GREEN SKILL DEVELOPMENT FOR SUSTAINABLE EMPLOYMENT: A STUDY ON ENHANCING WORKFORCE COMPETENCY

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Abstract:

The term "green skills" has been widely used in policy discussions, but there is a lack of empirical research on the skills needed to operate and develop green technologies. This paper proposes a data-driven methodology to identify green skills and examines how the demand for these skills responds to environmental regulations. Green skills refer to high-level analytical and technical knowledge related to the design, production, management, and monitoring of technology. The empirical analysis shows that environmental regulations lead to technological and organizational changes that increase the demand for hard technical, engineering, and scientific skills. Developing green skills is crucial for achieving sustainable development, and educational institutions need to prepare learners for emerging green jobs and provide them with green competencies to adapt to changing work processes and profiles. The Green Skill Development Programmes (GSDP) conducted by the Ministry of Environment, Forest & Climate Change in India aim to promote green skills, which can contribute to sustainable development and provide individuals with self-employment skills, dignity of labour, and confidence to face new age challenges.

This research paper explores the importance of green skill development in achieving employability in the changing trends of economic fabric. Green skills refer to the knowledge, abilities, and values required to promote sustainable development and mitigate environmental degradation. The paper uses a systematic review of the literature to examine the role of green skill development in meeting the SDGs. The study finds that green skill development can contribute significantly to SDGs and feasible training modules by promoting the adoption of sustainable practices and technologies, reducing environmental impacts, and enhancing social and economic well-being. The paper also identifies the challenges and opportunities associated with green skill development, including the need for effective policy frameworks, adequate funding, and targeted training programs. The study concludes that investing in green skilling can be a powerful tool for achieving SDGs and ensuring a sustainable future for all. The paper recommends that policymakers, educators, and employers work together to foster green skill development and support the transition towards a more sustainable economy.

1. Introduction: As the world faces increasing environmental challenges, the need for sustainable development has become more pressing. Green skill development plays a pivotal role in fostering sustainability by equipping the workforce with the necessary knowledge and expertise to address environmental concerns. This research paper explores the theoretical

framework that underpins green skill development, justifies the need for this study, and outlines the research methodologies employed.

Green skill development for sustainable employment refers to the process of equipping individuals with the necessary knowledge, abilities, and expertise to work in sectors and industries that prioritize environmental sustainability and promote green practices. As the world faces increasing environmental challenges, there is a growing need for a workforce that can contribute to sustainable development and help address issues such as climate change, resource depletion, and pollution. The concept of green skills acknowledges that conventional job roles may need to adapt to incorporate eco-friendly practices, and entirely new roles might emerge to cater to the needs of the green economy.[1] Some examples of green skills include renewable energy technology installation and maintenance, sustainable agriculture practices, waste management and recycling, green construction and architecture, sustainable transportation planning, and eco-friendly product design and development, among others.

A study on enhancing workforce competency in green skills aims to identify the specific skills required for various green job roles, assess the current skill levels of the workforce, and propose strategies to bridge the gap between demand and supply of green skills. Such studies could be conducted by governments, academic institutions, or research organizations to inform policy-making and educational initiatives. UNESCO's Strategy for Technical and Vocational Education and Training (TVET) aims to help member states transition towards sustainable societies and economies by incorporating green skills into teaching and learning. As a major supplier of skilled workers, TVET has a responsibility to promote generic green skills that align with the ten Sustainable Development Goals (SDGs) by exploring 21 relevant concepts. Education and training play a crucial role in increasing awareness and developing capacity for sustainable development, particularly in the Asian context where economic growth has been accompanied by high emissions, pollution, massive energy consumption, and uncontrolled use of limited resources. Therefore, technical and vocational programs must provide skills that enable individuals to understand and act in environmentally friendly ways to accelerate the shift to low-carbon and zero-waste economies.[2]

2. Theoretical Framework:

The theoretical framework of this study revolves around the concept of green skill development, which involves nurturing the competencies required to engage in environmentally sustainable practices across various industries. The paper draws on the principles of sustainable development, environmental stewardship, and the Triple Bottom Line theory to establish the significance of green skills in shaping a sustainable future. The United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 13 (Climate Action), provide essential perspectives for understanding the link between green skills and sustainable employment.

3. Need for the Study:

The pressing environmental challenges, including climate change, resource depletion, and biodiversity loss, call for urgent actions to transition towards a green economy. Green skill development is crucial to address these challenges effectively. The study aims to identify the current state of green skill development, the barriers to its implementation, and the potential for creating a green workforce. Understanding these needs will help policymakers and stakeholders formulate strategies to bridge the green skill gap and promote sustainable employment opportunities.

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[1] Arasinah Kamis, Ramlee Mustapha, Waliza, &BushraLamuna, "Green Skills as an Added Value Element in Producing Competent," Int. Journal of Engineering Research and Application, pp12-21, 2016

[2] Alwi A , Kamis A , Ismail BLH .(2018).Effects of Green skills module in Design and Technology subjects on the student's knowledge in primary school

4. Research Methodologies:
The research incorporates quantitative data from various sources, including government reports, international organizations, and industry-specific surveys, to assess the status of green skill development initiatives globally. Statistical analyses, such as data mining and comparative analysis, have been employed to identify trends and correlations.

5. Research Questions and Objectives:
A. Research Questions:

I. What are the key factors influencing the adoption of green skill development globally?
II. How can green skill development contribute to sustainable employment and a green economy?

B. Research Objectives:

I. To assess the current state of green skill development initiatives across various sectors and regions.
II. To explore the impact of green skills on sustainable employment and the green economy.
III. To propose strategies for fostering green skill development and enhancing workforce competency in environmental sustainability.

6. Findings and Discussion:

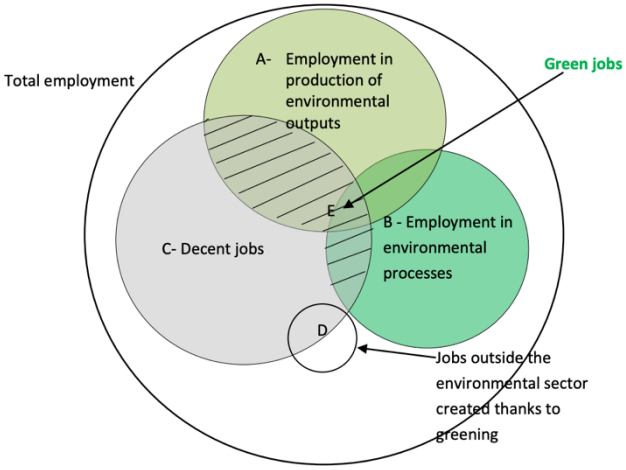
A. Defining Green Jobs:
Defining green jobs provides clarity and consistency in identifying roles that directly contribute to environmental sustainability and the transition to a green economy. It establishes a common understanding of the types of jobs that are environmentally beneficial and helps avoid confusion or ambiguity. Moreover, governments and policymakers need a clear definition of green jobs to design effective policies and initiatives that support the growth of the green economy. This includes developing targeted training programs, offering incentives for green job creation, and implementing regulations to promote sustainable practices.[3]

The ILO defines “green jobs” as follows.

> Green jobs are defined as jobs that reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable (UNEP et al., 2008).

It elaborates on the definition as follows:

> This definition covers work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment while also meeting the criteria for decent work – adequate wages, safe conditions, workers’ rights, social dialogue and social protection. It also covers activities related both to mitigation of and adaptation to climate change. This is a working definition.



Source: ILO, 2013h

Fig 1: Definition of Green Jobs

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[3] Pavlova, M., (2015). Green Skills: Defining and Reorienting Competencies for Environmentally friendly practices. Symposium on the Inclusion of Green Competences in the Recognition of Prior Learning

B. Need for employment shifts to green jobs:

As a direct result, climate change influences labour markets due to the escalation of climate-related natural occurrences resulting from global warming, including floods, heatwaves, and reduced precipitation levels. These events will ultimately cause resource and species depletion and have physical effects on both natural and constructed environments and human communities. Climate change has wide-ranging and complex impacts on labour markets, affecting both the demand for and supply of jobs. These impacts can vary across different regions and industries, but some common effects include:

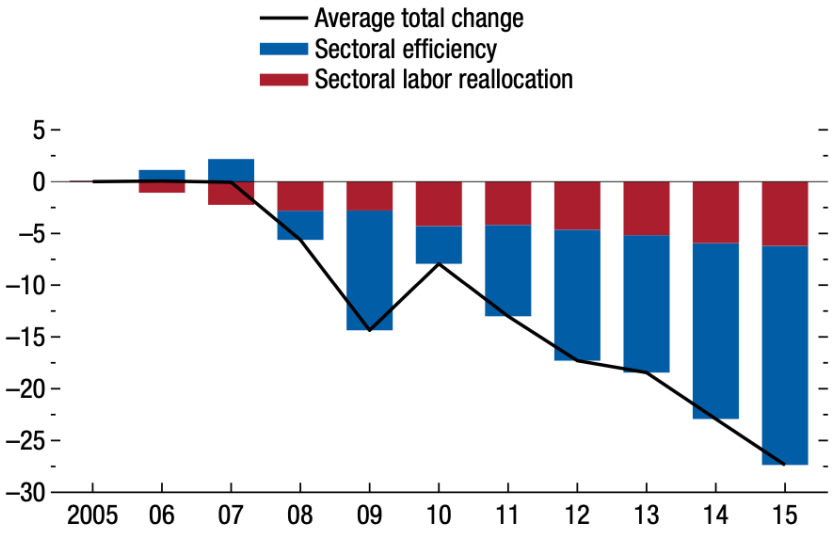
I. Job Disruptions and Losses: Climate change can lead to extreme weather events, such as hurricanes, floods, and wildfires, which can disrupt economic activities and result in job losses in affected areas.

II. Worker Health and Safety: Climate change can impact worker health and safety, particularly for those working in outdoor occupations or in regions exposed to extreme heat.

III. Supply Chain Disruptions: Climate-related events, such as storms and sea-level rise, can disrupt global supply chains, affecting industries and jobs that rely on imports and exports. Disruptions in supply chains can result in temporary or permanent job losses.

This calls for employment shifts which have already played a significant role in promoting sustainability, as observed in a selected group of advanced economies. From 2005 to 2015, the average total carbon emissions per worker, indicating emissions intensity, decreased by 27 percent in the analyzed sample (Figure 2). This reduction was primarily due to improved efficiency within sectors, achieved through a combination of emission-reducing measures, labor reallocation within sectors, and advancements in capital and technology. Notably, approximately 25 percent of this decrease can be attributed to workers transitioning from higher-emission-intensive sectors to lower-emission-intensive ones. While sectoral labour reallocation has not been the primary driver of emissions reduction, it has played a complementary role alongside within-sector labor reallocation.

Average emissions per worker decreased between 2005 and 2015 for the countries in the sample, with labor reallocation playing a role.



Sources: IMF, Climate Change Indicators Dashboard; International Labour Organization; Organisation for Economic Co-operation and Development; and IMF staff calculations.

Fig 2: Employment shift to renewable sectors

C. Green Economy Paradigm

Climate change is having widespread effects on economies and societies globally. The Intergovernmental Panel on Climate Change (IPCC) stated in 2021 that without prompt, substantial, and wide-reaching efforts to curb greenhouse gas emissions, it will be exceedingly difficult to achieve the goal of limiting global warming to 1.5°-2°C (Celsius). To confront this challenge, there is a necessity for a fundamental shift towards a new approach that can simultaneously protect natural resources by reducing emissions and facilitate economic growth and the generation of job opportunities.[4]

A green economy represents an economic framework designed to minimize the environmental impact of production and consumption, while fostering a positive correlation between economic growth and environmental welfare. It goes beyond merely reducing emissions and encompasses measures to enhance climate change adaptation, establish circular value chains, lower material consumption, and consequently, reduce waste generation. A green economy holds promise in delivering both financial and social advantages by promoting greater prosperity, stimulating local growth and innovation, and fostering competitiveness.

Fig3: More than five million renewable energy jobs have been created in the past decade. Image: IRENA

Green jobs are directly related to industries and sectors that prioritize environmental protection and sustainability. These jobs are cantered around practices that reduce carbon emissions, promote renewable energy, enhance resource efficiency, and mitigate the impact of human activities on the environment. As green jobs grow, the overall economy becomes more environmentally responsible and contributes to combating climate change and preserving natural resources. Investing 2% of global GDP into green initiatives yields a long-term growth from 2011 to 2050, which is at least as promising as an optimistic business-as-usual scenario. Additionally, this green investment approach mitigates significant risks associated with climate change, water scarcity, and the depletion of ecosystem services. In contrast, without considering the potential negative impacts of climate change or loss of ecosystem services, global economic growth under business as usual will still be constrained by the increasing scarcity of energy and natural resources. Even with conservative assumptions, adopting a green investment scenario results in higher annual growth rates within 5-10 years. (Fig 4)[5]

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[4] Maclean Rupert, Jagananthan Shante, Panth Brajesh,(2018)Education & skills for Inclusive growth, green jobs and the greening of economies in Asia ,Case study summaries of India, Indonesia, SriLanka and Vietnam ,Open access publications.

[5] Lai Chee Sern1, Adib Farhan Zaime1, Lee Ming Foon(2017) Green Skills for Green Industry: A Review of Literature. Journal of Physics: Conf. Series 1019.

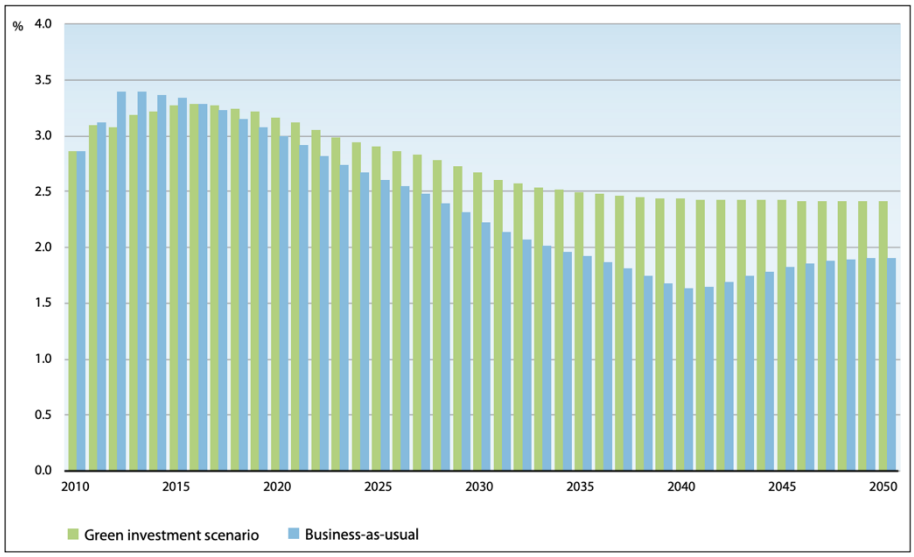

Fig 4: Growth of Green Investment

D. Modalities of Green Skill Development

i) Synergy with SDGs: Green skills contribute to the growth of green sectors such as renewable energy, sustainable agriculture, eco-tourism, and waste management. By providing training and education in these fields, green skill development creates employment opportunities and fosters economic growth while ensuring environmental sustainability which in turn promotes decent Work and Economic Growth (SDG 8). Industry, Innovation, and Infrastructure (SDG 9) calls for green job opportunities promotes skills that drive innovation and advancements in environmentally friendly technologies and practices. Training a skilled workforce in these areas helps develop sustainable infrastructure, such as green buildings and energy-efficient transportation systems.[6]

Green skills promote resource efficiency and waste reduction. By training individuals in sustainable production techniques, circular economy practices, and eco-friendly product design, green skill development contributes to responsible consumption and sustainable production patterns (SDG 12). Green skills are directly linked to climate action as they focus on mitigating greenhouse gas emissions and adapting to the impacts of climate change. Skilled professionals in renewable energy, energy efficiency, and climate adaptation play a crucial role in achieving climate-related targets (SDG 13).

ii) Vocational Training: The majority of vocational training programs primarily emphasize mechanical or technical skills, neglecting the importance of "soft" or "green" skills. Green skills are vital for preserving and restoring environmental quality to ensure a sustainable future. These skills encompass jobs that safeguard ecosystems and biodiversity, promote energy reduction, and minimize waste and pollution.

Aligned with the Skill India Mission of the Honourable Prime Minister, the Ministry of Environment, Forest & Climate Change (MoEF&CC) has taken the initiative to develop skills in the environment and forest sector through the Green Skill Development Programme (GSDP).[7] The GSDP aims to provide India's youth with opportunities for gainful employment or self-employment by equipping them with technical knowledge and a commitment to sustainable development. The program is designed to support the achievement of various national objectives, including the Nationally Determined Contributions (NDCs), Sustainable Development Goals (SDGs), National Biodiversity Targets (NBTs), and Waste Management Rules (2016). In its initial phase, the GSDP introduced a 3-month Basic Course for skilling

[6] Georgeta Vidican Auktor (2020) Green Industrial Skills for a Sustainable future .United Nations Industrial Development Organization, Vienna.

[7] GSDP-ENVIS . http://wiienvis.nic.in/Content/GSDP-ENVIS_8707.aspx.

Biodiversity Conservationists and an Advanced Course for Para-taxonomists.[8] The pilot project was conducted in ten select districts, covering nine bio-geographic regions, and successfully trained 94 Biodiversity Conservationists and 152 Para-taxonomists. The Botanical Survey of India (BSI) and the Zoological Survey of India (ZSI) served as the nodal centres for this pilot program.

Indicator	Units	Policy Scenario		Ambitious-1 Scenario		Ambitious-2 Scenario	
		2021	2031	2021	2031	2021	2031
Poverty	Millions of persons BPL	9.30	8.37	8.09	7.28	7.36	7.06
Number of additional skilled job creation	In lakhs	61	70	63	74	68	79
Number of additional unskilled job creation	In lakhs	24	29	26	31	29	38
Source: Modelling Estimates							

Fig 5: Projected Green Job Creations

In the United States, the Green Jobs Act and various state-level initiatives have supported workforce training in green industries. Programs such as the Weatherization Assistance Program provide training for workers to improve energy efficiency in residential buildings. Additionally, the Solar Ready Vets program focuses on training military veterans for careers in the solar industry, combining sustainable employment with support for veterans. Impact oriented green economy Sweden is renowned for its exemplary waste management practices. The country's waste-to-energy plants have significantly reduced landfill waste while generating renewable energy. To support its green workforce, Sweden provides training programs for waste management professionals, recycling experts, and policymakers. These initiatives have not only enhanced workforce competency but also contributed to Sweden's leadership in sustainable waste management.

iii) Potential of Green Skilling: Figure 6 illustrates the supply and demand of industry sectors based on their respective industry codes. The supply data comprised 42 unique industry code values, with 4581 cases considered after excluding incomplete data. Among these, the highest supply was observed in the water quality sector, accounting for 22.09% (1012 cases), followed by air quality at 18.82% (862 cases), environmental consulting at 9.65% (442 cases), wastewater at 7.71% (353 cases), and environmental impact assessment at 5.39% (247 cases). In contrast, the demand data consisted of 8192 cases due to multiple selections made.

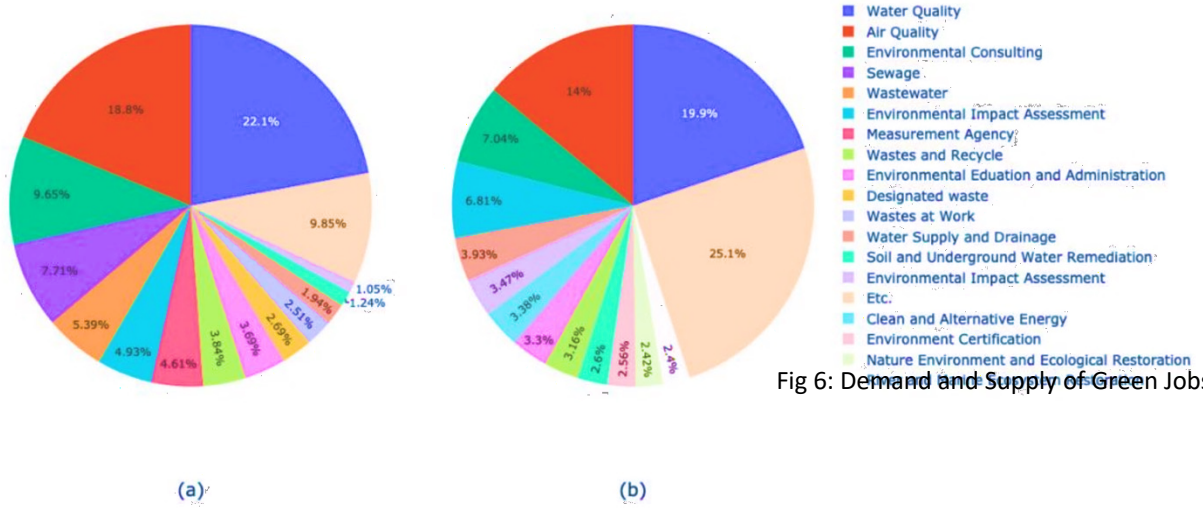

Fig 6: Demand and Supply of Green Jobs

[8] Green skills and environmental awareness in vocational education and training (2012),Synthesis report, European Union,Lexembourg.

Water quality also had the highest demand at 19.86% (1627 cases), followed by air quality at 14.00% (1147 cases), environmental consulting at 7.04% (577 cases), and environmental impact assessment at 6.81% (558 cases).[9]

Upon initial examination, the supply and demand for various industries appear to align. However, contrary to conventional perceptions of green jobs, it is challenging to find both supply and demand data for all five energy-related sectors, namely energy, energy conservation, energy recycling, energy recovery and recycling, and clean and alternative energy. Only a small portion, 2.14% (98 cases), of the supply was identified for these industries, while the demand accounted for a higher percentage of 9.19% (753 cases). This discrepancy could be attributed to the fact that the energy-related sectors fall under the jurisdiction of the Ministry of Trade, Industry, and Energy, rather than the Ministry of Environment. Additionally, it is possible that Eco job does not encompass the open competitive employment process commonly employed by large energy companies, as they often require economies of scale due to the nature of the industry.

7. Recommendations:

Initially, it is crucial to track the alignment and disparities between the supply and demand of green jobs to furnish valuable insights for businesses, job-seekers, and governments. By sharing job-seeking information and offering an overview of supply and demand on recruitment websites, stakeholders in the green job market can benefit. Subsequently, armed with this information, central and local governments can collaborate with local green enterprises to nurture eco-friendly industries and companies. Policymaking concerning green new deals and job creation should rely on locally available data. Furthermore, vocational education in high schools and colleges should be tailored to address the environmental challenges specific to each locality.[10] Encouraging green ventures and start-up companies would foster innovation and job generation within local communities. [11]

Lastly, to achieve a comprehensive perspective on green job supply and demand, Industries should integrate renewable and energy-related job listings. In Korea, the Ministry of Trade, Industry, and Energy oversees energy-related policies, including renewable energy and related jobs. Meanwhile, the Ministry of Environment oversees conventional environmental industries like water, air, and waste management. By encompassing all relevant job data, Eco job's analysis would encompass a wider scope of green jobs. Thus, combining data on both traditional and emerging green jobs is imperative.

8. Conclusion:

By adopting a holistic approach to green skill development, societies can create a competent and motivated green workforce capable of addressing environmental challenges and contributing to a greener, more sustainable future. For this Training and skill enhancement programmes are needed to prepare the workforce for a green economy transition. Inter-governmental organizations, international financial institutions, non-governmental organizations, the private sector and the international community as a whole can play a critical role in providing technical and financial assistance in developing countries. Green skills can bring many benefits to a country and consequently to the whole world. Integrating sustainability education into the PTV curriculum, particularly the green skill element, will

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[9] John Fien and Jose Roberto Guevara.(2011) Skills for a Green Economy: Practice, Possibilities, and Prospects . Technical and vocational education and training: Issues, Concerns and prospects 19 .255-263.

[10] Arasinah Kamis, Amarumi Alwi, Bushra Limuna, Hj Ismail, Zakaria N, Yunus F, Yunus N (2017) Integration of green skills in sustainable development in technical and vocational education. International Journal of Engineering Research and Applications , 7 ,2248-962208.

[11] Yee ei Heong, Lai Chee Sern, Tee Tze Kiong and Mimi Mohaffyza Binti Mohamad, (2016) The Role of Higher Order Thinking Skills in Green Skill Development. Retrieved from https://doi.org/10.1051/matecconf/20167005001.

benefit mankind and the environment. Educational institutions that adopt green skills and sustainable development elements in the courses will produce a workforce that is competent and able to contribute to the preservation of the environment in the long term. The policy makers should take the necessary actions such as promoting basic skills, and green skills so that well-equipped workers can meet the new challenges in their work place. At the same time, coherent policies must be introduced and there should be coordinated implementation of education and training for sustainable development.

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