Emerging environmental industries: Impact on required skills and TVET systems

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Emerging environmental industries: Impact on required skills and TVET systems

Abstract

The global urgency for green growth and mitigation of climate change has resulted in the need for a labor force with skill sets necessary for establishing and sustaining new environmental industries, services, and practices. This emerging labor market requires technical and vocational education and training (TVET) systems and skills development programs to respond. Occupations and industries such as water and wastewater, renewable energy, green buildings, and waste management all have new skills needs that TVET providers need to plan and cater for. This article analyzes recent trends in Hong Kong, China; India; and Malaysia where government policies in the last two decades have paved the way for the rapid development of industries and services that contribute to the greening of their economies, resulting in new employment opportunities for young people and new skills requirements. It analyzes how these are being met, and reports on some effective responses by governments and TVET providers. Finally, it suggests an evidence-based, holistic framework to support the development of road maps relevant to different contexts that extend beyond TVET to all levels of education, and which involves close partnerships between governments, industry, civil society, and education.

Keywords: green growth, labour market restructuring, environmental policies, green skills, Hong Kong, Malaysia, India

Introduction

The global imperatives of addressing the challenge posed by climate change, and the
need for sustainable development that reduces poverty and inequalities, increases human
well-being, and protects the planet from ecological destruction has profound implications
for education, as addressed in the 2030 Agenda for Sustainable Development adopted by
all United Nations member states in 2015. Irina Bokova, a former Director-General of the
United Nations Educational, Scientific and Cultural Organization (UNESCO),
summarized the implications:

> We must fundamentally change the way we think about education and its role in
> human well-being and global development. Now more than ever, education has a
> responsibility to foster the right type of skills, attitudes, and behavior that will lead to
> sustainable and inclusive growth. (Bokova, 2016, p. i)

Sachs, meanwhile, argues that education is core to achieving not just its own Goal
4 of the UN's Sustainable Development Goals but all the seventeen (Sachs, 2016). Two
specific targets lay down the challenge for technical and vocational education and
training (TVET) systems in Goal 4. Target 4.4 calls for a substantial increase, by 2030, in
the 'number of youth and adults who have relevant skills, including technical and
vocational skills, for employment, decent jobs and entrepreneurship'. Target 4.7 spells
out what that education needs to include: 'The knowledge and skills all learners needed
to promote sustainable development.' For all other Goals, at least one target involves
learning, training or education, or awareness raising. The *Global Education Monitoring
Report 2016* summarizes a framework for education capable of achieving sustainable
development:

The transformation needed for a cleaner, greener planet requires integrative, innovative, and creative thinking, cultivated jointly by schools, governments, civil society organizations and companies. This collaboration calls for education that goes beyond the transfer of knowledge and desirable behaviors by focusing on multiple perspectives—economic, ecological, environmental, and sociocultural—and by developing empowered, critical, mindful, and competent citizens. (Global Education Monitoring Team, 2016, p. 11)

Lifelong learning has a vital role in empowering consumers and producers to contribute to sustainability across the economy. Learning-related priorities identified by the United Nations Environment Programme include new forms of education for employees, including sustainability-oriented TVET, and ongoing training within companies (UNEP, 2015). Education systems are responding with some level of green skills and knowledge included in their curricula. Even business courses, for instance, increasingly teach the business case for sustainability (Sidiropoulos, 2013). However, there appears to be a consensus across international agencies that much more needs to be done to equip young people with skills and values for a green future. While policies in developed and emerging economies emphasise green growth and environmental technologies, countries face great challenges in implementing such strategies due to lack of financial and human capacity (Capozza and Samson, 2019), the latter including skills and knowledge.

TVET has a key role given its position as a transition between formal basic education and work or further study, and between old and new occupations; its focus on middle skill occupations; flexibility in modes of delivery; and partnerships with industry through internships, apprenticeships, and on the job training. While technological change means that specific skills may quickly become outdated, acquiring a range of transferable

generic and foundation skills is seen as extremely important for employment, including in green jobs. The Global Education Monitoring report team for the Sustainable Development Goals also highlights the importance of qualifications frameworks for ensuring programs meet the needs of employers and society (Global Education Monitoring Team, 2016).

In areas such as clean energy production, the Organization for Economic Co-operation and Development (OECD) has advised countries to build capacity by increasing investments in research and development, and training. Innovation is 'key to decoupling growth from pollution' (Capozza and Samson, 2019. p. 35). While a few of the eight emerging economies included in their review for the OECD have strategies for eco-innovation, many have adopted policies or programs for research and development, and enhanced environmental education (ibid).

Policies including enforcements, incentives, and infrastructure development have spured the growth of markets for environmental goods and services (Capozza and Samson, 2019). External levers such as international climate finance, emission trading and offset mechanisms, and green criteria contained in trade agreements and ISO standards have also supported the development of green industries and need for skills. The International Labour Organization (ILO) estimated that the transition to a green economy would result in a net increase of 24 million jobs, including 14 million in Asia and the Pacific (ILO, 2018). These will be in renewable energy, energy efficiency, and ecosystem services, such as air and water purification, soil renewal and fertilization, and protection against extreme weather. While net gains in jobs are predicted, it also acknowledges that policy is needed to address the challenges for labor as old industries

die out. Efforts to strengthen skills training for affected workers will be part of the measures taken by central and local governments. ILO argues that 'granular assessments' of skills and competences at the company, community, and subprovincial levels may provide useful tools for facilitating equitable structural transformation (see, for example, Caldecott et al., 2017). Its report calls on countries to take urgent action to train—and retrain—workers in skills needed for the transition. However, in the majority of the 27 countries in Asia and Pacific included in its review, achievement of an effective transition is hindered by the lack of knowledge of the environment–skills nexus, the absence of employment projections and financial mechanisms to promote investments in skills development, and sluggish participation of social partners.

Yet the ILO has also identified signs of emerging policy coherence in some countries, where environmental sustainability policies make explicit reference to skills and/or human resource development; or where full-fledged skills development policies and legislation for green transition are set up. Most of the countries surveyed (22 out of 27) have established platforms to anticipate skills needs and adapt TVET systems in general, while 19 have addressed issues related to developing skills for the green transition (ILO, 2018). In the majority of countries analyzed in the ILO report, skills for green transition are not yet integrated into the TVET curriculum. This is often due to the disconnect between TVET systems, environmental policies, and national development strategies; as well as between TVET institutions and industry (ILO, 2018). In many cases, training for the green transition is provided by employers, mainly because they are directly exposed to changing skills needs, and partly because of the lack of formal TVET provision. However, the fact that small and medium-sized enterprises (SMEs) dominate

such economies presents an added challenge for any reliance on in-house training, and need for support for SMEs to adopt green skills (Koirala, 2019).

Given the significance of education and training in green skills, it is somewhat surprising that Capozza and Sampson's paper for the OECD has not explicitly highlighted these among the seven key components they identify for green growth in emerging economies, which include the need to accelerate transition to green growth; the need for strategic direction and supporting institutional frameworks; increased investment in sustainable infrastructure; eco-innovation; and reducing poverty and social exclusion. Education and training provide the knowledge and capabilities necessary for each of these components. Capozza and Sampson cite cases of how TVET can support green development for the poorest sectors of society. In Brazil, for example, the *catador* (waste-picking) industry that the country relies on for waste recovery is being upgraded through government initiatives for technical and business skills development and health education among the *catador* community South Africa's Working for Water program introduced in 1995 and now hiring as many as 20,000 workers from marginal communities a year, is another example (Capozza and Samson, 2019).

The ILO (2018) points to other countries such as Denmark, Estonia, France, and Germany; as well as India, the Republic of Korea, the Philippines, and South Africa, where environmental policies and national development strategies make reference to skills development for the green transition, and where TVET institutions are responding. The Republic of Korea, for example, has a National Strategy for Green Growth (2009–2050) while national competency standards in skills for green transition have been determined for jobs in the environmental, energy, transport, and machinery sectors in

collaboration with industry experts. A New National Technical Qualification in skills for green transition has been established, as well as many programs at TVET and university institutions.

Having reviewed some of the recent global discourse on how education must and can help the move toward sustainable development and green economies, the following sections analyze how TVET is responding to green policies and the emergence of environmental industries that are delivering green growth in three very different settings: Hong Kong, China; India; and Malaysia. They have been selected due to their differences in size and levels of economic development that facilitate understanding challenges and approaches towards policy and skills development in different contexts. This is based on a review of policy documents and initiatives, documentary evidence from education providers and regulatory agencies, and comparative analysis.

Hong Kong, China

The Government of the Hong Kong Special Administrative Region of the People's Republic of China governs under the One Country Two Systems principle, whereby Hong Kong, China, which had a population of 7,391,700 in 2017 (Census and Statistics Department, 2018), enjoys a high degree of autonomy in its government, legal, and education systems, albeit involving increasing integration with the PRC. This mix of autonomy and convergence extends to policies to transition to a greener economy introduced over the last two decades. Various international agreements, such as the 1992 Convention on Biodiversity, Copenhagen Accord of 2009, and Paris Agreement of

2016—all of which the PRC is a signatory—have been drivers for policies and action plans from both sides of the border.

Hong Kong, China's response to the global sustainable development agenda culminated in 2017 with the launch of its Climate Change Action Plan 2030+, setting 2030 as the target for reducing carbon emissions by 65% to 70% from the levels of 2005 (Environment Bureau, 2017). To achieve this it would seek the following:

> …[to] optimise the implementation of renewable energy, make our buildings and infrastructure more energy-efficient, improve public transport and promote walking as a mobility means, strengthen the climate-readiness of the city as a whole, 'cool' the city through landscaping and partner with stakeholders so that our community can be climate-resilient now and in the long term. (K.S. Wong, Secretary for the Environment, 2017, p. 5)

Water security, promoting biodiversity and conservation, and reducing consumption emissions also feature prominently in the plan. Public education is addressed through campaigns to reduce waste, conserve water, and prepare for extreme weather events, and through field activities and competitions in primary and secondary schools. But like the bureau's other reports, such as the Hong Kong Blueprint for Sustainable Use of Resources, 2013–2022 (Environmental Bureau, 2013), the Climate Change Action Plan, 2030 does not indicate a deeper role for education in equipping the labor force with specific technical and professional skills needed to deliver the plan.

Promoting the development of environmental industry in Hong Kong, China

However, since 1997, successive chief executives of Hong Kong, China have promoted the development of an environmental industry, summarized in 2005 as mainly including

sewerage and waste management, environmental engineering and consultancy services as well as import/export and wholesale trading of waste and scrap (Census and Statistics Department, 2015). Measures to reduce air and water pollution, and promote green buildings, recycling, renewable energy, and conservation have featured in prominently in annual policy addresses.

Policy has been backed by funding from the Innovation and Technology Fund, which has provided more than HK$155 million to 80 projects since 1999. Green technologies are also among the five main technological clusters of science and technology parks in Hong Kong, China, which by 2016 could accommodate 150 green technology companies, employing 4,000 people in research and development activities (HKTDC, 2018). Government has also supported the growth of environmental industries through regulation. For example, the Building Energy Efficiency Ordinance, which came into force in 2012, includes energy efficiency design standards and audit requirements, measures that would lead to new business opportunities (The Electrical and Mechanical Services Demaptment, HKSAR, 2012). These policy incentives and regulations, along with awareness within some industry sectors, have had an impact on industry composition and the labor market. Hong Kong's environmental industry is now recognized as a significant growth sector. From 2010 to 2016 it grew by an average 6.7% a year, to HK$8.4 billion (albeit just 0.3% of gross domestic product [GDP] in that year), employing 44,300 people by 2016, or 1.3% of the workforce (HKTDC, 2018).

What is missing from government data and most policy documents is any review of the new skills needed for this fast emerging industry, or of the new opportunities they present to young people. Initiatives such as the sludge treatment T. Park in Tuen Mun, a

pioneering waste-to-energy project, have had to rely on imported talent (data collected by the author, 2015). Employer surveys on subdegree graduates (including from the TVET sector, and with around 700 respondents a year) between 1998 and 2014 show satisfaction to be flat between 'generally meeting' and 'sometimes exceeding' employers' requirements, without information on whether specific skills are met. A study by the management consultancy McKinsey & Company showed that 69% of employers in Hong Kong, China said they could not hire the right talent, and concluded that it lagged behind the Republic of Korea in the kind of education and training that the market needs (Yiu, 2018). What this review suggests is that there is a need for more research on whether Hong Kong, China's education provision, including TVET, meets the needs for green skills, to inform holistic planning for a green economy.

The education sector's response

Hong Kong, China's education reforms have upgraded and modernized provision—including what it now terms the VPET (vocational and professional education and training) sector. It has implemented curriculum reforms that have the potential to lay the foundation in terms of knowledge, skills, values, and attitudes that prepare young people to lead and contribute to sustainable development (Curriculum Development Council, Hong Kong Examinations and Assessment Authority, and Education Bureau, 2015). Unlike the previous system inherited from British colonial rule, the new model is designed to allow all students to achieve their potential, progressing through multiple pathways of postsecondary education, including TVET, and on to higher degrees, and continuing education through life. Frameworks have been established so that the system is responsive to societal expectations, notably through the Qualifications Framework

launched in 2008, which includes consultation through industry advisory committees on competencies needed. The Vocational Training Council, the lead provider of TVET includes 25 training boards, appointed from industry, within its governance, advising on skills and curricula needs. While none are focused on environmental industries, the Building and Civil Engineering Training Board could include a green perspective on skills, should the industry wish.

TVET is introduced at senior secondary level through Applied Learning subjects delivered with postsecondary colleges as an alternative to the academic stream, albeit catering for less than 10% of students. However, a review of the subjects offered shows that none specifically focus on environmental issues and industries. Out of the 17 courses available for 2019–2021, only the new course Constructing Smart Cities has some relevant modules, including smart environment development, resource management, and energy efficiency; while Entrepreneurship for SMEs briefly touches on business ethics and environmental factors (Education Bureau , 2019).

Beyond secondary school, the Vocational Training Council (VTC) offers a TVET pathway from craft level (for students leaving school at age 15); technician level (foundation and certificate courses for students not meeting entry requirements for subdegree places); and higher technician level (higher diplomas). The pathway continues through to top-up degrees (through VTC's Thei higher education institute and transnational education with overseas universities) and on to postgraduate programs, with a focus on higher technical and professional skills. A small number of TVET programs are directly relevant to the environmental services industry, such as high diplomas offered by the VTC's Hong Kong Institute of Vocational Education (IVE) and Hong Kong

University School of Professional and Continuing Education that focus on environmental

science, protection and management; conservation; and occupational safety. However,

while there is an increasing focus on generic skills across this pathway, and some specific

green skills training, research by Pavlova (2016) revealed that generic green skills have

yet to be universally included in the TVET curriculum across different disciplines at all

levels.

Public and private universities, meanwhile, have responded with a range of higher

education programs and research activities, with sustainable environment being one of

four themes prioritized for research funding by the University Grants Committee (UGC).

Among UGC-funded universities, environmental engineering or energy-related programs

have an intake of approximately 310 students per year (data collected by the author,

2015).

According to the Hong Kong Institute of Human Resource Management

(HKIHRM), larger companies support lifelong learning through their investments in

employee training and development (HKIHRM, 2019). However, a review of HKIHRM

surveys on training needs indicates that green skills are excluded as an issue for

investigation. The 2018 survey, for example, did focus on the need to upskill staff for the

future workplace, but one 'increasingly disrupted and transformed by artificial

intelligence, automation and digitised technology' (HKIHRM, 2019). Mainstream

industry, it appears, has yet to recognize green skills as a priority.

Hong Kong, China: Reflection

This section analyzed some policy documents relevant to sustainable development, namely, the labor market and emergence of environmental industries, and education provision, the latter including a focus on TVET. It has shown that in its policy intentions the government of Hong Kong, China has taken initiatives to move toward a greener economy. What is lacking is systematic definition and identification of skills needed for a greening economy and engagement across the policy network to ensure these are delivered in education and training. Schools, TVET and higher education institutions have introduced some relevant programs. However, it is not known if these are sufficient to meet green labor market needs, with some evidence suggesting they are not.

This disconnect between policy intentions and source of skilled labor for their implementation may reflect the lack of public and policy understanding of what it will take to successfully transition to a green economy, and even the lack of concern across society for such a transition. This may change as Hong Kong, China takes its place in the PRC's Greater Bay Area initiative for further economic integration, when both the need for action and opportunities for businesses in Hong Kong, China to engage in the new industries become more apparent. Greater coordination among government, all levels of education, and with industry and civil society will be the essential starting point. Given the essential role of TVET in training the workforce, the government should focus efforts in greening TVET in order to build labor capacity with specific and generic green skills.

The following sections focus on Malaysia and India, two large emerging economies that appear to be building policies and education structures that are better

aligned with changing industry needs, despite the far greater challenges they face. It offers an overview of these relationships, as a comparison for the analysis of Hong Kong, China.

Malaysia

The Malaysian government's commitment toward a greener economy has created significant impact on its labor market. Malaysia, ranked 75 out of 180 countries with a score of 59.22 out of 100 in the Environmental Performance Index 2018 (Yale University, 2018), aims to become a developed, high-income, low-carbon economy by 2020. Greening the economy has been one of its top priorities, reflecting determination to combat climate change in line with the spirit of the Copenhagen and Paris agreements.

The National Green Technology Policy developed by the Ministry of Energy, Green Technology and Water (KeTTHA) was launched in 2009 (KeTTHA, 2009). The adoption of green technologies in industries such as energy, building, water and waste management, and transportation are nurtured through training programs and financial support (Ministry of Energy, Technology, Science, Climate Change and Environment, 2016). Most recently, the Malaysian government aims to boost the growth of the green technology sector, targeting a revenue of RM180 billion and creating more than 200,000 green jobs by 2030 (Human Resources, 2017). This includes ambitious long-term goals to inculcate green technology in Malaysian culture; adopt green technology to reduce resource consumption while sustaining national economic growth; significantly reduce national energy consumption; improve Malaysia's ranking in environmental ratings; ensure the country can become a major producer of green technology in the global

market; and expand international collaborations between local universities and research institutions with green technology industries. The policy mandates strategic green technology hubs to be built across the economy under the direction of the Malaysian Green Technology Corporation. It also calls for the design and enhancement of green skills training and education programs, including the expansion of research institutes and institutions of higher learning to expand research, development, and innovation activities on green technology, as well as public awareness campaigns.

The transition to a greener economy will trigger shifts in labor markets, and demand for new skills and reskilling programs, while some jobs will be lost. It is hence important the government analyzes where these changes will occur. To do so, KeTTHA has proposed several strategic thrusts, including 'intensifying human capital development in green technology'. This involves policies to achieve 'skilled, qualified, competent and productive human resources that are crucial to Green Technology development' (KeTTHA, 2009, p. 16). This includes the following:

- design and enhancement of training and education programs to improve human resource capacity related to green technology;
- provision of financial and fiscal incentives for students to pursue green technology disciplines at undergraduate and postgraduate levels;
- implementation of retraining programs and apprenticeship schemes to enhance competency of semi-skilled labor to meet the demands of the green technology industry;

- formulation of grading and certification mechanisms for competent personnel in green technology; and

- exploitation of brain gain programs to strengthen local expertise in green technology (KeTTHA, 2009).

Various programs and projects have been launched to cultivate the necessary labor force and prepare the education and industrial sector for such structural change. For example, KeTTHA and the Ministry of Human Resources coordinate through the Joint Secretariat of the Working Group on Green Jobs to develop an occupational analysis for green jobs and national competency and occupational skills standards. The Green Jobs Malaysia Project was initiated by ILO to provide government, employers, and worker representatives with a clearer understanding of the distribution of green jobs and identify potential entry points for further green job creation (ILO, 2012).

Greening of TVET to reduce the skills gap

The TVET sector has responded by launching targeted policies and programs. For example, in 2015 Deputy Prime Minister Tan Sri Muhyiddin Yassin launched the Malaysian Polytechnic POLYGreen Blueprint, an implementation plan and strategic direction for green technology practice in polytechnics nationwide (Borneo Post, 2015), involving green campuses, green curriculum, green community, green research, and green culture.

One specific strategy to green TVET is to adapt existing programs in the polytechnic structure, with a starting point of identifying workplace needs and developing programs accordingly. For example, the new Diploma in Electrical Engineering (Energy

Efficiency) offered by Politeknek Port Dickson, Negeri Sembilan, was based on needs analysis, including a survey of industry, staff, and student representatives. Curriculum modifications included new content on energy efficiency and conservation, energy measurement and instrumentation, renewable energy, fundamentals of electrical utilities, and energy management and audit (UNESCO-UNEVOC, 2017).

Green skills have been practiced in almost all industry sectors. Strong growth, particularly in the renewable energy sector and production of equipment and installations for heating and energy, has been noted by Malaysia Prime Minister Mahathir Mohammad for generating both energy efficiency and new jobs. The coherence of Malaysia's commitment to transition to a green economy, including the upskilling of its workforce, can be seen as a strong model for how green economic development can be firmly linked to green skills development and education provision.

India

India ranks a low 177 out of 180 countries in the Environmental Performance Index (Yale University, 2018) with a rating of just 30.57 out of 100, indicative of the huge challenges it faces. These include addressing environmental health (as affected by poor air quality, water, and sanitation); ecosystem viability (in agriculture, fisheries, biodiversity, and habitat); and climate change. Meanwhile, only a minority of enterprises have embraced the need for eco-friendly development (Soda, Sachdeva, & Garg, 2015). However, as India embraces the need to address the environmental challenges and green its economy, opportunities are emerging for new skills and employment.

Green, low-carbon economy

As one of the fastest growing economies in the world, India has great potential in transitioning to a green, low-carbon economy, and in recent years has put in place plans and frameworks to facilitate progress. In 2008, the National Action Plan on Climate Change (NAPCC) established eight National Missions, on Solar Energy, Enhanced Energy Efficiency, Sustainable Habitat, Conserving Water, Sustaining the Himalayan Ecosystem, Creating a 'Green India', and Sustainable Agriculture. It also established the Strategic Knowledge Platform for Climate Change.

Renewable energy has been a major focus of NAPCC's plans. By 2016, about 600,000 people were employed in the sector, with 55% working in large hydroelectric power plants. Unstable energy supplies prompted the government to implement various policies to develop reliable renewable energy, such as the Electricity Act of 2003, which established the first regulatory interventions to accelerate the development of renewable energy. The act requires State Electricity Regulatory Commissions to fix quotas to procure power from renewable energy sources and ensure the connectivity of electricity to remote areas. The National Electricity Policy also encourages competition in the industry so as to reduce capital costs (Government of India, Ministry of Power, 2018). The NAPCC envisioned that renewable energy should constitute about 15% of the energy mix of India by 2020. In 2015, Prime Minister Narendra Modi upscaled the target of renewable energy capacity to 175 gigawatts (GW) by 2022, which includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power, and 5 GW from small hydropower (MNRE, 2016). With such ambitious goals, India could become one of the largest green energy producers in the world. In addition, the government aims to increase the ratio of

electric vehicle usage, and develop a proper water sewage system and e-waste management, among other policy intentions. However, achieving these goals requires comprehensive policy to address the lack of green skills in the labor market.

Skill Council for Green Jobs

India has addressed green skills development through its Skill Council for Green Jobs (SCGJ), established in 2016 with a mission to identify skilling needs of service users, manufacturers, and service providers within the green businesses sector, and implement nation-wide, industry-led, collaborative skills, and entrepreneur development initiatives (SCGJ, 2018). SCGJ focuses on the renewable energy, transportation, waste management, construction, and water management sectors. Through collaboration between industry and its 200 training centers, 10 assessment agencies, and 400 certified trainers, SCGJ has rolled out a range of training programs, with a majority focused on solar and wind energy (SCGJ, 2018). Its other work includes commissioning research to map industry's manpower needs and developing a TVET model curriculum for green skills.

Different approaches and strategies are adopted to green different industries, based on the contextual labour needs and national industry standards. For example in the construction industry, the Indian government has recognized the importance of green building and the need for skills training for workers and managerial training for enterprises to adapt to technological changes. Thus, SCGJ identified skills for green building initiatives, developed strategies to address skills issues, and facilitated appropriate training. In addition, SCGJ provides training for generic green skills such as an understanding of technology through its life cycle: from installation and maintenance,

to removal, disposal, and recycling. In this way, workers can establish a good background understanding of broader aspects of green building beyond their specific work area.

The TVET model curriculum of green jobs is part of the essential work of the SCGJ. To ensure the credibility of new green modules, all modules and their curricula must fit within the competency-based National Skills Qualifications Framework (NSQF). Each green curriculum is designed for a specific sector, occupation, and NSQF level (Ministry of Skill Development and Entrepreneurship, 2017). For example, one model curriculum approved by SCGJ, Rooftop Solar Photovoltaic Entrepreneur, is recognized at Level 6 of NSQF, equivalent to an advanced diploma (SCGJ, 2017).

In summary, India has a vast need for labor with green skills, given the priority for developing renewable energy within its fast-growing economy. The SCGJ will play an important role in facilitating industry collaboration, research, and standardization of training across different sectors. However, these are early days. With the council only established in 2016 and its capacity limited given the size of the country, the impact of its work will require further monitoring and study before it can be assessed as a model for best practice.

Discussion

Hong Kong, China; India; and Malaysia may be very different in scale, economic structure, development paths, and labor markets. However, all aim to shift to greener, low-carbon economies. Specific green skills are essential for achieving technological changes from green building technology to generating renewable energy supplies. However, generic green skills, such as problem solving, teamwork, and leadership in the

context of greening, and values that embrace concern for sustainability, are equally important.

While TVET has an important role in this skills development, education for a green future cannot begin in young adulthood. It is a part of lifelong learning that starts in early childhood, and involves the acquisition of knowledge, values, attitudes, and behaviors throughout basic education. This is implicitly reflected in the intentions behind Hong Kong, China's curriculum reforms. Thus, governments need to focus on greening education at all levels, to minimize skill gaps between labor supply and industry demand, and to ensure young people understand the imperatives for greening. This is especially the case in Hong Kong, China, where despite the reforms, the government has not engaged in explicit plans for developing green skills in basic, TVET, and higher education; neither has it created structures for close relationships between environmental industries and the education sector. The ILO study suggests Hong Kong, China is far from unique in this disconnect (ILO, 2018).

India and Malaysia, which face greater challenges in their social and economic development, as well as greater visibility of the perils of climate change, have made progress in bridging policy, education, and industry. As a consequence, they are developing green skill-oriented curriculums tailored to their sustainable development needs. Unlike Hong Kong, China, both India and Malaysia have established coordinating bodies to steer green skills development that are achieving coordination between different ministries, with industry and involving responses by the TVET sector across multiple levels of education. The countries are also using qualification framework structures to include green competencies, a move Hong Kong, China could learn from.

The very different scale of the two countries and the highly developed city of Hong Kong, China inevitably influences the mix of approaches in delivering training, whether within the formal education system, through public–private partnerships, or on the job training. Comparison of their different strategies can be used to develop a framework for green skills to help TVET meet the skills needs of environmental industries (Box 1).

[BOX about here]

Framework for green skills for environmental industries

1. Institutional mechanisms and social dialogue are key for effective policy formulation, identification of skills needs, and development of training provision

Coordination across public agendas is essential for effective design and implementation of public policies in general, but in the case of environmental sustainability it is vital. Indeed, conflicting needs among issues such as environmental sustainability, economic growth, and employment can be difficult to overcome when a country's economic activity and employment are largely reliant on environmentally harmful industries (van de Ree, 2017). Unsuccessful coordination of interests would hinder skills development for the green transition.

2. Collaborative networks are vital

Governments need to ensure close collaboration between education providers and qualifications and quality assurance agencies, and that industry boards are up to date; that both supply and demand of skills are monitored; and that TVET providers have the information and resources to adapt to the skills needs of a greening economy.

3. Collaboration between a government agency and specific enterprises can support TVET provision

In Thailand, for example, the Department of Skills Development began cooperating in 2017 with a private company, DAIKIN, and the German Agency for

International Cooperation, to develop skills standards and competencies for air-conditioning technicians working on refrigerators using natural refrigerants. The collaboration will result in courses, curricula, assessment tools, and training equipment in Department of Skills Development training centers (ILO, 2018).

4. Public funding arrangements are instrumental in supporting the provision of training through the formal education system

National and international studies affirm that public financial support has led to the creation of channels for training provision, including in TVET institutions, universities, and graduate schools (e.g., in the Republic of Korea, Malyasia). Importantly, public financial support has enabled disadvantaged groups to participate in training programs free of charge, as in Hong Kong, China. However, the sustainability of public funding remains a concern, suggesting the need for complementarity with a market-based approach and employer-led initiatives.

5. Flexibility in planning and provision is required

Policies and regulations need to achieve appropriate balance between flexibility in meeting changing skills needed in the market, the establishment of qualification standards, and the mainstreaming of green skills in formal TVET systems. Close engagement between education, training and industry, and robust systems for program development and review, can help achieve this. All levels of education have an important role to play.

Footnote:

ILO (2018). *World employment social outlook 2019: Greening with jobs—Key findings in Asia and the Pacific.* Retrieved from https://www.ilo.org/weso-greening/documents/WESO_Greening_EN_web2.pdf

van de Ree, K. 2017. Mainstreaming green job issues into national employment policies and implementation plans: A review, Employment Policy Department Working Paper No. 227 (Geneva, ILO).
[END BOX]

Conclusion

No one underestimatrd the huge challenges facing the global community in achieving the

United Nations' Sustainable Development Goals for 2030, and the uneven progress being

made in both developed and emerging economies. The cases of Hong Kong, China; India; and Malaysia are, however, instructive of how three very different but significant economies are rising to the challenge. These case studies demonstrate the type of policy commitment, frameworks and skills pathways, and engagement of all stakeholders, which can help build the skills needed for environmental industries and the greening of their economies. As the ILO has identified, greater awareness of environmental issues and their mainstreaming in skills policy discussions are required to ensure skills needed in the labor market are identified, and training programs provided (ILO, 2018). Case studies such as these, in which countries and cities can be seen as having at least embarked on a continuum of transition, give some reason for hope, and insight that much more needs to be done to create the green-skilled workforce of the future.

Acknowledgement

References

Bokova, I. (2016). Education for people and planet: Creating sustainable futures for all. Global Education Monitoring report 2016. Paris: UNESCO Publishing

Borneo Post. (2015, April 1). Muhyiddin launches Malaysian Polytechnic POLYgreen Blueprint. Retrieved from http://www.theborneopost.com/2015/04/02/muhyiddin-launches-malaysian-polytechnic-polygreen-blueprint/

Caldecott, B.; Bouveret, G.; Dericks, G.; Kruitwagen, L.; Tulloch, D.; Liao, X. (2017). Managing the political economy frictions of closing coal in China, Sustainable Finance Programme Discussion Paper, Feb., Smith School of Enterprise and the Environment. Oxford: University of Oxford.

Capozza, I., and R. Samson, R. (2019). Towards green growth in emerging market economies: Evidence from environmental performance reviews. *OECD Green Growth Papers*, 2019/01. Paris: OECD Publishing. Retrieved from https://doi.org/10.1787/d5e5b5d7-en

Census and Statistics Department. (2018). *Annual digest of statistics 2018*. Hong Kong, China. Retrieved from

https://www.statistics.gov.hk/pub/B10100032018AN18B0100.pdf

Census and Statistics Department. (2015) Hong Kong Monthly Digest of Statistics 2015. The Four Key Industries and Other Selected Industries in the Hong Kong Economy. Retrieved from http://www.statistics.gov.hk/pub/B71504FA2015XXXXB0100.pdf

Curriculum Development Council, Hong Kong Examinations and Assessment Authority, and Education Bureau. (2015). *Continual renewal from strength to strength—Report on the new academic structure medium-term review and beyond.* Retrieved from

https://334.edb.hkedcity.net/doc/eng/MTR_Report_e.pdf

Education Bureau. (2019). Applied learning—Course information. Hong Kong, China. Retrieved from https://www.edb.gov.hk/en/curriculum-development/cross-kla-studies/applied-learning/course-information/index.html

The Electrical and Mechanical Services Demaptment, HKSAR (2012). Buildings Energy Efficiency Ordinance (Cap 610). Retreived from

https://www.emsd.gov.hk/beeo/en/mibec_beeo.html

Environment Bureau. (2013). Hong Kong blueprint for sustainable use of resources, 2013–2022. Hong Kong, China.

Environment Bureau. (2017). *Hong Kong's climate action plan 2030+*. Hong Kong, China. Retrieved from

https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf

Global Education Monitoring Team. (2016). Education for people and planet: Creating sustainable futures for all. *Global education monitoring report, 2016*. UNESCO.

Government of India, Ministry of Power. (2019). National electricity policy. Retrieved from https://powermin.nic.in/en/content/national-electricity-policy

Hong Kong Institute of Human Resource Management. (2018, August 2). Press release: Disruptive technologies shape current and future development for training and learning. Retrieved from

http://www.hkihrm.org/phocadownload/press/2018/Press_Release_Training_Needs_Survey_2018_2_Aug_ENG.pdf

Hong Kong Trade Development Council. (2018, September 12). Green technology & environmental services industry in Hong Kong. Retrieved from http://hong-kong-economy-research.hktdc.com/business-news/article/Hong-Kong-Industry-Profiles/Green-Technology-Environmental-Services-Industry-in-Hong-Kong/hkip/en/1/1X000000/1X09TYPH.htm

Human Resources (2017, 16 October). GTMP aims to create over 200,000 jobs for Malaysia's green technology sector. Retrieved from https://www.humanresourcesonline.net/gtmp-aims-to-create-over-200000-jobs-for-malaysias-green-technology-sector/

International Labour Organization. (2012, May 15). Green jobs Malaysia. Retrieved from

https://www.ilo.org/asia/projects/WCMS_189399/lang--en/index.htm

International Labour Organization. (2018). *World employment social outlook 2019: Greening*

with jobs—Key findings in Asia and the Pacific. Retrieved from

https://www.ilo.org/weso-greening/documents/WESO_Greening_EN_web2.pdf

KeTTHA. (2009). National green technology policy (Malaysia, KeTTHA). Retrieved from

http://www.gunungganang.com.my/pdf/Malaysian-Policies-Standards-

Guidelines/Policy/National%20Green%20Technology%20Policy%202009.pdf

Koirala, S. (2019). SMEs: Key drivers of green and inclusive growth. *OECD Green Growth*

Papers, 2019-03. Paris: OECD Publishing.

Ministry of Skill Development and Entrepreneurship. (2019). National skills qualification

framework. Retrieved from https://www.msde.gov.in/nsqf.html

MNRE (2016a), "Annual Report 2015-16", http://mnre. gov.in/file-manager/annual-

report/2015-2016/EN/ index.htm

Pavlova, M. (2016). Unpublished report for the project Challenges and Opportunities in Skills

Building for Innovation: Human Resource Dimensions of Hong Kong's Green

Innovation. Unpublished report, funded by The Hong Kong Institute of Education.

Sachs, J. (2016). Foreword. In *Education for people and planet: creating sustainable*

futures for all, Global education monitoring report, 2016 (pp. ii -iii). Paris:

UNESCO.

Sidiropoulos, L. (2013). Education for sustainability in business education programs: A

question of value. *Journal of Cleaner Production,* 85, 1–16.

Skills Council for Green Jobs (SCGJ). Retrieved from http://sscgj.in/

Soda, S., Sachdeva, A., & Garg, R. K. (2015). GSCM: Practices, trends and prospects in the Indian context. *Journal of Manufacturing Technology Management*, *26*(6), 889–910.

Human Resources. (2018, November 29). Malaysia aims to promote green jobs and skills in ASEAN. Retrieved from https://www.humanresourcesonline.net/malaysia-aims-to-promote-green-jobs-and-skills-in-asean/

UNEP (2015). United Nations Environment Program Annual Report 2015.Retreived from https://www.unenvironment.org/annualreport/2015/en/index.html

UNESCO-UNEVOC. (2017). *Greening technical and vocational education and training: A practical guide for institutions*. United Nations Educational, Scientific and Cultural Organization and UNESCO-UNEVOC International Centre. Retrieved from https://unevoc.unesco.org/up/gtg.pdf

Wong, K. S. (2017). Foreword. In Environment Bureau, *Hong Kong's Climate Action Plan 2030+*. Retrieved from https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf

Yale University. (2018). Environmental performance index. Retrieved from https://epi.envirocenter.yale.edu/2018-epi-report/introduction

Yiu, E. (2018). Mind the gap: Hong Kong employers say youth don't have right skills, employees say jobs don't support growth.. Retrieved from https://www.scmp.com/business/companies/article/2149574/mind-gap-hong-kong-employers-say-youth-dont-have-right-skills