economy, and green skills were identified from electronic database and critically reviewed.

Results and Discussion

British environmentalist (Pearce et al.) introduced the idea of a 'green economy' that emphasized the importance of environmental preservation with industrial development. The United Nations classified the green economy and sustainable development concept into seven tracks: eco-efficiency, greening markets and public procurement, investments in sustainable infrastructure, restoration and upgrading of natural capital, getting prices right, and ecological tax reform. In October 2008, the United Nations Environment Programme (UNEP) launched The Green Economy Initiative to promote sustainability through green investment. This was further modified into the 'inclusive green economy' at the Rio+20

World Conference on climate mitigation and adaptation. It called for a global 'green transition' i.e. transitioning countries from carbon-intensive energy sources to the use of renewable resources or achievement of decarbonization and net zero targets of the SDGs and Paris Agreement. Further, the International Labour Organisation also emphasized that the green transition must be 'just' i.e. "as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind." (ILO).

Green Skills

Green skills are "the knowledge, abilities, values, and attitudes needed to live in, develop and support a sustainable and resource-efficient" (CEDEFOP). Green skills help to adapt products, services, and processes to the transformations due to climate change and environmental requirements and regulations" (OECD/CEDEFOP).

The green transition measures of climate mitigation and adaptation have affected the existing job profiles and created new job opportunities. The structural changes caused by the shift towards the emphasis on the use of renewable energy and the adoption of energy efficiency are causing an increase in demand in some occupations and a decrease in others. This is creating new 'green jobs' that require new skills, qualifications, and training and hence need re-training. According to the International Labour Organisation, (ILO Policy Brief), by 2030, approximately 103 million jobs will be created if the Paris Agreement is implemented successfully and countries shift to sustainable production and consumption patterns however there is a risk of loss of 78 million jobs in this transition. This implies that a net gain of 25 million jobs globally by 2030 can be achieved if skills development and upgrading measures are introduced to enable transitions in labor markets. Thus, countries need green skilling measures to promote skills for green jobs coherent with environmental policies (ILO: *Climate Change and Financing a just Transition*).

Green skills gaps imply the existence of a situation where the skills of the currently employed workforce are inadequate for performing the green job efficiently. Skills shortages and gaps are major impediments to green transition industrialization. In a low-carbon economy, these skill gaps hinder climate mitigation and adaptation actions (CEDEFOP/ OECD) Green skills development will play a major role in this transition.

Types of Green Skills

Education, especially at the higher levels needs reforms to integrate green skills because without green skills the future employability of the youth is at risk. The key challenge is identifying green skills. Vona et al., 2015 developed a 'Green General Skill Index' to identify green skills. The index measures a skill 'greenness' as the ratio between the number of green-specific tasks and the total number of specific tasks performed in a specific occupation. The index identified skills that complement green activities and four groups of green-skill occupations:

Engineering and technical skills: related to skills of engineers and technicians for renewable energy design and energy-saving R&D.

Science skills: knowledge essential for scientists.

Operation management skills: knowledge related to the change in the organizational structure required in green activities and life-cycle management, production, etc. like skills of climate change analysts, and sustainability planners.

Monitoring skills: skills required to assess the extent to which the technical criteria and legal standards are observed in an industry. For example, environmental inspectors, and monitoring technicians.

Soft skills: related to design thinking, creativity, innovation, and adaptability.

Thus, green skills cover a broad spectrum and are technical / non-technical, STEM skills, sector-specific skills, and cross-sectoral skills. They are emerging in new sectors of environment and climate action and existing sectors undergoing 'green transition'.

Pre-requisites for An Effective Green Skills Development Policy

An effective green skill development policy has three main aspects - coordination, forecasting, monitoring and evaluation, and forecasting.

Coordination: The needs, availability, and gaps in skills have to be identified, and mapped across various sectors and regions to develop and start appropriate training programs. This requires coordination between stakeholders in the public and private sector industries, trade unions, training institutions, and policymakers.

Monitoring, Evaluation, and Adaptation: A database like a labor market information system and national classification of occupations is essential to fill the skill gap. The green jobs in the economy must be defined and assessed in both the formal and informal sectors and the green skills needed must be identified accordingly. The education system must then undertake the task of providing the youth with these green skills.

Forecasting: Given the high level of uncertainty and rapid innovations associated with the green transition process, forecasting plays an important role in developing green skills. It is essential to forecast the needs of the new green sectors/ activities emerging across the globe and make policy decisions and investments to keep pace with them. Further, forecasting is not limited to emerging sectors, changes are rapidly taking place in existing occupations and have to be addressed.

Without effective anticipation of green skills, effective interaction between industry and training institutes cannot be achieved (CEDEFOP/OECD).

Green Skills in India

India has to achieve the net zero target by 2070 as per its low-carbon development strategy. More than 138 Indian companies have committed to achieving net-zero emissions by 2050. Investments are being made in the industrial sector to meet this commitment. Electric vehicles (EVs), green construction, sustainable textiles, renewable energy, and E-waste management are major sectors in India's green transition.

	Emerging Green Jobs in India
1.	Solar Energy - 3.26 million jobs projected by 2050
2.	Wind Energy - 0.18 million jobs projected by 2030
3.	Bioenergy and Green Hydrogen Sectors - 0.27 million projected by 2030
4.	E-waste Management - 0.5 million formal jobs projected by 2025
5.	Electric Vehicles - 10 million direct and 50 million indirect jobs by 2030
6.	Construction Sector - 11 million jobs to be affected by 2030 due to sustainability transitions
Source: Ministry of Finance	

These rapidly growing green jobs require green-skilled youth. This demand can be met only when India establishes a skill education/ training setup as per the changing demands of the industrial sector (Ramli et al.). Further, many existing jobs (e.g., plumber, construction, electrical repairing, etc.) must be 'greened' as new green technology is being adopted otherwise workers will be displaced or will lose employment. The social cost of the green transition in terms of unemployment has to be minimized by reskilling.

Accordingly, different policy measures have to be adopted to meet the demands of the green skill sectors:

- A short-run approach to provide short-term green skilling courses as per the demand and generate awareness about green skills.
- A medium-run approach to enable the stakeholders to adapt to the green skills and broaden their existing job perspectives.
- A Long-run approach - training in green skills, and upskilling in science, technology, engineering, and mathematics (STEM) fields.

The TVET sector should develop a new curriculum on sustainable development issues, energy efficiency, energy measurement and instrumentation, and renewable energy to upskill the labor supply for green jobs (UNESCO and UNECOV).

India's initial steps in climate action through education included curriculum reform reforms to give children foundational knowledge to improve awareness of climate risks. Various measures were taken for increasing environmental education at the school level and soft skills such as problem-solving can lead to innovative solutions to climate challenges. However, these are not sufficient for a green transition. India has also adopted specific measures:

Green Skill Development Program (GSDP): National Council for Vocational Education and Training (NCVET), National Skill Development Corporation (NSDC), National Skill Development Fund (NSDF), and 37 Sector Skill Councils (SSCs) are various organizations committed to the promotion of Skill India Initiative which aims at building a vocational and technical training framework for skill up-gradation and building of new skills. The objectives of Skill India were integrated with the environment sector through the Green Skill Development Program, in June 2017, for skilling about 7 million youth in environment, forestry, wildlife, and climate change sectors by 2021.

The Skill Council for Green Jobs, SCGJ, was established in 2015-16, "To identify skilling needs of service users as well as manufacturers/ service providers, within Green Businesses sector, and implement nation-wide, Industry-led, collaborative skills development & entrepreneur development initiatives" (*Skill Council for Green Jobs. Annual Report 2015-16*). The SCJF started introducing green skills in vocational education. Forty-four nationally approved green skill qualifications in solar and other renewable energy domains, e-waste management, and green technologies. SCGJ's vision for 2047 is "that the shift to clean energy in India will result in 30-35 million additional jobs created across several sectors by 2047, and over 10 million skills training and job facilitations will be undertaken." (*Skill Council for Green Jobs. Annual Report 2023-24*).

The National Education Policy, 2020 recommends building employability skills for 'jobs of the future'. The government has undertaken measures to introduce a skill development system, launching the National Credit Framework (NCrF) at the school level, which enables youth skills for better employability.

Challenges for Green Skills Development in India

India faces significant challenges in developing green skills despite various initiatives and programs that have been undertaken. These include:

Challenges Related to Green Skills Training/ Education Setup

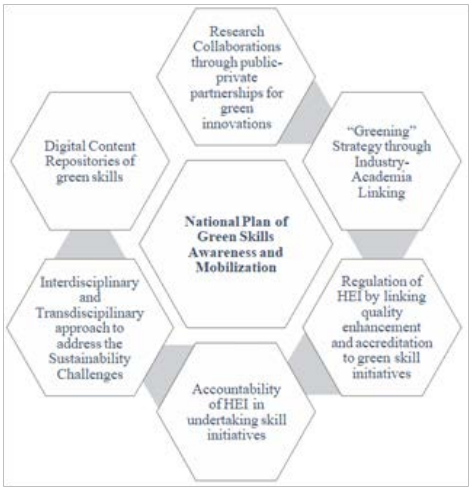
- Weak Industry—Technical and vocational education training (TVET) linkages: Courses offered by TVET institutes, have limited programs offering green skills training. Only 50% of TVET providers have "shades of green" content in their curricula. Courses, certified by the National Council for Vocational Training or the All-India Council of Technical Education, are limited and are offered by very few institutions.
- The green skills are being imparted as 'add-on' skills and specialized green skills targeted especially to 'green jobs' continue to be ignored in the educational curriculum.
- Lack of practical hands-on learning experiences through measures like industrial internship.
- Insufficient Training for teaching staff for imparting training in green skills.
- Low Motivation in teaching faculty to integrate green skills into their teaching practices.
- Lack of infrastructure facilities needed for green skill training institutions like laboratories. Educational initiatives.
- Inadequate Learning Resources like books, digital tools, and lab equipment for effective green skill training/education.

Challenges Related to Policy and Governance

- Lack of coherence in policies related to environmental education and green skill training at the central and state levels.
- Inconsistent implementation across different regions and at various levels of education.
- Insufficient resource allocation for developing the required infrastructure and employing trained faculty to teach green skills.

Suggestions for Integration of Green Skills into the National Development Plan

A green skills development strategy has to be integrated into the national development strategy, and this requires designing a framework to facilitate the incorporation of green skills in education and training programs and curricula. The policy recommendations are



Government policies must take the following steps to achieve these recommendations

- Ensure that the maximum potential of green jobs is utilized for employment generation and identify green skills;
- Promote green training, capacity building, and curriculum changes in TVET as per the demand;
- Promote short stackable courses for green skilling including in technical and STEM fields that are easily accessible.
- Provide special entitlements, additional budgetary support, technical assistance, and/or international industrial exposure to TVETs offering green skill courses.
- Strengthen green STEM and technical education pathways through partnerships with the private sector that have potential green jobs such as apprenticeships, skills camps, and on-the-job training.
- Develop green skills standards and dovetail them with the National Skills Qualification Framework and National Occupational Standards. The NSDC can include green skill criteria in the validation process for National Operational Standards.
- Coordinate the demand and supply of green skills, skills need assessments, and labor market
- Information by developing database mechanisms;
- Allocate resources to training institutions especially those related to green skills;

The above suggestions can enable the transition to a green economy such that important benefits of green skilling i.e. employment generation and climate adaptation are harnessed.

Conclusion

Investment in human capital is necessary for climate adaptation. The green skill policy must concentrate on the ground realities, understand the changing demand scenario in the job market, adapt the education policies, allocate adequate budgets to training institutions, and ensure proper implementation and evaluation. As we face the realities of climate change, proactive adaptation strategies are essential for building resilience. The green transition of human capital i.e. protecting it and skilling it for sustainable development—must be the focus of climate action strategy.

References

Avanjali, Satapathy. "Greening of School Education: A Case Study." *Indian Journal of Environmental Sciences*, vol. 24, no. 2, 2020.

Bala, Shashi. "Green Jobs in India: Present and Future Prospects." *NLI Research Studies Series No. 157/2023*, 2023.

Caruso, Germán; et al. "Climate Changes Affect Human Capital." *CESifo Working Paper No. 10374*, 2023.

CEDEFOP. "Green Skills and Environmental Awareness in Vocational Education and Training." *Research paper No. 24*, 2012.

CEDEFOP/OECD. *Green Skills and Innovation for Inclusive Growth*. Publications Office of European Union, 2015.

Duflo, Esther. "Investing in Human Capital for a Greener Future." *World Bank Group*, 2023.

Filho, W. Leal, et al. "The Role of Transformation in Learning and Education for Sustainability." *Journal of Cleaner Production*. vol. 199, 2018, pp. 286-95.

ILO. *Climate Change and Financing a just Transition*. International Labour Organization, 2024.

ILO. *Greening with Jobs and a Just Transition*. International Labour Organization, 2022.

ILO Policy Brief. *Skills Development for a Just Transition*. International Labour Organization, 2022.

Kamble, P. S. "Green Economy a Design for Sustainable Development of India." *International Journal of Inclusive Development*, vol. 6, no. 1, 2020, pp. 45-61.

Lindsey, Rebecca, and Luann Dahlman. "Climate Change: Global Temperature." *Climate.gov*, 2024.

Ministry of Finance. *Economic Survey: 2022-2023*. Government of India, 2023.

Ministry of Skill Development and Entrepreneurship. *Skill Council for Green Jobs. Annual Report 2015-16*. Government of India.

Ministry of Skill Development and Entrepreneurship. *Skill Council for Green Jobs. Annual Report 2023-24*. Government of India.

OECD/CEDEFOP. *Greener Skills and Jobs*. OECD Publishing, 2014.

Pearce, David, et al. *Blueprint for a Green Economy*. Earthscan Publications, 2000.

Ramli, Syarina, et al. "Sustainable Development: Needs of Green Skills in the Fourth Industrial Revolution (4IR)." *International Journal of Academic Research in Business and Social Sciences*, vol. 8, no. 9, 2018, pp. 1082-95.

Ruiz-Mallén, Isabel, and Maria Heras. "What Sustainability? Higher Education Institutions' Pathways to Reach the Agenda 2030 Goals." *Sustainability*, vol. 12, no. 4, 2020.

Sabarwal, Shwetlena, et al. *Choosing Our Future: Education for Climate Action*. World Bank, 2024.

UNESCO and UNECOV. *Skill Development and Climate Change Action Plan, Enhancing TVET's Contribution*. United Nations Educational, Scientific and Cultural Organization and UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training, 2021.

UNFCCC. *What are United Nations Climate Change Conferences?*. United Nations Climate Change.

UNIDO. "What are Green Skills?." *United Nations Industrial Development Organization*, 2022.

United Nations, Department of Economic and Social Welfare. *Sustainable Development Goals*.

United Nations. *Report of the United Nations Conference on the Human Environment*. 1972.

United Nations. *Report of the World Commission on Environment and Development: Our Common Future*. 1987.

United Nations Environment Programme. *Green Economy*.

Vona, Francesco, et al. "Green Skills." *NBER Working Paper 21116*, 2015.

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