



TITI

<https://doi.org/10.3126/jtd.v8i1.95900>

**Journal of
Training and Development**

2026, Volume 8

ISSN: 2392-456X (Print)

ISSN: 2392-4587 (Online)

Greening TVET for a Sustainable Future

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Abstract

There are several environmental challenges faced by the world, and providing green jobs for a green economy through Technical and Vocational Education and Training (TVET) is seen as a way forward. This review article on Greening TVET integrates skills for sustainable practices, green skills, green curriculum, and programs. The policies, curriculum integration, awareness, and industry institution linkage to share sustainable practices are an urgent need which needs to be planned and implemented. Some of the practices are seen in the context of greening TVET in Nepal. But the continuation of incorporating the gaps between what is and what needs to be is needed. The strategies focused on in this review article are: incorporating Greening TVET into all policies and governance, including the curriculum; increasing teachers' capacity development programs; fostering industry partnerships; practicing green practices by schools; and conducting research on greening TVET. So, reforms to institutions in terms of greening, policy support, partnerships, and linkages with industry to develop green skills and prepare graduates for the labour market are essential to fully realize the potential of greening TVET as an enabler of sustainable development and a sustainable future in Nepal.

Keywords: Curriculum, Greening, Greening TVET, industry institute linkage, Sustainable practices

Introduction

Sustainable employment and long-term economic growth are essential to Nepal's progress. In the absence of a change to a greener economy, Climate change, resource scarcity, environmental deterioration, and economic instability will all persist in Nepal. To spearhead the development of green skills for the workforce of the future, Nepal's TVET sector must take the lead in the shift to green growth.

Greening TVET has drawn the attention of the

world as it is taken as one of the enablers of a sustainable future. Incorporating sustainable practices, developing green competencies, and TVET policies that are environmentally conscious, UNESCO-UNEVOC (2017) focuses on the idea of incorporating sustainable practices, green competencies, and environmental consciousness into policies related to TVET, curriculum, teaching pedagogy, and the culture of the institution. Nepal, a nation that is particularly vulnerable to climate change, has determined that green growth is essential to its future development.

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However, changing it into TVET circumstances is difficult (Bagale, 2021).

Literature Review

The literature review is based on the thematic review, policy review, and empirical review. Recent past studies were reviewed, and the theory related to TVET was highlighted. Based on the gap, some strategies were developed and the gap was analyzed.

Greening TVET

The green economy focuses on the transversal of green skills that basically align with systems thinking, problem-solving and environmental awareness. Not only this, it has some technical capabilities like solar installation, energy audits, and sustainable agriculture (Cedefop, 2022). Majumdar (2011), TVET offers a distinct comparative advantage since it directly matches training to the demands of the labour market, making it an effective tool for fostering sustainable development and green growth. UNESCO (2022) also focuses on the fact that trainers' inadequate preparation, having poor institutional capacity, lack of the nation's framework on developing green skills and competencies are the main issues.

Technologies are shifted from carbon intensive to carbon light, the process and behaviour of workers with the skills of greening is needed not only in present but also in the future. Integrating those technologies, skills related to greening, curriculum, and research based on the latest technologies incorporating greening should be developed in both the developing and developed nations.

Orienting TVET institutions in terms of curricula, procedure of providing training incorporating low carbon practices, behaviours related to environmental sustainability, low carbon emission, and green skills is the greening of TVET institutions. It focuses on incorporating clean and green technologies, sustainable and green practices, environmentally conscious workforce in the field of vocational education (Maclean & Fien, 2017). It helps to encourage awareness, change in behaviour, boost the resources in efficient and finally stimulates clean technology, which

contributes to the green economy and green growth (Sharma, 2020).

Green technology is rapidly increasing across different industries and institutions. Most scholars believe that green technology helps reconcile the environment with basic human needs. Green technology refers to environmentally friendly technology (Sharma, 2020).

Green technology refers to the technology that reduces human impact and conserves natural resources by developing and utilizing systems, procedures, goods, and technologies. Green technology prioritizes long-term economic and commercial sustainability.

Green skills

In the framework of lifelong learning, which supports numerous SDGs, green skills development, or, more simply, greening of skills, goes hand in hand with climate change and environmental protection initiatives, inclusive economic growth, and decent work for all. Greening of the skills is one of the main objectives of technical and vocational education and training (TVET) in UNESCO's 2030 education agenda.

Greening TVET Policy in Nepal

The federalized TVET system in Nepal is being reformed to improve governance and match skill development to the needs of the labor market. Along with digitalization and corporate sector involvement, greening TVET was listed as a top goal in a 2024 UNESCO-UNEVOC national policy conversation (UNESCO-UNEVOC, 2024).

TVET Sector Strategic Plan (TSSP, 2023, 2032), the 16th five-year plan has talked about sustainable development, but the exact way of implementing the TVET policy is not discussed. Nepal does not have a unified Green Skills Framework, despite policy debates. Donor-supported initiatives like ENSSURE (Swisscontact, 2022) and Dakchyata (British Council, 2022), which function in priority industries like construction, agriculture, and tourism, are a major component of current policies.

Evaluation of Empirical Studies

There are several studies done on greening TVET. The findings of the empirical research are highlighted below:

Integrating Green TVET into Curriculum Design:

Pavlova (2018) has done research highlighting the incorporation of the concepts of sustainability. The results of the study show that the country which had adopted green skills in its curriculum had a higher rate of employment in the field of manufacturing and sectors like renewable energy.

In another study done by Okolie et al. (2020) in Sub-Saharan Africa, on the policy framework for creation of sustainable industries through work-based learning in TVET, focuses on the need for stronger linkage with the industry to align the training with the labour market needs, which supports sustainability. The main theme was that incorporating the market demand in the curriculum is most beneficial for sustainability.

In a study done by Ibrahim and Abdul Rahim, (2024) on integrating green skills into the Malaysian curriculum, it shows that the importance of incorporating greening skills in the curriculum is shown. It focuses on the best practices and sustainable practices in integrating green skills in the curriculum. The study has highlighted the need for training for teachers, constraints of resources and curriculum flexibility to integrate the latest and emerging issues. It suggests developing a green skills framework and integrating it with the TVET system, which helps to prepare the human resources as per the demand of the green jobs in the market.

Similar findings were made in research done by Lyu et al. (2025). The study was done on integrating green finance into education, which focuses on the curriculum design and implementation strategies for sustainable development. It has focused on incorporating green finance competencies in vocational education. It highlights the alignment of the curriculum with the industry standards and the mandate of fulfilling the green skills gap seen

in vocational education through the curriculum. This study concluded with the enhancement of graduates' employability in sustainable financial roles.

Development of Green Skills and Preparedness for the Labour Market:

A study done by Fien and Guevara (2019) shows how green skills affect the employability of the graduates. The students who have green skills have a higher chance of being employed in business as the era of implementing sustainable practices. This study highlights the importance of green skills and their effect on workforce adaptation by graduates and employers.

The research done by Albertz and Pilz (2025) on Green Alignment, Green Vocational Education and Training, Green Skills, and Related Subjects focuses on existing green skills and green jobs, which have insufficient comprehensiveness in policy and conceptualization. The study highlights the general and broader concept of green in TVET. The main discourse in this research is about the policy and research practices.

The study of OECD (2025), on how the green transition reshapes vocational education and training, has found that the green transition has assisted in reshaping the labour market by creating the urgent need for skills that support a low-carbon economy and lead to a green economy. This further explores that VET is the key to the green economy, as sectors like construction, transportation, energy, and manufacturing are directly related to the green economy, and the green transition is very important. The need for green-driven jobs and youths with green skills is required. Several new high-skilled jobs have emerged in different occupations. The traditional jobs are being replaced by green jobs, and the demand for youths with green skills is increasing. So, VET programs should adopt the skills that lead the green transition.

Industry Cooperation and Institutional Change

The industry and institutions can have good relations and student participation with the

industry, which focuses on green skills and programs (Maclean & Wilson, 2021). So, developing the green competencies and green certificates has a direct impact on employment and industries. This not only helps the students but also helps them to be environmentally responsible citizens. The study focuses on maintaining a green culture among the students.

A study done by the World Bank (2025) on industry engagement in TVET and skills development, it focuses on the industry as one of the co-leaders in TVET for green transformation. Industry can play the role of an active co-leader, having a positive impact on shaping the TVET by financing and coordinating, and helping to enhance the green competencies in teaching and training. Close coordination and collaboration can help in developing the occupational standards, curriculum, and training methodologies could be changed, and the alignment and linkage of the TVET with the industry and labour market needs can be enhanced. So, the industry can shape TVET as per the demand of the industry, which helps to maintain better linkage.

In a study done by Dhameja et al. (2026) on empowering regional sustainability and inclusivity through greening TVET, it shows that the regional Asia-Pacific countries' TVET systems are in the transitional stage. It focuses on the gap between the circular economy, green competencies, and innovative practices in greening. A clear pathway of implementing greening TVET by incorporating the initiatives, competencies in the curriculum, inclusive industry partnership, coordination, and collaboration is given in the findings of the study.

Theoretical Understanding of Greening TVET

Greening TVET is supported by several theories. The theoretical underpinnings are discussed below:

Ecological Modernization Theory:

Ecological Modernization Theory (Mol & Sonnenfeld, 2000) focuses on the reform of the industry and technological advancement of sustainable growth. It is the relation between

the environment and the economic development of the nation; the importance of the training institutions is highlighted by this theory. So Lotz-Sisitka et al. (2024) argue that the current greening of TVET is to reform the institutions rather than a transformative approach. It helps in developing the human resources with the knowledge of sustainable and green practices, innovative and creative ideas for the environment and industry.

The basic idea of this theory is that the environmental problems are the problems created by humans, and they could be solved by making people aware by sharing the knowledge and skills through the institutions in society. Institutional changes are needed to solve the ecological problems caused by society itself. So, this theory shows that the one who has created the problem can solve the problem too. For this technological innovation, policy formulation and implementation are needed, and society can achieve economic prosperity without harming the environment (Mol, 1995).

Human Capital Theory

Human capital theory (Becker, 1964) emphasises investing in the skills that support economic growth, and green skills are one of them. This provided the rationale of investing in education and training and its return on economic development. The workforce that is highly educated can perform the task quickly, absorb new technologies, and implement those with innovative solutions. So, the productive resources that are developed through the education of the individual are the main theme of this theory.

In the greening of TVET, the theory has significance in fostering the green talents related to green energy, sustainable agricultural practices, and clean and green technologies. The one who is educated can generate the workforce needed for green skills and green jobs. The development of human resources with the needed green skills has a direct impact on economic growth and the green economy (Khan et al., 2025). So, the term human capital can be coined as green human capital as it has a positive correlation with the organizational performance of humans and is linked with sustainability.

Kholifah et al. (2025) focus on employability skills as a vital indicator to make the individual ready for the work. So, investing in human capital is adapting the platform for digitalization approach to education. Having greening skills has a direct impact on career development. So, skills in greening TVET are the capital of humans, which ultimately helps in employment.

Transformative Learning Theory

Transformative theory by Mezirow (1978) focuses on the learning of the individual on the basis of the assumptions, belief system, and the perspective on how they shape on interpreting the world.

Basically, it focuses on the disorienting dilemma, critical self-reflection, rational discourse, and action. So, in the context of greening TVET, it is not only adding the content but also it is the way of helping the learners shift themselves in the world. It is the education system that helps to encourage critical thinking, problem-solving skills and change in behaviour through sustainability (Mezirow, 1991).

The emphasis of this theory is on the necessity of the training programs, development of the curriculum based on environmental consciousness practices, problem-solving techniques and learning, developing sustainability educators. This helps to assess the sustainability in the workplace, forming green occupations and their identities. This theory not only equips learners with practical skills but also shapes environmentally responsible citizens who could contribute to sustainable community and industrial development. The main challenge is the readiness of developing the curriculum based on the latest technology and green skills, developing the pedagogical approaches, and developing teachers and instructors. (Singer-Brodowski, 2023) focuses on changing the meaning in terms of the sustainability learning process.

Existing Research Gap

Although there are several studies in the field of greening TVET, there is no significant research

in the context of Nepal. The major gap is the understanding of greening TVET, as greening is understood as a tool, but it's a process to enable a sustainable future in the TVET institutions and the nation. The main gap is in the conceptual ambiguity of the generic green skills and sector-specific green skills. TVET, in the context of Nepal, has not developed a standardized definition regarding the concepts. Also, the next gap is distinguishing between the employees or the graduates who have green skills and those who do not have green skills. So, the measurable utilization of green skills demand of the green skills in the workplace is not clearly seen. This directly misaligns with how the institutions perceive the green skills and how industry perceives green skills (Persson Thunqvist, 2023).

Also, how the curriculum is developed regarding green jobs and green skills is not clear. With the rapid development of green technologies, the curriculum does not have a clear vision of developing graduates with green skills. So, only sensitization is done, but the policy, curriculum, vision, and demand and supply of green skills are not seen, which is the major gap. Regarding the curriculum, are the instructors ready for implementing greening TVET, what is the future prospects and job-related to greening that are still unclear. So green literacy, instructors' readiness, adaptation of greening components, implication of greening in the job, need and scope of green jobs and skills in the instruction and industry are the major gaps. To address the research gap, the empirical review is done, and findings and implications are developed.

Methodology of the study

This paper has applied the interpretive paradigm in my qualitative research. The nature of the research is an integrative literature review. This technique has helped to make sense of emergent research concepts. This research is based on a review of various research related to greening TVET. Descriptive analytical research was applied in this study, which has helped the researcher to critically evaluate the theme of greening and how it is conceptualized, implemented and utilized in the context of TVET (Li et al., 2023).

This paper has been developed by using the thematic literature review. The academic sources related to the previous literature are the main ones. The related databases, relevant websites, and relevant literature on greening TVET were searched. Thematic synthesis was done based on the conceptual saturation regarding the theme on the greening TVET, green jobs, green skills, strategies for greening TVET and the challenges. Policy review was also done.

Mainstreaming Greening TVET in Practice

From the empirical studies and theoretical underpinnings, the challenges faced in mainstreaming Greening TVET in practice are as follows:

Resource Constraints

The main challenge is the resource constraints in terms of implementing greening TVET. (ADB & EdUHK, as cited in Maclean et al., 2018) focuses on the necessity of greening, but the main problem is funding. So, funding is the main way to develop and implement the course and programs.

Implementing green training facilities is also disturbed by financial and infrastructure constraints (UNEVOC, 2019). Not only this, but also many TVET teachers do not have the latest equipment based on clean and green technology. UNESCO, World Bank & ILO (2023) also focus on the outdated equipment and infrastructure seen in the TVET institutions, which is the urgent need to equip the institutions with the latest clean and green technologies. Bagale (2022) also focuses on the main hindering factors as resource-related barriers to implementing programs and other facilities. Also, in another study by Sharma et al. (2024), teachers have insufficient knowledge regarding the practical knowledge about emerging technologies in Nepal, and the instructors are having significant challenges with inadequate professional development opportunities.

Not only are there physical resources and equipment, but there is also a need for prepared human resources. International Labor Organization [ILO] (2023) emphasizes that

many low and middle-income countries lack human resources who are prepared to meet the increasing demand for green and climate-responsive training. Colombo Plan Staff College [CPSC] (2026) also indicates that there is moderate integration of the greening skills and digital green competencies required for human resources.

Policy Gaps

In most of the countries, the mainstreaming of greening TVET is delayed by the lack of comprehensive national policies (Pavlova, 2020). If there are no national policies, then the planning and implementation of the programs cannot be effective. ADB (2025) has also documented that Nepal's TVET programs suffer from quality, capacity, and governance issues.

UNESCO (2026), in a study done in Nepal's status of greening TVET, has found that there is a need to develop greening TVET guidelines and establish a comprehensive implementation framework based on the guidelines. The framework covers the institutional arrangements, capacity development of the human resources, development of the curriculum and competency, linking the industry and improving the training environments.

Nepal's TVET sector strategic plan (TSSP 2023-2032) signals that greening TEVT is Nepal's overarching issue. The Labour Act, Industrial Enterprise Act, and CTEVT Act are fragmented, and the concerns of greening TVET are not included, so an integrated act or guidelines on greening TVET are needed.

Industry Linkage: TVET is directly related to industry as the industry are the exposure to the graduates. The institutions develop the graduates, and the practice opportunity in terms of internship, on-the-job training, and apprenticeship training is provided in the industry. So, industry linkage is mandatory not only for the exposure but also for meeting the standard of the skill-based instruction program to industry standards and adaptation of the latest technology. If training and market demand are aligned, then there would be higher chances of job placement for the graduates. But

in Nepal, the linkage is seen as poor. In most of the cases, the involvement of the private sector is weak (Shrestha, 2021).

Minimal engagement of the private sector is seen in the curriculum development and policy formulation. Lack of cooperation between TVET institutions and industries has an impact on the market demand (Maclean & Wilson, 2021). Though Nepal's TVET is largely concentrated on internships and student placements in the industry, which is a strong participation of TVET in the industry, there is a weakness in research engagement, policy formulation and designing a greening curriculum with industry linkages (CPSC, 2026).

In a study by Bhatarai (2025) on strengthening TVET through private sector engagement, sufficient industry engagement is not seen. There's minimal involvement of the private sector, and the minimal engagement has adverse impacts on the employability of the graduates.

Findings From the Review

- Greening TVET is essential for preparing a workforce capable of supporting low-carbon, resource-efficient, and climate-resilient development. The following key findings summarize current progress and gaps relevant to Nepal's transition. The key findings are:
- Policy commitment is seen, but still the implementation is inconsistent, and the development of greening TVET policy and guidelines is seen as an urgent need.
- Framework on greening TVET, greening skills are lacking, so integrating with the National Qualifications Frameworks, the development is needed.
- Prioritize the high-potential sectors of greening TVET and make a plan of action as per the priority
- Develop effective models to standardized the curriculum, teaching learning strategies and assessment process, incorporating sustainable green practices.
- Embed green practices and sustainable practices in the Work-based learning platforms, including dual TVET and OJT,

which are directly related to the implementation of the learning.

- Incorporating greening skills and competencies in all the curriculum with the green and clean technology as per the market need is seen.
- Capacity enhancement of the instructors and staff is needed in green skills, pedagogy, and assessment.
- Developing agreed indicators to implement and measure readiness of the programs, providers and implementers.
- Stronger industry engagement and incentive mechanisms are needed to accelerate enterprise adoption of green practices.
- Coordination with the government, local bodies, and development partners is essential to achieve system-level transformation in implementing greening TVET.

Discussion

From the findings of the review of the previous studies, policies and theories, some Strategies for the Greening TVET should be focused. TVET providers can begin implementing green practices by ensuring that school campuses promote resource conservation and sustainability. Greener ways can often be identified and the environmental impact assessed before investing in green employment, partnerships, and skills.

Physical and infrastructure improvements are necessary, as are innovative solid waste management strategies like recycling or composting, new water-saving facilities that collect grey water, and reducing consumption and boosting energy efficiency with the use of solar energy and more energy-efficient electrical equipment (Bagale, 2021). These changes are less expensive and more fundamental in nature. So, some changes need to be made to ensure the implementation of greening skills, cost, and carbon saving to implement greener practices for TVET providers.

- **Policy and Governance- Green Skills Integration in the National TVET Policy Framework**

The main aspect of implementing greening TVET is integrating green skills in the national policy frameworks. Without the integration of greening in the policies related to TVET, implementation and monitoring could not be done. Development of the curriculum integrating greening TVET, greening skills, teachers, instructors' training for making them aware about greening TVET, assessment standards based on the objectives, allocating resources sustainably, are some of the aspects of greening TVET that could be added to the policy framework (UNESCO-UNEVOC, 2017). Policy integration guarantees the national and international objectives of greening TVET that might be aligned with the Paris Climate Agreement and Sustainable Development Goals (UNESCO 2017, ILO 2019). So, integrating green skills in TVET policies enhances eco-friendly practices and enhances resource efficiency, which finally promotes innovation in economic sectors (UNESCO-UNEVOC, 2003; Leal Filho et al., 2018)

Policy-driven in Greening TVET rather than donor-led initiatives helps to ensure sustainability (UNESCO-UNEVOC, 2017). In the context of Nepal, the alignment between the three levels of government is necessary. National, provincial, and local level authorities should have a strong alignment for these initiatives (UNESCO-UNEVOC, 2024). Not only this, the competencies on the job alignment, green skills are needed for the institute and industry both to enhance the labour market in a more sustainable and friendly way (ILO, 2019). Nations that led with the national policy-driven strategies have more improvements in the vocational training systems, which help them prepare for green jobs (ILO, 2019; Wang et al., 2020). This helps to incorporate green skills in the policy framework, helps to improve accountability of institutions, helps with funding, and mainstream competencies related to environmentally friendly behavior which finally leads to enhancing green skills and the

green economy.

- **Integrating Greening in Existing TVET Curriculum**

Waste management, renewable energy, and sustainable agricultural practices are some of the green competencies that should be incorporated into the curriculum. The training facilities and environment of the educational institution should have sustainable resources, its utilization, green building practices, waste management, and other sustainable practices should be included in the curriculum. Not only this, collaboration with the industries which prioritize sustainable practices, integrating green practices into existing courses, adding sustainability topics, including green modules in the curriculum, including the competency-based design, and implementing on a practical basis (UNESCO, 2017) are the aspects that need to be incorporated in the curriculum. Collaborating with companies that prioritize sustainability could provide students with practical exposure to eco-friendly technologies and best practices.

Developing different strategies helps to integrate the long-term green strategies into the curriculum. So, the curriculum should include all abilities where the teacher can teach the climate-resilient, energy-efficient techniques (UNESCO, 2018). The sector-specific and green curricula are needed to meet the local needs (British Council, 2022). The programs that create graduates would apply conscious and ecological solutions by coordinating the curriculum-related materials in real sectors. Developing greening practices and the staff's abilities in greening is necessary (CEDEFOP, 2021).

- **Increasing the Capacity of Teachers, Instructors and Other Staffs**

Education and making the teachers aware are the main aspects of increasing the capacity of the teachers. Because they translate and transfer the sustainable policies into classroom practices. They can incorporate it in the curriculum, including workplace skills.

Diep and Hartmann (2016) also focus on greening the capacity of the teachers. They

further explore that the understanding of teachers is enhanced and improved on sustainable development and the greening skills, which helps the teachers to teach those skills clearly. It also helps them to design the lesson, assessment, and training activities based on the greening skills and competencies, and it helps the teacher's ability to develop the greening behaviour and the skills in the workshop, classroom, lab and the surrounding. Also, in the teachers' training, it could be included. This helps the teachers to develop green entrepreneurship and helps the students with it.

A study done by Okeowo et al. (2024) shows that the problem with teachers' competencies is because of the lack of up-to-date infrastructure, not the availability of the latest teaching materials and the resources for greening and policy integration are needed, especially in the TVET curriculum.

- **Work-Based Learning and Industry Partnerships in Green TVET**

Work-based learning is the linkage between the academic understanding of the students and the real-world exposure, with the application of the academic understanding. This is essential in greening TVET to link and make connections between classroom-taught experiences and the real workplace expectations. Some of the projects have incorporated sustainable practices, and that has helped to adopt environmentally sustainable practices, such as energy-efficient processes and waste management, in their respective industries (Swisscontact, 2022). Incorporating some of the competencies of green skills helps the student not only gain the technical proficiency but also promotes the problem-solving abilities in the real-world that are needed to successfully use green technologies.

UNESCO-UNEVOC (2021) also focuses on the need for work-based learning as the learning objectives are achieved in the real workplace with the guidance and practical instruction of the related skills. They can apply the classroom teaching in the WBL, which makes it easier for the students to understand and apply their experiences of classroom teaching.

British Council (2022) also focuses on the collaborations of TVET institutions with the industries where green technologies and sustainability standards are applied. It helps to develop a sustainable curriculum and meet the training standards as per the industry needs. This also helps to minimize the skill mismatch between the academic institutes and industry for WBL. This ultimately develops the relation between the industry and academia and helps improve employability (UNESCO-UNEVOC, 2021).

The environmentally conscious behavior helps for greening economy and builds a partnership between the industry and the institute through participation in business activities, training opportunities, and recognition of the programs with financial support (ILO, 2019).

- **Practices of Institutions in Greening**

Greening the institution is changing and shaping the greening behaviour. It aims to promote sustainable development concepts in the institutions, and the institutions are one of the best examples of greening. Basically, it focuses on the sustainable practices of the institutions and apply real world application of sustainability in practice (Bagale, 2021). This helps the academicians and the students in maintaining environmentally responsible citizens where energy efficiency, waste management, and water management are the basics (Majumdar, 2010).

There are several practices in Nepal's TVET institutions regarding the greening of TVET. Solar energy, cost-efficient resources, groundwater, rainwater harvesting, engaging students in activities that are clean and green, amendment of the curriculum based on the latest and greening technologies, and incorporating greening TVET in the curriculum are some of the aspects that are being practiced. UNESCO (2018) also focuses on the active participation and engagement in the awareness program, developing leadership, and creating cultural responsibility in the institutions and beyond them.

Engaging in participation activities raises awareness, develops leadership abilities, and creates a culture of environmental

responsibility that permeates the community beyond the campus. (CPSC, 2019) also focuses on greening TVET as one of the crosscutting issues. Adopting sustainable practices in energy and resource efficiency is needed. For this, planning is necessary. And finally, it becomes school culture to adopt and apply greening behaviour.

- **Innovation in TVET Institutions Through Research**

Innovation and creativity are always needed to generate new ideas, technology, teaching methodologies, and ways of thinking. UNESCO-UNEVOC (2019) explains that research is one of the key pathways of the TVET to act as a driver for greening TVET and developing green products and services. Not only this, but greening research helps to develop solutions with locally available community practices. CPSC (2019) suggests community engagement and practices in innovation, which only increases the impact of green TVET programs. This also helps the organization implement the unique and best community practices.

International Labour Organization (ILO, 2019) also focuses on innovative and creative jobs, is in demand in the market, leading to a green economy. TVET institutions can innovate some renewable energy practices, research on waste management can be done, and sustainable construction and sustainable farming help in low-carbon manufacturing. These types of content should be incorporated in the curriculum, and teachers/instructors could be made aware of implementing the greening practices with innovation. Organizing the workshops, research dissemination program, awareness on clean and green technology that are suggested by research, their importance, including such findings in the curriculum helps in better economic and academic results. Developing a research unit, linking institutions and industry, engaging students in the research, innovating greening in technology enhancement, supporting the students and staff on research, and building partnerships enhances the innovative ideas in research (UNESCO-UNEVOC, 2021).

Conclusion

From the various literature and the context of Nepal, greening TVET is one of the pertinent and emerging issues that is set as a main enabler of sustainable development. Achieving sustainability in the TVET sector is through the green skills, green practices, and ultimately leading to the green economy. The world is also in the transition phase of greening TVET, and green transformation is needed sustainably. The only way of incorporating those skills needed as per the market demand and meeting the industry standards is through the policy, curriculum, partnership, and awareness programs. So, there is a lag in institutional readiness (Bagale, 2021). Most of the literature focuses on the lack of pedagogical competence among the TVET instructors as the curriculum is not focused on green skills, and also green awareness is not seen among the TVET professionals (Sharma et al., 2024).

The greening practices, sustainable practices, green jobs and skills have reframed the mandate of the TVET globally (ILO, 2022). TVET is not limited to technical knowledge and skills, but also soft skills and green behaviour are needed in the job market. The contemporary literature also suggests that the integration of green skills, green finance and sustainable technologies in TVET curriculum is a must (UNESCO-UNEVOC, 2019; UNESCO, 2023). The literature has highlighted the green transition and green economy, which are directly connected with the sustainable future of human resources.

Implications

From the different reviews and the findings, there are some implications of the review on greening TVET.

1. The first is providing capacity-building programs to the teachers, as several studies have focused on the lack of awareness. So, providing capacity enhancement programs helps to develop the green competencies.
2. Also, the public-private partnership is seen as a major need which helps to scale up the innovative and sustainable practices programs in the national framework.

3. Apart from this, the curriculum update is also mandatory as the emerging green skills, technologies and competencies related to the occupation should be updated in the curriculum.
4. In the context of Nepal, the greening TVET framework has not been developed, which is an urgent need to apply the greening vocational standards in the institutions.

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