Vision Paper

# What TVET can and must do in a Just Transition to a Green Economy


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Discussion Paper: Skills for a Just Transition to a Green Future
Sectoral Study: TVET for Renewable Energies
Sectoral Study: TVET for Sustainable Construction
Sectoral Study: TVET for Sustainable Mobility
Vision Paper: What TVET can and must do in a Just Transition to a Green Economy

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Training of trainers for electrical vehicles in Hyderabad, India. © GIZ IGVET II Page 21
Participants in a tea plantation during a training course for ecotourism, Project 'Green Colleges' in Uganda, © Welthungerhilfe, Page 23
Solar powered irrigation system training for farmers in Arua, Uganda, GIZ project Green People's Energy for Africa. © GIZ, Page 28
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# Table of Contents

## List of figures



## List of tables



## List of abbreviations

| | |
|---|---|
| BMZ | Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development) |
| CLD | Community Learning and Development |
| $CO_2$ | Carbon dioxide |
| DC | Development cooperation |
| GW | Gigawatt |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH |
| ICT | Information and communications technology |
| KfW | KfW Development Bank |
| SDG | Sustainable Development Goal |
| SHS | Solar home system (small, off-grid photovoltaic system) |
| TUMI | Transformative Urban Mobility Initiative |
| TVET | Technical and Vocational Education and Training |
| PtX | Power-to-X |
| UN | United Nations |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNFCCC | United Nations Framework Convention on Climate Change |

# 0 Abstract

The transition to a market-based, socially inclusive economic system geared towards environmental sustainability requires major changes in traditional economic patterns. **As a catalyst for change, Technical and Vocational Education and Training (TVET) plays a key role in shaping a Just Transition to a Green Future.** Given the urgency of the task, the German Federal Ministry for Economic Cooperation and Development (BMZ) considers it paramount to focus official bilateral development cooperation on the implementation of the global 2030 Agenda and the Paris Agreement. Setting out a **vision of a 2030 TVET cooperation arrangement for a Just Transition to a Green Future,** this paper offers four different and complementary perspectives on a field of activity characterised by the coexistence of a variety of instruments and approaches as well as by highly heterogeneous contexts in the partner countries. These four perspectives challenge current practice and outline new approaches for realising more of the transformative potential of TVET by:

- integrating 'green' aspects into reform approaches at system level;
- making governance at all levels (local to national) more effective in supporting change;
- having TVET fuel the development of Green Sectors to a greater degree;
- better empowering people in the informal sector to shape the transformation.

Taking into consideration the requirements for transformative TVET and an analysis of the major trends in employment and training needs both in and beyond the three sectors of energy, transport and construction, four complementary approaches for German cooperation in TVET are set out:

- **The basis is formed by general 'green literacy', which needs to be disseminated and mainstreamed as widely as possible in the population.** It serves to raise awareness not only of the fact that such change is necessary and possible, but also that it brings with it individual and collective opportunities for sustainable, fair and inclusive development.
- Based on this literacy, **links with TVET can be established for people working in the informal economy.** The aim here is to support the development of local and regional paths towards green transformation and green value creation by using offerings that have very low thresholds. Effective approaches are based on the close and long-term involvement of local and regional actors and include cooperation with formal companies, schools, and other institutions such as local authorities.
- The third level focuses more specifically on the **transition from informal to formal employment.** In order to facilitate these transitions, mechanisms for recognising skills and competences acquired in the informal sector and for closing skills gaps through short-term measures and training modules are needed.

- The fourth level comprises **industries that are striving for or have already established defossilised value creation on a large scale through the application of cleantech;** this also includes renewable energy generation. Developing skilled workers and taking the measures needed to do this (basic training plans, reskilling and upskilling) can and must be integral to linking up the policy areas required to develop these industries as part of a (regional, national or even international) mission orientation.

The trends summarised here and the findings that have been derived are intended to help structure reflection on development cooperation in the field of TVET against the backdrop of the Just Transition to a Green Future and to provide impetus for further discussion within BMZ as well as with national and international partners.

Training for solar powered irrigation systems in Uganda, GIZ project Green People's Energy for Africa. © GIZ

# 1 Positioning

**Numerous national and international strategies, agendas and frameworks as well as national and international development plans are calling for a shift to a more environmentally friendly way of living and doing business.** These include the Paris Agreement, the United Nations Framework Convention on Climate Change (UNFCCC) and not least the 2030 Agenda for Sustainable Development. A variety of terms are used in this context, not always clearly delineated from each other, such as the *'Green Economy'*, '*green transition*' and '*green transformation*'. In essence, these mean the decarbonisation or defossilisation of value creation and they address the use of (often carbon-based) resources, both to generate power and as materials. Conceptual differences reflect long-standing debates on how to reconcile economic development, the environment and social justice (see Langthaler et al. 2021). Each narrative embodies a different take on what must be transformed and for what purpose, and is founded on different theories of change, objectives and perceptions of the challenges posed. However, it is increasingly clear that social aspects have to play a key role in this process.

**This study discusses a Just Transition to a Green Future, drawing upon the concepts of a green transformation and socially Just Transition to a Green Economy[1].** The transition to such a market-based, socially inclusive economic system that is oriented towards environmental sustainability will necessitate major changes in traditional economic patterns. In terms of the labour market, new jobs will be created, but jobs will also be lost and the skill requirements for many jobs will change. Skilled workers are not a subordinate cog in the wheel of this change process, required to adapt reactively to changing requirements. **Rather, trained and creative skilled workers with the desire to shape the future are a key prerequisite for transformative processes.** This core value of skilled human labour for the green transformation gives rise to opportunities for a Just Transition to a Green Future. The term 'Just Transition' highlights the interconnectedness of the environmental and social spheres in the sense of a socio-environmental transformation and describes the process of decarbonising or defossilising the economy in a way 'that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind' (ILO 2021). As such, it addresses shaping the impact of the transition to a more climate friendly, less polluting and resource-efficient economy and society offering more, better and decent work as well as social and environmental justice (GIZ 2021a). Accordingly, education and vocational training are an important prerequisite to green and just value creation and employment.

**An enormously broad spectrum of skills requirements and training needs have to be examined and considered by the TVET sector for a Just Transition to a Green Future.** This starts from adapting and improving the skills and competences of informal waste pickers as a contribution to a rudimentary circular economy. It ranges to the provision of basic training for jobs and occupations formalised and secured to varying degrees in established sectors such as the construction industry and to capacity development for cleantech industries, as required for a green hydrogen sector, for example.



1 We refer to a shift in an economic sector towards zero emissions/decarbonisation as 'transformation'.

While the respective labour market situation and the individual skills profiles or educational backgrounds of the various target groups must be considered, that in itself is not enough. The specific socio-economic, cultural and structural contexts also need to be addressed in the corresponding measures.

Interventions in the education sector related to environmental sustainability have been part of German development cooperation (DC) since the 1990s. There are 108 relevant BMZ-commissioned TVET projects ongoing (BMZ, 2023). Activities such as the mainstreaming of sustainability in the TVET system or the training of skilled workers, for example in the renewable energy sector, are documented in a wide range of *best practice* papers and sector reports published by German DC organisations such as the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and KfW Development Bank (KfW); the VET Toolbox Partnership supported by GIZ and other European DC partners provides a very clear overview and in-depth insights. **Despite current measures and endeavours, most partner countries have so far been unable, and in some cases unwilling, to undertake far-reaching reforms for the transition to a decarbonised economy. More systematic DC effort is therefore needed to effectively support the partner countries in this transition and, in doing so, strengthen the catalytic function of TVET systems to facilitate this change.**

Given the urgency of a Just Transition to a Green Future, the German Federal Ministry for Economic Cooperation and Development (BMZ) considers it a matter of priority to focus official bilateral DC on the implementation of the global 2030 Agenda and the Paris Agreement. This objective has been defined for the employment promotion and vocational training priority area, for example in the Decent Work for a Just Transition special initiative (see text box 1). The Just Transition guiding priority also indicates already an increase in newly commissioned bilateral TVET projects with a focus on the Green Economy.

A teacher from College of Technology II instructing a trainee on a wastewater process automation model system in Vietnam.
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## Text box 1: 'Decent Work for a Just Transition' BMZ special initiative

The initiative aims to achieve several goals:

- **Creating good jobs in ecologically relevant industries of the future.**
  We are promoting employment and helping to build skills in green industries. Moreover, we are supporting the ecological and digital transformation of traditional economic sectors in order to create sustainable jobs. In doing so, we are also supporting the Climate and Development Partnerships in Africa.
- **Creating more quality jobs for women.**
  We are empowering female entrepreneurs and managers and, for example, supporting gender-transformative approaches in companies that help rectify the uneven distribution of power and change those rules that result in women being disadvantaged and discriminated against.
- **Improving working conditions and promoting social protection.**
  We are working with companies to increase incomes and improve working conditions and strengthen social protection schemes in companies. We are also engaged in efforts to improve the formalisation of jobs, especially for women and girls.
- **Scaling up collaboration with companies.**
  We are supporting the integration of African companies in local, regional and global supply chains. In the future, our cooperation with German and European companies will focus more on establishing links with African companies.
- **Strengthening global structural policy for more and better jobs.**
  We are scaling up our strategic approaches with multilateral partners on labour standards and the topic of 'Green Jobs and Green Skills', in particular with the International Labour Organization (ILO), the EU, the World Bank and the G7' (BMZ 2023a).

In the short and medium term (until 2030), these aims should not be challenged. Instead, in connection with BMZ's guiding focal areas, they should provide impetus for their practical implementation and continuation in the field of TVET cooperation. This Vision Paper is directly linked to the 'Pushing back poverty, hunger and inequality', 'Forging ahead with the Just Transition' and 'Embracing a feminist development policy' priority areas (BMZ 2023b). Its guiding question is:

> **How should German DC position itself in future with regard to TVET so that it can enable and shape a Just Transition to a Green Future with new skills and abilities?**

At cross-sectoral level, we can differentiate between four categories of programmes and projects in German DC that differ in respect of their scope of influence (system reform versus sector-specific programmes) and also with regard to their direction of impact. While some are designed to strengthen the capacities of the education system to offer

'green' training profiles (supply-side support), others target the creation of 'Green' Jobs and training measures tailored to these (demand-side support). These approaches must be adopted, linked together in new ways and further developed in order to broadly and effectively support the contribution of TVET to a Just Transition to a Green Future (see GIZ 2022b).

**Perspectives for the further development of German DC approaches in the field of TVET are provided** here, based on the studies commissioned by GIZ on the topic of '*Skills for a Just Transition to a Green Future*' as well as additional literature research and expert consultations. The following three elements are incorporated into the development of these perspectives:

- The vision of transformative TVET that functions as a catalyst for a Just Transition to a Green Future (Section 2)
- Major trends in employment and training needs in the three sectors of energy, transport and construction and beyond (Section 3) (see also the three sectoral studies in this series on renewable energy, sustainable mobility and green construction)
- Experiences and lessons learned from previous DC approaches that can be used to derive recommendations for action and new impetus for strengthening and developing professional skills and competences for a Just Transition to a Green Future (Sections 4 to 6)

The **vision of a 2030 TVET cooperation arrangement for a Just Transition to a Green Future** offers four different and mutually complementary perspectives on a field of activity that is characterised by the parallel existence of a variety of instruments and approaches as well as highly heterogeneous contexts in the partner countries. The perspectives challenge current practice and outline new approaches for realising more of the transformative potential of TVET by:

- integrating 'green' aspects into reform approaches at system level
- making governance at all levels (local to national) more effective in supporting change
- having TVET fuel the development of Green Sectors to a greater degree
- better empowering people in the informal sector to shape a Just Transition to a Green Future

The guiding principle of transformative 'green' TVET, broken down for all levels (from institutions at macro level to teaching and learning materials at micro level) and underpinned by all German actors in the area of TVET cooperation, is yet to be developed. This Vision Paper can therefore be understood as a contribution to the ongoing discourse. In addition to ideas described in general terms, specific practical examples are provided in order to inspire the drawing up of new strategies, plans of action and DC projects for the further development of DC practice in the field of TVET.

# 2 Vision: the potential and required contribution of basic and advanced TVET to a Just Transition to a green and fair economy

Developing countries and emerging economies find themselves confronted with a fundamental dilemma in the context of climate change. On the one hand, they need to significantly improve the living conditions of their population and therefore pursue economic development. On the other hand, they have to adapt to the consequences of climate change and contribute to global efforts to conserve vital resources for future generations. A Green Economy therefore offers genuine opportunities for these countries, but also places high demands on them (KfW 2022). Not least, **TVET systems developed according to models for the training of skilled labour in the context of industrialisation have to be renewed and redesigned, in particular in the informal sector, to make a contribution to a Just Transition to a Green Future and sustainable development**. The understanding of work that has evolved in industrialised countries can no longer serve as a guiding principle for TVET in this regard. Self-employment (entrepreneurship) and project work (intrapreneurship) in more or less precarious contractual relationships, as well as unpaid work (family and care work) and even volunteering, present a new set of challenges with regard to (lifelong) learning (see text box 2).

### Text box 2: A new take on work and TVET for a Just Transition to a Green Future

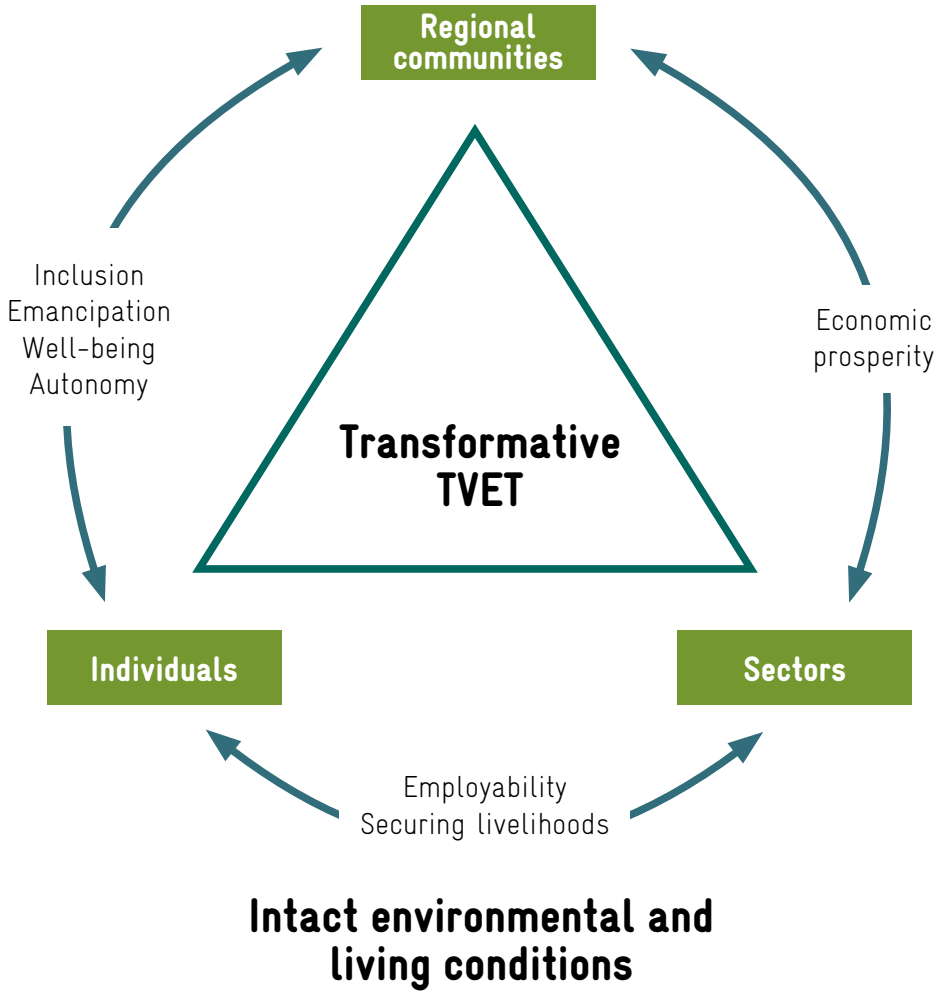
'Work has two faces. It is both a space of learning, belonging and flourishing, and also a space of violence and a "Monday through Friday sort of dying" (Terkel, 1972: xi). How these two faces are experienced is shaped, though not determined, by key characteristics such as gender and race, acting intersectionally. Importantly, these dynamics also influence the types of work (e.g. formal, informal, caring, subsistence, etc.) that individuals do, often sequentially or simultaneously. 'If VET is truly about preparation for work in terms of both skills and socialisation, then it must also be about these complex realities and possibilities of work and not some masculine, industrial and urban myth of real work that simply cannot be sustained' (McGrath et al. 2020).

A new direction for TVET as a prerequisite for decarbonised value creation and employment has already been emerging for years – for example in the area of renewable energy. Numerous European and international organisations, supported by Germany, are striving for a deeper understanding of the practical implications of these visions as well as broad acceptance in industrialised but also developing countries and emerging economies. The UNESCO Strategy for TVET (2022–2029) published in 2022 differentiates between three TVET priorities in which integration and sustainability play a key role:

- Developing skills for all individuals to learn, work and live
- Developing skills for economies to transition to sustainable development
- Developing skills for inclusive and resilient societies

**The transformative nature of TVET for a Just Transition to a Green Future therefore implies a broader definition of the objectives of TVET that goes beyond employability and the securing of skilled workers**. **This in turn means that cooperation between various stakeholders has to be strengthened at all levels of the TVET system and at the local level in particular**. Beyond the formally organised economy – incorporating, for example, energy suppliers and major construction and transport companies – regional communities are also part of the education ecosystem (see figure 1). These regional communities, themselves a conglomerate of different stakeholders, including environmental and youth organisations as well as associations of informal workers alongside local authorities and bodies, have for the most part played no major role in the design of TVET to date. However, they can contribute in a very significant way to creating enabling frameworks for economic prosperity and promoting social integration. This also offers opportunities for the people involved to tap into new sources of employment and income that materialise during the Just Transition to a Green Future. The stakeholders should therefore be strengthened in their role and their involvement in TVET should be promoted in governance structures, which are very state-dominated and top-down in nature in many places. Proven approaches, such as *Community Learning and Development* (CLD), can be used to involve communities in the development of (vocational) skills and competences for the design of a Just Transition to a Green Future. CLD is a field of professional practice that enables people to identify their own individual and collective goals, to engage in learning and take action to bring about change for themselves and their communities. It uses a range of formal and informal methods of learning and social development with individuals and groups in their communities. **The corresponding programmes and activities are developed in dialogue with communities and participants, working particularly with those excluded from participation in the decisions and processes that shape their lives, fully in keeping with feminist development cooperation** (Standards Council Scotland 2018); it is, so to speak, a broadly supported co-creation that seems particularly suitable for the informal sector and thrives on mutual exchange (of experiences, good practices, etc.), and provides an opportunity to consider traditional knowledge (for example in sustainable and integrated agriculture) in the development of skills (see Lotz-Sisitka et al. 2017). The basis for gainful employment and a secure income is thus strengthened and broadened.

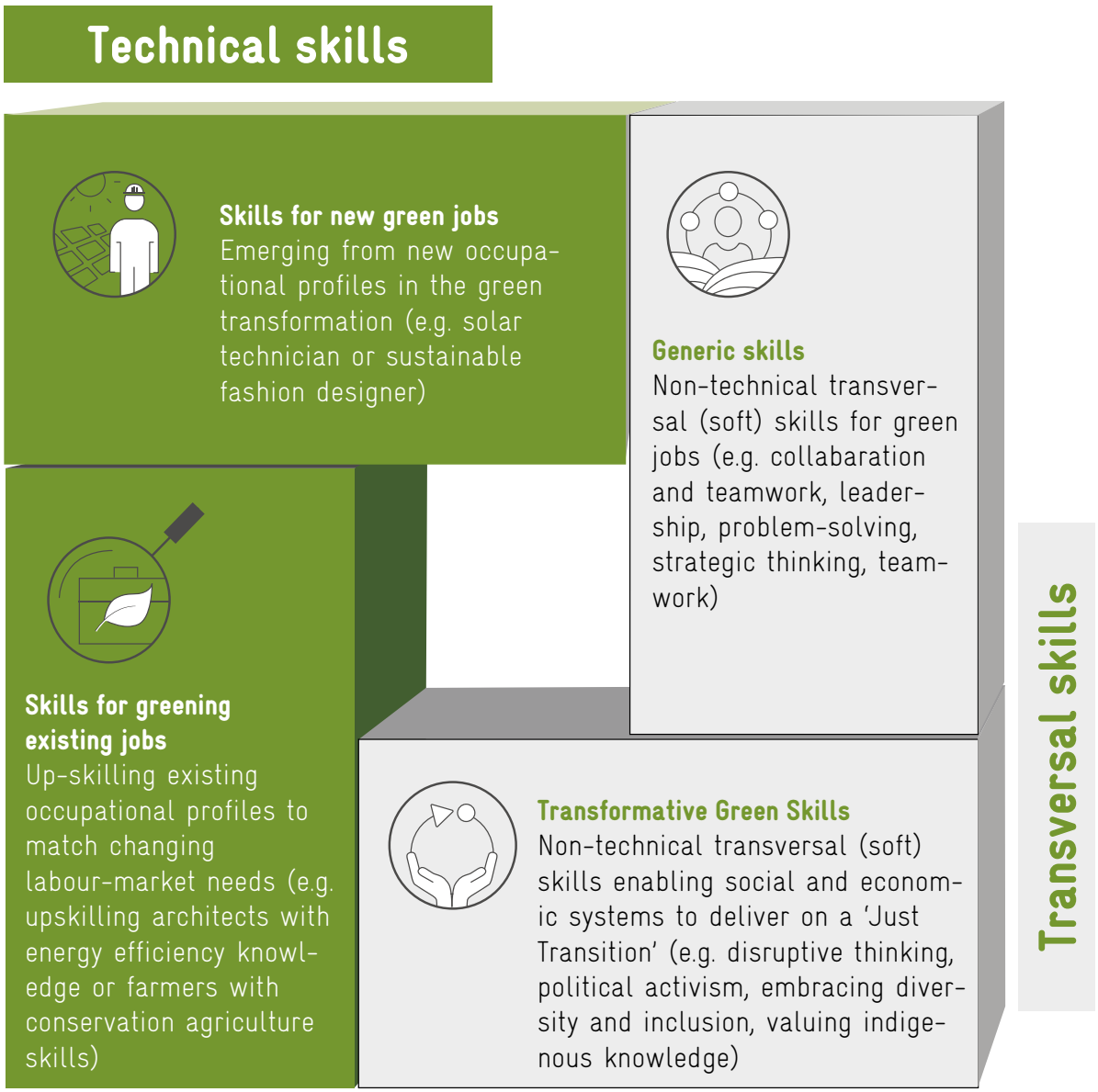
**Figure 1:** Goals of transformative TVET, which, based on skills and competences for a green or greening economy, addresses not only the adjustment or renewal of employability but also non-economic elements of feminist development policy, such as inclusion, emancipation, well-being and autonomy, both at individual level as well as at the level of regional communities. Unlike in formally structured economic sectors, informal jobs and occupations (e.g. in smallholder farming) are also addressed at community level.




**One key element of TVET for a Just Transition to a Green Future is the definition of skills that strengthen each individual as an agent of socio-environmental transformations.** This means cross-cutting and overarching skills and competences in addition to the technical skills that are traditionally portrayed as the core of the TVET curriculum and which should, in future, be heavily geared towards the requirements of 'green' and 'greening' activities. The vision of TVET that trains people to also become co-creators of the working world and society is close to the understanding of holistic education rooted in Germany. In the context of transformative TVET, the skills to be taught should go a step further and strive to impart a capacity to act not only in the worlds of business and politics but also beyond that in the social and cultural sphere (see figure 2). Care should always be taken to ensure here a high degree of relevance

to the labour market when developing skills and competences for a Just Transition to a Green Future. With a transformation that implies fundamental systemic change, however, it can be expected that cross-cutting and overarching skills and competences will become ever more important for employability in the future given the increase in interaction, interdisciplinarity and diversity in the workforce. The skills needed for the labour market are increasingly the same as those needed to shape social developments. **Accordingly, slight adjustments to existing mechanisms are not sufficient for TVET for socio-environmental transformation**.

**Figure 2:** Vocational skills and competences for a Just Transition to a Green Future (VET Toolbox Partnership 2023, p. 16).



**The vision of transformative TVET for a Just Transition to a Green Future has not yet been translated into guiding principles for action for all German DC actors.** The five core principles of cooperative TVET jointly developed in 2013 and reaffirmed in 2019 are therefore still used in public communication (see The Federal Government 2019). The core aspects of transformative TVET are not yet sufficiently reflected therein and can be summarised as follows:

- Transformative TVET aims to go beyond establishing employability to empowering learners to play an active role in helping to shape the working world and society. It therefore promotes both technical and key skills ('skills for new Green Jobs', 'skills for greening existing jobs', 'generic skills', 'transformative Green Skills').
- Transformative TVET requires TVET actors to cooperate with the private sector and with employee organisations as well as with local communities and civil society (education ecosystems).
- As a system itself, transformative TVET has to reflect the principles of the Just Transition to a Green Future. In particular, this means that it must be environmentally sustainable and socially inclusive, for example in the form of a green campus (UNESCO-UNEVOC 2010).

These general requirements in respect of TVET are addressed in Sections 4 to 6 below, with specific proposals for DC action. As a next step, these perspectives should be developed further in dialogue with German DC actors to produce a strategy that can also be used effectively for communication with the partner countries.

# 3 Key trends and challenges in selected industries

German DC has placed a focus on the **energy sector**, especially the generation of renewable energy. In order to generate and purchase this energy, however, it is very important to take account of energy-intensive industries such as mobility and construction. At the same time, TVET measures must also consider agriculture, which accounts for more than 50% of jobs in sub-Saharan Africa and over 40% in South Asia (see also Section 7). According to data from the International Labour Organization, **the transition to renewable and clean energy by 2030 will have an impact on employment to the tune of a net increase of 18 million jobs by 2030**. 25 million new jobs will be created in the resulting value chains, while seven million jobs will be lost in the shrinking traditional energy sector. Five million of these workers will be able to find equivalent work in the emerging industry, but will need retraining and reskilling (IRENA & ILO 2021).

**The greatest potential for growth for Africa and Asia lies in wind power and solar energy** (price, climatic conditions). But there is also relevant potential in geothermal energy (e.g. potential of 15 gigawatts (GW) in the African Rift Valley) and power generation with modern biomass. However, solar energy and wind power require technologies to even out fluctuations in energy generation (e.g. weather-related variations in wind power and solar energy production). Various sector coupling technologies can be used for this, such as *Power-to-X* (PtX), combined heat and power, fuel cells and electric vehicles. Digitalisation has an important role to play in this. **A holistic approach is crucial for the success of the transition – in other words, linking TVET measures with labour market interventions and industrial policy** so that newly trained skilled workers find suitable employment (see also Section 3 in the sectoral study *TVET for Renewable Energies*). In this context, it is insufficient and of little use to train solar installers in the informal sector in the near term, for example, if photovoltaic systems are unaffordable for private consumers and unattractive compared with diesel generators due to price subsidies.

### Text box 3: New opportunities for women and girls in green occupations

A Green Economy creates opportunities for girls and women in new green occupations that have not yet been stereotyped along gender lines – for example, as engineers, architects and planners for green cities and buildings, energy consultants and drivers of new forms of public transport. The exemplary role of these female pioneers will be of decisive importance in enabling women to gain new access to industries that were previously largely closed to them, such as the construction and energy sectors. However, good education and the relevant specialist skills are a fundamental requirement for this.

In agriculture, women often carry out unpaid work in family businesses. New opportunities may also present themselves here if agriculture's contribution to environmental protection is recognised and rewarded to a greater extent. Half of households involved in agriculture already have additional, non-agricultural sources of income. Female founders of green businesses should receive better support so that they can find a way out of the informal economy with their products and services. Entrepreneurial skills in addition to technical skills, for example in permaculture, sustainable tourism or food processing, have to go hand in hand with improved access to land, capital, public markets and professional networks.

See also UN Women & African Development Bank 2021.

**In the transport sector, a Just Transition to a Green Future requires a mobility transition – in concrete terms mainly a shift to passenger and goods transportation services with lower greenhouse gas emissions and the expansion of public transportation systems** (ILO 2019). Electrifying almost all road transport by 2050 in the Net Zero Scenario[2] would add around 27% to global electricity demand (Bloomberg 2022). In this context, e-mobility must also be understood as a systemic approach that intensifies the links between the previously separate conventional sub-systems, namely vehicle, transport, and energy. Current German DC projects are supporting the mobility transition through TVET measures in a variety of ways, in particular (see sectoral study *TVET for Sustainable Mobility*):

- **Employment forecasts**: A range of skilled workers are needed for a transition to a sustainable mobility sector, including in urban and spatial planning, engineering, administration, economics and technical and operational professions. However, it is difficult to produce reliable quantitative forecasts of the impact on employment in the mobility sector given the strong link to technological developments, political strategies and infrastructure investment. The complexity of employment prospects applies in particular to developing countries and emerging economies, which lack reliable data on informal workers. Given the generally high proportion of informal employment, it can be assumed in many DC partner countries that there is a high proportion of people without formal qualifications in the transport sector, for example drivers and automotive mechanics (ILO 2019). A number of projects and initiatives, such as SOLUTIONSplus and TUMI, are currently working on establishing a data pool that should provide a clearer picture of current (formal and informal) employment and the future potential of employment and economic development.
- **Creation of training courses for new occupations and the revision of existing curricula**: The aim of the *Kenyan-German TVET Initiative* is to increase the technical capacities of the training institutions in Nairobi, Kiambu and Thika as centres of excellence. One of the core areas of the cooperation is the development of curricula and professional standards for automotive mechatronics engineers and the preparation of learning guidelines for in-company training in cooperation with industrial partners in Kenya. This process is still at a really early stage. It will be very important



2 The Net Zero Scenario means that all man-made greenhouse gas emissions are removed from the atmosphere through reduction measures. This would make humanity climate neutral and stabilise the global temperature.

here to link the mobility projects of various DC actors with the further development of the curricula. In addition to long-standing companies such as the Kenya Vehicle Manufacturers, the intention is also to include start-ups from the growing e-mobility sector in dual training courses. In a similar project in India, the *Indo-German VET Programme (IGVET),* GIZ cooperated with the Ministry of Skill Development and Entrepreneurship to develop training programmes, for example on vehicle components, which also provided car mechanics with knowledge on electric motors. It could prove very useful for other countries as well if this approach were replicated.

**There has been little systematic integration of TVET and mobility projects in the area of sustainable mobility to date.** Closer dovetailing of projects that address short-term capacity requirements and mainstream sustainability in both TVET and universities is essential to actively promoting a Just Transition in the mobility sector.

The mobility transition will also create a need for new transport infrastructure. Through population growth and increasing urbanisation, the **construction industry** is a major contributor to climate change and biodiversity loss (Roth et al. 2021). For example, it is assumed that almost 40% of annual energy-related $CO_2$ emissions can be attributed to buildings (WGBC 2019).

The construction industry is characterised by complex value chains that incorporate many different economic sectors and areas which in turn are themselves closely intertwined. They cover a large number of different materials and equipment, include various forms of work, such as manual and machine work, and depend on multi-tier supplier relationships with subcontractors. The success of green construction projects therefore depends on the transition of the entire value chain. It should be borne in mind here that in many cases up to 75% of employees in the construction sector in developing countries and emerging economies are working informally. The figure is even around 93% in countries like India (97% of women and 89% of men) (Santamouris & Vasilakopoulou 2021).

**There has been little environmental awareness in the construction sector in the partner countries to date and demand for Green Skills has been very weak**. A rethinking is needed at political level. In the meantime, practical TVET systems should not simply 'react' to demand. In order to boost demand in the medium term, Green Skills and an awareness of sustainable construction should be incorporated into training courses. **Skills that build consumer trust in new methods and materials through the provision of appropriate advisory services are just as important as improvements in the quality infrastructure (certification, auditing and inspection) to enable innovation and the adjustment of local markets to the sustainability goals.** Green trends should already be incorporated into partner countries' TVET programmes now in order to accelerate the Green Transformation in the medium term (Pavlova 2019; UNIDO 2022).

**In German DC, there are only a few examples of TVET projects for a Just Transition to a green construction sector.** In particular, this seems to be due to the fact that there is not (yet) demand (on the part of building contractors and investors) for sustainable construction for a whole host of reasons and there are hardly any efforts to draft corresponding regulations in developing countries and emerging economies. Against this backdrop, three approaches appear to have the potential to set in train a rethink both

in the industry and on the market (for a more comprehensive insight, please see the sectoral study *TVET for Sustainable Construction*):

- TVET can play an important role in creating awareness among consumers and skilled workers of the need for and benefits of green construction, for example in the context of *green campus* approaches, through teacher training and education on sustainability.
- TVET must be included when thinking about and designing sustainable construction strategies. However, this will probably mean short courses initially (*upskilling*), for example in the use of sustainable construction materials.
- TVET can play an important role in local approaches to strengthening climate resilience and income generation through investment at municipal level in infrastructure (e.g. rainwater systems) or housing, taking traditional building methods and materials into account.

**A more comprehensive insight into the selected sectors of energy, mobility and construction can be found in the sectoral studies also published by GIZ on behalf of BMZ.**

# 4 Green TVET systems: supporting reform approaches at system level

German DC has been supporting the reform of TVET systems in partner countries for decades. Since 2013, this has been guided by the five core principles of cooperative TVET as set out in the German Government's strategy on international cooperation in vocational education and training (The Federal Government 2019), which was updated in 2019. In particular, these aim to improve the links between the TVET system and the private sector, with sustainable development as a guiding principle (2030 Agenda). However, the transformative role of TVET in a context in which climate change is making a policy shift an increasingly pressing requirement is not considered. BMZ is a valued and experienced DC partner for reforming TVET systems. It can build on this but must **be even more consistent in advocating for systems approaches for transformative TVET** and talk with the partner countries about this.

**In particular, this means that climate and environmental protection as well as the requirements for a Just Transition must be incorporated as a cross-cutting dimension into the reform efforts of the partner countries to a much greater extent than before.** The example of South Africa clearly illustrates the challenge of strategically harmonising TVET and other policy areas and also institutionalising cross-sectoral coordination mechanisms. South Africa has set itself particularly ambitious and far-reaching goals and demonstrated a strong political will for a Just Transition to a Green Future (Langthaler et al. 2021). Building on the experiences of the implementing organisations in the provision of advisory services and in capacity building, as well as on the expertise developed in Germany in relation to TVET for a Just Transition, BMZ is comparatively well placed to develop its activities further.

In particular, such development should include the following steps:

- A revision of the Strategy of the Federal Government on international cooperation in vocational education and training of 2019 and of the other core policy documents and position papers with the aim of mainstreaming therein the topic of a Just Transition to a Green Future and establishing it as a guiding principle for all German actors in the field of international TVET cooperation.
- With the revision of the aforementioned strategies, communication with the partner countries should also change so as to place a much greater emphasis on the opportunities and scope for action that will arise from restructuring TVET in the context of a Just Transition to a Green Future.
- Internally, existing experience and approaches should still be carefully evaluated and analysed. There are already many combinations of DC 'good practice' in the area of TVET (see text box 4). However, this knowledge must be continuously updated,

expanded and fed back to the employees in the relevant divisions as well as the other organisations involved.

## Text box 4: Existing toolboxes and aids for planning TVET projects for a Just Transition to a Green Future

- VET Toolbox Partnership
- Greening TVET and skills development: A practical guidance tool
- Skills development and climate change action plans
- BILT – Bridging Innovation and Learning in TVET

Training of trainers for electrical vehicles in Hyderabad, India. © GIZ IGVET II

# 5 Governance of the transition

German DC can play a key role, together with other partners, in designing steering structures and mechanisms for a Just Transition in developing countries and emerging economies. While experience gained in Germany with Just Transitions is not directly exportable, it can provide useful insights and examples of good practice for developing countries that are pursuing similar approaches tailored to local conditions (see also figure 4 and the example presented there of transformation paths for the Central German coal-mining region) and are looking to go beyond direct labour market measures in doing so (GIZ 2021a). In terms of governance, two aspects are particularly significant in enabling and designing a Just Transition to a Green Future:

- **Establishing transformation or transition communities that also include civil society and local and regional stakeholders who have not been (sufficiently) involved in TVET measures to date.**

In order to achieve lasting effects and establish self-sustaining structures, **local and regional education ecosystems that are complementary to both the informal and the formalised value-creation ecosystems have to be established at an early stage.** For the overwhelming majority of developing countries and emerging economies, this means a decentralisation and opening up to new stakeholder groups, although coordination between local, regional and national level should still remain important (GIZ 2021b). Linking up the various stakeholders (e.g. TVET stakeholders, schools and universities, companies, chambers of commerce and local administrations) to form an interconnected education landscape is the basis for this (FU Berlin 2018, p. 5). This primarily involves considering and making use of local and regional circumstances and specifically adapting and designing overarching frameworks.

- **Structural change provides an opportunity to introduce a new form of diversity and participation into business and society that primarily benefits women and marginalised groups.**

This aspect is especially important in advancing the emancipatory function of transformative TVET as it can be assumed **that existing structures in a state of flux due to impetus for change also generally have a greater openness to procedural and structural change and therefore become promoters of diversity, participation and balance**. This creates opportunities for women and marginalised groups in particular (UN Women & African Development Bank 2021), as green and sustainable value creation tends to be characterised less by concepts of (technical) mastery of nature with masculine connotations, making access easier. There is some evidence that women are also more willing than men to embrace the change associated with a green and Just Transition, as in most cases they have not been well represented in existing hierarchies to date and therefore have less to gain from established (power) structures remaining in place (Interdisciplinary Centre for Gender Studies, Bielefeld University, 2017, p. 33). Accordingly, feminist development policy (BMZ 2023c) can act as a particular lever for designing the transition with women as agents of change. The current Green People´s

Energy BMZ measure in various African countries, which has been in place since 2017, also relies on these effects; among the offerings are TVET courses specifically for women and aimed at breaking down structural barriers.

The development of vocational skills and competences is just one part of this comprehensive systemic and cultural change needed to achieve a green and Just Transition. Nevertheless, it has a very important role to play in linking education and active citizen involvement as well as school and work (McGarth & Powell 2015). Particular attention should be paid to the fact that the proportion of unpaid work (family and care work) performed by women is three times that of men (UN Women & African Development Bank 2021, p. 19). As this fact significantly weakens the status of women when it comes to the everyday issue of gender equality, **the green transformation can create a Just Transition here too. Promoting employability and economic independence through earning one's own income is important when aiming for equal treatment of women and men and their socio-economic independence** (see Section 7).

Participants in a tea plantation during a training course for ecotourism, Project 'Green Colleges' in Uganda. © Welthungerhilfe

# 6 Promoting Green Sectors: TVET as an integral part of sectoral approaches

The analyses contained in the sectoral studies show that proven approaches have to be supplemented in order to drive change processes in the private sector more intensively than in the past. In particular, **greater expertise must be developed and the networks in the partner countries have to be opened up further to support innovation and decent work in Green Sectors even more effectively.** This is especially necessary given demographic change and population growth, as the number of people living in Africa will grow to around 2.4 billion by 2050. With an additional 20 million people already joining the workforce each year (FES 2021), the importance of work in both qualitative and quantitative terms will also increase significantly. Designing a Just Transition to a Green Future can play an important role here through the creation of high-quality jobs.

## TVET for *cleantech*[3] industries: harnessing the momentum of global change processes

The UN climate targets can only be reached, and global warming limited to 1.5 to 2 degrees Celsius by replacing fossil energy sources with $CO_2$ free energy and therefore mostly renewable energies. Many countries in the global North will not be able to cover the quantity of green electricity needed themselves, especially with regard to the generation of green hydrogen. They will therefore be dependent on imports of green electricity or hydrogen (and its derivatives). Due to high solar irradiation, the wind conditions and the availability of land, many countries in the global South will be able to produce wind power and solar energy, not to mention green hydrogen in the future, both affordably and in large quantities. With its excellent climatic and geographical conditions and the help of foreign investment, Mauritania in West Africa is – like Namibia, Morocco and South Africa – endeavouring to become the 'Kuwait of the hydrogen era' through hydrogen production with a future capacity of 10 gigawatts (Dieterich 2023). Initially, the green hydrogen produced is intended exclusively for export. However, depending on the technical, industrial and framework conditions and possibilities of the countries in Africa and Asia – ranging from countries like Malawi and South Africa to Vietnam and India – **the global energy transition offers not only great possibilities for energy export but also, in particular, opportunities for the countries' own development, even though decentralised power supply systems are often the initial focus in these countries and only later large-scale plants and industry** (see text box 5).

3 'The term cleantech refers to a cross-sectoral growth market incorporating a multitude of different technologies, products and services that aim to reduce the consumption of natural resources. Cleantech is a particularly innovation-intensive market that is composed of six lead markets – environmentally friendly energy and energy storage, energy efficiency, sustainable mobility, circular economy, sustainable water management and resource and material efficiency. Climate change and rising demand for natural raw materials and scarce resources due to global population growth are just some of the factors that are driving the cleantech market and make it an important growth market' (KPMG & DCTI 2013).

## Text box 5: Bangladesh, a success story

Bangladesh provides a successful example of a growth path to the generation and provision of renewable electrical energy (SDG 7.1: 'By 2030, ensure universal access to affordable, reliable and modern energy services') and therefore an alternative to the customary diesel generators. As early as 2003, the authorities launched a publicly co-financed loan programme for *solar home systems* (SHS) managed by the state-owned *Infrastructure Development Company Limited* (IDCOL). The IDCOL SHS programme was implemented on a decentralised basis by local stakeholders. The highly standardised SHS were packaged with a simple consumer loan (TU Berlin 2019). The standardisation also meant it was easier to install and maintain the SHS in terms of technology and qualifications. With this measure, Bangladesh is now the world leader in off-grid power supply sources in rural areas; SHS account for 6% of the total power supply, with a comparable value of 4% in Kenya too (DIW 2020).

The following was ascertained with regard to the success factors: 'IDCOL brought governments, non-governmental organizations, and MFIs (partner organizations), international development partners, and the private sector together. The key ingredient for success was the program's adaptability to changing conditions; an essential requirement for a program that spanned 15 years. The program set smaller-scale goals and progressively built up to more considerable achievements' (World Bank 2021). To supplement the decentralised supply structures, Bangladesh is now also relying on solar power instead of fossil power plants on a large scale (GTAI 2021).

Although it can be assumed that not all emerging economies will have sufficient resources of their own to build power generation facilities, such as large-scale wind and solar farms or plants for generating green hydrogen and its derivatives (PtX), there is no question that such a step offers numerous development opportunities. **Not only the planning, construction, manufacturing and assembly, but also the operation, repair and maintenance of such cleantech systems requires qualified staff and offers high-quality, well-paid jobs** (see also the sectoral study *TVET for Renewable Energies*).

In terms of content, such qualifications for renewable energy and related processes and value chains are based on existing 'engineer', 'technician' and 'craftsman' profiles (VDE & DVGW 2022). **Green TVET in the narrower sense is therefore primarily a technical-organisational training, which then increasingly loses specificity and form in the downstream process**. While, for example, a significant amount of specific green know-how is needed to redesign processes when switching from fossil fuels to renewables for the material use of hydrogen in particular, this is often not the case in subsequent process steps.

Irrespective of these different forms of green vocational skills and competences, newly emerging cleantech industries offer huge potential for sectoral development. After all, professional and mostly formal vocational training (regardless of the specifically 'green' proportion) is needed throughout all of the emerging value creation stages. Taking current job profiles with sectoral suitability as the basis, additional training according to

technical needs is generally required. For example, additional safety-relevant knowledge is required when dealing with hydrogen instead of natural gas (flash point, explosiveness, odourlessness, transparent flame in daylight, volatility, material compatibility, corrosiveness, etc.). According to a recent international review (GIZ 2022a), between eight and forty hours of advanced and transitional training is needed on average to learn this information, depending on the extent of prior knowledge. (Safety) certificates are required in some cases to work in given occupations, such as a gas technician. It is important that hands-on instruction is provided in addition to theoretical insights. Learning labs that provide access to technical apparatus and installations in particular are therefore suited to conducting such training. This is especially important in the case of emerging industries, **where the technical structures and skills have to be developed in parallel**.

The development of a set of transversal skills that goes beyond technical and organisational competences, such as problem-solving skills, disruptive thinking, the ability to collaborate and interact, etc. (see figure 2), should be very relevant for developing cleantech industries like PtX, in order to be able to respond flexibly to technical and regulatory changes. Digitally supported applications are generally utilised throughout the entire life cycle when implementing and using such technologies, from planning, pre-production, manufacturing and installation to commissioning, regular operation, process control, monitoring, maintenance, renewal, expansion and deconstruction. **Digital competences are inextricably linked with the vocational skills and competences for a Just Transition to a Green Future** (see figure 6). Taken together, problem-solving skills and the ability to independently explore sources of knowledge will be vital in enabling individual skills to be adapted to ongoing development. Cleantech industries do not differ from other industries in this regard. **Transversal skills can be especially developed and tested in teaching-learning settings characterised by innovation relevance, group work and interaction, fully in line with a mission orientation (see below), as such settings are conducive to acquiring the latest expertise but also promoting the interaction and 'systemic view' needed to solve problems.** What is often already normal practice in basic and advanced academic education and training and is offered in laboratories as project-based learning on the area of cleantech as well, must also be made possible for basic and advanced TVET. **Despite the initial lack of industrial applications, universities and research institutions should open their laboratories to non-academic skilled workers as well. This would allow the costly installations that are necessary for learning to be put to dual use until the labour market for cleantech-specific skilled workers develops**. Although green professional qualifications will therefore be taught and acquired in the form of upskilling and additional modules for existing curricula (GIZ 2022a, p. 24 et seq.) in the vast majority of cases, new and formally structured job profiles may also emerge in some areas. For example, basic curricula such as 'electrolysis plant operator' are also being developed by SENAI in cooperation with GIZ as part of the BMZ-funded H2Brasil project (VET Toolbox Partnership 2023, p. 45 et seq.).

Ideally, an integrated framework concept for a comprehensive TVET offering will emerge from the sum of all elements (UNESCO-UNEVOC 2010): socio-environmental transformation can be experienced in a green campus where learners not only have the opportunity to train for green occupations but also develop a 'green culture' and themselves come up with creative solutions to the complex problems of our time in their local community (see also the *TVET for Renewable Energies* sectoral study). The link with research and development for a Just Transition to a Green Future also

provides a means of connecting vocational and academic training and thereby implementing learning labs (see above).

Developing significant capacities for renewable energy generation etc. not only leads to Green TVET for the use of the systems but also provides opportunities to **become part of the supply industry (development of local supply structures and providers of technical services**) and therefore to also be able to recruit suitable skilled workers. At the initial stage, the focus is on parts and components rather than complete plants and systems or the related electrolysers. In manufacturing, there are opportunities to produce significant quantities of wear-and-tear components in particular. This in turn leads to the establishment of business models that can initially serve the local and national market before expanding their geographic reach. In this way, the green transformation is providing a **strong industrial impetus for the emergence of decent work as well as the training and upskilling of suitable skilled workers that are required to this end**. In support of this, continuing training courses are needed for decision-makers in the private sector, local authorities and civil society to raise awareness of the green transformation and implement it in day-to-day activities – an approach also being pursued by the International PtX Hub in Namibia, for example (GIZ 2022c). Last but not least, qualified trainers and teachers who can pass on the theoretical and practical knowledge are needed.

It is important to get the timing right with such an approach and to solve the chicken and egg problem: skilled workers are needed to plan and build new plants for generating wind power and solar energy, as well as the related green hydrogen. On the other hand, installations are needed so that skilled workers have opportunities for hands-on training. **The existence of a certain technical industry or skilled trades structure locally is therefore a productive basis which can be geared towards cleantech industries in support of 'related variety' (**Frenken et al. 2007**) and can be extended for path renewal**[4]. This is the case in particular if a country's existing fossil fuel-based energy generation is to be replaced by or supplemented with renewables. Skilled workers already employed in coal-fired power plants, oil refineries or even car repair workshops generally have **highly technical skills that align closely with those needed for renewable energy and green hydrogen and thus offer a Just Transition from a fossil-fuel-based to a Green Economy**. As is the case in many industries that undergo a green transformation, the focus is therefore not primarily on job losses (see 'Energy' in Section 3), but rather **reskilling** (Brandt et al. 2021, p. 63 et seq.). At this point in time (Q1 2023), for example, a project of the International PtX Hub is surveying the industrial and skilled worker situation in Namibia in order to collect data on the potential for (training) path renewal in support of hydrogen production (including derivatives based on methane or ammonia)[5]. The European Centre for the Development of Vocational Training describes the process of developing skills and competences for a Just Transition to a Green Future and a corresponding path renewal as follows:

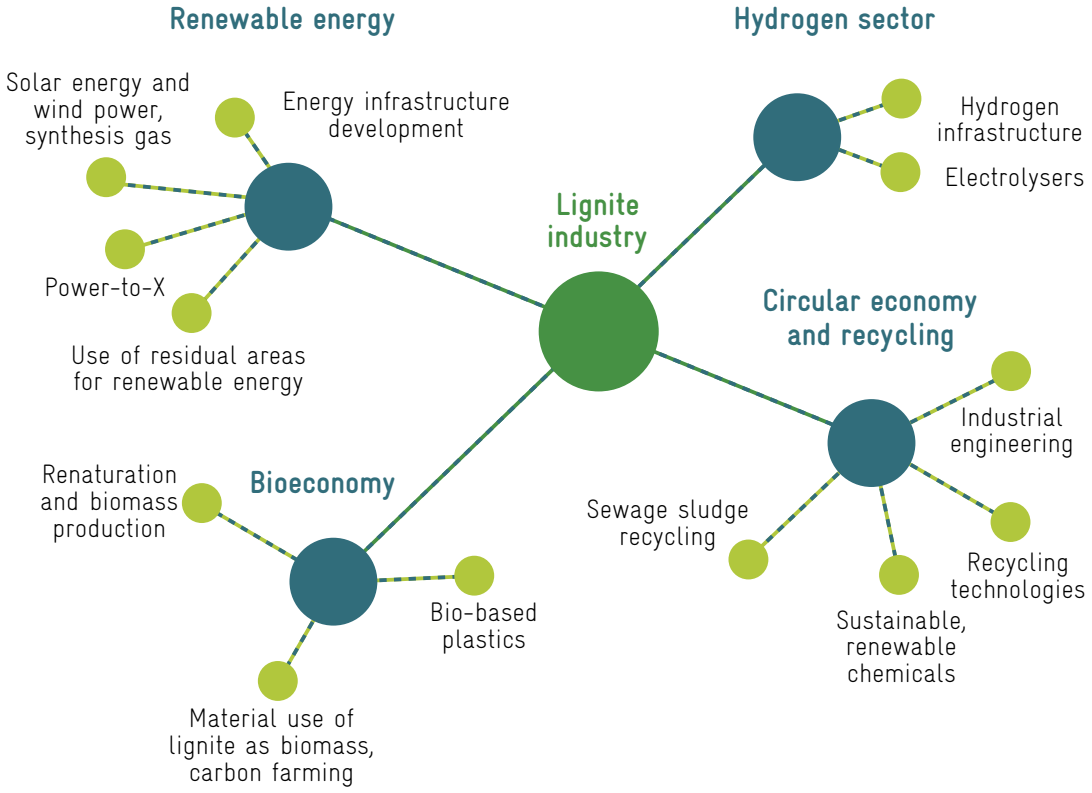
4 **Path renewal** describes the adjustment of value creation and employment along existing technological paths. For example, fossil energy companies are likely to become renewable energy companies or apply their know-how in other related fields. In contrast, **the creation of new paths** involves the development and implementation of entirely new business models – for which the technological leap needed may be relatively large. New paths can be created even without 'predecessor industries', for example through start-ups. This means there is the possibility for economies to leapfrog and realise disruptive potential. Depending on the business sector, such strategies may be very capital-intensive and contingent on many factors.

5 The aim of this survey is to increase the prospects of local workers finding work in one of the planned PtX projects and the developing industry. It is also intended to create opportunities for local suppliers in Namibia to sell their products to the PtX industry.

**The shift to a low-carbon economy implies structural changes across sectors and occupations as new 'green' occupations arise or grow in demand. However, 'greening' of existing ones is what is mostly required. This translates into new skills sets that necessitate curriculum updates or even new qualifications across education and training levels.** These new 'Green Skills' can range from very technical and job-specific skills to 'softer' ones, such as responsible use of resources, which can be relevant across occupations, levels of hierarchy and sectors. While the 'greening' of the economy creates skill needs, particularly in specific sectors such as energy and resource efficiency, construction or manufacturing, moving towards a circular economy creates 'green' skill needs across the board' (CEDEFOP 2019). Against this backdrop and despite the path dependencies of established industries, there is great potential for using the technical, organisational and training knowledge concentrated within them for a Just Transition. Figure 4 shows possible transition paths for the lignite industry in the Central German coal-mining region in line with 'related variety'. Similar path renewals that address local, regional and national circumstances are offered by the future-oriented sectors of renewable energy (in interaction with mobility and construction), hydrogen, bioeconomy (including agriculture) and circular economy, including for fossil fuels and value creation models in Africa and Asia.

Solar powered irrigation system training for farmers in Arua, Uganda, GIZ project Green People's Energy for Africa. © GIZ

**Figure 3:** Starting points for enabling a Just Transition to a Green Future for the Central German coal-mining region which could also serve as an example for fossil energy stakeholders in Africa and Asia. The future-oriented sectors set out here offer excellent opportunities for a realignment of value creation and employment (source: Brandt et al. 2021, p. 38).




The establishment of cleantech plants and industries is contingent on many factors in particular if the country concerned has no technical industry or skilled trades structures (or those that do exist are poorly developed) and lacks the relevant (already trained) specialists and workers. To support the creation of new paths here, new structures based on general 'green literacy' (roughly equivalent to the 'systemic skills' in table 1) have to be created in **a targeted basic and advanced education and training system in the context of the emerging cleantech industry, with skilled trades included as an integral part**. This is an extremely challenging task, as an extensive cleantech ecosystem like that of renewable energy comprises a multitude of job profiles. While all may not have or even require a separate curriculum, they are based on a range of prior experience and also specialisations in some cases. Figure 5 shows various clusters of professions and the job profiles therein, which are produced by analysing examples of job advertisements on the (German) platform www.greenjobs.de (as of November 2021).

**Figure 4:** Clusters of renewable energy professions based on an analysis of examples of job advertisements and job profiles on the platform www.greenjobs.de (source: BMAS 2022, p. 27).

## Green missions: the interplay of innovation, industry, business and labour market, skills policy and civil society

The question of how to design the green transformation and a Just Transition is a pertinent issue worldwide, as its success depends on a multitude of factors. Key to this is structural change, which is often marked by disruption and therefore by path breaks and the creation of new paths. Disruption calls into question the status quo, including achievements to date. This is not a cumulative process, however; disruption also creates opportunities that, once they are realised, offset any losses that have been incurred. This means that a new, green path – whether in an existing company, value chain or even economy or society – will not achieve all the qualities of the replaced path right from the outset (compare, for example, the range of a car with a combustion engine with that of a battery electric vehicle), but will instead have other qualities that may take on a greater significance (zero emissions, quiet travel). The car example also clearly highlights that green transformation generally involves system innovations (vehicles, charging infrastructure, workshops, recycling system for batteries, etc.) rather than new kinds of individual products or applications. The characteristics of the green system sometimes lead to a change in user behaviour, new service offerings emerge, and the new quality characteristics improve quality of life and health (e.g. less exposure to exhaust fumes) (see also the sectoral study *TVET for Sustainable Mobility*).

The **mission orientation model** has emerged since the early 2010s as a means of dealing with and steering large-scale change processes and major societal challenges, as well as the related visions (EFI 2021, p. 38). Missions are innovation-driven and aim to achieve societal goals – with well-known examples being the Apollo missions to the Moon and the fight against cancer. It stands to reason that the green transformation and its goals also have the character of a mission – as does the Just Transition ('leave no one behind'). Green missions may have some equivalent in nationally determined contributions (NDCs) – in other words, countries' (voluntary) commitments for the transition to a low-carbon, sustainable economy. Only 40% of the 32 countries surveyed in a study mentioned plans for developing vocational skills and competences in the measures for achieving the goals set out in the National Determined Contributions (NDCs) (ILO 2019, p. 21); **there is great potential here to compensate for the deficits of the NDCs through missions that explicitly incorporate the development of Green Skills.**

Interplay of leading stakeholders and policy areas is needed for successful mission implementation. This means that (sub-)missions based in particular on cleantech, such as the green hydrogen economy, have to take into account the emerging nature in the form of corresponding innovation policies. Process support through industrial and economic policies is also needed given the value creation structures addressed by the cleantech innovations. And as value creation always means employment of varying quantity and quality, elements of labour market and skilled worker policies are required. This triad of innovation, labour market and skilled worker policies constitutes the core of the policy as part of the quadruple helix. In this helix, politics, business, science and civil society are ideally closely interwoven to form a functional stakeholder network with a common direction of impact (Carayannis & Campbell 2009). It is reasonable to expect that the

interconnection of stakeholders within such a helix in a Green Economy would have a societal impact beyond the generation of monetary gains to the benefit of civil society and community.

As the mission concept is still comparatively new, there are relatively few practical guidelines on its specific planning and implementation or the determination of results. The **toolbox for mission-oriented (innovation) policy** offers a good overview and application-oriented summary (Fraunhofer ISI 2022).

### Text box 6: Cleantech mission funding

Almost 94% of all climate finance is debt or equity investments that promise the funders some financial return (Climate Policy Initiative 2021). These parties include commercial banks, investors, governments as well as multilateral and national financial institutions, such as the World Bank and International Monetary Fund.

As climate investments are expected to produce a return, the success and likelihood of operations is linked structurally to broader macroeconomic and political trends. Climate investments have therefore been slow to materialise given the real and perceived risk of operations in developing countries and emerging economies that are in the midst of or adjacent to armed conflict, facing political or economic instability or experiencing humanitarian crises. Although private funding parties do want to invest in developing countries and emerging economies, most of these projects are extremely risky and carry a level of risk that is well above what is considered investment grade and therefore justifiable. Almost all projects that meet investment grade criteria are geared towards renewable energy. 90% of all recent climate finance has been directed exclusively towards activities aimed at reducing greenhouse gas emissions (Climate Policy Initiative 2021), as electricity can be sold and thus a return can be generated.

The conditions for attracting international investments for emerging cleantech industries are favourable if sufficient stability is indicated through policy and societal frameworks. Since forming a mission already involves a significant degree of negotiation, there is a greater chance of being able to avoid or at least resolve major tensions, thereby increasing the security of investments. Steps should be taken to ensure that the topic of Green TVET is given appropriate consideration in such investment packages (see table 1).

Through the collaboration of partners from politics, science, the private sector, civil society organisations and other stakeholders, there is an opportunity to develop and implement innovative Green TVET strategies and programmes that are tailored to the needs of the respective communities and sectors. Partnerships between businesses and educational institutions can provide workers with real-world, hands-on training experiences and help to ensure that the training being provided is relevant to the current and future needs of green value creation and employment. By providing training in the latest technologies and techniques, TVET can also make sure that (future) skilled workers are equipped with the knowledge and competences they need to be productive

and competitive in the global economy. Within a mission framework and in response to the funding challenge, governments can explore different innovative and blended mechanisms, such as public-private partnerships, to finance TVET programmes and initiatives (Radfar 2023).

While Green Skills and competences may thus be a prerequisite for a functional mission orientation, the mission orientation itself also strengthens the economic and social structures that in turn promote the development of Green Skills and competences. The enabling effects are not necessarily restricted to the (industrial) core of the missions but may radiate out to other industries and sectors (in the form of spill-over effects), fully in keeping with systemic transformation. In overarching terms, a mission therefore offers the stakeholders involved a way of developing solutions for different dimensions when implementing Green TVET (see table 1).

**Table 1:** Challenges and solutions for Green TVET that can be addressed in the context of missions through the close collaboration of different actors and stakeholders (as per Radfar 2023).

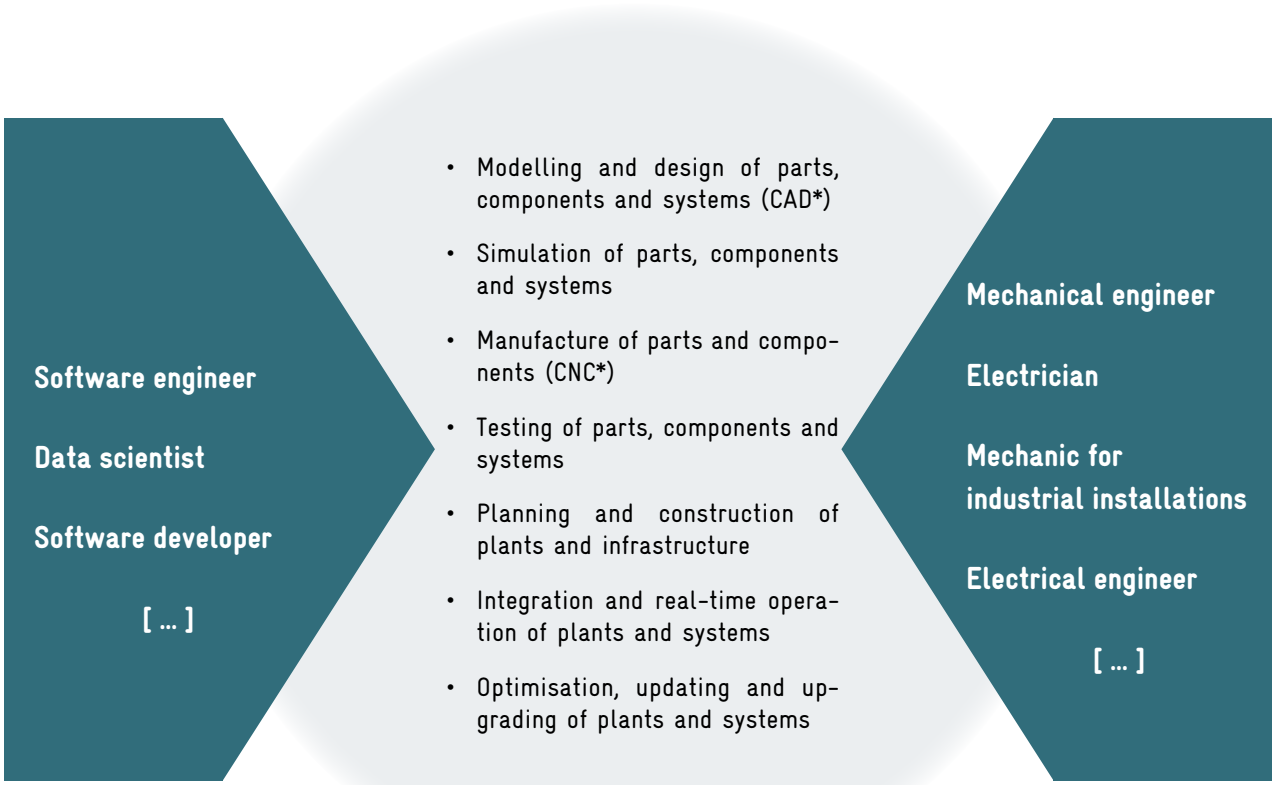
| Challenges | Solutions |
|---|---|
| **Funding** | Prioritising the development of TVET programmes and initiatives for a Just Transition to a Green Future and investing in the development of corresponding curricula, training programmes and educational resources |
| **Policies** | Developing and implementing innovative TVET policies and programmes for a Just Transition to a Green Future that address the needs of the respective communities and sectors (local/regional/national value creation systems) as an integral part of the development of (cleantech) sectors |
| **Political will** | Strengthening political interest to prioritise the development of TVET programmes and initiatives for a Just Transition to a Green Future |
| **Awareness** | Raising awareness about the importance of adapted TVET in achieving low-carbon, climate-resilient economies |
| **Coordination and collaboration** | Collaboration among different stakeholders (quadruple helix) to develop and implement effective TVET programmes and initiatives for a Just Transition to a Green Future within the context of missions |

## Jointly thinking out and developing green and digital skills

A high proportion of skills and competences related to the digital world and information and communications technology (ICT) are essential to various green technologies (supply industry and production), for example to produce green hydrogen and derivatives. Therefore, with a view to the environmental transformation of value creation, extensive digitalisation skills will be important at the various training levels (Cologne Institute for Economic Research 2021). The training needs resulting from such a dual

transformation – comprising decarbonisation and digitalisation – require, not least on quality and safety grounds, a comprehensive and formalised spectrum of vocational skills and competences for a Just Transition to a green future (see figure 6).

**Figure 5:** A multitude of technical skills and competences as well as complementary digital expertise are needed to successfully implement and develop a hydrogen sector, comprising the manufacture of equipment, the production of hydrogen and derivatives as well as the transportation, storage and use of hydrogen across various stages of the value chain (source: GIZ 2022a, p. 34).
*CAD = *Computer-Aided Design*; *CNC = *Computerised Numerical Control*.




Beyond the specific definition of digital and other technical skills and competences in cleantech industries, general skills ('literacy') can be described for both digital change and the transition to green and sustainable value creation. Table 2 provides a comparison of the three fundamental categories of digital skills as per OECD 2016 and their equivalent in the form of green, and therefore, decarbonisation skills as per the definition of the ILO: '"Green jobs" are defined as jobs that reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable' (ILO 2011, p. 4).

**Table 2:** Classification of digital/ICT and 'Green' Skills (as per BMAS 2022, p. 76).

| Digital/ICT skills categories | Categories of 'Green' Skills |
|---|---|
| **The making of ICT** (information and communications technology) products and digitally provided services – such as software, websites, e-commerce and cloud computing – requires specialised ICT skills, such as application programming and network management. | **Planning and development skills** describe the theoretical and practical skills needed to plan and manufacture processes and technical devices and equipment as well as design and test them in such a way that the effects on the climate, environment and people are kept as low as possible. This also includes actively searching for new methods and technologies and implementing these as prototypes with the aim of reducing the unwelcome effects on the climate and biosphere to the greatest extent possible, as well as establishing and defining goals. |
| **The use of ICT** in daily work requires generic ICT skills in an increasing number of professions. In other words, employees have to be able to utilise ICT appropriately in support of their work and activities, obtain information and use software. | **Application and adaptive skills** comprise skills for integrating and using existing (technical) systems and work equipment in work and working processes in an independent and evidence-based way to achieve or exceed the respective sustainability goals and minimise influences harmful to the environment, climate and health in operational use. |
| ICT is changing the nature of work and increasing demand **for ICT complementary skills,** such as individual skills relating to information processing, problem solving, individual responsibility and communication. | **Systemic skills** comprise specialised and contextual knowledge as well as attitudes that place protection of the environment and climate at the centre of activities and are integrated in a comprehensive and calculated way into daily (work) routines while also being applied and communicated in a proactive and independent fashion. |

In addition to their use in productive processes, digital technologies are also an increasingly important learning medium. Online learning platforms offer a multitude of means of transferring knowledge, conducting practice exercises and tracking learning achievements. Using what are known as 'learning analytics', individual learning achievements and difficulties can be identified and addressed on an individual basis.

Industry 4.0 technologies[6] can also be used to take the quality of on-the-job learning to a new level. As production systems fuse with information systems in (decarbonised or cleantech) Industry 4.0 (to form cyber-physical systems), every stage of production can also be a stage of knowledge acquisition. Operating systems then also serve as learning systems, ensuring constant further development of skills and competences on the job (BMAS 2018, p. 96). In addition, modern production facilities generally improve not only work ergonomics but also occupational safety. However, manufacturing of cleantech applications themselves often has a considerable impact on the environment and people, as rare earth elements are needed and composite materials that are often (still) petroleum-based are used. In many cases, there are still no economically viable recycling processes for these (Bovenschulte 2023).



6 See. :https://www.sciencedirect.com/science/article/pii/S219985312200837X?via%3Dihub

# 7 Green Skills and competences for the informal economy: bottom-up transformation

Around 85% of employment in Africa and almost 70% in Asia is in the informal sector (ILO 2018). This is often associated with precarious employment conditions in terms of productivity and earnings as well as social recognition and associated rights and political participation. In addition to low pay, there is also a lack of social security in the event of illness and in old age as well as a low quality of work in many cases (long working hours, limited access to sanitation facilities, long commutes, outdoor working, inadequate work equipment, few occupational safety measures, lack of representation of interests, lack of training, etc.); breaches of ILO core labour standards, for example in the form of child labour, are not uncommon in these contexts (ILO 1998). Despite the aforementioned deficiencies and shortcomings, the informal sector offers many people a livelihood where there are not sufficient jobs in the formal labour market. The informal economy worldwide is estimated to be worth USD 10 trillion, equivalent to 13% of global gross domestic product (IIED 2016). In developing countries, the informal sector permeates all areas of life and will remain an established part of reality for the medium term.

### Text box 7: Just Transition to green agriculture

Agriculture accounts for approximately 30% of global greenhouse gas emissions and employs around one billion people globally (GIZ 2021a). The proportion of informal work is very high, especially the widespread subsistence farming with which producers and their families achieve self-sufficiency. The President of the African Development Bank stated in this context, **'Agriculture is crucial to inclusive growth and wealth creation in Africa, and for job creation, especially for millions of Africa's youth and women'** (BMEL 2020).

However, agricultural productivity is low in many countries in Africa and also Asia, which leads to food insecurity. Helpful information that can be used to increase yields and agricultural production sustainability is now available through the use of smartphones, although a minimum level of **digital literacy** is required for this. The same applies to the increasing use of agricultural machinery: up to 85% of agricultural work is undertaken by hand in African countries. Only around five per cent of farms have a tractor and just six per cent of cultivated land is irrigated; in Asia the figure is 37% (BMEL 2020, p. 22). Agricultural mechanisation and digitalisation are frequently associated

with a productivity-driven trend towards (emissions-)intensive agro-industry, often producing products for export. But concepts such as **smart farming** can also help to improve the sustainability of production and reduce resource use. However, this means a) increasing qualification requirements (digitalisation, use of machinery) and b) job losses on account of automation.

Alternatives include concepts such as **integrated agriculture,** one example of which is combining aquaculture with rice cultivation, which can thus increase yields and incomes. Over 7,000 farmers have already been trained on production methods for increased yields at the **Ethio-German Agricultural Training Centre.** They receive recognised training certificates and act as regional multipliers for the modernisation of the agricultural sector (BMEL 2020). In the five Knowledge Centres for Organic Agriculture, BMZ is enhancing knowledge for the production of sustainable agricultural products. In addition to strengthening food security, productivity and resilience to weather and climate-related events, this also increases job security because no agrochemicals, such as synthetic pesticides, are used (BMZ 2020). In this context the development and application of specific knowledge is indispensable. As it is often women who develop and share this knowledge, there is an opportunity to improve economic and societal participation already in the process of a Just Transition to green agriculture.

A Just Transition can be financed by reforming agricultural subsidies, developing smart green fiscal policies and scaling up private finance (GIZ 2021a).

Many activities in the informal economy are directly linked to the processing of natural resources – whether in agriculture, fisheries, timber processing, mining, etc. Accordingly, a lot of people in this area are particularly affected by climate change and environmental destruction, which threaten their jobs and livelihoods and thus exacerbate poverty. Certain activities in the informal sector are themselves harmful to the environment, such as the illegal production of charcoal and artisanal mining. The development and production of 'green' technologies in (mainly) the global North also has an adverse impact on countries in Africa and Asia – through the extraction of the mineral raw materials required and also the subsequent (where possible) recycling and scrapping of wind turbines and photovoltaic systems, etc. (BMAS 2021, p. 23). However, the informal sector also shows forward-looking traits of sustainable economic activity. For example, waste pickers are part of a circular economy with considerably more efficient and resource-friendly practices in many places than such operations undertaken by large enterprises. Street traders, which represent 11% of informal workers in India's cities, mainly sell local and regional products and use less packaging material and energy (WIEGO, no year). In rural areas, subsistence farming is better at conserving biodiversity and landscapes in many places than intensive, mechanised agriculture. In principle, the social practices geared heavily towards cooperation, the inventiveness born mainly out of necessity (frugal innovations) and the resource-friendly economic models as well as the socially integrative force of the informal economy provide a valuable basis for a Just Transition to a Green Future. Without glorifying the informal economy, which has many drawbacks, it is increasingly clear that the perception of it must change in order to better understand and exploit its contribution to socio-environmental transformation (IIED 2016).

In many respects, TVET measures should be part of initiatives targeting workers in the informal economy:

- Supporting the training of young people in the informal sector to better prepare them for the challenges of climate change
- Strengthening transformative skills, such as skills for self-organisation and participation in local, national and international decision-making processes
- Targeted development of 'Green' Skills as part of local transformation projects, for example in sustainable agriculture, the construction sector, transport or the energy industry

## Text box 8: Six principles for integrating the informal economy in a Just Transition to a Green Future

**1. Use positive language:** There is a clear need to move away from prejudiced narratives on the informal economy towards language that is positive and helps realise the dynamism that can be found in the informal sector. 'We need to find words to describe this bottom-up, locally-based, innovative and wonderful diversity that gives strength to economic ecosystems,' said Camilla Toulmin of IIED.

**2. Build platforms for exchange:** If informal workers are to identify their needs, talk about them and engage governments to shape policies that address them, then they need access to platforms where they can come together. Three types have been tried and tested in cities across the global South: information sharing platforms; dialogue platforms; and negotiation platforms.

**3. Support self-organisation:** The starting point for any new policy agenda should be to support informal workers to self-organise. From the waste pickers in Colombia that have won government waste contracts to the 5.5 million micro-businesses that have been formalised in Brazil, success stories about integrating the informal economy begin with self-organisation.

**4. Design from the bottom-up:** This is about economic and policy planning where informal workers – including the poor, ethnic groups and all genders – are given a seat at the table on their own terms. These terms of inclusion are crucial: just being included is not necessarily enough.

**5. Use evidence:** There are many excellent examples of best practice and these should be captured and used to drive learning and exchange across countries and contexts. At the same time, there is a need for hard evidence on the scale and contribution of the informal economy, which is often unmeasured and invisible in official statistics [author's note: in industrialised economies, too, the shadow economy is added to gross domestic product by means of estimates; in Italy, for example, it accounts for around 12.5% of GDP].

**6. Look beyond regulation:** Policy-makers may look for easy proxies, such as legality and formalisation. But legality can be inherently anti-poor if there are

no safety measures in place. And small-scale producers will not formalise if it is bureaucratically cumbersome, expensive, and comes without any benefits.

Result of the conference titled 'The biggest "private sector": what place for the informal economy in green and inclusive growth?' and held in London on 25 February 2016 by IIED, Green Economy Coalition, WIEGO, CIFOR, OECD; see also the conference documentation (IIED 2016).

The **six principles for integrating the informal economy in a Just Transition to a Green Future** should be taken into account when devising DC approaches. They can also be applied to TVET cooperation. The informal sector in developing countries and emerging economies therefore plays a significant role in technical vocational education and training of young people, although this contribution is often neglected in TVET policies or unilaterally described as deficient. This view is slowly changing due to more recent studies on the effectiveness of traditional forms of training for transitioning young people to working life. For example, a comparative study in three African countries concludes: 'The analysis shows that despite significant shortcomings and barriers, the system provides a range of choices for many young workers and offers a solid pathway into employment, including informal, formal or self-employment' (ILO 2022). Building on the strengths of this training system, German DC already has some experience with programmes aimed at improving the quality and recognition of the skills gained there, for example the Ghana Skills Development Initiative. Core measures of this include the training of trainers and the recognition of informally acquired skills. German actors are also playing an active role in knowledge sharing and generation at the conceptual level, for example in the context of the VET Toolbox 'Skills for the Green Transformation' as well as the toolkit 'Learning and working in the informal economy' and a study on the digitalisation of apprenticeship training in sub-Saharan Africa. Green Skills, however, have only been taken into account to date in specific professions, such as that of a solar installer. **Green topics have not yet been systematically embedded in strategies and implementation measures, not least due to the fact that partner ministries and education authorities have limited knowledge about traditional apprenticeship training works in practice**. Labour market information systems and studies on training needs often consider only the formal labour market. There are few statistics for the informal sector, and traditional forms of apprenticeship often fall outside the remit of education ministries. With their TVET research expertise, German DC actors can make a valuable contribution here to designing cooperative TVET approaches and to work-based learning.

The **breadth of DC instruments should be taken into account in this**. For example, TVET partnerships through which German chambers of commerce cooperate with business associations in the partner countries can provide interesting input at regional level or in certain professions. Such cooperation projects require a great deal of patience to achieve long-term success, as trusting and reliable working relationships can only be built up over a long period of time. However, such forms of cooperation on an equal footing offer excellent opportunities for the development of innovative, locally adapted solutions by taking a bottom-up approach and building the informal sector's capacity to self-organise.

The growth in the informal sector is primarily attributable to continued rapid population growth (FES 2021) and, to a not insignificant degree, to the increasing participation of women in paid work (Brown et al. 2014, p. 12). The reservoir for a further increase in the informal sector is therefore by no means depleted. What are needed are mechanisms aimed at women in particular that: a) provide prospects in informal green employment in order to strengthen their economic independence and ensure their physical and mental integrity; b) enable a transition from informal work to formal employment; and c) allow for direct access to quality education. Essentially (for people of all genders, naturally), **'The level of education is a key factor affecting the level of informality. Globally, when the level of education increases, the level of informality decreases.'** People who have completed secondary and tertiary education are less likely to be in informal employment compared to workers who have either no education or completed primary education' (ILO 2018). The provision of education on the systemic skills needed for the green transformation (see table 2) is of fundamental importance to developing means of accessing both formal and informal green value creation and employment. On the one hand, this involves establishing a suitable degree of employability that is essential for performing (skilled) activities (especially in cleantech industries and technical skilled crafts). On the other, transformative TVET goals that go beyond ensuring a supply of skilled workers (see figure 1) must also be considered, as a Just Transition here is also a question of gender equality and therefore of a feminist development policy (BMZ 2023c). Essentially, feminist development policy – in TVET and beyond – can be guided by the "three Rs" (BMZ 2023c):

- Equal **rights** for women and disadvantaged groups
- Appropriate **representation** on bodies, etc. and therefore a voice in decisions
- Access to **resources** and therefore own capacity to act[7]



7 In its feminist foreign policy handbook, Sweden adds a fourth R – a reality check of the measures in the form of scientific proof of efficacy (Swedish Ministry for Foreign Affairs 2018).

# 8 Conclusions and outlook

The processes of change and upheaval initiating a shift to a just green future are not the same everywhere. Local circumstances, climatic conditions, economic and social models (including cultural determinants) and other factors characterise these processes to varying degrees in different parts of the world, where the pace of progress also differs. Customized solutions must therefore be developed and implemented. As the green transformation implies a change to systems and structures, a variety of skills and competences are needed to shape this change locally. A target of 'green & just' is therefore a challenging paradigm shift: it is not sufficient to simply adapt individual elements of the TVET system. Instead, systemic realignment and re-evaluation are needed here along the same lines as the economic transformation. The sector strategies for the focal sectors of energy, mobility and construction have to be dovetailed with (new) TVET approaches, for example in the form of sector-based determination of employment potential and employment needs. However, we can also assume that developments such as sector coupling (the linking of electricity, heating and transport) or even the circular economy encompassing several industries and sectors will also lead to new requirements here.

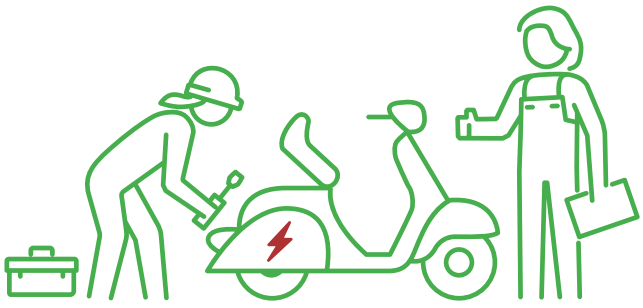
The variety of requirements will result in TVET of varying quality. **General 'green literacy' will form the basis and will have to be disseminated and mainstreamed as widely as possible in the population.** This is fundamental to the transition and will serve to raise awareness that a) such change is necessary and possible, and b) this transformation will bring with it individual and collective opportunities that go far beyond companies' pursuit of profit: **the prospect of sustainable, fair and inclusive development must be the goal of green transformation, also termed socio-environmental change with good reason.**

Based on this literacy, **links can be established with TVET for informal employment**. This involves providing support in the form of very low-threshold offerings that can fulfil the promise associated with the narrative of sustainable social development: local and regional paths to becoming part of the green transformation and value creation will be developed on a community basis, thereby creating added value for individuals and collectively in the form of higher earnings, improved living conditions, better health, more education and so on. Such an approach is not programmatic, but primarily opportunity-driven and reactive. It is contingent on many factors, however, as it requires permanent monitoring of changing environmental factors and agile adaptation and restructuring of training measures and activities designed to create opportunities in the course of the Just Transition. This in turn relies on the close and permanent inclusion of local and regional stakeholders and involves cooperation with formal companies, schools and other institutions, such as local authorities.

The third level encompasses the **transitional area from informal to formal employment**. Mechanisms for recognising skills and competences acquired in the informal sector and closing skills gaps through short-term measures and training modules are needed to facilitate these transitions. It is important that these measures are always carried out alongside employment. Given the structure-changing nature of the green

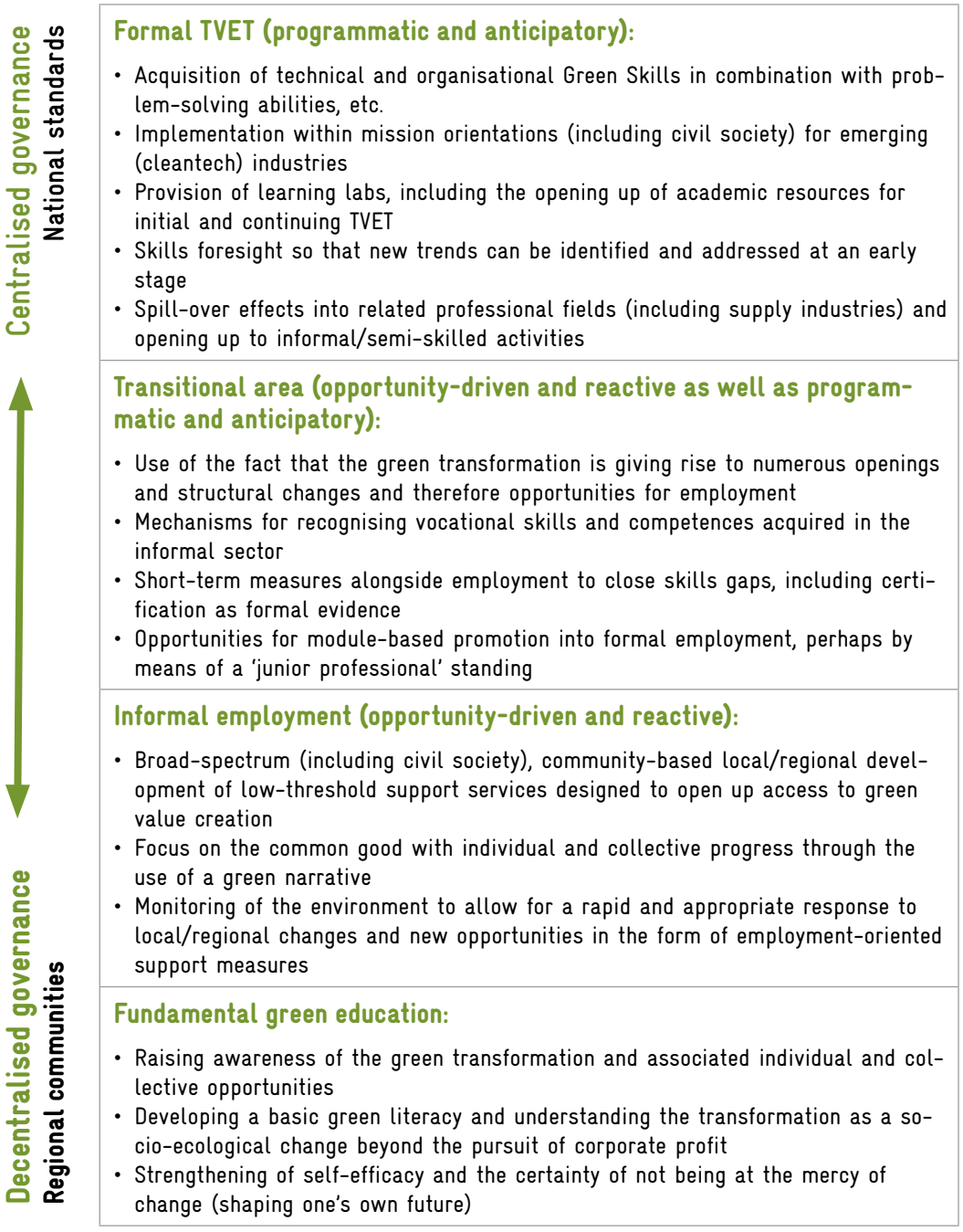
transformation (generally in interplay with the digital transformation), it can be assumed that there will be numerous openings that will facilitate the transition to formal employment (new job profiles, lack of skilled workers). At this level, TVET is a blended format that is opportunity-driven and reactive but also programmatic and anticipatory.

At the topmost level are **industries that are striving to create or have already established on a large scale value creation without the use of fossil fuels through the application of cleantech**; this includes renewable energy generation. These industries are characterised by the need for highly skilled workers who receive basic and advanced education and training through structured and formalised measures. As these industries are only just emerging in many cases (and doing so with foreign assistance), it makes sense to develop formalised TVET in parallel to the technical and economic implementation of the cleantech industries and their suppliers. Developing skilled workers and taking the measures needed for this (basic training plans, reskilling and upskilling) must be an integral part of linking up the policy areas required to develop these industries within the framework of a (regional, national or even international) mission orientation. This form of Green TVET is therefore programmatic and anticipatory. It is largely compatible with existing TVET systems and requires broad foresight of future job requirements so that these can be responded to at an early stage[8]. Depending on the scope of the missions, a suitable form of implementation are centres of excellence and competence centres with the relevant technical installations (learning labs with interaction between initial and continuing TVET and higher education, see also the sectoral study *TVET for Sustainable Mobility*). The measures are not limited to the focal cleantech industries, however. Given the systemic nature of the transition, they should also seek to achieve a broad impact through opportunities for lateral link-ups as well as spill-over effects. For there to be progress for the common good, feedback to the other levels of the system pyramid, and therefore a connection to the various stakeholders and communities, is also required at all times.



8 Determining qualitative and quantitative demand for skilled workers in the medium term and deriving training requirements on this basis is an established field of research in industrialised nations. Examples include the model-based BMAS skilled worker monitoring at national level and the CEDEFOP Skills Forecast for Europe. Consistent data is a particularly important prerequisite for determining quantitative change – and is not a given in all countries. The qualitative effects (anticipated changes to requirement profiles) can also be transferred to emerging economies as the measures taken are global development steps; this can be done to some extent for established industries, taking into account a time component, and very extensively for emerging industries such as hydrogen production.

**Figure 6:** Chart showing transformative TVET aimed at four levels including general green literacy. The goal of addressing more than just employability with such measures is reflected in the inclusion of civil society and its needs (individual and collective well-being – see Figure 1), both in the community-based focus of the measures for informal employment and the involvement of communities during mission orientation (based on the quadruple helix) for emerging (cleantech) industries.



Looking at the big picture, the following questions can help to guide action for the further development of German DC in the area of TVET up to 2030 and beyond:

- **How can the changing requirements in the countries and sectors be captured and TVET objectives adjusted accordingly?**
  In the industrial age, the main focus was on adapting skilled workers to the needs of the (formal) labour market (employability, use of human capital). Given the structural changes and ruptures during the Just Transition to a Green Future, however, it is increasingly the case that new forms of work and income generation (entrepreneurship and intrapreneurship both in the formal and informal sector, finding flexible ways to collaborate, combining paid and unpaid work, etc.) are having to be actively shaped.
- **How can the training aspect of TVET be strengthened?**
  Given the socio-environmental transformation, developing specialist skills is not enough in itself, even though such skills naturally remain important. There is a greater emphasis on learning skills and problem-solving skills, personal training as part of green literacy, and social and interaction skills as they empower individuals to play an active role in shaping a 'green' and inclusive future.
- **How can the various stakeholder groups at all levels (local to national and also international) increase collaboration to create a TVET system that is fit for the future?**
  In future, TVET will have to address a broad spectrum of levels and 'ecosystems' with their respective realities and standards and integrate it despite such variations. The involvement of local and regional communities has an important role to play, especially with regard to the informal sector. This means involving not only the obvious stakeholders like educational institutions, employers and trade unions in the processes, but also local authorities, environmental and youth organisations and other civil society groups and structures.
- **How can local solutions be implemented?**
  Given regionally diverse economic production and our complex, uncertain world, standardised solutions cannot be implemented. Rather, needs-driven offerings must be developed in cooperation with local and regional stakeholders and involving (potential) workers. Nevertheless, an enabling framework has to be created with a yet-to-be defined balance of bottom-up and top-down elements so that the measures can have an overarching effect (professional transitions, refresher training and training aimed at advancement, permeability between basic and advanced education and training offerings).

The International Renewable Energy Agency (IRENA) and ILO have stated the following – with a view to the global energy transition, but also with general application to a Just Transition to a Green Future: 'Along with gender equity, adequate opportunities for youth and greater inclusion of minorities and marginalised groups are the keys to developing a workforce that reflects society at large' (IRENA & ILO 2021, p. 9). The goal of a Just Transition to a Green Future is ambitious and of extreme urgency as climate change progresses. By 2030, BMZ can set a new course in the area of TVET cooperation and provide impetus for joint efforts at multilateral and bilateral level.

The trends summarised here and the findings that have been derived are intended to help structure reflection on development cooperation in the field of TVET against the backdrop of the Just Transition to a Green Future and provide impetus for further discussion within BMZ as well as with national and international partners. The focus

and integration point of the aforementioned elements is answering the question posed at the outset: **How should German DC position itself in future with regard to TVET so that it can enable and shape a Just Transition to a Green Future through the strengthening and teaching of skills and competences?** The foreseeable disruption in the current value creation and employment systems as a consequence of and prerequisite for the green transformation and the associated expansion of the concept of 'green' (vocational) training beyond direct employability are touchstones that matter just as much as recognising the informal sector as a field of application for TVET.

Consistency and agility are needed in equal measure in the associated process. Time is required precisely because of the complexity of the problems and the related need for cooperation with a variety of stakeholders – time to achieve a common understanding of the problem and to develop partnerships based on trust while ensuring the agility and ability to adapt so as to appropriately address uncertainty and risks appropriately.

A teacher from College of Technology instructing a trainee to use VR simulation in Vietnam. © GIZ/Nguyễn Minh Đức

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