BIBB SPECIALIST PAPERS ON VET

Ralf Hermann | Hannelore Kress | Julia Olesen (Eds.)

Sustainability in Vocational Education and Training – National and International Experiences

Federal Institute for Vocational Education and Training

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Federal Ministry of Education and Research

GO:VET German Office for International Cooperation in Vocational Education and Training

bibb Federal Institute for Vocational Education and Training

Imprint

Citation:

Hermann, Ralf; Kress, Hannelore; Olesen, Julia (Eds.): Sustainability in Vocational Education and Training – National and International Experiences. Bonn 2024. URL: https://www.bibb.de/dienst/publikationen/de/19901

1st Edition 2024

Publisher:
Federal Institute for Vocational Education and Training
Friedrich-Ebert-Allee 114 – 116
53113 Bonn
Website: www.bibb.de/en

Publication management:
Strategic Office "Publications and Scientific Information Services"
Email: publikationsmanagement@bibb.de
Website: www.bibb.de/publications

Production and distribution:
Verlag Barbara Budrich
Stauffenbergstraße 7
51379 Leverkusen
Email: info@budrich.de
Website: www.budrich.eu

ISBN 978-3-8474-2832-9 (Print)
ISBN 978-3-96208-485-1 (Open Access)
urn:nbn:de:0035-1120-1

Bibliographic information of the German National Library
The German National Library catalogues this publication in the German National Bibliography. Detailed information is available online at https://www.dnb.de/EN/Home.

Printed on environmentally friendly paper.

Preface: Experiencing transformation through sustainability in work and vocational training

In recent decades, at the latest after the Paris Climate Agreement and the UN Agenda 2030, awareness has grown worldwide that in addition to political agreement, massive financial expenditures and relevant research and development, another component is essential for a successful transformation: education. We see professional skills in particular as an ability to achieve sustainability, which is a decisive factor for successful innovation and transformation. The Federal Government's action plan for the implementation of „Education for Sustainable Development" therefore includes a separate field of action for vocational education and training, which we at the Federal Institute for Vocational Education and Training (BIBB) play a key role in shaping.

Cooperation with the social partners in terms of economic, ecological, cultural and social sustainability has long been anchored in Germany's vocational education and training. The relevance of the topic of „environmental protection" in training has been clear for over 40 years – from the development of the first occupation in environmental protection „supply and disposal specialist" in 1984, to the recommendation for the inclusion of occupation-related environmental protection content for vocational education and training and examination requirements (1988). In 1998, the so-called standard occupational profile items for environmental protection in modernised or new training occupations were formulated. Since August 2021, every new or revised training regulation has been required to include the minimum cross-occupational standard position „Environment and sustainability". This offers trainers starting points for implementing modern, demanding and resource-conserving and, therefore, sustainable vocational training. In addition to structural framework conditions, we need vocational trainers who consider themselves as part of the transformation and fulfil this role competently. Only in this way can vocational education and training reach the young generation in the long term, for whom their own self-efficacy in their career choice is particularly important.

The Federal Ministry of Education and Research (BMBF) and BIBB have placed international cooperation in the context of the sustainability of vocational education and training. In recent years, the BMBF's bilateral cooperation programmes conducted by GOVET, the German Office for International Cooperation in Vocational Education and Training, have been explicitly dedicated to the exchange of experiences and strategies for a just transition to a sustainable economy. This publication documents the learning experiences that were shared and discussed in workshops, webinars and study visits. It builds bridges between partners around the world and offers numerous good examples of how we can tackle the challenges of a transformation to a sustainable economy together in the spirit of global learning. Gathering experiences from international practice and research is particularly im-

portant in times of change. We are curious about the innovative ideas of our international partners and take them as inspiration for our own deliberations.

I would like to expressly thank the authors for their contributions and wish all readers an insightful read.

Professor Dr Friedrich Hubert Esser
President of BIBB

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Ralf Hermann, Hannelore Kress, Julia Olesen

Introduction: Sustainability in the context of international technical and vocational education and training – Analyses, best practices and experiences

The integration of sustainable development into Technical Education and Vocational Training (TVET) has become a priority in many countries. As Precious Lisulo from Zambia put it: "Sustainable development is a vision of education that balances human and economic well-being with cultural traditions and respect for Earth's natural resources" (see page 40 in this book). The approaches might differ from country to country, but the goals are the same. Vocational education and training is a game changer in transitional processes, especially in times of digital transformation, new technologies, artificial intelligence, and innovation. Institutions and TVET systems interpret sustainability in their contexts differently and come to individual strategies. The experiences on how practitioners implement aspects of sustainability in their daily work vary from country to country. Facing similar challenges, though, it is time to look beyond our understanding and learn from each other in this common endeavour to make our world of work and TVET more sustainable.

Based on these aspects dominating the global discourse in TVET, the German Office in Vocational Education and Training (GOVET) has put the topic of sustainability on the agenda in the international cooperation since the year 2021, until today. This volume documents workshops, expert talks and papers with the intent to facilitate the exchange of experiences on the macro, meso and micro levels in different national settings. It comprises papers from all participating countries. In line with the intended research-practice-politics encounter, the range of contributions is deliberately diverse, reaching from research-based findings to shop floor reports, and strategic policy outlines.

The publication sheds light on fundamental questions regarding sustainability in TVET. The contributions range from pilot project reports to academic analyses, from review of government strategies to reports of TVET experts and practitioners. The authors have different backgrounds when it comes to their institutions and fields of practice, as well as countries: A total of 40 authors from 11 countries have compiled 25 texts united in this publication.

The 7th BIBB projection "QuBe"[1] tool analyses on a regular basis the effect of climate change measures on the demand of necessary competencies in all dual occupations: "The

1 Project QuBe stands for „Qualifikations- und Berufsprojektionen" (QuBe) and is a joint projection with the IAB (Institut für Arbeitsmarkt- und Berufsforschung) and GWS (Gesellschaft für Wirtschaftliche Strukturforschung), taking place every two years. More information: **https://www.bibb.de/de/11727.php**

upcoming socio-ecological transformation processes include not only the energy turnaround and CO_2 reduction, but also climate impact mitigation and the necessary changes in agricultural production, water pollution control and biodiversity. What is certain is that workers who perform 'green jobs' in their workplaces are instrumental in ensuring that transformations succeed and that energy and raw materials are used efficiently. If these workers are missing, jobs cannot be filled and the transformation is at least slowed down" (Maier et al. 2022, p.17). The Institute of Employment Research (IAB), a longstanding institutional partner of BIBB, states the adaptation to climate change and response to it will create approximately 400,000 additional jobs in Germany in areas such as electrical, air-conditioning and heating technology. "The same applies to the transformation of mobility: Established jobs will be lost as a result of the switch from combustion engines or autonomous driving. But this will be more than counterweighed by employment in a modern transportation system, in the areas of organization, control, IT and infrastructure creating often well-qualified jobs. There is no trading good industrial jobs for cheap jobs" (Weber 2023). This transition is also a source of innovation with new business models, storage, battery control, electrolysers, energy infrastructure, new materials, and much more (ibid). These changes and demands in the labor market require adaptations in TVET and put existing beliefs, certainties and structures under pressure.

International cooperation in VET – Sustainability

International cooperation has also seen an increasing demand of 'sustainability' as topic for cooperation and expert exchange in recent years. In 2022, GOVET organized a fact-finding study tour for water management experts from six African countries. The mutual exchange concerning resource-saving approaches to water usage and the training of technical personnel enriched the common understanding of an effective introduction of a modern technical infrastructure in vocational education on initial and continuing level.

A future-oriented consideration of digitalisation (with regard to critical infrastructure) and sustainability (with regard to the conservation of resources and to climate change) are of particular relevance to these occupations, especially in light of the UN's sustainable development goals (SDGs) and the World of Work 4.0. For this reason, the so-called technical environmental occupations were recently reviewed in Germany. Existing occupational profiles have been modernised by the introduction of three new occupations: environmental technologist for wastewater management, environmental technologist for recycling and waste management and environmental technologist for pipeline networks and industrial plants.

Bilateral workshops as exchange platform

Following up on the exchange of experts from various African countries, GOVET intensified the dialogue on aspects of sustainability with bilateral Federal Ministry of Education and Research (BMBF) partners in Ghana, Costa Rica and South Africa. The workshops on sus-

tainability and vocational education and training highlighted the importance of ensuring that learners acquire the knowledge, skills and values needed to support sustainable development. This includes not only adequate teaching practices but also modelling them in the design and delivery of VET programmes.

The South African-German workshop in 2023 served to network the expert communities on sustainability and vocational training and to fuse their rather distinct discourses with each other. Further impulses on sustainability at vocational schools and in-company-based training led to engaged discussions with the competent participants in the hall and in the virtual room. The ideas and perspectives of young people were also discussed. An entire study week in Berlin gave the South African participants insights into the dual system and the commitment of its actors to the turn towards sustainability.[2]

Experts from Costa Rica highlighted experiences and project results as well as the respective national approach from the regulatory and structural work. There was consensus among the participants as to why sustainability plays a role in vocational education and training at all: due to the global challenges posed by climate change and resource scarcity, sustainable behaviour is no longer a fancy add-on but increasingly a necessity. Vocational training makes a significant contribution to a more sustainable working environment by teaching trainees about topics such as environmental protection, the use of resources and a long-term perspective from the outset.[3]

In Ghana, similar to the water study tour, participants first visited a water extraction plant and received information about the status quo of TVET in water management in Ghana. While sustainability plays an important role when it comes to greening institutions and increasing sustainability of vocational schools, it has not yet entered curricula and practices of learning.[4]

Joint publication with international voices

The discussions during the workshops gave evidence to the fact that sustainability in TVET is not (yet) a term that is internationally perceived and described in the same way. While in South Africa, for example, sustainability is closely attached to just (energy) transition and the ongoing discussions in this area, Germany has implemented a variety of pilot projects under the motto "Vocational Education and Training for Sustainable Development" (VESD). In other countries, like Ghana, the main objective has been so far to increase sustainability of vocational training institutes as learning venues, rather than in the field of cross-cutting competencies, as has been a more recent approach in Germany, for example.

The aim of this publication is to provide a platform for the variety of discussions, approaches and identified best practices on the international level. Because of this variety, the contributions range from experience reports, to policy analyses and pilot project results. We have clustered the texts according to the systemic level that they or the described ac-

2 More information: **https://www.govet.international/en/176512.php**
3 More information: **https://www.govet.international/en/159684.php**
4 More information (in German): **https://www.govet.international/de/175582.php**

tivities aim at. The first chapter covers contributions on the macro level, i. e. on structural and systemic aspects of TVET. The second chapter considers the matching between system and implementation level by providing perspectives from the meso level. Most texts aim at showing the implementation on the institutional and organisational level. The third and fourth chapter focus on the micro level and the implementation at schools and companies, respectively.

Besides the aforementioned countries Costa Rica, Ghana, South Africa and Germany, this volume also highlights perspectives on sustainability and TVET from Brazil, Kenya, Mexico (and Latin America), Uzbekistan, Zambia and Zimbabwe. The variety of world regions and countries represented in this volume speaks to the global relevance of its topic and to the collaborative international approach it requires.

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Sustainability in vocational education – Macro level, systemic and structural

Moritz Ansmann, Maria Schwarz, Christian Melzig, Barbara Hemkes

Professional competencies for sustainable transformation

Climate change, species extinction and the unequal distribution of finite resources require a shift of paradigm in Vocational Education and Training (VET). VET has the responsibility to promote competencies that are necessary for advancing and helping to shape the sustainable transformation. The BIBB (German Federal Institute of Vocational Training) is addressing this with the corresponding modernisation of training regulations, but also with the promotion of pilot projects. Pilot Projects are collaborative projects between universities, research institutions, companies, and industry associations aimed at developing and testing practical innovations for vocational education and training. The article presents core findings and highlights the role of training personnel in the integration of sustainability in VET.

1 Vocational training for sustainable development

The socio-ecological transformation requires qualified professionals who can foresee the impact of their job-related actions on the living conditions of present and future generations, make informed and responsible decisions and, at the same time, initiate sustainable innovations in the economy and working world.

According to the National Action Plan for the implementation of the UNESCO World Programme of Action on Education for Sustainable Development (ESD), in 2017, Germany stipulated that education for sustainable development should also be implemented and structurally anchored in vocational education and training (cf. BMBF 2017). Such vocational education and training for sustainable development (VESD) should contribute to promoting competencies with which the world of work can be shaped sustainably. In this understanding, sustainability represents a guiding principle with which the improvement of economic and social living conditions can be reconciled with the safeguarding of the natural foundations of life for present and all future generations. For vocational education and training, this is accompanied by the task and responsibility of imparting the necessary knowledge and competencies in vocational action to achieve this.

With the modernised standard occupational profile item „Environmental protection and sustainability“, sustainability has been an integral compulsory component of all vocational training in the dual system in Germany since 2021 (cf. BIBB 2021). References to sustainability have also increasingly found their way into the training regulations of the individual occupations in recent years. The Federal Institute for Vocational Education and Training (BIBB) has helped to initiate and support these modernisation processes at the level of the regulatory instruments.

However, it is not only what is written in the regulations that is decisive but above all what is delivered and implemented in company-based training practice. In order to fill the formal requirements with life, targeted concepts and practice-oriented teaching/learning materials are needed to enable the occupation-specific translation of the requirements into everyday training. Within the framework of so-called „pilot projects“ (further on BBNE projects[1]), which have been funded by BIBB with funds from the Federal Ministry of Education and Research (BMBF) since the beginning of the 2000s, such training offers have been developed and made available in the past. This way, BIBB contributes to anchoring sustainability in the practice of initial and continuing vocational education and training.

Figure 1: Project on sustainability in the chemical industry with apprentices in the ANLIN 2018 pilot project

Source: Bildungszentrum für Beruf und Wirtschaft e. V., Wittenberg

1 BBNE: Abbreviation in German for „Berufsbildung für Nachhaltige Entwicklung“. BBNE translates to English as VET for Sustainable Development (VESD).

2 Review: The BBNE pilot projects – innovation partnerships between science and practice

Model experiments are „pioneering projects" in which universities and research institutions work together with companies, training providers and industry associations to productively co-develop and test innovations for vocational education and training that are scientifically sound and closely oriented to practical needs and prepare them for transfer. Characteristic of this funding instrument is a transdisciplinary, open-ended research and innovation process that does not take place in the hallowed halls of academia but essentially in the real-life practical contexts of in-company training. Looking back at the history of the BBNE pilot projects, it is possible to distinguish between different key objectives of the funding (cf. Hemkes/Melzig 2021):

- *Raising awareness of sustainable development* among trainees, training staff, but also managers was identified as necessary in the early years (2001–2010) of the pilot projects. Thus, methods such as the determination of the ecological footprint were used to generate individual concern, which was reflected on the basis of practical work tasks. Even though BBNE is much more present nowadays, raising awareness is still an ongoing task.
- *Sector-oriented strategies* to promote sustainable development in education and training were the main focus of the pilot projects from 2010–2013. Sustainability requirements were addressed in a variety of ways, from the curricular development of corresponding learning modules to the development of new professions and further training.
- *Sustainability-oriented vocational action competence*, or more precisely the promotion of it, was the central goal of the pilot projects from 2015–2019. Trainees were strengthened to help shape the world of work sustainably through informed decisions. The pilot projects developed work tasks, teaching-learning methods or entire curricula for a wide range of occupations. These were tested and evaluated together with companies and educational institutions (cf. Melzig/Kuhlmeier/Kretschmer 2021; Ansmann/Kastrup/Kuhlmeier 2023).
- *Sustainable learning venues*, especially in the company are prerequisites for testing and experiencing sustainability-oriented vocational action. The (more) sustainable design of the learning venue was also the focus of the pilot projects, whereby, among other things, specific teaching-learning settings can be created or sustainability-oriented organisational development processes can be designed in the company (cf. Feichtenbeiner et al. 2022).
- *Qualification of training staff* is an important factor in systematically anchoring sustainability in VET. For this reason, the funding programme „BBNE Transfer 2020–2022" was recently launched, in which corresponding further training offers will further developed, disseminated and established. At the same time, the obstacles and opportunities for the implementation of BBNE will be investigated and generalised in a transfer model (cf. Schlömer et al. 2023).

The BBNE pilot projects have repeatedly demonstrated the great impact of the world of work and professions on sustainable development across all focal points.

Figure 2: Partners of the University of Oldenburg and the Dairy Education Centre Oldenburg in the joint pilot project QuaNEM for sustainability-related qualification of training personnel in the dairy industry, 2023

Source: Thomas Hartwig/Lufa Nordwest

3 Lessons learned from the pilot project funding

From the concrete project results and experiences of the pilot projects, general conclusions can be drawn on the successful implementation of anchoring sustainability in VET:

- **Lesson 1: Sustainability must be made tangible and must therefore be developed from within the professions.**

  For a baker, the professional context results in different references to sustainability than for a logistics clerk. It has been shown that the promotion of sustainability-related vocational action competence is successful when it is primarily based on the vocational field of action and is based on authentic work situations in the sense of experiential learning. In this regard, sustainability must be developed from within the professions. This is the

only way to make the abstract topic of „sustainability“ concrete and tangible for trainees and training staff.

- **Lesson 2: Sustainability is not an „extra topic“ but must be integrated into the existing training content.**

  Sustainability does not mean doing ‚more‘ but taking a ‚different‘ look at one‘s own professional decisions and actions, i. e. with regard to the consequences for people and the environment. In this regard, sustainability is not to be understood as an isolated „additional topic“ but as an integrative principle of action to be considered in all professional activities and work processes. BBNE is successful when sustainability is not added ‚on top‘ as an additional learning material but is interwoven with the already existing training content.

- **Lesson 3: Not only the green professions – all professions can become more sustainable**

  Sustainability looks different from job to job. This means different challenges but also different opportunities. VESD is aimed at all professions, not just the „green professions“. The basic assumption is that *all* professions have the potential to contribute to sustainable development. Against this background, the mission of ESD is to tease out these individual potentials. This then applies to those „green professions“ that already have a good sustainability footprint as well as to those professions that at first glance do not have a close relationship to sustainability, such as e. g. the meat industry. The pilot projects have shown *that it is possible* to make all professions more sustainable.

- **Lesson 4: The training staff is the key and must therefore be qualified!**

  BBNE is challenging – both for the trainees and also for the skilled workers who train them. The prerequisite is therefore both sensitised and committed trainers and, above all, qualified trainers; this has been shown many times before in the experiences of the pilot projects. In principle, the training staff are predestined to act as „BBNE change agents“ in the sense of sustainable development (cf. Kastrup; Kuhlmeier; Nölle-Krug 2023). As experts, trainers know the occupational activities and company processes, but above all they are the ones who control the training process, design the teaching/learning arrangements and act as role models for many trainees. In order to be able to implement VESD in this role, they need both specific technical and didactic VESD competencies.

Figure 3: Teaching-learning materials for trainees and trainers developed and tested in the pilot projects (2023)

Source: Hausser/BIBB

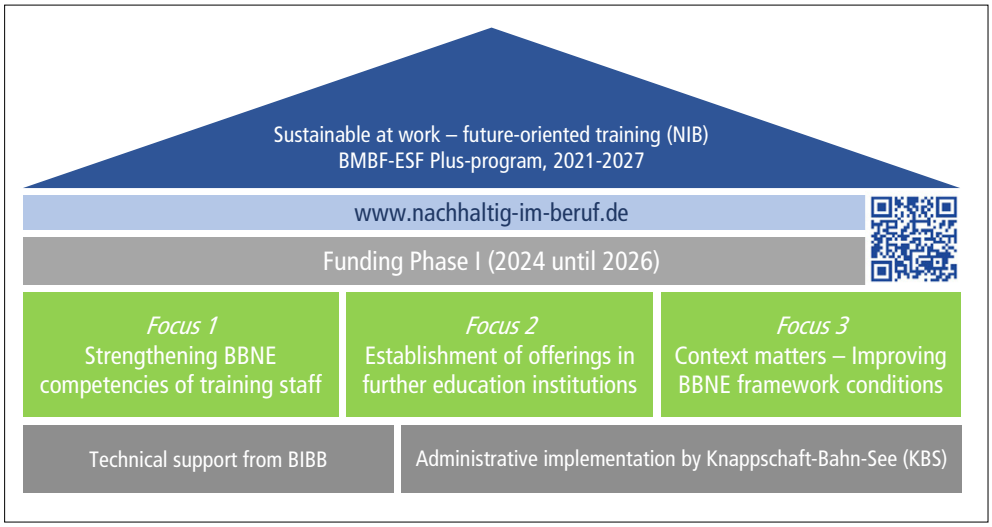
While the pilot projects on ESD have mainly focused on the development of individual sustainability-oriented vocational training measures on a small scale so far, at the same time, these findings have created the basis for a new large funding programme for the qualification of training personnel.

4 Outlook: The new "Sustainable at work" (NIB)[2] funding programme for the qualification of training staff

The pilot projects have recently revealed both the importance of and the need for sustainability-related qualification of skilled workers in training. In order to take this into account, the BMBF has now launched the ESF Plus co-financed funding programme "Sustainable at work – future-oriented training" (NIB). In its first phase, the programme supports the implementation, dissemination and anchoring of continuing education programmes for this target group. In order to professionalise the training staff, train-the-trainer courses and networking activities between trainers are also supported. The creation of framework conditions beneficial to VESD through the strengthening of VESD in the examination system, the establishment and expansion of networks and the implementation of qualification measures for decision-makers and multipliers in VET are also core components of the funding (cf. Ansmann/Benke 2023).

2 In German, the Sustainable at work programme is called: Nachhaltig im Beruf – zukunftsorientiert ausbilden (NIB).

Figure 4: Goals and structure of the funding programme „Nachhaltig im Beruf (NIB)“; 2023



Source: own illustration

Funding is primarily provided for sector- and occupation-specific measures that give trainers the tools to integrate sustainability into training practice. In accordance with the premise that all occupations must become more sustainable, the projects can be directed at all dual training occupations under the Vocational Training Act and the Crafts Code as well as at occupations in the health and social sectors and in the public service. Particularly welcome, however, are project proposals that create opportunities for new or reorganised occupations and those that contribute to the transformation of energy, agriculture, construction or transport. With this broad-based qualification approach, the NIB programme aims to turn the training staff into „change agents“ of VESD and thus to bring VESD into company training practice across the board. The goal is and remains that all of tomorrow‘s skilled workers learn today how to act in an ecologically, socially and economically responsible manner.

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Tobias Schlömer, Karina Kiepe, Gerrit Rüdebusch, Niklas Günther, Jennifer Liehr

Pilot projects: Phenomena and key points of transfer of vocational education and training for sustainable development (VETSD)

Pilot projects have been used in vocational education and training since the 1980s to promote vocational environmental education and training for sustainable development (VETSD). On the one hand, pilot projects have proven their worth in testing concepts of sustainable vocational education and training and in demonstrating new ways of thinking for a sustainable transformation in society, economy, and education. On the other hand, there are regularly excessive expectations of the immediate output of pilot projects and thus of the transfer claim. Against this background, the transfer processes of seven projects that were funded within the framework of the funding programme „Vocational training for sustainable development in transfer for training personnel 2020–2022" were examined. The article is the abridged version of a study published in spring 2023 (see Schlömer et al. 2023).

1 Pilot projects on environmental vocational education and training and VETSD

Pilot projects have a long tradition as a political funding instrument in German vocational education and training (VET). They have been used as temporary and project-based measures since the 1980s to establish an environmental vocational education and since the 2000s VET for sustainable development (VETSD) (see Hemkes/Melzig 2021; Schnurpel 2001, pp. 83ff.). Their core objective is to develop and test innovative solutions and to prepare them in such a way that they can ideally be made permanent after the end of the project (see Diettrich 2013, p. 93; Fischer et al. 2017, p. 259).

Pilot projects thus act as „pioneers" and „catalysts"; they are intended to raise awareness of alternative paths (see Böhle 2017, pp. 82ff.; Ludwig 2017, p. 111). The model concept emphasises the exemplary nature of the experiment; in most cases, something new is tried out (see Sloane/Fischer 2018, p. 790). The aim here is to be able to draw conclusions from the exemplary to the whole. Firstly, transferable and concrete products such as concepts, materials, methods, tools or training courses and qualification modules are to be created (see Kuhlmeier/Weber 2021, p. 434). Secondly, scientific explanations for the trials should be provided. And thirdly, pilot projects should guide educational policy decisions (see Sloane/Fischer 2018, p. 791).

The transfer claims for pilot projects are critically discussed. For example, since the beginning of pilot project funding, it has become apparent that pilot projects usually pro-

duce single case solutions. The transfer of principles from a single project to larger system contexts appears to be very complex and difficult to control (Diettrich 2013, p. 99; Ehrke 2017, p. 44; Ludwig 2017, pp. 119f.).

It has been shown time and again that the transfer of pilot project results is not an imitation „in the sense of identical elements" (see Diettrich 2013, p. 99). The results of a pilot project always emerge in micropolitical systems in which the stakeholders each bring in their specific perspectives, interpretations, interests and values (see Sloane/Gössling 2014, p. 135). The institutions and individuals in the transfer field therefore establish new micropolitical systems in which system-specific perceptions, interpretations, re-contextualisations and even implementation breakdowns can happen (see Schrader et al. 2020, p. 13).

2 Transfer of VETSD

Consequently, pilot projects primarily have an important indirect effect: They show transformation paths towards VETSD by means of exemplary projects. In this way, they can create conditions for the long-term implementation of sustainability in the VET system.

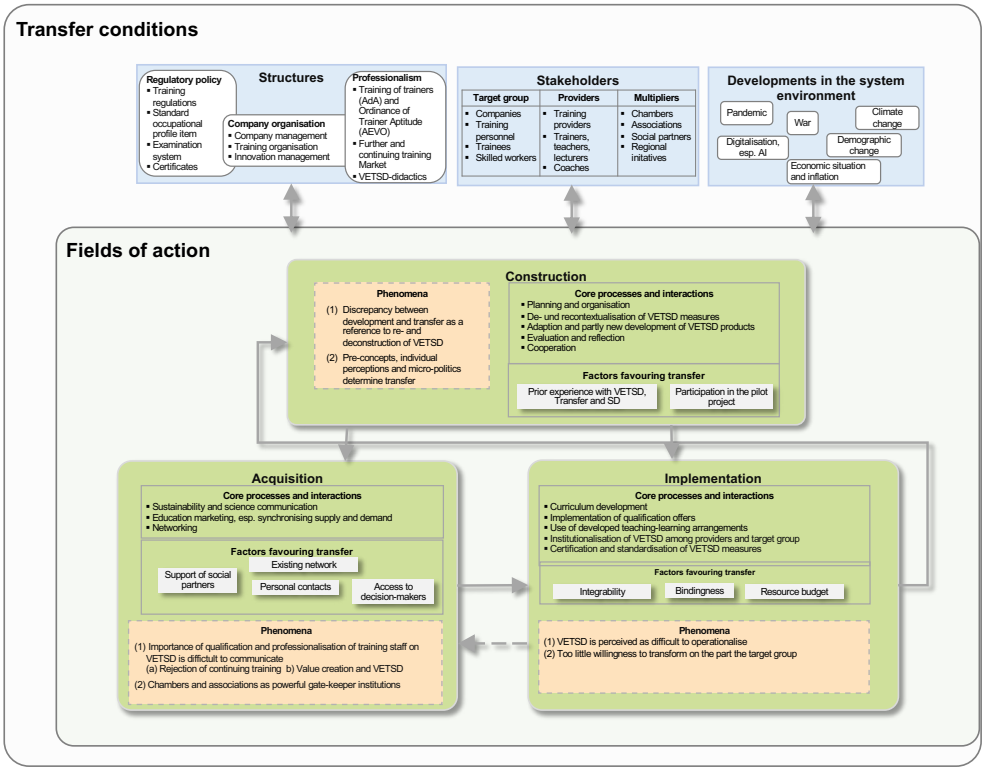
The funding programme „Vocational training for sustainable development in transfer for training personnel 2020–2022" is to be classified under this perspective: with funds from the Federal Ministry of Education and Research (BMBF), the Federal Institute for Vocational Education and Training (BIBB) has supported seven projects, each with a specific focus on a different occupational field, in order to move the results from a previous pilot phase (from 2015 to 2019) from „project to structure" (BIBB 2021, p. 4).

The previous VETSD pilot projects have shown that a scientific analysis of the complex, open and only partially calculable transfer processes is essential in order to offer the stakeholders in the pilot project research knowledge for orientation and action. Accordingly, the transfer conditions and experiences were systematically investigated in the above-mentioned funding programme. Furthermore, insights for future VETSD activities are to be gained (see Hemkes/Melzig 2021, p. 22).

Against this background, a study accompanying the project was prepared. By means of group discussions and individual interviews, the conditions for success, phenomena and challenges of the seven transfer projects were examined (see in more detail Schlömer et al. 2023, pp. 5ff.). The findings were brought together in the form of a transfer model (see Figure 1). The transfer model depicts the typical logic of the VETSD transfer projects in an aggregated form. It is intended to offer both a processual perspective on project implementation and to reveal systemic connections and problem areas of VETSD transfer. To this end, the model describes three fields of action with their core processes and interactions: the construction of VETSD transfer (1.), the acquisition of stakeholders (2.) and the implementation of VETSD measures (3.). On the one hand, for each of these three interconnected fields of action, factors that promote transfer can be named. On the other hand, it was possible to identify obstacles to transfer that cannot be expressed as individual factors but can be described as overarching phenomena. The three fields of action are influenced by

contextual conditions that result from regulatory, entrepreneurial and professional structures, from the constellations of stakeholders as well as from overarching influences of the social, ecological and economic environment of the transfer projects.

Figure 1: VETSD transfer model



Source: own illustration

3 Conclusions and recommendations for action

Three recommendations for action and further questions were derived from the work on the transfer model and are presented below. A more detailed presentation of the results can be found in the long version of the study (see Schlömer et al. 2023, pp. 7ff.).

I Expectations for the transfer of VETSD pilot project results

The model brings to mind the difficulties of transferring pilot projects results. At the same time, the model raises the familiar question of expectations of the output of pilot project research. It becomes clear that even extensively tested and documented learning materials, learning objects and module qualifications cannot be directly transferred to new contexts.

The empirical and socio-theoretical rationale for this is: transfer projects are independent social systems. They „function" on the basis of micro-political interests, established patterns of interaction and individual ideas of the stakeholders. VETSD is always newly constructed and (further) developed in transfer fields.

This shows the core yield of pilot projects and transfer projects: they operationalise visions of sustainable VET and reveal new ways of thinking that guide action for sustainable transformation in society, the economy and education.

It does not (yet) make sense to aim for a directly measurable output of pilot projects in terms of quantifiable changes in individual behaviour. For this, a more empirically-oriented pilot project research would be necessary. That would be helpful to counteract the criticism of the lack of theory building through pilot project research and the lack of evidence of VETSD pilot project results (see among others Beck 2015, pp. 57f.; Geiser 2022, p. 211).

The design-based research approach, which has been pushed for some years, could in principle contribute to the interlinking of development, innovation and empirical research in the context of pilot project research (see Sloane/Gössling 2014, p. 138; Slopinski 2022).

II Linking model experiment research and regulatory policy

The transfer projects have shown how much the implementation of VETSD depends on regulatory policy and curricula. With the standard occupational profile item „environmental protection and sustainability", the training regulations and framework curricula are to be expanded with VETSD learning content in the coming years. The extent to which this implementation succeeds depends on the stakeholders who modernise and reorganise the occupations, training regulations and curricula. The expertise from the pilot projects and transfer projects should be used to avoid developing curricula that fall behind the state of research.

There is also still an enormous need for action with regard to the training of trainers. For example, the transfer projects have strongly emphasised the particular importance of professionalising in-company training staff and strengthening their role as change agents in the companies. Trainers must be enabled to accept the relevance and challenges of complex and time-consuming search and learning processes in the context of VETSD. The existing structures of the training of trainers in Germany are not sufficient for this professional requirement.

III Institutionalisation of sustainability and science communication

A very large amount of resources was spent in the projects on sustainability communication and education marketing. The project stakeholders had to convince multipliers and gate-keepers such as chambers and associations of the importance of sustainable management and VETSD. The dissemination of the actual learning offers and thus the promotion of vocational competencies for sustainable management in the transfer projects were significantly impaired as a result. In many projects, there was a lack of resources at the end.

Therefore, the question arises as to how it might be possible to make VETSD accessible to decision-makers in the future.

One approach could be to cultivate the practice of discussion on sustainable management much more strongly than before. The guiding idea of sustainable management – including its contradictions and barriers – should be discussed and shaped in continuous and in-depth formats with business associations and companies. For this purpose, forums, workshops and continuous discussion groups are necessary in which the feasibility of VETSD is negotiated in a controversial, knowledge-based and open manner. Suitable formats and communication strategies could be explored through pilot project research. The effects of pilot project research can be measured, as indicated by Pütz (1995, p. 29) almost three decades ago (!). He pointed out that „pilot projects can be designed as objects of identification that can illustrate the educational visions of the state, associations and industry in a practical way".

Conclusion

The aforementioned fields of action relate to the implementation of sustainability in the German VET system with its specific regulatory instruments, educational cultures and, above all, dual training traditions. The specifics of the system may make direct exchange and comparison with other countries difficult, but, at the same time, they are essential. The principles of globality and retinity of sustainable development point to the need to promote cooperative pilot projects and working forums on science and practice of VETSD in the international arena much more strongly in the future than has been the case to date.

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Presha Ramsarup

Just transition: A call for a transformative approach to skills

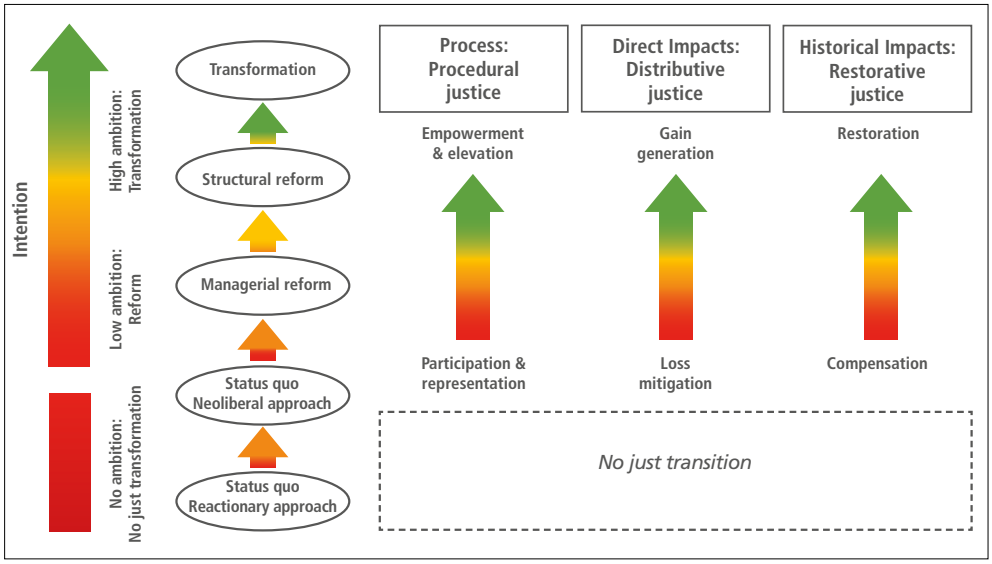
This brief paper argues that, in a context where VET approaches have been largely inadequate in responding to the multidimensional nature of the contemporary social and ecological sustainability crises, the expanding just transitions commitments will place new demands on VET to become more transformative. It hence highlights skills ecosystem as a useful place-based perspective that foregrounds context within skill development planning and helps to give attention to the history, social context, institutions and actors comprising the ecosystem, as well as the community and collaborative networks. This reframing, the paper argues, could provide VET with a transformative edge to rethink its role within a just transition.

Writing from the Global South, in the midst of an energy outage, gives a window into the types of problems we will face as the environmental crisis continues to take hold. The current global energy crisis has enabled insights into some of the critical fault lines in our economies and societies and has forced the recognition that environmental and social justice are intersecting struggles, and environmental issues have a direct impact on both economic growth and social wellbeing. Thus, making it clear that unless we act fast and decisively, environmental issues will exacerbate inequality, poverty and unemployment. Within this context, this brief discussion paper argues that emphasising the importance of justice to environmental, social and economic discourses has forced skills systems to address the challenges of altering the existing state of vocational education and training (VET) and hence prompts a rethink of skills to facilitate a green and just transition.

Before exploring the role of VET within the just transition, it is important to understand what we mean by the concept just transitions and how it is articulated in South Africa. Although it is argued that the concept of just transitions is problematically amorphous (see Wang/Lo 2021; Ramsarup et al. 2023), we see a growing recognition that the causes of environmental pollution are rooted in political, economic, and cultural inequalities. The environmental justice concept, hence, takes a more holistic view to identify who is affected, and in what ways and how to address those inequities. Consequently, in addition to its initial focus on the inequitable distribution of environmental risks, the elements of recognition and participation have been integrated into environmental justice advocacy as crucial demands (Wang & Lo, 2021). While some perspectives of just transitions focus on workers, in South Africa it has a much broader social and economic intent and is aiming at a new growth path towards uplifting society as a whole. Arguably the just transition literature has a strong normative framing but does, however, clearly point to how recognition and participation are not only 'crucial demands' but are also critical components of any conception of a just transition.

The just transition agenda in South Africa aims to bridge and address three dimensions of transitional justice, i. e. procedural justice, distributive justice and restorative justice, with a transformative agenda that overall integrates social, environmental and economic justice as represented in the figure below:

Figure 1: Dimension of a Just Transition



Source: Montmasson-Clair 2021

The figure shows three elements of what the just transition should achieve:

- Procedural justice focuses on the form. It aims at facilitating an inclusive process. It acknowledges and recognises vulnerable and/or marginalised groups by including them in decision-making processes.
- Distributive justice deals with the distribution of risks and responsibilities. Effectively, this focuses on addressing the direct impacts resulting from the transition process.
- Restorative justice considers past, present and future damages that have occurred against individuals, communities and the environment and provides a framework to rectify or ameliorate the situations of harmed or disenfranchised communities (see Montmasson-Clair 2021)

The just transitions framing provides a way to move beyond the jobs versus environment argument and intersects with the environmental, social and economic justice and climate justice movements to provide a broad framing that supports an expanded scale of considerations across economic, social and environmental dimensions. This envisaged transition is an ambitious one and will require a comprehensive policy mix. Simultaneously, this will

necessitate transversal engagement across the education and training system, as sustainability and energy practices are located in schooling, higher education, and occupationally directed training. In this rapidly changing context characterised by 'newness' and quick emergence, the education and training system generally has struggled to be responsive. While schooling and higher education has managed to catalyse some large-scale responses, vocational education has been much slower, reactive and ad hoc. This has created a landscape of fragmented interventions that are incoherent and fail to maximise their impact on implementing the just transition.

Understanding skills formation within the just transition

In this brief paper, I argue that the just transitions agenda needs an approach to skill formation that is not just an individualised activity. It needs to be viewed as a process embedded in a system. At a systemic level, skill formation for a just transition must be understood as a set of systems and sub-systems that are shaped by, and shape economies, institutions, and social relations. When referring to 'skill formation systems', the word 'skill' is shorthand for expertise that is used and developed at work and acquired through schools, formal vocational education institutions, universities, short courses, workplace-training, labour market demand for different types of qualifications and different forms of expertise, and so on. The 'skill formation system' is how these things fit together. Crucially, short term individualised approaches to skills formation will result in skills responses that are fragmented, sporadic, and lacking sustainability or longevity. To understand skills systemically, it is necessary to think about institutions, dynamics, and relationships. Institutions include internal systems, mechanisms, rules and institutional identity, practices, limitations, capabilities. These offer transformative niches to catalyse change in ecosystems.

In trying to develop an analytical framing to look at skills for a just transition, cognizant of addressing critiques of the individualistic fallacy embedded in skill responses, I attempted to examine an approach that focused on distributed agency that is needed across individuals, organisations and systems. I hence drew on constructs of skills ecosystems.

Skills ecosystems as a framework for thinking about skills for a green and just transition

The just transition raises the need for a much more nuanced investigation of skills actors, institutions and the dynamics between them. Skills ecosystems offer a useful way to understand regional or sectoral social formations in which skill is developed and deployed. Although the construct was originally used for productive purposes, today there are strong arguments for skills ecosystems that connect living, working and learning. As part of this approach, we draw on the work of Spours et al. (2019) to help us frame the nature of skills ecosystems that are essential for a green and just transition which "envisages bringing together a wide range of social partners around the relationship between working, living and learning" (see Hodgson/Spours 2018 p4; Spours 2019).

Spours argues that skills ecosystems have three key elements. First, facilitating verticalities, those policies and actors intended to support learning, living and working. These verticalities are often top-down and in the policy sphere. Second, collaborative horizontalities, the networks between various actors at the local level. Spours argues that individual VET institutions can only be strengthened effectively as part of wider networks. Third, mediation refers to the points of connection between these two dimensions by individuals and organisations. Skills are thus framed as a continuum between the vertical and horizontal domain and seen as a critical enabler to linking these distinctive elements of the skills ecosystem (see Spours 2019).

Spours argues further that social-ecosystemic skills planning leadership should be place-based and should involve capability to define the problem terrain, and the goal of inclusive, sustainable social, economic and educational development (Lotz-Sisitka 2020). Skills ecosystem as a place-based perspective foregrounds context within skill development planning. It helps us to give attention to the history, social context, institutions, and actors comprising the ecosystem, as well as the community and collaborative networks. Hence, skills ecosystems thinking brings relationality centre stage and provides a useful lens to investigate and explore relational dynamics with the skills ecosystem. It asks us to think about how these dimensions are connected to policy and government structures. Skills ecosystem thinking encapsulates much of our thinking about the necessity of going beyond productivist notions of skills for work and the economy to thinking more sustainably and holistically about reimagining the purpose and functioning of VET towards just transitions.

Drawing from these ecosystemic ideas, we tried to understand how sustainability was being enacted within VET systems. We conducted a review of approximately 40 sustainability programmes in VET located in Europe, United Kingdom, Africa, Asia. In this review we found that there were many interesting initiatives but very few were thinking or framed systemically. Many were framed to examine specific moving parts of the VET system in isolation from the broader factors that shape them. We found in the review that there are currently four dominant approaches to sustainability interventions evident within VET:

- *institutional greening responses* that included elements like greening campus, curriculum, community, research, culture;
- introduction of *short courses focused around an 'employable skill'*—e. g. install, repair and maintain solar geysers, qualifications not focused around an occupation;
- integration of *generic 'green' skills into traditional TVET programmes*—examine a sector like hospitality and integrate the generic sustainability skills and knowledge that industry will require;
- *integration of training packages* (whole qualification on Renewable Energy Technologies) *into colleges' curricula*, focusing on the inclusion of a targeted 'green' training programme, which included curriculum packages, training of lecturers, running programmes.

This shows that the overwhelming response reflects 'bolt-on' interventions (see Sterling 2004, p. 58–59), which amounts to a 'bolt-on' of sustainability ideas to the existing system,

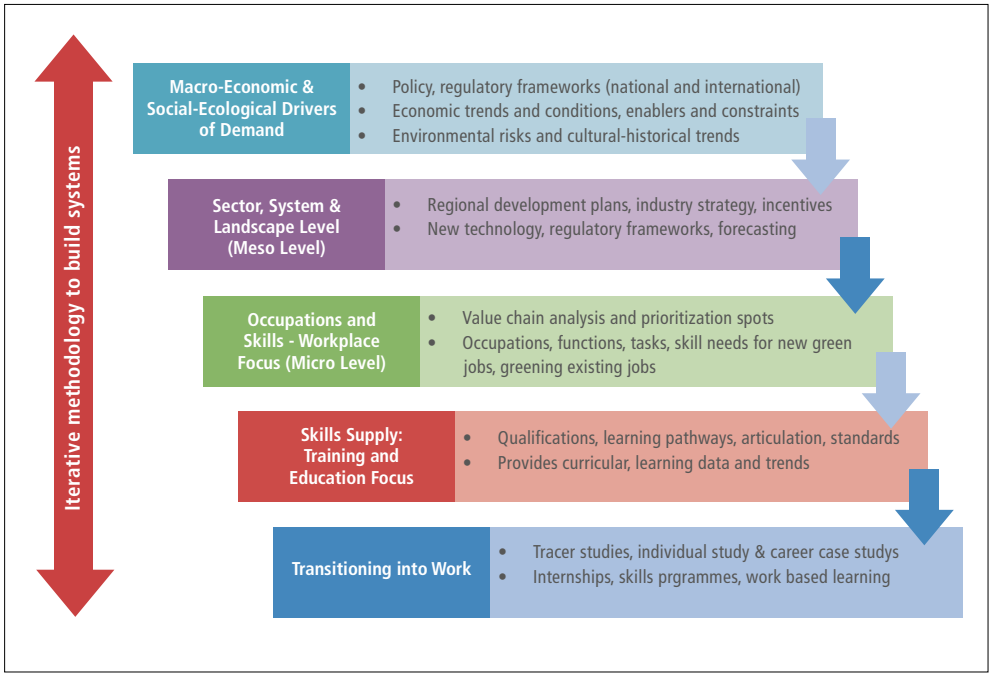
while the system itself remains largely unchanged. Very far from a whole systems approach, these 'bolt-on' approaches are resulting in a fragmented landscape of sustainability interventions within VET that do not cohere.

What does this then mean for VET?

The VET 4.0 Africa Collective argues that taking the sustainability challenge seriously means disrupting conventional VET assumptions about VET skills for sustainability (see VET 4.0 AFRICA COLLECTIVE 2023). It suggests that VET needs to begin addressing questions of how vocational learning can "promote decent work that contributes both to sustainable livelihoods for individuals and communities, and to wider efforts to restructure work and economic activities so that we live within our planetary boundaries" (MCGRATH 2020, p. 8). Furthermore, the directionality of the 'Just Transition', which seeks to ensure distributive, reparative and justice participative in and through VET, indicates that we need a more radical/disruptive whole system approach rather than the fragmented approach that is currently evident within VET.

Drawing on our experiences in South Africa, we have seen that a multi-level, systemic response is needed for skilling for a just transition (certainly WAY beyond individualist notions of training individuals). It also requires a multi-scalar, iterative and relational approach methodology that combines micro and macro perspectives into building coherent system-wide knowledge that is inter-generational and involves multi-actor processes that engage actors in unpredictable ways from all sectors (public, private, non-profit). The figure below shows some of the levels that should be incorporated in a systematic analysis to support the demand, the development and utilisation of skills that need to be investigated to understand skills for just transitions within VET. This illustrates a more substantive approach, a methodology that enables a view of multi-level, multi-stakeholder skill development dynamics that enables us to connect macro and micro data and study them as analytically separate but systemically whole while acknowledging that they represent different layers of empirical reality.

Figure 2: Multi-level considerations for surfacing skills for just transitions



Source: Own elaboration

Conclusion

This brief paper has argued that a transformed VET sector that is inclusive and oriented towards sustainability cannot be built by separate actors or institutions in isolation. The need for regional horizontal connectivity between VET institutions, universities, NGOs, business foundations, youth organisations and other societal actors is pivotal. Furthermore, just transitions requires VET to interrogate the truth-claims and normative assumptions on which VET resides as a prelude to re-imagining itself for alternative futures and what can be construed as a just social, economic and ecological transition. I leave you with two thoughts from David Orr, who argues "the skills, aptitudes, and attitudes necessary to industrialize the earth are not necessarily the same as those that will be needed to heal the earth or to build durable economies and good communities" (ORR 1994, p.1), and as we work at trying to profile sustainability in VET, Orr describes the plight as walking north on a south-bound train. The train of economic globalisation, he argues, is barrelling south and the advocates of sustainability in VET are taking small steps to create a more humane, just and sustainable path. But as we walk north, we are still passengers of this accelerating train moving in the opposite direction.

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Precious Lisulo

Sustainability as a driver for transformation in vocational education and training

This article discusses key drivers and challenges associated with integrating sustainability into Vocational Education and Training (VET), including curriculum development, teacher training, industry engagement, and policy frameworks. Further, the role of VET in supporting sustainable development goals (SDGs) and addressing global challenges related to climate change, resource depletion, and social inequality is discussed. In conclusion, the article advocates for a transformative approach to VET that places sustainability at its core, ensuring that future generations of workers are equipped with the knowledge, skills, and values necessary to contribute to a more sustainable and equitable society. Lastly, the national digital transformation strategy is discussed as an emerging technology.

1 Introduction

In recent years, the concept of sustainability has gained significant traction across various sectors, from business and industry to policy-making and education. As the world grapples with pressing environmental, social, and economic challenges, there is a growing recognition of the need to adopt sustainable practices and promote sustainable development at all levels. According to McGrath/Russon, they indicate that 'within the realm of education, particularly VET, sustainability has emerged as a powerful driver for transformation, shaping the way we prepare individuals for the workforce and equip them with the skills and knowledge needed to thrive in a rapidly changing global landscape' (2023, p. 4).

The traditional role of VET has been to provide learners with technical skills and competencies relevant to specific industries. However, the increasing emphasis on sustainability has expanded the scope of VET to include broader considerations such as environmental stewardship, social responsibility, and ethical business practices (cf. Australia Ministerial Council for Vocational and Technical Education 2009). This shift reflects a broader societal awareness of the interconnectedness between human activities and the health of our planet, as well as the recognition of the role that VET can play in fostering sustainable development.

The integration of sustainable development into VET in Zambia has been a priority for the Government through the Ministry of Technology and Science (MoTS). In Zambia, artificial intelligence, digital transformation, new technologies, and innovation are expected to play a significant role in ensuring sustainability through Technical and Vocational Education and Training (TVET). The MoTS is implementing various programmes to address these issues. Entrepreneurship training has been introduced in TVET institutions since 1996 to

address the shrinking formal sector. Sustainable development is a vision of education that balances human and economic well-being with cultural traditions and respect for Earth's natural resources (cf. Mutono 2008).

This article seeks to explore the multifaceted relationship between sustainability and VET, examining how sustainability principles are being integrated into VET systems, the challenges and opportunities associated with this integration, and the potential impact on learners, educators, industries, and society as a whole. By delving into case studies, best practices, and emerging trends, we aim to shed light on the transformative potential of sustainability in shaping the future of vocational education and training.

In responding to the topic at hand, skills development and job creation is critical for the transformation into sustainable economic growth of a nation. To attain economic transformation and productivity of our youth, technological advancement such as digitalisation and artificial intelligence are of great significance and require a robust curriculum development and review to respond to the changing needs of the sector. At the national level, Zambia has also realized the importance of Technical Education, Vocational and Entrepreneurship Training (TEVET) as the vehicle to address youth unemployment and contribute to economic development and productivity, which will ultimately result in achieving the Vision 2030 of being a prosperous middle-income country. TVET denotes the system that was earlier used before the incorporation of Entrepreneurship to make TEVET in Zambia.

1.1 Definition of sustainable development

"Sustainable Development is an organizing principle that aims to meet human development goals while also enabling natural systems to provide necessary natural resources and ecosystem services to humans" (Emas 1987, p. 2). The four main types of sustainability are human, social, economic and environmental.

The four (4) training institutions mentioned in this article premised sustainable development from the perspective of training human capital and having entrepreneurship courses and other related hands-on activities in their respective institutions to enable sustainability of the future. However, it was clear from the element of cooperation with entities like Germany Agency for International Cooperation (GIZ) that environmental, social, human, economic and technological issues that focus on national development goals were being implemented in the training programmes offered at the institutional level.

2 Background

The Zambian Government has intentionally set out to develop pro poor policies and national budgets since the formulation of the 8NDP (Eighth National Development Plan)[1]. To this effect, the Government is committed to increasing spending to education and skills development, health, social protection, agriculture and rural infrastructure. This will be done through increased allocation and fiscal decentralisation to districts.

1 https://www.sh.gov.zm/wp-content/uploads/2022/09/SUMMARY-8NDP-26.08.22-1.pdf

There have been initiatives to enhance skills development and vocational training in Zambia. The Government has implemented programmes to promote TEVET to equip individuals with practical skills for employment. These efforts aim to bridge the skills gap and promote economic growth.

The Government commits to improve vocational skills by investing in TEVET institutions which plans to increase the annual enrolment from the current 46,537 learners in 2023 to 60,000 learners by 2030. Technical education and vocational skills lead to improved employability. When young people have access to high-quality technical education and vocational skills training, they are more likely to develop the skills and knowledge needed to succeed in the job market.

To enhance youth employability, the Government commits to developing legislation on Work Based Learning. The envisaged legislation is aimed at facilitating acquisition of skills and experience in order to enhance youth employability. Zambia is committed to enhancing labour productivity. To this effect, the Government committed to developing the National Productivity Policy in 2020 to provide a comprehensive mechanism/legislation for improving productivity by enhancing competitiveness, promoting decent employment and accelerating inclusive economic development.

Job creation leads to improved economic outcomes. When new jobs are created, individuals have more opportunities to earn income and contribute to the economy. This can lead to improved economic outcomes, such as increased GDP, reduced poverty, and greater economic stability.

3 Integration of sustainable development in VET

The integration of sustainable development into TEVET is a subject that has been on the agenda of the MoTS, as well as the Government of the Republic of Zambia at large. On the global level, it's a subject that has been on the agenda of various organisations including the UNESCO for over a decade.

To underscore the importance and drive towards aligning sustainable development to TEVET, the Second International Congress on TVET held in 1999, in Seoul, South Korea, drew attention for the need to re-orienting TVET to include the subject of sustainability (cf. UNESCO 2022).

Being an agent for change, TEVET conveys various competencies for transformation. In the context of Zambia, it is in this transformation where it is hoped that issues of artificial intelligence, digital transformation, new technologies and innovation would play a huge role towards ensuring sustainability through TEVET. In addressing these and related issues, the MoTS in Zambia is implementing various programmes as intervention towards the major areas highlighted above.

Efforts to embed sustainability of TVET in Zambia stems from the introduction of entrepreneurship training in the TEVET Policy in Zambia. Entrepreneurship training has been offered in TVET institutions in Zambia since 1996. It was introduced in order to meet the challenges of a shrinking formal sector. Entrepreneurship is the process whereby an indi-

vidual or group uses organised efforts and means to pursue opportunities to create value and growth by fulfilling wants and needs through innovation and uniqueness, no matter what resources are currently controlled (cf. Robbins/Coulter 2004, p. 43). In pursuing entrepreneurship, issues of digitalisation, technology and innovation, and the environment are brought to light. Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment so that those needs can be met not only in the present but also by future generations.

UNESCO defines Educational Sustainable Development (ESD) as a "vision of education that seeks to balance human and economic well-being with cultural traditions and respect for Earth's natural resources" (McGrath/Russon 2023, p. 3). Zambia places great value on TEVET as a driver for national development. As such, even though students need to acquire skills to earn an income and run a profitable enterprise, this should be done in a way that takes into consideration the well-being of present and future societies. Sustainable development has been made one of the priority national programmes within Government Ministries, some of whom have taken a leading role such as Finance and National Planning, Foreign Affairs, Tourism and Arts, Technology and Science and Environment and Natural Resources.

In order to illustrate the situation analysis as regards the subject matter, a study was undertaken with the perspective of the practice of VET in Zambia. It refers to situation analysis at four (4) institutions in Zambia reflecting their tilt and aspirations towards adopting TEVET as a driver to achieve sustainable development. The four institutions include; the Technical Education, Vocational and Entrepreneurship Training Authority (TEVETA), Evelyn Hone College in Lusaka, Lusaka Business and Technology College (LBTC) in Lusaka and St Mawaggali Trades Training Institute (SMTTI) in Choma. The details of their aspirations in addressing the thematic areas are illustrated in the results section.

4 Methodology

The study used interviews and literature reviews to collect data. Three college principals and the Director General of TEVETA were interviewed. The institutional leaders interviewed were from the following institutions:

- Evelyn Hone College – Principal;
- Lusaka Business and Technical College – Principal;
- St Mawaggali Trades Training Institute – Principal; and
- TEVETA – Director General

4.1 Data collection

Data was collected through interviews, both face-to-face and electronically, from the four representatives of the institutions, as stated above. Three of the institutions are public institutions delivering TEVET in Zambia. The fourth (TEVETA) is a regulator and developer

of curriculum in Zambia. The questions were designed to inform the definition of sustainable development, to assess the inclusiveness of sustainable development in the delivery systems of the respective institutions, to assess the degree of awareness and understanding of new technologies in a dynamic global environment. The interviews were designed to gather data as it related to the definition of sustainable development, relevance of sustainable development in TEVET systems, integration of sustainable development and barriers/challenges to establishing sustainable development-based tilt. Further, the questions tilted towards situation analyses with regard to implementation of sustainability towards the attainment of National Development Goals.

4.2 Data analysis

The responses given to the thematic questions were meant to establish common and different responses to understanding, relevance, reference and implementation of sustainable VET systems. The various barriers/challenges were analysed to give a situation analysis of each stakeholder.

5 Results

The findings showed about the current perspectives with regard to comprehending TEVET as a key driver to effecting sustainability. For ease of approach, the findings discussed were structured according to four sub areas as illustrated in the data collection.

5.1 Digitalisation

The Evelyn Hone College of Applied Arts and Commerce has developed a student Management Information System (MIS) which they have rolled out to facilitate student management. The system has several modules, including a module for library management. This development is intended to address the shift towards the attainment of digitalisation of the learning platforms and reducing the use of paper, thereby positively impacting the environment. This is the aspect of TEVET contributing to sustainable development. Further, one of their graduates has set up a diagnostic centre, Med-Point Medical Centre, which shares an electronic interface with a number of hospitals in his local area. The centre provides a digital platform for medical intervention.

The study established that TEVETA as regulator of TEVET in the sector has signed a memorandum of understanding with the United Nations Capital Development Fund (UNCDF) 2022 to 2023 to start the process of providing support for digital skills. This will entail the production of digital skills curricula and its implementation. These skills would then address thematic areas such as digital marketing.

5.2 Digital Transformation

At the level of government, a digital strategy is being embarked upon. The strategy has taken into account digital technologies as means by which developing countries can leapfrog

development stages to achieve both economic growth and sustainable, inclusive development. The use of these technologies can improve service delivery, unlock new opportunities for job and wealth creation, enhance accountability and transparency, and assist with generating data to drive responsive and evidence-based policy and strategy formulation and thus contribute to enhanced productivity and growth. One of the pillars in implementing this strategy is skills development and transfer. As such, the skills transfer will be done through the TEVET training institutions (cf. Ministry of Technology and Science 2023, p. 7).

5.3 New technologies and sustainable development

In this area, the study established that there is a drive towards the use of new technologies as they address environmental and sustainability issues. These efforts are set towards the provision of or creation of sustainable jobs as environmental changes take effect. New technologies and skills will have to be imparted so that people do not lose jobs as a result of environmental changes. To this end, for example, TEVETA is expected to develop tailour-made programmes to keep human capital relevant.

5.4 Climate change resilience

At St Mawaggali Trades Training Institute and Lusaka Business and Technology College, with support of GIZ, the institutions have embarked on solar technology training. This is an area that addresses sustainability with regard to the energy mix. Graduates on these programmes could either join the formal sector or set up entrepreneurship activities in the informal sector. It was also observed from TEVETA that skills awards are now being elevated to provide smart skills in areas such as agriculture, tourism, hospitality and construction programmes. These are skills that will drive sustainability.

On the side of the environment, the study established that there are efforts towards protecting the environment. At St Mawaggali, for example, with the support of GIZ, a bio-digester programme has been established. This is sustainable development drive that will ensure that relevant skills are delivered towards the production of alternative energy.

6 Barriers to integrating sustainable development

6.1 Lack of awareness and understanding

One of the primary barriers is a general lack of awareness and understanding among educators, policymakers, and stakeholders about the importance and benefits of integrating sustainable development into education. This can lead to resistance or indifference towards incorporating sustainability principles into curricula and educational practices.

6.2 Complexity and Inter-disciplinarity

Sustainable development is a complex and inter-disciplinary concept that encompasses environmental, social, economic dimensions. Integrating these aspects into educational frameworks requires a holistic approach, which can be challenging to implement within traditional educational structures that are often siloed by subject areas.

6.3 Inadequate training and capacity building

Educators may lack the necessary training skills and resources to effectively integrate sustainable development into their teaching practices. Professional development opportunities focused on sustainability education are often limited, leading to a skills gap among teachers and instructors.

6.4 Curriculum constraints

Existing curricula may be rigid and focused on traditional subject matter, making it difficult to incorporate new topics related to sustainable development. Curriculum frameworks and standards may not explicitly include sustainability as a core component, resulting in limited opportunities for its integration.

6.5 Resource constraints

Limited financial resources, access to updated teaching materials, and infrastructure can hinder efforts to integrate educational sustainable development. Schools and educational institutions may struggle to procure sustainable technology, equipment, and resources needed for hands-on learning experiences.

6.6 Assessment and accountability

Traditional assessment methods may not adequately measure students' understanding of sustainability concepts or their ability to apply sustainable practices. The lack of standardized assessments and accountability measures related to sustainability education can undermine its prioritisation within educational systems.

6.7 Resistance to change

Resistance to change from various stakeholders, including parents, administrators, and policymakers, can be a significant barrier to integrating educational sustainable development. Concerns about added workload, perceived ideological biases, or conflicting priorities may hinder progress in this area.

6.8 Limited policy support

The absence of clear policies, guidelines, and incentives to promote educational sustainable development can impede progress. Without supportive policy frameworks at the national,

regional, and institutional levels, efforts to integrate sustainability into education may lack direction and sustainability (cf. Dawe/Juncker/Stephen 2005, p. 5).

Addressing these challenges requires a coordinated effort involving government agencies, educational institutions, industry partners, civil society organisations, and development partners. Strategies such as curriculum reform, capacity building for educators, increased industry collaboration, investment in infrastructure and technology, and raising awareness about the benefits of sustainability in VET, can contribute to overcoming these challenges and promoting sustainable development in Zambia's vocational education and training sector.

7 Discussion of results

From the findings it was clear that the training institutions focus on sustainable development mainly through human capital development. This is done through provision of skills development with the element of entrepreneurship training to comprehend the value and importance of TEVET as a driver of sustainable development. It was equally evident that with the support of international organisation, there is a clear drive towards tilting TEVET towards sustainable development-based skills. At the national level, the Government of the Republic of Zambia is equal to the task, towards ensuring that TEVET drives skills that will transform the development agenda to include digitalisation, new technologies and environmental sustainability. The barriers identified need a consented effort to address them. Given the will and zeal demonstrated, it can be concluded that TEVET can and will be the key driver towards sustainable development in Zambia.

8 Conclusion

Given the discussion, there is need to heighten the sensitisation of sustainable development across the country, but with particular emphasis to the TEVET value chain. It is further very clear that sustainable development through TEVET is a very relevant subject. There remains therefore a call to policymakers and regulators to foster this understanding and challenge. Without doubt the TEVET value chain is the most effective for delivering sustainable development. This is largely because TEVET hinges on capacity building among the most technical cadre of learners. Further, TEVET is well placed to anchor new technologies and smart skills. There has to be therefore a deliberate effort to enhance steps to ensure that TEVET be the main carrier. The barriers identified can be overcome. We therefore need to be intentional in ensuring that steps are taken to address the barriers.

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Hannelore Kress

Uzbekistan – Bridge country on a CO_2-neutral path

Uzbekistan experienced impressive economic growth for years. This led to environmental problems such as soil salinisation, high methane emissions and air pollution. Since the change of power in 2016, the country opened up to foreign investment and has since been striving for a „green economy". With the ratification of the Paris Agreement in 2018, ambitious targets are implemented to reduce greenhouse gas emissions and decrease pollution. To realize the transformation to a green economy, Uzbekistan is investing massively in education and skilled workforce training.

Background

In recent decades, Uzbekistan's remarkable economic growth has been fueled by resource extraction, intensive agriculture as well as mining, and industrial manufacturing. But this progress has come at a high ecological price. Besides agricultural products, mineral energy sources as rare earths and precious metals such as gold, silver, molybdenum[1] are of great importance. The opening of the country towards its neighbours and newer allies has attracted more foreign direct investment, mainly from Russia, China, Germany, Turkey, the USA and South Korea (see Norkulov 2023). This led to a great demand of qualified skilled workers as an important indicator for the settlement of manufacturing companies.

With 36.1 million inhabitants, Uzbekistan has the largest population in Central Asia with a growing trend. Of these, around 15% are between 15 and 24 years old and 49.6% between 25 and 64 years old[2]. In 2022,13.7 million people were officially employed (67.2%). Of all those employed, slightly less than half worked in the formal sector and just under two-fifths in the informal sector. About 2 million earn their money as migrant workers abroad, mainly in Russia and Kazakhstan. The agricultural sector provides most of the jobs in Uzbekistan, officially employing about 3.4 million people and unofficially about 4 million. The official unemployment rate of 8.9% in 2022 is measured by the more than 1.3 million people who officially registered for job placement during the year[3]. Nationwide, however, the real unemployment rate could be as high as 30 %, with rural regions more affected than cities.

A radical transformation into an efficient, resource-conserving and environmentally compatible economy is linked to major challenges. The demand for resources is enormous.

1 Possible transistor material for microchips.

2 See **http://stat.uz/en/official-statistics/demography** (Retrieved on 31.07.2023).

3 See **https://stat.uz/en/official-statistics/labor-market** (Retrieved on 01.08.2023), Skills Development in Uzbekistan, ADB, 2022.

And yet, post-Soviet practices of planned economy and protectionism persist. The far-reaching reform of the state apparatus with the opening of the economy since 2016 is slowly but steadily taking effect. This path, also recognised internationally, points to stabilisation and development oriented towards sustainability.

Environment – framework

Like the other countries of Central Asia, Uzbekistan is highly exposed to climate change, which threatens the natural capital, agriculture, soil and water productivity and exacerbates the risk of natural disasters. The country ranks 72nd out of 185 countries in climate vulnerability according to the Notre Dame Global Adaptation Initiative (ND-GAIN) in 2021[4]. It is also exposed to earthquakes and floods, which affect around 1.4 million people and cause nearly $3 billion in damages each year. At the same time, severe water scarcity and land degradation threaten agricultural productivity and food security.[5]

The main sources of air pollution in Uzbekistan are metallurgy, the energy industry, the building materials industry, the oil and gas industry, broken pipelines and pipe systems, mining, and road transport. Anthropogenic activities have led to the accumulation of billions of tonnes of industrial waste as well as domestic solid waste, often stored in low-grade landfills, dumps and sludge repositories[6].

Green economy – the conversion

The change against the backdrop of this ecological reality came with Shavkat Mirziyoyev, who succeeded the founder of the state, Islom Karimov, who died in 2016. While still coming from the old state apparatus, he has since been following the transforming the country into a green economic powerhouse.

For example, the Republic of Uzbekistan ratified the Paris Agreement[7] in 2018, in which the country committed to making a nationally determined contribution (NDC[8]) to its implementation and to reducing greenhouse gas emissions per unit of GDP by 10% of 2010 levels by 2030. At the COP26 meeting[9] in November 2021, Uzbekistan increased its share by 35%.[10]

4 See Rankings **https://gain.nd.edu/our-work/country-index/rankings** (Retrieved on 20.06.2023).

5 Ibid.

6 See Uzbekistan energy profile **https://www.iea.org/reports/uzbekistan-energy-profile** (Retrieved on 30.07.23.

7 See **https://unfccc.int/process-and-meetings/the-paris-agreement** (Retrieved on 26.03.2024).

8 Nationally Determined Contributions. These are the nationally determined contributions that each country submits under the Paris Agreement to reduce greenhouse gas emissions and adapt to climate change. The NDCs are intended to help limit global warming to below 2 degrees Celsius.

9 COP is the United Nations Framework Convention on Climate Change, 26th Conference of the Parties.

10 See **https://climatepromise.undp.org/news-and-stories/people-and-government-uzbekistan-take-action-confront-climate-crisis-collectively** (Retrieved on 26.03.2024).

Five basic priorities were already set from 2017 to 2021[11], some of which can be seen as a withdrawal from previous policies, such as liberalisation of the economy and protection of private property (see Schmitz 2020). The Decree of the President of the Republic of Uzbekistan of 4 October 2019, No. PD-4477, kicked off the strategy, at the end of which should be a "green Uzbek economy" in 2030 (see Decree, No. PD-4477). In addition, Uzbekistan joined the global initiative "Global Methane Pledge". It aims for countries to collectively reduce methane emissions by at least 30% by 2030 compared to 2020[12]. In addition, the Decree of the President of the Republic of Uzbekistan of 2 December 2022, no. PP-436, set the strategic roadmap and action plan for the transition to a "green" economy (ensuring "green" growth Resolution of the President of the Republic of Uzbekistan: "About measures for increase in efficiency of the reforms directed to transition of the Republic of Uzbekistan to "green" economy till 2030"[13]). Uzbekistan wants to prove that these are not just declarations of intent by having its ecological milestones and successes measured. Uzbekistan introduced the GGI framework, Green Growth Indicators[14]. It offers G20 and OSCE countries to monitor progress towards green growth since 2023.

Green economy – measures

The overarching goal of the country's strategy is to achieve middle-income status by 2030 and to reduce poverty by half by 2026. Consistent human capital development, improving vocational training and access to quality pre-school care[15] are basic prerequisites for this. Thus, at least 300,000 skilled workers are needed to implement the ambitious ecological goals. According to the Uzbekistan Statistical Agency, more than 500,000 workers and especially young people with academic education are available annually in 2022[16]. How to mobilise and train young people to consider a non-academic career is one of the major infrastructural projects.

11 Democratic reforms and further strengthening of the role of parliaments and political parties, reform of the system of public administration, etc.
1. Ensure the rule of law and further reform the judicial and legal system;
2. Development and liberalisation of the economy;
3. Securing employment for the population, especially the young, social protection and the improvement of science, education, culture and sport;
4. Ensuring security, national harmony and religious tolerance, see **https://strategy.uz** (Retrieved on 27.07.2023).

12 See **https://www.globalmethanepledge.org** (Retrieved on 03.07.2023).

13 See **https://cis-legislation.com** (Retrieved on 03.08.2023).

14 See **https://gggi.org/country/uzbekistan** (Retrieved on 03.08.2023).

15 Whereas in 2012 only 23% of children in Uzbekistan attended preschool, and in rural areas the figure was as low as 8.5 percent, in 2020, it is over 60% of Uzbek children. The enrolment rate of 6-year-olds in one-year preschool reached 83.7% in September 2022.

16 See **https://stat.uz/en/official-statistics/labor-market** (Retrieved on 01.08.2023); Zhukov 2022. URL: **https://www.adb.org/sites/default/files/institutional-document/859636/skills-development-uzbekistan-sector-assessment.pdf** (Retrieved on 01.08.2023).

Legal frameworks have been created to support projects with their implementation as public-private partnerships. For example, more than 20 solar and wind energy projects will create a capacity of 10.75 GigaWatts with a volume of 9.5 billion US dollars. By 2030, together with hydro energy, more than 5,000 jobs will be created and more than 16 million tonnes of CO_2 will be saved[17] (see Mirzamakhmudov 2023). Germany is particularly involved in solar, wind and water projects, the construction of storage facilities and carbon and fertiliser production. Other large-scale projects include the construction of huge greenhouses covering several hectares. Here, vegetables and fruit, especially strawberry and melon products, are to be grown and processed for export. Development in food technology focuses on: production of animal feed, bioproteins, pectin, baby food and natural food colours. In further large-scale projects, local value creation is to be promoted with the production of electric motors, aluminum cans, PVC and soda (see Mirzamakhmudov 2023). Also traditional industries are in transition to more sustainable production as the textile industry. It remains an important industrial sector that wants to maintain its position on the global market by producing modern fibres and fabrics and adding value within the country. Since 2021, domestic companies have been processing the entire production of cotton fibres; in comparison, it was only 40% in 2016[18]. For a long time, the country was on the boycott lists of leading textile manufacturers due to child labour in the cotton harvest until well into the 2000s. In its monitoring report, the ILO certifies that Uzbekistan's cotton harvest is now free of child and forced labour[19]. The sector continues to grow and needs skilled workers.

Although the younger population is open to new technologies, a high hidden unemployment, on the one side, and a shortage of skilled workers, on the other, in complex, technologically-oriented sectors remain. For example, an ICT- service hub is being established to provide programming and software development for other countries; to attract more young people to these jobs, a better transition from school is being promoted. Especially girls and young women are promoted in STEM/subjects[20].

Green economy – education system

As in other countries several ministries and state institutions play a role in the management, financing and provision of VET. Under the overall coordination of the Cabinet of Ministers,

17 "By 2026, the power system capacity is expected to reach 27,400 MW, of which 16,600 MW are thermal power plants, 2,834 MW hydroelectric power plants, and 8,000 MW solar and wind power capacity. By 2030, additional energy capacity is planned to include and reach a total capacity of 7,000 MW solar, 3,400 MW hydro, and 5,000 MW wind", Mirzamakhmudov Minister of Energy in Usbekistan. See **https://www.beyondinvestmentsgroup.com/uzbekistan2023-jurabekmirzamakhmudov** (Retrieved on 28.08.2023).

18 See **https://www.gtai.de/de/trade/usbekistan-wirtschaft** (Retrieved on 25.07.2023).

19 The Cotton Campaign is a coalition of non-governmental human rights organisations, independent trade unions, brand associations, responsible investors and academics working to end forced labour in cotton production, see **https://www.gesamtmasche.de/news/usbekische-baumwolle-sieg-uber-kinder-und-zwangsarbeit/** (Retrieved on 25.07.2023). Meanwhile, the ILO is encouraging international manufacturers to get involved in the country, as Uzbekistan is now seen as a sustainable sourcing alternative to China.

20 See **www.unicef.org/topics/uzbekistan** (Retrieved on 29.07.2023).

three ministries are responsible for the public education system: the Ministry of Pre-school Education (MPE), the Ministry of Public Education (MoPE) and the Ministry of Higher and Secondary Specialised Education (MoHSSE). The Presidential Decree of 21.09.2018, No. EP-5544 provides for the building of the education system and development of human capital, among others, as follows:

- Further improve the quality of education in institutions by introducing new instructional programmes;
- Modern pedagogical and intelligent didactics and methodology in the educational process;
- Develop inclusive education with the creation of a "barrier-free environment";
- Establish a national system for assessing the quality of education, with implications for the country's level of innovative development and monitoring the results of the education process at regional and national levels;
- Organisation of short-term training in vocational schools for young people in need of retraining, considering labour market trends[21]

In accordance with the Decree of the President of the Republic of Uzbekistan "On additional measures to further improve the vocational education system" dated September 6, 2019 (No. UP-5812. No.-5812),[22] vocational education is part of the 11-year compulsory education for 9th grade graduates. The legislation allows students to continue their education after the 9th grade either in high schools or vocational schools corresponding to ISCED level 3 programmes. The education policy emphasises the permeability of the system and the nationwide activation of stakeholders to work on the implementation of the reform and the increase of quality. Thus, on 31 December 2020, the Cabinet of Ministers adopted a decree on qualifications and skills development (see Resolution, 31.12.2020 No. PP-4939). This established 33 councils on areas of qualifications. These councils are responsible for contributing to VET programmes in their area(s) of competence, setting their own qualifications frameworks and aligning these with the national framework set by the National Qualifications Council of the Ministry of Labour. Under Decree 2020, the Ministry of Labour and the Sector Skills Councils (SSCs) planned to develop 957 new TVET occupations.

As a further priority, Uzbekistan, like some other countries, introduced a dual option for vocational education and training by Cabinet Decision (No. 163 of 29.03.2021). The state wants to expand precisely this option because of the urgent skilled labour problem, even though there are yet no references to "green content". So far, about 6,000 young people are learning and working in the practice-oriented training in the service, industry and construction sectors. Quickly, the 56 training courses are to become 100 with about 9,000 further trained teachers working in the context of the EQVET[23] framework (see Abdurakhmonov 2023).

21 See **https://nrm.uz/** (Retrieved on 20.07.2023).

22 See **https://lex.uz/ru/docs/4500929** (Retrieved on 26.03.2024).

23 EQVET means the European Quality Assurance Reference Framework for Vocational Education and Training.

A network of educational institutions of three types of schools relevant to the VET system includes: 330 "basic vocational schools" (195,371 students), "170 colleges" (105,228 students) and 204 "technicums" (168,681 students) (see European Training Foundation 2021). However, the schools are often only used up to 50% of their capacity; the image of VET still needs to be improved. Increasingly, vocational training centres ("Ishga Markhamat") are also being set up in the Mahalla neighbourhood communities (lowest level of local government); capacities are far from exhausted[24].

In general, regional vocational training councils decide which vocational profiles should be trained. The council consists of representatives of the regional economy, chambers of commerce and agriculture and higher-level authorities. It is also supposed to take over a coordinating function for practical in-company training (see Abdurakhmonov 2023).

Officials have recognised that the country can only make the leap into the "green" economy through consistent training of skilled workers. Accordingly, for some time now this has also included the retraining of staff and their better pay as well as equal status with lecturers at universities. Thus, curricula in relevant areas of higher and secondary technical education are being improved or completely rewritten taking into account the fundamentals of the "green" economy, e. g. materials on the introduction of renewable energy sources, the development of a "clean" economy and energy-saving targets. Training curricula and textbooks for general secondary education, higher, technical secondary education are updated. Contents include topics like, "Green technologies", "Basics of ecological standardisation taking into account sustainable criteria", "Technologies of renewable energy sources", "Problems of energy saving and energy efficiency"; support for scientific research and innovative developments in the field of "green" technologies (see Decree, 4.10.2019, No. PP-4477b, item 19); this also applies to lifelong learning.

The learning and teaching of sustainable content, tools and technologies also permeates companies. They should train technical staff and professionals, for example, in environmental fields; this mainly involves the careful use of energy and resources, procurement, improving the qualifications and awareness of staff, including management, taking into account the new requirements for professional skills resulting from the development of the green economy (see Decree, 4.10.2019, No. PP-4477b, item 20).

Uzbekistan has managed to precisely define the roles of stakeholders in vocational education and training among several ministries and state institutions to promote social partnership dialogue nationwide and in the regions. New educational programmes are introduced, modern pedagogical methods are applied and a "barrier-free environment" is created. A national quality assessment system is being established and short-term training in vocational schools is being organised for retraining, and there is also a dual option for VET. In itself, a good framework to encourage young people to seek their professional career in the non-academic sector. They can prepare very well in this "green" system for a professional placement also as skilled workers in the German labour market.

24 See **www.president.uz** (Retrieved on 15.06.2022).

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Pioneer of climate-neutral energy generation – Brazil

Germany and Brazil have been collaborating on sustainability issues for a long time. Germany supports Brazil in sustainable energy and protecting tropical forests. The potential of biomass, sun, and wind will be better utilised. The vocational training system in Brazil needs improvement to meet the demands of the green transition. Julia Giebeler Santos manages a project that advises the Ministry of Education and other relevant organisations to develop green sector education and training. The Ministry of Education has already integrated sustainability into vocational training, with a focus on renewable energy. The public vocational schools have been equipped with solar panels and teachers have been trained for curriculum development. However, vocational education still faces challenges such as drop-out rates and negative reputation of vocational education in general.

Together determined on common grounds in renewable energy and VET

Germany and Brazil have been working together on sustainability issues for half a century. In 2015, both countries committed to accelerate the decarbonisation of their economies.

As home to reservoirs of greenhouse gases and as one of the most biodiverse countries, Germany supports the Brazilian partners particularly in the areas of sustainable energy and protection and environmentally sound use of tropical forests. The potential of biomass, sun and wind as environmentally-friendly alternatives to hydro energy will be better exploited.

For the construction and maintenance of the infrastructures of the green transition, many skilled workers are needed that the vocational training system has not yet provided in sufficient quality and number. People living beyond the metropolises cannot easily access vocational education and training opportunities and employment that offer prospects in the local labour market.

Julia Giebeler Santos is the GIZ project manager "Technical and Vocational Education and Training (TVET) for Green Economic Development and Employment". The project advises the Ministry of Education (MEC), the Ministry of Labour (MTP), the National Service Provider for Industrial Education and Training (SENAI) and the Federal Network for Vocational, Scientific and Technological Education (IF) to develop needs-based education and training in green economic sectors. The project is commissioned by the Federal Ministry for Economic Cooperation and Development (BMZ). Mrs. Giebeler-Santos outlines further: "The technical and vocational education system is based on two pillars – one public and one private. Compulsory education in Brazil goes up to 12th grade. After graduation there

are entry points to vocational training at secondary level. This is offered by vocational and technical education institutes of the Ministry of Education. They work directly under the supervision of the Ministry of Education. They have to follow the regulations, the specifications in terms of professional profiles etc., but they have a relatively high degree of autonomy in terms of pedagogy and of the courses they offer. In many cases they are lacking a well structured connection to labour market needs or the economy at large; but they have laboratories, etc. to offer practice mainly in the institutes".

Since the new government took office in 2023, the just transformation plays an even greater role, she says.

The project manager continues: "The Ministry of Education has developed strategies to integrate sustainability aspects into vocational training. But even before the change of government, a lot of funding was invested in vocational training, in the field of skilled workers and the development for renewable energy sectors. The expansion of solar energy and wind in particular plays a very important role with onshore parks. Especially in the northeast, Brazil has extremely great potential and skilled workers are needed at various levels for the construction and maintenance. The country's public vocational schools have been equipped with solar panels to convert their own electricity consumption. Together with GIZ, curricula have been developed for the assembly of photovoltaic systems. VET teachers were trained in these fields on a nationwide basis. This was financed by a significant investment programme of the Ministry of Education. Own PV systems were financed by the ministry. The training approach by BMZ/GIZ, as well as the Ministry's own contribution and the participating regional locations. Those who complete the course find generally employment in the area of the course. This is yet still too little known. The image of VET is not yet as positive as we would like it to be". The trend to use vocational training centres as a stepstone to university is still widely spread, she said. "We are especially targeting people who have not completed basic education at all, but do have informally acquired skills, such as in the electrical sector. We want to encourage more young women to enter the energy sector. We are working very closely with companies and business associations to get them involved in raising awareness, educating and recruiting women. In terms of renewable energies, near to 15% of women were enrolled so far. The public vocational training institutes have a big drop-out problem. Participants face challenges such as transport, meals or training schedules. The courses at the public institutes are free of charge and sometimes scholarships are offered for some qualifications."

The second major pillar of vocational education in Brazil is the National Service for Vocational Education and Training (SENAI). The VET service is financed by a "payroll levy" on member companies of the industry. Nationwide, SENAI operates about 580 schools. The teaching staff train exclusively on demand of the companies. Mrs Giebeler Santos from GIZ reckons: "The quality of the schools and training centres is very high, the equipment meets in several regions the most modern requirements and the take-up rate of graduates is around 80%. Due to the agility with which the SENAI network can react, the innovative power is also much higher than in the public system".

Educational System in Brazil

Schooling in Brazil comprises basic education (educação básica) – which consists of preschool care and instruction (up to the age of six), school-based primary and secondary education (ensino fundamental I and II 1st–8th and Ensino medio 9th–12th grade, respectively) – and higher education. Higher education (educação superior) consists of the first academic degree (graduação, on average five years) and a subsequent possible postgraduate degree (pós-graduação or mestrado), which concludes with a master's degree (about two and a half years). A doctorate (doutorado) could be concluded after about four years. Please find more information here: OECD (Ed.): Brazil. In: Education at a Glance 2023. OECD Indicators. Paris 2023. DOI: **https://doi.org/10.1787/7a9958a8-en** (Retrieved on 21.08.2024).

Bruno Backes

The Kenyan vocational training system from 2008 to 2023. A big step forward to sustainability

The Kenyan Vocational Training System in 2023 is making significant strides towards sustainability, but still access to formal education and vocational training remains challenging for many Kenyan youths, leading to a high number of young people entering the informal sector or facing unemployment. For many years the prevailing belief that a university degree offers better job prospects resulted in overcrowded universities, while vocational training institutions suffered from a lack of resources and a skills mismatch with the job market. In response to these challenges, the „Kenya Vision 2030" (established in 2008) aims to transform the country into a middle-income nation, with a specific focus on improving science, technology, and education, including comprehensive reforms in the Technical and Vocational Education and Training (TVET) sector.

Introduction

In 2013, the Technical and Vocational Education and Training Act brought significant changes to the vocational training system in Kenya. The introduction of the Competency-Based Education and Training System (CBET) aimed to make vocational education more practical-oriented and relevant to the economy, addressing the skills mismatch issue. However, challenges arose due to the lack of available CBET curricula and the need for accordingly trained trainers. To further enhance sustainability, the Kenyan National Qualification Framework (KNQF) and the Recognition of Prior Learning (RPL) concept were introduced, offering the potential to formalise the competencies and knowledge of informal sector workers, thereby recognising their skills.

To tackle the issue of skills mismatch and improve the alignment of education with the job market, TVET institutions in Kenya have slowly started collaborating with industries to provide practical training opportunities. This approach can bridge the gap between the skills possessed by trainees and the demands of industry, enhancing employability and promoting workforce readiness. Additionally, the government's emphasis on entrepreneurship and green skills training aims to contribute to a sustainable green economy and foster self-employment opportunities.

The growing interest in vocational education is evident through vocational education fairs, such as Hands on the Future (HOTF), which have become popular platforms showcasing vocational education as a viable alternative to pursuing university degrees. These fairs offer hands-on experiences and practical contributions from various industries and training

providers. Despite the challenges posed by the COVID-19 pandemic, the success of these fairs highlights the increasingly positive perception and approval among the population.

Parallel to the efforts of the Kenyan government, international collaborations have also played a crucial role in advancing vocational education. The government and international development partners have been working to make vocational education in Kenya more attractive, sustainable, and aligned with the needs of the labour market.

Another important factor is the informal sector's significance for the Kenyan economy. To fully utilise the potential of the informal sector, a holistic approach to vocational training is essential, encompassing skill enhancement, theoretical knowledge, ecology, and economy. While challenges persist in formalising the informal sector, positive steps have been taken to engage stakeholders, including the government, development partners and the formal private sector, recognising the need for collaboration and sustained efforts to unlock the potential of the informal sector and provide better opportunities for its workforce.

In conclusion, the efforts made by the Kenyan Vocational Training System towards sustainability, coupled with collaborations with other countries to enhance vocational training, exemplify the strengths of the company-centred training programmes and their potential impact on Kenya's workforce. By tailoring approaches to local contexts, addressing the informal sector, and promoting vocational education, Kenya's economic growth and development can be significantly fostered, providing better prospects for the youth and contributing to the realisation of the "Kenya Vision 2030."

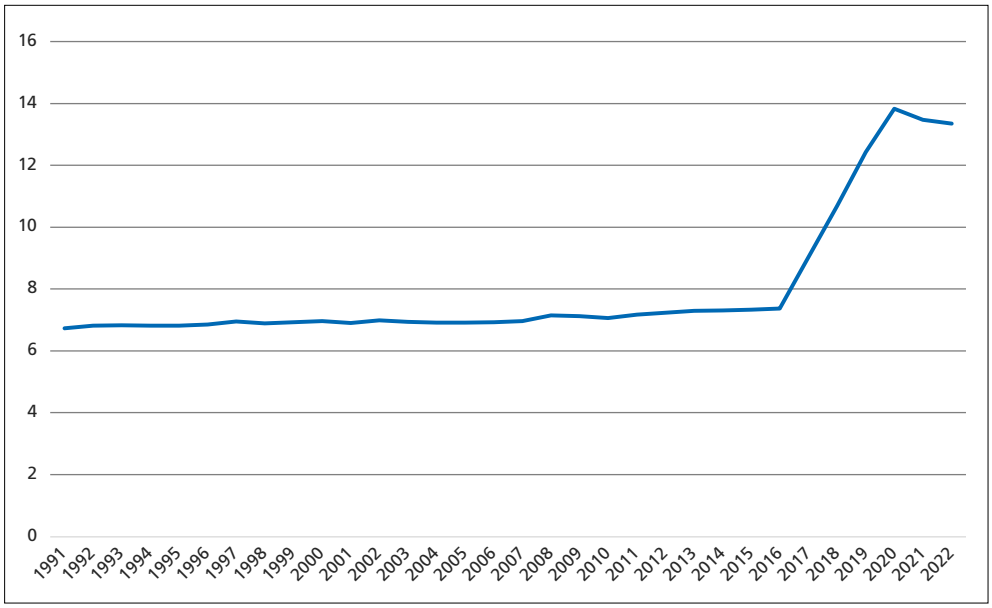
Kenya and its technical and vocational training system

1. Kenya's economic and educational landscape

Kenya is a presidential republic and is considered one of the most politically stable countries in East Africa. The nation has approximately 55 million inhabitants, with the population growing by about one million each year. The average age is approximately 20 years. Over the years, Kenya has transitioned from a developing country to the third-largest economy in Sub-Saharan Africa, following South Africa and Nigeria. It plays a significant role as an economic hub for the eastern part of the African continent.

Kenya's economy has experienced above-average growth rates in both global and regional comparisons, with an average growth rate of around 5% over the last decade. Despite the stable economic growth, the country faces high unemployment rates, particularly among young people and young adults, see Figure 1. According to the World Bank, approximately 37% of the population still lives below the poverty line of 1.90 USD per day.

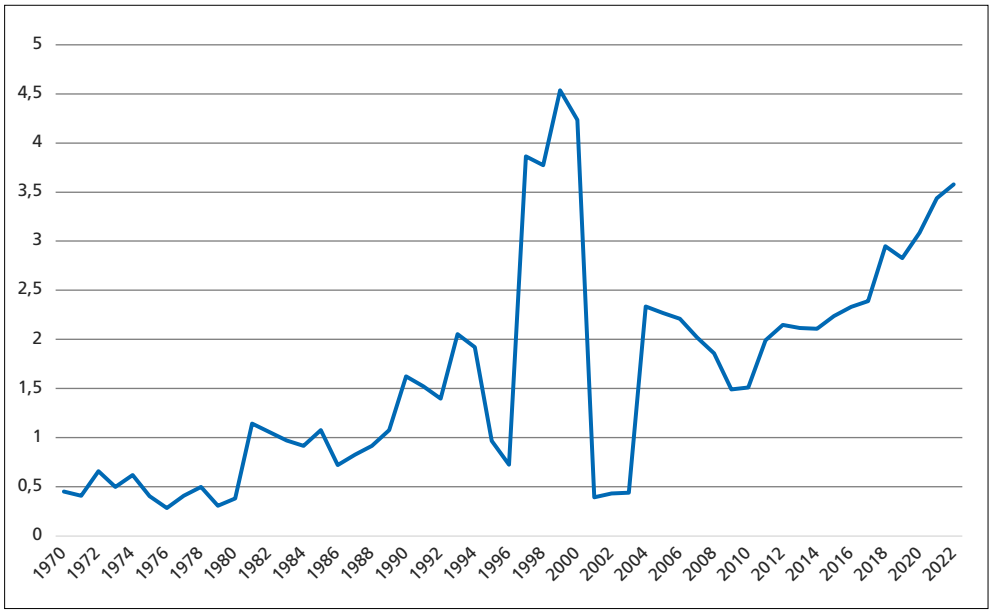
Figure 1: Kenya youth unemployment rate 2013–2022



Kenya: Unemployment, youth total (% of total labour force ages 15–24) (modeled ILO estimate).
Last updated date: 19.09.2023
Source: own representation according to The World Bank Data 2023a

The most important economic sectors in Kenya are agriculture, followed by the service sector (particularly tourism and financial services), and industry. It's worth noting that according to the World Bank, remittances accounted for approximately 3.6% of Kenya's GDP, see Figure 2 (remittances refer to the money sent back home by Kenyan nationals working abroad, which plays a significant role in the country's economy).

Figure 2: Remittances 1970–2022



Kenya: Personal remittances, received (% of GDP). Last updated date: 19.09.2023
Source: own representation according to The World Bank Data *2023b*

As in many other African countries, Kenya also has a substantial informal sector alongside the formal economy. Between 1974 and 2018, the proportion of workers in the formal and informal sectors has almost reversed. In 1974, 91% of the workforce was engaged in the formal sector, whereas currently, it is only around 17%. This shift also impacts the official unemployment rate, which predominantly focuses on the formal sector, leading to a probably significantly higher rate considering the informal sector's size (see Federation of Kenya Employers 2021, p. 13f).

The informal sector in Kenya is referred to as "Jua Kali", which translates to "hot sun" describing the work done under the scorching equatorial sun. Most workers in this sector operate at the roadside and engage in various activities such as small-scale trading, cabinet making, cobbling, welding, tailoring, mechanics, plumbing, and others. The Jua Kali sector plays a vital role in the Kenyan economy, providing livelihood opportunities for a significant portion of the population and contributing to economic activities in diverse ways.

The Kenyan general education system ends with the "Kenya Certificate of Secondary Education" (KCSE). Afterward, graduates have the option to either attend a university or a vocational training institution. Many young Kenyans enter the workforce directly after completing their education, often in the informal sector, because they cannot afford a further education at universities or vocational training institutions, many become unemployed.

This situation highlights that access to formal education and vocational training remains a challenge for many Kenyans. Consequently, numerous youths seek employment in

the informal sector to sustain themselves financially. Promoting educational opportunities and generating job opportunities are crucial factors to improve living conditions and prospects for Kenyan youths.

As in many other countries, the prevailing belief in Kenya is that a university degree offers better job prospects compared to vocational training. It is perceived that having a degree can lead to finding better paid jobs and smoother advancement into leadership positions. This perspective is particularly endorsed by parents who pressure their children to pursue higher education as a means of social advancement. Consequently, universities have been experiencing overcrowding for decades, while vocational training institutions suffer from a lack not only of trainees but also of financial resources, equipment, and teachers. Additionally, many curricula still do not align with the demands of the job market, resulting in a skills mismatch. This forces companies to invest significant time and money in retraining graduates from vocational institutions to meet their requirements.

The Kenyan job market has been unable to absorb all university graduates for quite some time, partly due to a mismatch between the qualifications of graduates and the actual needs of the economy. Moreover, complicated admission requirements further exacerbate the issue, preventing individuals from studying in fields that align with their interests.

As a consequence, a significant number of university graduates struggle to find suitable employment opportunities. Many end up working in positions that do not utilise their acquired skills or may even face unemployment and on the other side companies are struggling to find well-trained workers.

2. Reforming vocational education in Kenya: Strategies and challenges

The "Kenya Vision 2030" is a comprehensive national development strategy launched by the Kenyan government in 2008. Its main objective is to transform Kenya into a middle-income country with a high quality of life by the year 2030. The strategy focuses on strengthening key sectors of the economy, including tourism, agriculture, wholesale and retail trade, manufacturing, financial services, and information technology, to stimulate economic growth. To meet the demands of these growing sectors, the "Kenya Vision 2030" emphasises the improvement of science, technology, and education. This includes a priority on reforming the Technical and Vocational Education and Training (TVET) sector. The aim is to enhance access to vocational education by removing barriers that prevent individuals from obtaining high-quality vocational training. Additionally, the strategy seeks to raise the quality of vocational education to ensure that graduates possess the skills and knowledge required by employers in the relevant industries. By making vocational education more relevant to the job market, graduates can be better prepared to meet the actual needs of the economy.

In 2013, the Technical and Vocational Education and Training Act was passed "to provide for the governance and management of institutions offering technical and vocational education and training; to provide for coordinated assessment, examination, and certification; to institute a mechanism for promoting access and equity in training; to assure standards, quality, and relevance; and for connected purposes" (The Republic Of Kenya 2013).

The adoption of this law triggered significant changes in Kenya's vocational education and training system, leading to the restructuring of the Ministry of Education of the Republic of Kenya (MoE). The new vision is stated as follows: "A globally competitive education, training, research, and innovation system for sustainable development". The mission is defined as: "To provide, promote and coordinate quality education, training, and research; and enhance the integration of Science, Technology, and Innovation into national production systems for sustainable development" (MoE 2023). Additionally, the State Department for Vocational and Technical Training was established within the MoE. Three of the most important departments within the State Department for Vocational Education & Training are:

1. Technical and Vocational Education and Training Authority (TVETA): established in 2013, TVETA's creation is based on the TVET Act of 2013, which aims to provide a legal framework for the regulation, coordination, and financing of technical and vocational education and training in Kenya. TVETA plays a crucial role in ensuring quality standards and promoting the development of vocational education and training institutions in the country.
2. The Technical and Vocational Education and Training Curriculum Development, Assessment, and Certification Council (TVET CDACC): established in 2013, TVET CDACC is responsible for designing and developing curricula for the assessment and certification of competencies in educational institutions. It also advises the government in this area.
3. The Kenya National Qualifications Authority (KNQA): established in 2015, KNQA is responsible for coordinating and maintaining the National Qualifications Framework (NQF) in Kenya. It develops and implements guidelines and criteria for the evaluation, recognition, and accreditation of qualifications. Additionally, KNQA ensures quality assurance in educational and training programmes throughout the country. The authority plays a vital role in standardising and recognising qualifications in various sectors, promoting access to quality education, and facilitating the mobility of learners and workers within and outside Kenya.

Due to the unsatisfactory experiences with the very theory-based training in Vocational Training Centers, Kenya introduced the Competency-Based Education and Training System (CBET) in 2019. The objective was to make vocational education more practical-oriented and better aligned with the actual needs of the economy. This way, qualifications would become more fitting, and the need for extensive retraining could be minimised. There were high expectations surrounding this move, as it was marketed as the solution to the existing problems, leading to the anticipation of rapid results. However, what many stakeholders were not aware of was the fact that there were no CBET curricula available up to that point. Consequently, trainers and teachers who were not yet familiar with the new system needed to be trained themselves, and such processes take time.

Another important step towards a more sustainable education system was the introduction of the Kenyan National Qualification Framework (KNQF), for which the Kenya National Qualifications Authority (KNQA) is responsible.

> "The principles for which the KNQF is established is to promote access to and equity in education, quality and relevance of qualifications, evidence-based competence, and flexibility of access to and affordability of education, training assessment and qualifications" (KNQA 2019).

Through the KNQF, the education system becomes more permeable, and now graduates of vocational training can also begin an academic education (see diagram KNQA 2019).

The responsibility for introducing the Recognition of Prior Learning (RPL) concept lies within the domain of the Kenya National Qualifications Authority (KNQA). This concept could possibly be the most crucial step towards creating a modern and sustainable education system. Prior to the introduction of RPL in 2020, it was necessary in Kenya to attend the corresponding course and pass the subsequent examination in order to obtain any type of certification.

> "Recognition of Prior Learning (RPL) is the process used to identify, assess, and certify an individual's knowledge, skills, and competencies acquired through non-formal or informal learning, such as work or life experiences. This assessment is done against prescribed standards or learning outcomes. The main objective is to provide societal recognition and validation for entry into a program of study, enhance employability, and offer opportunities for up-skilling and reskilling. The RPL system focuses on evaluating outcomes rather than how, when, or where the learning occurred. It allows individuals to receive credit for the skills and knowledge they acquired through various avenues, including school, work, home, the informal Jua Kali sector, or through involvement in clubs and hobbies" (MoE 2021, p. 1).

The implementation of this system is not yet complete, but progress has been made, indicating that it will likely be achieved in a few years. Through RPL, it is theoretically possible for any Jua Kali worker to have their competencies and knowledge officially recognized, paving the way for formal sector employment or further education. Theoretically, because this process is not free, and casual workers or those in the informal sector may not be able to afford the fees required. "The cost of RPL is based on the needs of the Candidate and the number of units of competency for which they are seeking recognition. As such, the cost will vary from application to application. The Qualification Awarding Institutions (QAIs) in conjunction with stakeholders shall develop a differentiated Unit cost of Assessment to inform the total cost payable for an RPL application and advise the Candidate before proceeding with the RPL assessment process. The fees chargeable will ensure sustainability of the RPL process and shall cover charges for KNQA, QAIs, Regulators and Assessment Centres" (Knqa 2020, p. 37).

In recent years, the Kenyan government has been increasingly focused on making vocational education more appealing and sustainable. Various ideas and concepts have been developed to enhance the quality of education, increase the relevance of training according to the job market, and broaden opportunities for graduates.

To address the issue of skills mismatch, TVET institutions in Kenya are very slowly beginning to collaborate with industries to strengthen the sustainability of vocational education. Partnerships with various companies and sectors are being established to provide trainees with practical training opportunities. These collaborations aim to ensure that TVET programmes align with the needs of the industry and promote the development of sustainable practices in specific sectors. By working closely with industries, TVET institutions might be able to bridge the gap between the skills acquired by students and the demands of the job market, ultimately enhancing the employability and relevance of vocational training in Kenya.

In close collaboration with various organisations, the Kenyan government is promoting entrepreneurship and skill development in the field of vocational education. Initiatives like the Kenya Youth Employment and Opportunities Project (KYEOP) aim to equip vocational education graduates with entrepreneurial skills to foster self-employment and sustainable income opportunities.

The focus on promoting green jobs and sustainable employment opportunities in the field of TVET is continuously growing. Kenya is taking steps to introduce training programmes for green skills, equipping students with knowledge and abilities in areas such as renewable energy, environmental protection, and sustainable agriculture. Furthermore, the integration of environmental protection and energy-related topics into TVET curricula is gradually becoming more prominent. These efforts are aimed at both conserving the environment and contributing to the development of a green economy.

That's encouraging. Although these measures are still in their early stages, and there is much work to be done to implement them adequately, it is good to see that they are already yielding some positive results. The continuous improvement of the image of vocational education over the past few years is evident in the increasing number of TVET institutions and trainees (see Palmer 2023, p. 41f.).

Another example of the increasing interest in vocational education is the two vocational education fairs, Hands on the Future (HOTF), which took place in Nairobi in 2017 and 2019. The goal of these fairs was to familiarise a wide audience, including students, teachers, and parents, with the idea that vocational education can be a viable alternative to pursuing a university degree.

The concept of these fairs was that each exhibitor had to present a practical contribution; purely distributing flyers, was prohibited. So, they provided hands-on experiences, enabling visitors to interact directly with various industries and vocational training providers. Both fairs were organised by the Permanent Working Group on Technical and Vocational Education and Training (PWG) in collaboration with TVETA.

> "The PWG is a multi-stakeholder platform that promotes collaboration and provides guidance on implementation of technical and vocational education and training (TVET) reforms in Kenya and enables sector stakeholders to network and share ideas and strategies. […] PWG works in the framework of Kenyan reform processes and, in particular, the Vision 2030 Session Paper No. 14 of 2012 which identified a number of the challenges that are facing the TVET sector: curricu-

> lum issues, instruction design and assessment, management and organization, qualified trainers, inflexibility of training programs, lack of framework on linkage between training institutions and the industry, negative perception and poor image on TVET, weak coordination on quality assurance across TVET institutions domiciled in other state departments and ministries, lack of uniformity in qualifications, and low financing of TVET, among others" (PWG 2017).

The Delegation of German Industry and Commerce for Eastern Africa is one of the founding partners and current secretariat of PWG TVET Trust.

The first vocational education fair in January 2017 took place over two days. The focus of the first day was a conference that brought together 700 stakeholders from the TVET sector. The second day was dedicated to the actual "Kenya Skills Show", featuring 122 exhibitors and approximately 3,000 visitors, a surprisingly high number of attendees.

The second HOTF, however, exceeded all expectations; 20,000 visitors were queuing for three days to learn more about vocational education. This outstanding success clearly demonstrated that the topic had resonated with the Kenyan population. The original plan for the HOTF concept was to hold the fair biennially and also bring it to various Kenyan counties on a smaller scale. Unfortunately, due to the COVID-19 pandemic, these plans could not be realized, and the project is currently being revised. For data on the Skills Show, refer to the final report (see PWG 2019).

3. Practical examples

In their efforts to advance the vocational education system, make it more attractive and sustainable, the Kenyan government also receives support from outside. Several development partners have initiated programmes to promote vocational education. Additionally, there are programmes from foreign business associations, companies, and private initiatives.

There are two examples from Germany that promote the German dual vocational education system in Kenya with different approaches.

The first programme, the Skills Expert Program (SEP), initiated by the Federal Ministry for Economic Affairs and Climate Action (BMWK), collaborates with German and Kenyan companies to provide needs-based practical training. The SEP programme was established in November 2017 at the Delegation of German Industry and Commerce for Eastern Africa (AHK Eastern Africa), the pilot with a specific focus on the hospitality sector. By training trainers and establishing structured curricula, the pilot of the SEP programme has seen positive outcomes, with around 60 trainees enrolled in September 2023, enhancing the potential not only of the Kenyan hospitality workforce. The SEP programme ended in December 2022, however, the Department of Vocational Training at AHK Eastern Africa continues the project even without financial grants and has successfully implemented the dual training system until September 2023 in other sectors as well, including the shoe manufacturing industry, mechatronics, solar technology, and the pharmaceutical machinery sector. A significant achievement of the project is the introduction of the international version of the German "Training of Trainer Courses" (AdA-Courses) in Kenya. These courses are based on

the German Trainer Aptitude Regulation (AEVO) and are indispensable for practical training. By mid-2023, over 400 Kenyans have successfully completed this course.

The second programme, "Promotion of Youth Employment and Vocational Training", led by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the German Kreditanstalt für Wiederaufbau (KfW), aimed to enhance employability and vocational training quality in Kenya. This programme focused on transforming Technical Training Centers (TTI) into Centers of Excellence, offering vocational training programmes in collaboration with partner companies. The programme started officially in February 2020 with phase 1, followed by phase 2 which ended in December 2022. In January 2023, the Finnish Ministry for Foreign Affairs joined the project, which is called now "Youth Employment and Vocational Training II" and shall run until December 2026.

Both programmes contribute significantly to bridge the skills gap and provide better opportunities for the Kenyan youth.

For a more detailed presentation and analysis, please refer to URL:

- **https://www.kenia.ahk.de/vocational-training**
- **https://www.oph.fi/sites/default/files/documents/Youth%20Employment%20and%20TVET%20in%20Kenya%20-%20Project%20description.pdf**

4. Special case: the informal sector

It has been pointed out that 83% of the Kenyan economy is classified as the informal sector. Millions of Kenyans work in this system, earning a meager livelihood through small-scale craftsmanship, vending, or casual labour, and they generally do not pay taxes. In 2021, the Federation of Kenya Employers, in partnership with the International Labour Organization (ILO), published a study titled "The Informal Economy in Kenya" (see Federation Of Kenya Employers 2021, p. 66f).

Some of the key findings are: most informal businesses don't advertise their products; there's no policy to strengthen the relationship between informal businesses and formal companies; informal businesses need training in customer service, marketing and communication; on average, about 94% of informal MSMEs don't pay taxes, no matter how big they are (see Federation Of Kenya Employers 2021).

The study concludes with recommendations directed towards the government, state agencies, and other stakeholders. Interestingly, vocational training is only briefly mentioned in these recommendations, focusing solely on "tailor-made trainings" in customer relationships, marketing, price determination, and recognition of prior learning.

> "19. In view of the weak levels of competitiveness of the informal enterprises, TVET institutions, […] and county governments in partnership with informal economy associations should establish mechanisms to build the capacities of the enterprises. Areas of training needs would include marketing, innovation, contracting and price determination. This may be done in the format of targeted tailor-made skills training through workplace-based training programmes. The

> skills training should incorporate assessment that would culminate in recognition of prior learning and certification for attainment of industry recognized skills within the Kenya National Qualification Framework" (Federation Of Kenya Employers 2021, p. 71).

The informal sector holds immense potential in terms of labour force and innovation power, which needs to be utilised. However, this can only work if the issue of vocational training is approached in a structured manner. For instance, a Jua Kali "carpenter" typically lacks formal training but possesses the craftsmanship skills to build furniture, such as cabinets and doors. These doors and cabinets can then be found, for example, along Ngong Road in Nairobi, prefabricated to any desired measurement – either fitting perfectly or not at all. This pattern applies to all craft industries and results in an incredible waste of resources.

A holistic approach is required, involving structured and sustainable vocational training built upon existing skills. Individual training programmes that overlook important aspects such as skill enhancement, theoretical background, ecology, and economy are not effective. To fully unlock the potential of the informal sector, a comprehensive vocational training system that addresses all relevant aspects is essential.

The challenges in the informal sector cannot be solved overnight. It requires a gradual and sustained effort. However, the fact that initial approaches and ideas are already present, and that the government and policymakers are increasingly engaging with the issue, is a significant step forward. By acknowledging the potential and importance of the informal sector and recognising the need for structured vocational training, the groundwork is being laid for positive changes and improvements in the future. Continued collaboration between relevant stakeholders, including the government, employers, educational institutions, and international organisations, will be essential to develop effective and sustainable solutions to utilise the potential of the informal sector and provide better opportunities for its workforce.

The private sector has already begun developing its own concepts. A large furniture manufacturer, for example, operates a modern factory in Nairobi, producing furniture in a modular design. Customers can order customised furniture, such as a wardrobe, online according to their specific measurements. The individual components of the wardrobe are manufactured in the factory and packaged with all the necessary accessories for pick-up.

This is where the Jua Kali sector comes into play. In order to provide excellent customer service, the company engages skilled Jua Kali workers to pick the packets, assemble and install the furniture for the customers. To achieve this, the company implements a holistic approach to train the Jua Kali workers. The training goes beyond simply teaching how to assemble the furniture properly; the workers are taught to take precise measurements, interact with customers, understand various types of wood and materials, and even consider environmental aspects.

By providing comprehensive training to the Jua Kali workers, the furniture manufacturer ensures that they possess a diverse skill set, enabling them to deliver top-notch services to customers. This approach not only benefits the company but also contributes to the development of the Jua Kali sector by enhancing the workers' expertise and capabilities. It is

a win-win situation, promoting local craftsmanship while meeting the demands of modern manufacturing and customer needs.

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Constanza Correa Sarmiento, Emmanuel Winkler

Integral sustainability concepts for strengthening vocational education and training in a development context – Case studies from vocational education and training, Mexico and dual higher education, Latin America

This article addresses the intersection between sustainability and vocational education and training (VET), emphasising the importance of integrating sustainability principles into education and training programmes. It highlights the need for an integral view of sustainability, encompassing environmental, social, and economic aspects, and underscores that the Sustainable Development Goals (SDGs) should not be perceived as mere symbolic gestures but as significant goals prioritising those objectives in line with their regional and corporate strategy, and provides best practices of how sustainability concepts have been implemented in VET in Mexico and Latin America. In conclusion, the article points to the need of combining dual TVET programmes with a modern economic interpretation of sustainable development goals, considering the three pillars or dimensions of an integral sustainability reporting system.

1. Introduction

With Artificial Intelligence and Industry 4.0, we are experiencing another revolution in society and thus in work, which is also having an impact on our training systems. The future of work and education is and always has been significantly influenced by technological change. In this context, adaptability in today's reality of lifelong learning is just as crucial as the development of versatile competencies to meet the new, ever faster changing requirements.

At the same time, in an increasingly technologically-efficient world, we must strive for social justice, sustainability and the protection of labour rights to create a just and sustainable world of work. For this, cooperation between governments, businesses and educational institutions is essential.

To introduce integral sustainability, companies, organisations, and vocational institutions should first identify their stakeholders, followed by a risk assessment which aligns their goals and strategy with the global and national state sustainability targets. We see that more and more stakeholders are referencing the United Nations' 17 Sustainable De-

velopment Goals (SDGs) and are increasingly attempting to develop robust metrics. It is important not to perceive these 17 SDGs as mere "nice stamps" but rather to initially focus on a few that are relevant. Organisations should then utilise the 169 sub-goals of the 17 SDGs. These should be prioritised in alignment with the company's strategy and can also be published as metrics in sustainability reports. Such an integral strategy empowers the organisation to maintain focus on what matters during times of global transformation, using metrics and the company's strategy to adapt to new environmental influences and substantiate decisions with robust data. Similar to the financial annual reports, it is meaningful and will become obligatory for larger organisations to also present robust and mature sustainability reports. Therefore, organisations might refer to the United Nations Sustainable Development Goals (SDGs). Matching the SDGs to dual Technical and Vocational Education and Training (TVET) programmes, the most relevant SDGs and sub-goals for vocational education are SDG 4 "Quality education" (4.3, 4.4, 4.5, 4.7), SDG 8 "Decent work and economic growth" (8.2, 8.3, 8.5, 8.6, 8.8). For TVET professions in industrial innovation or infrastructure programmes SDG 9 "Industry, innovation and infrastructure" (9.2, 9.4, 9.5) is also a relevant goal. A rather specific job focus can also be seen within SDG 17, which aims to strengthen the means of implementing the other 16 goals and promoting cooperation among all stakeholders. On SDG 17, some however argue that dual education can only indirectly contribute to SDG 17 by enhancing the qualifications and competencies of apprentices and companies, thus increasing their ability to participate in the global partnership, so that dual TVET programmes are not the primary instrument for achieving this goal and are more related to achieve economic goals, such as SDG 4, 8, and 9. However, to us, it seems that the core of any dual TVET Programmes and of SDG17 is based on the collaboration and partnerships between governments, the private sector, civil society, and other stakeholders. Any TVET programme that is not connecting to these stakeholders can hardly be named dual TVET programme, which makes the collaboration between public private partnerships within the SDG 17 relevant when reporting on dual TVET efforts.

Some organisations are linking their strategy to SDGs, which means that they should prioritise and define with a clear focus which SDGs influence them and then report which SDGs they work with. Using SDGs in an integral sustainability report might provide additional advice how to present and promote TVET programmes.

2. Case Studies

In the following sections, we will present and analyse how the German Chambers of Commerce and Industry (AHK) in Mexico and Colombia (CAMEXA and AHK Colombia) have implemented sustainability concepts in their vocational training approaches, in vocational education and training in Mexico, as well as in dual higher education in Latin America.

2.1 Sustainability and vocational training in Mexico

In Mexico, we have initially focused on the companies and have successfully integrated the concepts of integral sustainability into training the trainer (Ausbildung der Ausbilder

(AdA)). Having different dual TVET models, we decided to start in the purist dual model of CAMEXA according to the Association of German Chambers of Commerce and Industry (DIHK) certification standard (A-corridor)[1], as the quality and awareness of sustainability among the trainers/trainees and the accompanying vocational schools and inter-company training centres is especially high in this TVET-Model. In four different regions of Mexico, we first conducted a basic introduction to the concept, followed by evaluation workshops where we reached about 100 participants, mostly trainers or *vinculadores*[2], the latter being the contact persons of the companies in the vocational schools (Gobierno de México 2019). After we had evaluated the state of knowledge in the companies and educational institutions, we developed a course and learning materials for the trainers and *vinculadores*. In this course, 29 trainers and *vinculadores* from 14 companies participated. In a competition and an accompanying coaching, the trainers together with their trainees had to identify an integral sustainability project based on the three integral sustainability pillars: environment, social and economic. In the projects, the dual trainees and trainers succeeded not only in involving their personal environment (family) and saving resources. They also succeeded in raising awareness within the company in order to pursue a modern and integral approach to sustainability that goes beyond a philanthropic view of Corporate Social Responsibility (CSR) goals and evaluates the corporate commitment of the companies along the three pillars with key figures (e. g. vocational training in the social area: number of apprentices, staff retention, further and advanced training), which can result from the commitment of dual training. In at least three cases, this course was the first time that the company really understood the company's sustainability strategy.

2.2 Sustainability and dual higher vocational education in Latin America

In dual higher education, integral sustainability was launched through the Dual University Latin America Network[3] (DHLA) in four countries and 14 universities (see Deutsche Hochschule Lateinamerika 2023). The main objective of the project is to provide knowledge about climate change and sustainability within the DHLA network and raise awareness among the participating higher education institutions and companies as well as students within the network.

1 DIHK certification corridor ABC models (DIHK 2019).

2 *Vinculadores*, term in Spanish, are the people who act as interfaces between the educational institution and the company to support the companies in the implementation of dual (Vocational Education and Training) VET, as the companies do not know the tradition of dual VET. See references (Gesellschaft für Internationale Zusammenarbeit 2019).

3 DHLA network: Under the leadership of AHK Colombia and with the support of the GIZ programme develoPPP, the dual study system of the Baden-Württemberg Cooperative State University -DHBW was introduced in Colombia at the end of the 1980s under the name Network Dual University Latin America (Red Duale Hochschule Latinoamerica -DHLA). Originally, the DHLA was a bilateral cooperation project, but in the meantime dual courses of study based on the DHBW study model are offered at a total of 14 universities in 4 countries (Brazil, Colombia, Ecuador, and Mexico). Among other things, this cooperation has resulted in a very successful double degree programme in International Affairs (DIHK 2019).

Many of the universities already had a sustainability strategy in place, and 35 dual lecturers were trained to develop and expand an integral, modern, and indicator-based sustainability management along the three pillars. 24 lecturers were able to pass the examination by identifying a holistic and suitable practical project and implementing it at their university. Furthermore, the dual lecturers of the DHLA network developed a 20-hours Environment, Social and Governance (ESG) elective course with ECTS credits, which is now also available to other students at the universities after the pilot in the dual sector. With this elective course, students are enabled to introduce a modern understanding of sustainability as dual sustainability ambassadors in their practical companies by means of an accompanied practical project. This not only promotes the know-how of the lecturers and students but also benefits the companies and their stakeholders in the supply chains to initiate sustainable development beyond the otherwise often mere lip service. More than 800 students have shown interest in the pilot, and more than 20 projects have been implemented. The formation of a learning network and the founding of a sustainability committee in the DHLA network are to be initiated and thus the interaction, the sustainable further development of the ESG elective course as well as the long-term establishment of so-called "dual sustainability ambassadors".

3. Historical derivation of vocational education and training

In Germany, the roots of vocational education go back to the 12th century, first as purely practical vocational training under the guidance of a master craftsman in craft guilds and later also in commercial guilds. It was not until the 17th century that the first technical schools for theoretical knowledge transfer were established. With industrialisation in the 18th/19th century, the demands on skilled workers increased and this also gave rise to new professions. From 1869, vocational training in Germany was institutionalised for the first time through state subsidies for the establishment of vocational schools and compulsory schooling for apprentices under the age of 18. The Chambers of Crafts organised training with the Crafts Protection Act from 1897. The Chambers of Industry and Commerce were founded in 1808 to represent the interests of merchants and traders but were initially only responsible for administering the examinations in training, as training was mostly carried out by the companies themselves.

General compulsory state education was not introduced in Germany until 1938, and the training courses tended to have a practical vocational application, but with industrialisation more demanding theoretical knowledge was required, and thus the school-based aspects of training gained in importance. Today's dual system of vocational education and training with its responsibilities was only regulated nationwide across all sectors in Germany from 1969 onwards by the Vocational Training Act (BBiG), and the chambers of commerce have since taken on a special role both in the organisation of training and, as before, in the conduct of examinations.

In the beginning, the emphasis between vocational experience and school-based training was often still assessed differently depending on the training occupation and is now 70% vocational and 30% school-based training in Germany, Switzerland, and Austria. Thus, the focus in these countries is still clearly on the company-based and thus practical side of a Vocational Education and Training (VET) programme.

If we look at the development of vocational training in Mexico, there were initial impulses to introduce training in individual German companies with advisors as early as the 1960s, but it was not until 1990 that we find evidence of dual training programmes (for young people without a university connection) being set up in companies, particularly in the automotive sector, which still exist today. Since then, interest in vocational training has grown and in 2020, we were able to identify 27 variants of dual training in Mexico at the school level alone. In addition, dual training programmes are increasingly being set up at universities.

Dual higher education was introduced in Colombia in 1996[4] as result of the bilateral cooperation with Germany, following the Duale Hochschule Baden-Württemberg (DHBW) study model. In 2002, the first two dual universities were founded in Colombia, and over the years, universities from Ecuador, Mexico and Brazil also joined. A transfer of knowledge took place in which the dual elements were "Latinised" for the development and implementation of the study programmes. The DHLA network and the member universities are certified by CERTQUA[5] and receive academic support from the DHBW. The legal framework conditions are different in each country where the DHLA network is present.

4. Historical background of sustainability

The first concepts of sustainability can also be traced back to the 17th and 18th centuries and originate from Europe and the principles in force in forestry. H. C. von Carlowitz first mentioned the importance of responsible use of forests in 1713 to preserve resources for future generations (see von Carlowitz 1713). In the course of time, the concept of sustainability was further developed in various areas and gained more and more importance in the 20th century, especially after the report of the "Club of Rome – Limits to Growth" (see Meadows et al. 1972). Agenda 21, adopted in 1992 at the United Nations Conference on Environment and Development in Rio de Janeiro, emphasised the importance of education and training for sustainable development. Already at that time, vocational education and training was seen as an important factor for the implementation of Agenda 21 and the promotion of sustainability.

In 1994, John Elkington introduced the concept of the triple bottom line, which is the overarching concept of many international agreements, and from 2000 on more and more companies began to increasingly introduce environmental management systems via ISO standards (ISO 1400) to promote environmentally-friendly practices. This also influenced

4 Further information: Deutsche Hochschule Lateinamerika (2023).

5 Certqua is an international certification service provider for quality management for educational trainings provider, which is recognised in Germany and worldwide (Certqua 2023).

VET, which increasingly adopted sustainability aspects in training, especially in the founding nations of VET Germany, Switzerland, Austria (D/CH/AUT). In 2000, the United Nations adopted the eight Millennium Development Goals (MDGs), which were replaced by the 17 Sustainable Development Goals (SDGs) in 2015. This has had a major impact on the promotion of sustainability worldwide. Educational institutions, including vocational schools and training companies worldwide, now increasingly began to also use the SDGs as a guideline for their educational programmes and increasingly incorporate integral sustainability concepts. It is important to note that new legislation such as value chain due diligence in both Germany and the EU requires more qualified professionals.

5. How can sustainability and vocational training be linked in development cooperation?

Internationally, terms such as Green Jobs[6], Green Recovery[7] and Just Transition[8] are gaining in importance. But what is meant by this? Originally, the term "green jobs" also originated in forestry and agriculture. Green jobs, however, have recently come to include more and more occupations from other sectors that reflect modern principles of integral sustainability in the economy. As more and more market access, financial resources, human rights, CSR, LKSG, industry standards such as ISO, GRI, IFRS[9] are tied to sustainability criteria and demand transparency from companies in the weighting, optimisation, and measurement of their sustainability aspects, they need skilled workers and technological progress to meet these increasing demands. While most companies are aware of the why and wherefore of sustainability, there are still large gaps in the how, i. e., the implementation. For this, companies need new know-how and skilled personnel.

6 Green jobs: Green jobs are jobs that are created in companies that produce goods or services that benefit the environment or conserve natural resources. They may also be jobs in which workers' tasks involve making their company's production processes more environmentally-friendly or using fewer natural resources. The BLS Green Jobs Definition: U.S. Bureau of Labor Statistics (2023) and ILO (2016).

7 Green Recovery: Green Recovery is a term used to describe environmental, regulatory, and financial reforms proposed to rebuild prosperity after an economic crisis such as the COVID-19 pandemic or the Global Financial Crisis (GFC). These measures aim to restore economic growth while positively impacting the environment, including renewable energy measures, efficient energy use, nature-based solutions, sustainable transport, green innovation, and green jobs (Van der Ree 2022).

8 Just Transition: Just Transition is a concept that focuses on the transition from a carbon-intensive economy to a green economy. It aims to ensure that harm to workers, communities, countries, and regions is avoided while maximising the benefits of climate action. The concept was originally supported by trade unions and includes a strong commitment to social dialogue and workplace rights. Just Transition is an evolving concept that was endorsed in the 2015 Paris Agreement and gained prominence at the 2021 UN Climate Change Conference in Glasgow (COP26), Institute for Human Rights and Business (2023) and GIZ (2019).

9 CSR: Corporate Social Responsibility, LKSG: Lieferkettensorgfaltspflichtengesetz (The German Supply Chain Due Diligence Act. The German federal government aims to protect human rights and the environment across the supply chains of companies operating in Germany), ISO: International Organization for Standardization, GRI: Global Reporting Initiative, IFRS: International Financial Reporting Standards.

However, the inclusion of sustainability standards in industry also provides an opportunity to make the recognition of the lack of skilled workers in companies measurable as a sustainability aspect and to recognise that this can strengthen the commitment in companies and thereby contribute to the creation of new training places. As already mentioned, the company side of training is often weak in Latin America, which is also related to the fact that companies often do not see any added value in providing training. Companies and businesses in Latin America have heard about the advantages of dual vocational education and training but are usually not aware of the core elements and the rights and duties usually associated with it. In Latin America, a rather school-based, and economically efficient approach is frequently favoured when implementing a dual system. However, this approach may not fully promote the advantages seen in Germany and other countries in Europe, such as strong social protection standards and high-quality job profiles, resulting in challenges like low staff retention and high turnover rates. Stakeholders are often heard to introduce apprenticeships only for the benefit of the apprentice, but this is not tenable if the ESG benefits of vocational training are also considered from the perspective of modern sustainability. This lack of a modern and integral understanding of the term sustainability, together with the habit and weighting of school-based training systems, are forming a lasting negative bottleneck to the successful introduction of dual systems. Fortunately, as more and more companies are introducing sustainability aspects measurably as integral sustainability systems from the inside out, this offers great opportunities and possibilities to strengthen vocational education and training in development cooperation, and thus following an integral approach as best practices can foster new green professions and a just transition.

6. Conclusions

In Germany, both sustainability and vocational training are enshrined in law. However, the focus is often only on the environmental aspect, such as saving resources and recycling. Social and economic aspects should also be considered in the sense of an integral understanding of sustainability for future generations. Europe has already developed many green educational contents in the last decades, especially in their educational institutions, which refer to sustainability, but mainly deal with environmental topics, while social and economic aspects are often neglected. This could be due to historically developed and system-immanent structures and the strict and stronger environmental and social regulations in Europe, which, however, usually do not exist in this form in developing and emerging countries or can be taught differently.

Therefore, it is important to raise awareness of a modern interpretation of sustainable development in development cooperation and consider precisely the three pillars of integral sustainability and to communicate these in companies, politics, and schools. Such an integral view and the introduction of monitoring according to international standards that is valid in the business and driven forward especially by the financial sector could also strengthen other development cooperation programmes and cooperation with the business sector.

The inclusion of the internationally ratified SDGs can also strengthen the implementation of VET systems and ensure a sustainable future. Today, VET mostly refers to SDGs 4, 8, 9 (related to "industry, innovation and infrastructure"), with particular significance to SDG 12, which focuses on environmental professions related to fields such as 'Circular Economy and Recycling. Additionally, SDGs 5[10] and 17 are also referenced. Interestingly before, SDG 1 (poverty reduction) and SDG 10 (less inequality between countries) were often cited when introducing VET, but poverty reduction is no longer mentioned in connection with dual VET, as VET programmes accompanied by the AHKs are mostly related to the private sector and SDG 1 and 17 are rather overarching political tasks and goals.

While more and more businesses, companies and financial institutions worldwide are already identifying their relevant sectorial key performance indicators (KPIs) and preparing sustainability reports, it seems that development cooperation as an expert in sustainable development is not managing to make its funding programmes compatible to these indicators. Despite the growing importance of sustainability standards, development aid programmes are still sticking to a less integral programme design and following their own impact monitoring, which today often follows an outdated public funding policy logic. However, here too, certain disadvantages of an overly normative regulation of sustainability in Europe become apparent, although laws can provide necessary and important impulses.

But unfortunately, these regulations are often too cumbersome due to additional administrative requirements and represent a disconnected reality of life for subcontractors. They are often not linked to the respective corporate strategy but are seen as pure compliance measures, which as such do not offer the companies any added value, as they are not decision-making and steering tools without key figures and integral sustainability management. For these new challenges we need qualified personnel on the operative and strategic level.

It is important to emphasise that the integration of sustainability concepts in VET is an ongoing process and continuously evolving. The challenges of climate change and other global problems make the promotion of sustainability in VET an increasingly important task to prepare the young generation for a sustainable future. In order to make VET and sustainability long lasting, normative frameworks need to be created, but based on SDG 17, they need to allow for public-private partnerships, agile and linkable solutions in the respective countries.

10 Sometimes, other SDGs are mentioned. Thus, the following explains why they are not particularly relevant to us as a company in the Train the Trainer vocational training for dual education: SDG 5 is also an important goal for sustainable development, but it is not specific to dual education. SDG 5 aims to achieve gender equality. Gender equality is a fundamental human right and a necessary condition for a peaceful, prosperous, and sustainable world. While dual education can contribute to SDG 5 by improving women and girls' access to high-quality vocational education and employment, promoting their leadership and decision-making skills, and enhancing their social security and equality, it is not the sole or primary instrument for achieving this goal. Gender equality also requires other measures that address the structural causes and obstacles to gender equality in all aspects of life. This includes the elimination of all forms of discrimination, violence, and harmful practices against women and girls, recognizing and valuing unpaid care and domestic work, ensuring universal access to sexual and reproductive health and rights, and strengthening the global partnership for gender equality.

The two best practices in sustainability and dual higher education and vocational training from Mexico and Latin America show that integrated and holistic implementation is possible and the way to a better today and tomorrow.

The successful implementation of these best practice projects was possible due to the funding from the Federal Ministry for Economic Cooperation and Development (BMZ) and the commitment of the Business Scouts for Development (BSfD), which are Partners in Transformation within the Agency for Business and Economic Development. The BSfD, also financially supported by the BMZ, endeavours to enhance connections and elevate private sector involvement in development aid.

Therefore, we started this journey developing an integral sustainability training (Inhouse Sustainability Manager). This project was then scaled up in other Latin American Chambers. Due to the success, a programme called "Green Jobs & Green Recovery" identified green jobs in seven sectors creating three new job standards. In all these sectors, the need of an integral approach and know-how of an Inhouse Sustainability Manager on the operative and strategical level was highlighted.

The Latin American Network of Dual Universities (DHLA) introduced sustainability concepts, trained teachers, developed an elective course for students to expand sustainability activities in universities and companies, promoted the formation of a learning network and the founding of a sustainability committee in the DHLA network, as well as initiated the long-term establishment of the "dual sustainability ambassadors".

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Kirsten Freimann, Gerda Magnus

Skills for a just transition to a green future: Analysis and support of the South African TVET system

The Just Transition towards a Green Economy will have significant implications for the current and future workforce. Skills development is one of the key elements in ensuring that the transition is 'just' and as such the responsiveness of the Technical and Vocational Education and Training (TVET) sector is paramount. This paper evaluates the South African TVET context against global trends as recently published in a discussion paper by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Key strengths and weaknesses of the South African system are highlighted against seven thematic areas. The integrated approach to employment promotion, a holistic and multi-dimensional approach adopted by German development cooperation, is foregrounded as an approach to support skills development in a just transition. The paper describes the project Career Path Development for Employment (CPD4E) as an example for implementation.

1 Background

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) recently published a discussion paper[1] exploring the implications for Technical and Vocational Education and Training (TVET) in creating a workforce which will be able to address not only the labour market needs for the Green Economy but also the socio-economic dimensions of this transformation processes ("Just Transition"). The paper comprises seven separate research theses which explore various aspects such as the policy dimension, the anticipated changes in labour markets and how TVET systems need to respond. The paper also discusses how Development Cooperation (DC) more broadly can support the TVET sector in partner countries in the context of Just Transition. The theses posed in the discussion paper were developed through a comprehensive literature review, numerous interviews and case studies of policies and projects addressing green economic transformation and skills development across the globe (see GIZ 2022).

This document evaluates the South African context against the theses to provide key areas of intervention required by the South African TVET system. It also seeks to provide guidance for DC support, which in the context of South Africa has been strongly shaped by the Just Energy Transition Partnership (JET-P) between South Africa, France, the EU, UK, US and Germany. The JET-P, agreed on during the COP 26 in 2021, supports South

1 See GIZ (2022): Discussion Paper: Skills for a Just Transition to a Green Future. Available via **https://www.giz.de/fachexpertise/downloads/27_giz2022-0387en-just-transition-green-future.pdf**.

Africa's path to a more climate-friendly future, which should be socially just and inclusive. To this end, financial commitments were made to the South African government totaling USD 8.5 billion from the partner countries over the next five years, with Germany contributing more than EUR 1.1 billion.

This document has been developed by the GIZ in South Africa through the Career Path Development for Employment project (CPD4E), which is specifically focused on vocational skills development and employment within the framework of the Just Energy Transition (JET). The issues raised are subject to discussion with partners where priorities can be set for the joint effort to facilitate an effective Just Transition process.

In this paper, a succinct abstract will be provided first for each of the seven theses, followed by a review of their relevance and applicability in the South African status quo. This discussion will focus specifically on employability and TVET-related matters as defined in the GIZ integrated employment promotion approach, which will be discussed in the final chapter of this paper.

2 Major research findings – 7 theses for a Just Transition

The seven theses cover a variety of topics ranging from the general coordination of JET at country level to the specific approach in TVET and Skills development and employability. The main research findings and conclusions of each of the papers are briefly provided below.

1. A successful Just Transition requires a coherent alignment of green agendas and skills development policies

> "A successful transition to a Green Economy requires the systematic orientation of educational systems and TVET systems towards sustainability. This can only succeed if sustainability is incorporated into a country's development strategies and all policy areas, including TVET – and vice versa, if TVET is integrated in environmental and sustainability policies. Coherent policy and implementation structures are indispensable to accelerate the demand for Green Skills, but also to promote their supply. This is a particular challenge for developing countries, which often lack a proactive government and suffer from weak governance structures" (GIZ 2022, p. 8).

2. The private sector needs incentives, sanctions and support to develop a demand for Green Skills

> "In many countries, the private sector does not yet demand Green Skills as policies creating demand and market incentives are often insufficient. The employment gains of a skilled workforce with green skills will not materialise if the private

sector is not comprehensively incentivised and supported to develop Green Jobs and demand Green Skills. Companies are often unmotivated to invest in costly environmental protection measures if (a) regulations are not effectively enforced by authorities and (b) if they do not bring significant cost savings or additional revenue in the short term. DC measures promoting sectors with green potential such as renewable energy, energy efficiency, construction or waste recycling should examine and address both the regulatory and incentive systems in order to promote the growth of Green Jobs" (GIZ 2022, p. 8).

3. A Just Transition cannot be successful without the integration of the informal economy in green, economic and TVET policies

"Given the prominence of the informal economy in many developing countries, it has to be given appropriate weight in the transition processes for two reasons: (1) to potentially reduce environmentally harmful activities in the informal economy and (2) in the context of Leave No One Behind (LNOB), to facilitate the inclusion of marginalised people working in the informal economy in modernised TVET systems" (GIZ 2022, p. 9).

4. TVET is crucial to prepare the labour force for a Just Transition, but TVET systems need to be strengthened and aligned with comprehensive social protection measures

"The transition to a low-carbon economy will inevitably lead to structural and sometimes disruptive changes in the labour market. TVET systems and labour market policies are crucial instruments to prepare in time for this shift, if they (1) react flexibly to changing skill requirements, (2) transmit solid occupational and transferable core skills, (3) address initial training as well as re- and upskilling, (4) equally include women and (5) are aligned with active labour market policy for facilitating a Just Transition" (GIZ 2022, p. 9).

5. Transition requires holistic TVET reforms, in line with Education for Sustainable Development, to ensure relevance, attractiveness and inclusivity.

"Current TVET systems are too weak to support a Just Transition. They often miss the necessary governance mechanisms, are poorly financed, lack sufficiently skilled teachers and instructors and are not linked to other education pathways. As a consequence, TVET continues to be portrayed as second-rate education. There

is a need for broad and holistic TVET reforms that are well coordinated with other relevant policies. These reforms should include alignment with sustainability and digitalisation policies, multilevel-governance approaches and close interlinkage with other forms of education. This needs to be complemented by mainstreaming of Education for Sustainable Development (ESD), integration of local knowledge and last but not least, initial and further training of TVET personnel that incorporates Green Skills and ESD" (GIZ 2022, p. 9).

6. Just Transition increases the need for labour market forecasting to match emerging skill demands

"Due to higher workforce mobility, shorter innovation cycles and the mega trends digitalisation and greening, the skill needs of future labour markets will become increasingly dynamic and the importance of skills forecasting will continue to increase. Anticipation mechanisms can be based on national labour market information systems (LMIS) if they exist and are functional. Alternative and sometimes more efficient solutions are sectoral or locally based skills forecasting approaches. Private sector engagement and a close interlinkage of labour market forecasting with TVET systems is indispensable to make use of the findings for the modernization and greening of occupational profiles and curricula" (GIZ 2022, p. 10).

7. The emerging skill demand in a green economy will require TVET to rapidly adapt existing occupational profiles and develop new ones

"TVET systems are often slow in responding to changing skill demand. Thus, policy makers, project designers and practitioners need to strike a balance between a sufficiently rapid response to market needs and the anchoring of modernised or new green qualifications in qualification frameworks and TVET systems. Potential approaches for 'rapid response' include providing support to the private sector to develop in-company training programmes and the development of non-formal trainings as well as of certified training modules that can later be added to an existing occupational profile. The greening of occupational profiles should be guided by the relevance of occupational fields to greening, the demand for Green Skills, as well as an analysis of industry practice and the need for greening this practice. Further guiding aspects should be policies for mainstreaming green content in occupational profiles and curricula and the existing standards of a country for development of qualifications and curricula" (GIZ 2022, p. 10).

2 Analysis of the South African contexts in view of the major findings

2.1 Policy coherence (Framework conditions)

In 2020, the *Presidential Climate Commission (PCC)* was established as an independent, multi-stakeholder body as a direct result of the job summit held in 2018 and a response to the sustainability agenda of the country. The PCC comprises 10 ministers and 23 organisations representing a cross section of stakeholders. Such a *coordinating structure* is critical for the advancement of JET. The PCC is in an optimal position to ensure the coordination of JET processes. Private sector and civil society have to be part of and need to play an active role in these coordination structures.

According to the JET declarations of the RSA Government, "the process of transition needs to be based on the full involvement of the organized labour and businesses in *targeted programmes of reskilling and upskilling*, providing employment and providing other forms of support to ensure that workers are the main beneficiaries of our transition to a greener future" (The Presidency 2021). This statement underlines the high relevance of skills development and active labour market policy measures to enable the implementation of a Just Transition policy.

The central document for the implementation of the national agenda 2030 is the National Development Plan (NDP) which aims to create employment through an inclusive job-growth that improves the employment perspectives especially of young people (SDG 8, decent employment). The Economic Reconstruction and Recovery Plan (ERRP) emphasises the reduction of poverty, inequality and unemployment. Both guiding policy documents remain vague on the topic of green economic transformation. There is no policy document yet that provides guidance for Just Transition and green economic transformation across the different pillars of economic and social development.

The *guiding policy documents for education and TVET* are the National Skills Development Plan 2030 (NSDP) and the Skills Strategy under the ERRP. These strategies aim at improving labour market relevance of TVET, expanding work-based learning and placing greater emphasis on upskilling and reskilling of the labour force. They do not provide direct references on the greening of skills (apart from the inclusion of a few qualifications) and on education for sustainable development (policy gap).

While significant work has been done, national level policies need to be translated into *action plans at the provincial level*, that link the action plans for renewable energies, energy efficient infrastructure development, and circular economy with the agenda for skills development and inclusive employment promotion at the national, provincial and municipal level.

2.2 Employment opportunities (demand side)

Past experiences showed that investments by the state into the renewable energy sector, such as the Renewable Energy Independent Power Producer Programme (REIPPP) had a

significant impact on jobs created in this sector. However, three quarters of the total jobs created by this programme were in construction and installation, i. e., in the installation of photovoltaic (PV) power plants. These jobs are usually temporary. Since PV technology is almost "maintenance free", only one-quarter of the jobs in this sector were of a more permanent nature (see IRENA 2022, p. 52). Experiences also show that state investments in the past have not been stable, creating incentives over a limited period of time (in some cases, several programmes were launched in parallel) which created peaks of demand that were followed by periods of low demand (COBENEFITS 2019). There are numerous interventions underway in a range of industries to support greening. An example is Notice 700 of 2020 by the Department of Mineral Resources and Energy (DMRE) for the "Regulations for the mandatory display and submission of energy performance certificated for buildings" (Department of Mineral Resources and Energy 1998). Many of the economic master plans include skills requirements with a view to future skills requirements. Currently, the level of detail required by training institutions is often still lacking. However, significant research and forecasting processes are on-going.

The overall policy landscape in South Africa is considered favourable to create a more permanent and growing demand for *jobs in the renewable energy sector*. However, scenarios for job creation differ vastly. They range from 15,000 jobs created per year till 2030 (base scenario) to 36,000 jobs per year (accelerated scenario) (see SAPVIA 2021, p. 14–15).

Rising energy prices and the lack of energy availability are a primary motivating factor for the industry to invest in energy-efficient technologies and modes of production.

While job potentials in the PV industry are well researched, far less information is available about the enabling framework for job creation and skill demand in other environment- and climate-relevant fields of the economy. The construction and manufacturing industries have the potential to create "greener jobs", if the industries were both incentivised and regulated to move to more climate and environmentally friendly ways of production. Legislation forcing the auditing of all buildings against an energy efficiency rating has the potential to be a catalyst for job creation (example of regulation).

The level of informal employment in South Africa is estimated at 44%, including the agriculture sector. Without agriculture, the proportion of informal employment is at 32% (see ILO 2022, quoting Labour Force Survey data of 2021). The Labour Force Survey (LFS) report (Q4 2022) says that ca. 20% of employed persons work in the informal sector (2,955,000 persons out of 15,934,000 employed persons) (see LFS, 2022).

According to the Small Enterprise Development Agency of South Africa (SEDA), 67 % of around 2.3 million micro-, small and medium-sized enterprises (MSMEs) are informal. All MSMEs are estimated to provide employment for 9.7 million persons. Despite the high proportion of informal businesses, these provide "only" 13% of the employment given to other persons (i. e., excluding own-account and employers). No explicit data on the gender dimension has been found, but it has been estimated that around 38% are female (see SEDA 2021).

The extent of informality differs between economic sectors such as manufacturing, construction, and services.

Making informal sector businesses more climate and environmentally-responsive will require a substantial effort in creating awareness and in upskilling of informal sector workers. National skills development policy should play a part in promoting green skills in the context of micro and small enterprises. While there have been numerous studies on potential jobs in the formal sector, a lot less has been documented about the potential of the informal sector.

2.3 TVET and skills development (supply side)

The TVET sector in South Africa is generally viewed as weak and the links to the labour market are seen as tenuous. Within this context, supporting the Just Energy Transition and sustainable development goals in general is not without difficulty.

Significant strides have been taken to strengthen the governance structures in TVET colleges, and particular emphasis has been given to the role of the private sector in the governance of institutions. However, in the context of energy transition, the labour market itself is still emerging and unlikely to play a significant role in the colleges at present.

Programmes and pathways

In 2013, Renewable Energy Technology was introduced into the TVET Colleges as an elective subject within the National Certificate Vocational (NC(V)) electrical curriculum. This provides an excellent starting point to expand the offer of renewable energy programmes. At inception, five colleges offered the programme, today there are already 19.

Through the SETAs and QCTO[2], various occupational programmes have been developed, such as the PV Technician programme. This can become a qualification which provides a good career path for both NC(V) students as well as electrical artisans. Some other qualifications in this area have been developed, but a comprehensive analysis of the qualifications available and qualifications required is necessary as explained in the Renewable Energy Skills roadmap (see SANEA 2023).

Funding

Greening the curriculum of TVET colleges will require significant resources and plans to increase student enrolment in TVET colleges as Just Transition is expected to create about 250,000 new jobs by 2023 (see SANEA 2023). The non-alignment of funding between the skills levy system and the TVET fiscal system remains a critical deterrent for the public colleges to increase enrolments. Lessons learnt from the Centre of Specialisation[3] implementation must be considered for the scalability of the occupational programmes in public TVET colleges.

2 Sector Education and Training Authorities (SETAs) are authorities appointed for 21 sectors of the economy to administer skills levies and support skills development in the various sectors. The Quality Council for Trades and Occupations (QCTO) is the Quality Assurance body responsible for occupational qualification development and quality assurance of provision and certification.

3 Centres of Specialisation is a government initiative to deliver priority trades in selected centres through a "Dual System" methodology.

The JET partnership contributors (international partners as announced at COP 26) offer funding of the green economy as per the COP 26 commitments, and while there is a coordinating committee for skills development, this has not resulted into dedicated coordination of funding of skills development.

Lecturer development

The skills of lecturers remain one of the most critical conditions for effective skills development. Programmes for lecturer upskilling must be systematically undertaken. Currently GIZ is supporting Renewable Energy Technology (RET) lecturer development. Metal, Engineering and related (MerSeta) Seta Centre of Specialisation has also invested into PV technicians who can support colleges and, finally, the South African Renewable Energy Technology Centre (SARETEC) is seen as a key partner in the development and support of colleges.

Forecasting

In March 2017, the South African Department for Higher Education and Training (DHET) issued a ten-year forecast (Modelling Future Demand and Supply of Skills in South Africa) as an important contribution to the establishment of the institutional mechanism for skills planning in South Africa. No reference to the transition to a green economy was made, and developments from 2020 (COVID-19 pandemic, JET-P are not covered yet.

In recent years, the worsening of the energy crisis has emphasised the demand of specific skills in South Africa. A shortfall in electricity supply of around 5,000–6,000 megawatts, caused by run-down infrastructure, corruption, and mismanagement at the energy supplier ESKOM, led to a nationwide controlled shutdown of the energy supply (load shedding) on 200 days in 2022. In the context of these events and the proclamation of the JET-P, the interest in specific forecasting for Green Skills (in particular in the energy sector) has risen significantly as the inevitable transition to renewable energy sources is generally being associated with the creation of new jobs, but also the need of reskilling of workers whose jobs will gradually disappear (e. g. in coal mines). Coal fired power plants provide employment to 113,000 direct jobs and a further 339,000 indirect and induced jobs. It is considered that close to 50% of these jobs will be lost through the transition. However, through construction and operations of wind farms and PV installations 609,000 and 253,000, respectively, are projected to be gained (see PwC 2021, p. 11).

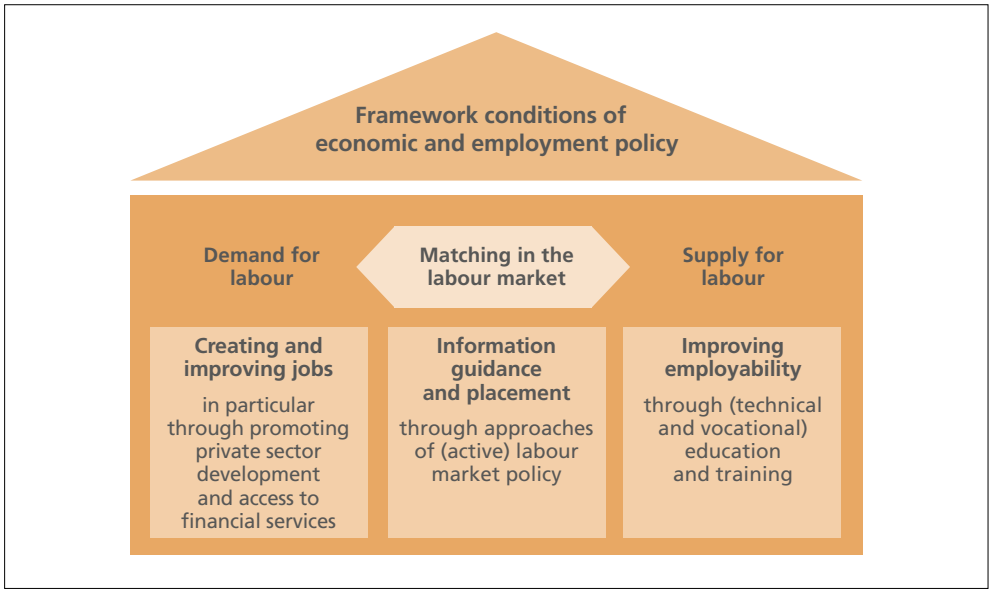
We are therefore able to see that with effective interventions of upskilling and reskilling there will be a net job gain. One of the things that is still a serious consideration is the geographical impact of the transition as some provinces will be disproportionately affected.

Through the newly launched occupational qualification framework it is now possible to register short occupational programmes with the QCTO. This is a significant opportunity to introduce partial qualifications or specialisations into the formal qualification system. This provides for an ideal landscape to re- and upskill the current workforce.

3 Example: Career Path Development for Employment Project

The Career Path Development for Employment Project (CPD4E)[4] by GIZ South Africa promotes a Just Transition and inclusive employment creation by supporting the supply and demand side to understand and address the emerging opportunities for enterprise and skills development. CPD4E will unlock opportunities for young people and SMEs to gain access to employment in low-carbon footprint economic sectors. In the framework of the JET-P, the CPD4E project identifies and addresses the significant future skills needs in the labour market and employment implications of the Just Energy Transition process with a special focus on promoting the employability of youth and disadvantaged gender groups as well as employees in the fossil fuel industry threatened by job-loss.

Figure 1: Integrated Approach to Employment Promotion



Source: own illustration

To achieve its complex and ambitious task, the CPD4E project follows a holistic concept, using the *"Integrated Approach to Employment Promotion"*. German development cooperation addresses employment promotion by using an integrated, multi-dimensional approach

4 Commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and co-financed by the Swiss State Secretariat for Economic Affairs (SECO), implemented in partnership with the South African Department for Higher Education and Training (DHET). The project duration is June 2022 to May 2026.

that focuses on the supply and demand sides of the labour market as well as on active labour market policies and instruments. The approach combines elements of technical vocational education and training, labour market policy, and private sector development. A particular focus is set on the challenges for new entrants to the labour market. The aim is to achieve positive long-term employment and income effects by coordinating all relevant intervention areas. Economic policy, which determines the general labour market conditions such as the business and investment climate, plays a key role by streamlining policy decisions with respect to employment targets.

As outlined in the analysis above, policy coherence (framework conditions), employment opportunities (demand side) and TVET and skills development (supply side) must go hand in hand to support a Just Transition in South Africa.

Corresponding to that and conceptionally based on the integrated approach, the CPD4E project is being implemented through a combination of measures in four areas:

Framework conditions – Strengthen capacities of institutions of employment promotion:

CPD4E is part of the German DC programme "TVET and Employment Promotion" in South Africa which addresses Just Transition as one of its strategic priorities. German DC projects in this programme apply a multi-level approach and comprehensive capacity development strategies that address the policy dimensions as well as the multi-stakeholder cooperation of public, private and civil society actors involved in Just Transition. The CPD4E project aims to strengthen the capacity of South African actors to develop and implement new approaches to employment promotion in the context of a Just Transition. Innovative support options will be developed and piloted for this, and their results will be fed into central political decision-making bodies.

For example, local employment initiatives in the context of Just Transition shall be supported and pilot programmes that will address reskilling and employment promotion of workers in the coal industry shall be developed. One pilot intervention has been designed together with the International Labour Organisation (ILO) in South Africa with a special focus on promoting the employability of youth and disadvantaged gender groups as well as employees in the coal sector threatened by job loss: through a comprehensive approach involving labour market analysis and forecasting, target audience identification, and social dialogue in communities affected by the structural change, mainly in the Mpumalanga region, tailor-made upskilling and reskilling programmes will be developed and delivered.

Demand side – Creating jobs through private sector development:

A major part of the CPD4E project focuses on improving the support options for South African small, medium and micro enterprises (SMMEs) and entrepreneurs as an important prerequisite to demand for skilled workers. CPD4E wishes to support South African SMMEs in the sectors of relevance to the green economy in order to stabilise their economic situation, strengthen their competitiveness and create opportunities for growth which will generate new jobs.

One example of how the integrated approach to employment promotion can be put into practice is CPD4E's cooperation with the National Business Initiative (NBI). The cooperation seeks to create local conditions that are favourable to unlocking inclusive demand for skilled labour within entrepreneurial Small, Medium and Micro Enterprises (SMME) in township economies, with a particular focus on the opportunities in the transition to the green economy. The initiative adopts an ecosystem approach, not only supporting inclusive market system development and emerging entrepreneurial ecosystems but also capacitating TVET institutions to become effective entrepreneurial learning environments and providing demand-led dual vocational skills programmes at the TVET institutions. At the heart of the programme is the establishment of enterprise hubs within six TVET institutions located in townships combined with the implementation of demand-led training linked to the Green Economy of facilitators and unemployed youth, as well as matching of learners and employers.

Supply side – Promoting employability through training:

The transition to a decarbonised economy will lead to a change in the skills required of employees and job seekers. CPD4E, therefore, aims at strengthening the delivery capacity of training providers to develop and implement training measures that will address new skills requirements and be designed in a gender-sensitive manner. Young people, especially girls and women, who take part in training interventions should increase their employability in respect of the skills that will be demanded in the labour market in the future. CPD4E is supporting the linking of the skills anticipation with the updating and design of training programmes as well as strengthening institutional capacities through a process of consultation and exchange among all stakeholders in order to formulate a response of the SA TVET system towards the development to a green economy.

For example, CPD4E builds the capacity of TVET institutions and industry partners to develop, adapt and implement pilot programmes, supports the development of new occupational profiles, curricula or short skills programmes based on the needs of the labour market and supports processes for accreditation of new programmes in the area of green skills.

Lecturers are being trained, e. g., on renewable energy technologies. A study which is under preparation and will be conducted towards the end of 2023 together with the University of the Witwatersrand will analyse and identify the various factors, key labour market and economic challenges, trends and opportunities in the South African economy that serve as possible enablers or inhibitors of a Just Transition towards an environmentally sustainable economy and society. The "Employment and Labour Market Analysis", an instrument developed by GIZ which uses the logic of the integrated approach to employment promotion (see GIZ 2014), will be used for this purpose. The findings from this exercise shall lay an evidence base for planning and designing green skill interventions.

Going beyond the 7 theses, the CPD4E project puts a particular focus on bridging the gap between the supply and the demand side of the labour market:

Better matching in the labour market – Job placement and career counselling services:

The existence of productive jobs and qualified workers does not guarantee more employment if there is a shortage of labour market information and a mismatch between labour supply and demand. To improve job placement, the CPD4E project supports the development and application of active labour market policy instruments such as matching, placements, soft skill training and specific measures for girls and women to promote the transition from learning to earning. Although numerous support measures for improving the employability of young job seekers in South Africa are already available, these are not geared towards the specific support needs of girls and young women and have not sufficiently considered the potential of the transition to a sustainable, decarbonised economy. Therefore, CPD4E aims to expand the range of support measures accordingly.

For example, unemployed youths are trained as energy performance practitioners in cooperation with the Institute of Energy Professionals Africa (IEPA). Through mentored working on real-life assignments and the combination with work placements, the learners acquire skills in high demand in the labour market which are very relevant for a decarbonising economy.

4 Conclusion

A Just Transition to a green economy is a Herculean task, especially against the backdrop of a struggling South African economy as it means nothing less than a significant shift in the way society and economy operate. With the tremendous pressure to solve the energy crisis and the stipulation of the JET-P, this transition towards a more sustainable and low-carbon economy has gained significant momentum. It will be complex, challenging to implement and will require a significant amount of resources. Moreover, the transition to a green economy is not only about reducing greenhouse gas emissions but also requires ensuring that the transition is equitable, inclusive, and fair for all communities, including workers and vulnerable populations who may be disproportionately affected by these changes. Therefore, the Just Transition needs a collective effort from individuals, businesses, governments, and civil society to create a sustainable and equitable future for all.

By prioritizing job creation and supporting workers, a Just Transition can help to ensure that the shift towards a green economy is carried out in a way that is fair and inclusive. While some jobs may be lost as a result of the transition, such as those in the fossil fuel industry, many new jobs will also be created in emerging green sectors. Employment can be promoted by using an integrated and multi-dimensional approach that focusses on the supply and demand sides of the labour market as well as on active labour market policies and instruments to achieve sustainable employment and income effects by coordinating all relevant intervention areas.

With concerted effort, the TVET system must play a central role for a Just Transition process which strongly requires a labour force with relevant skills and up-to-date knowledge in rapidly evolving sectors. The TVET system must adjust and respond to this critical

challenge to ensure that jobseekers and workers are equipped with the skills to stay competitive and adapt to a changing job market. Without this, a Just Transition will not be possible.

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Gert Zinke

Vocational training as a framework condition for a successful energy transition using hydrogen as an example

Which role will hydrogen play in achieving German climate targets through the transition to renewable energy. The German government aims to build 10 GW of green hydrogen capacity by 2030, with a focus on electrification, decarbonisation, and multifunctional hydrogen applications. The importance of training skilled workers for hydrogen-related fields is emphasised, acknowledging the need for a corresponding infrastructure. Two projects funded by the Federal Ministry of Education and Research address the quantitative and qualitative demand for skilled workers in the hydrogen value chain. Sector analyses reveal a projected increase in the labour force by 61,000 persons by 2045, with a net job creation. The impact on skilled workers at all qualification levels is discussed, particularly in intermediate-skilled occupations related to hydrogen.

Hydrogen as a "sustainable" contribution to the energy transition

In order to achieve the German climate targets, the German energy system will have to be converted to renewable energy sources within the next few years. The focus is on the electrification of end-use applications and the decarbonisation of electricity generation by expanding the use of wind and solar energy.

Hydrogen plays a multifunctional role. With the update of the hydrogen strategy in 2023, the German government has set the goal of building an electrolysis capacity of 10 GW of green hydrogen by 2030. The majority of the future electrolysers should then already be system-serving. In relation to the entire process chain of hydrogen production and utilisation, "demand-oriented training and further education of skilled workers in the field of hydrogen is elementary for the development of Germany's domestic market and technology development" (Bundesregierung 2023).

It is also assumed that the far greater part of the necessary hydrogen will be covered by imports and only a smaller part will be produced in Germany. The renewable electricity required for this will be provided by offshore and onshore wind turbines as well as photovoltaic plants.

Green hydrogen can be used in many ways. Five important possible applications are listed below:

1. Initially, there is the option of converting it back into electrical energy. Hydrogen is used as an energy store. The prerequisite for this is suitable storage, e. g. caverns. Any energy losses that occur can be at least partially compensated for by sector coupling (e. g. by using waste heat).
2. Another path is the usage of decentrally produced hydrogen in the mobility sector, including the development of a larger hydrogen filling station network, e. g. for commercial vehicles, construction and agricultural machinery as well as rail vehicles and ships.
3. One option is the usage of hydrogen as an energy carrier in the heating sector, e. g. by blending it into the existing gas supply, maybe also a decentralised feeding into the gas grids.
4. Hydrogen is an important reduction agent for the steel industry. Instead of blast furnaces, direct reduction plants are being planned and built.
5. Green hydrogen is an important raw material for the chemical industry, e. g. for ammonia synthesis. Grey hydrogen has already been used here for decades.

All these measures contribute to decarbonisation. The extent to which they are implemented in the future will also be determined by the economic and political framework conditions.

Hydrogen and the question of future demand for skilled workers

A corresponding infrastructure must be built and operated for both the production and utilisation of hydrogen. In view of the current labour and training market situation in Germany, securing the demand for skilled workers is a basic prerequisite.

The BIBB is implementing two projects funded by the Federal Ministry of Education and Research; they are implemented independently:

a. on the quantitative demand for skilled workers Labour demand and labour supply along the "hydrogen" value chain (IV-21 – I-25)
b. on the qualitative demand for skilled workers H2Pro – Hydrogen – a future topic of vocational education and training in the context of the energy transition (IV-21 – III-24)

Concerning the quantitative demand for skilled labour, a project team produced cyclical qualification and occupational projections[1]. In joint leadership of the Federal Institute for Vocational Education and Training (BIBB) and the Institute for Employment Research (IAB) in cooperation with the Society for Economic Structure Research (GWS,) has made an initial projection of labour demand and labour supply along the "hydrogen" value chain using the QuBE model. The projection shows that by 2045 the labour force will increase by an average of 61,000 persons compared to the reference scenario without hydrogen ramp-

1 See QuBe, **www.qube-projekt.de**.

up. Depending on the economic sector and occupation, jobs will be created or lost. In total, job creation exceeds job loss. Losses in individual economic sectors are therefore very small (see Schur/Mönnig/Ronsiek 2023).

This will affect skilled workers of all qualification levels. In relation to the intermediate skilled worker level, for which the vocational training system stands, a larger number of gainful employment and training occupations will be active in the context of hydrogen use. It can be assumed that the clear majority of people are already trained and employed. The smaller part will enter corresponding jobs via initial vocational training.

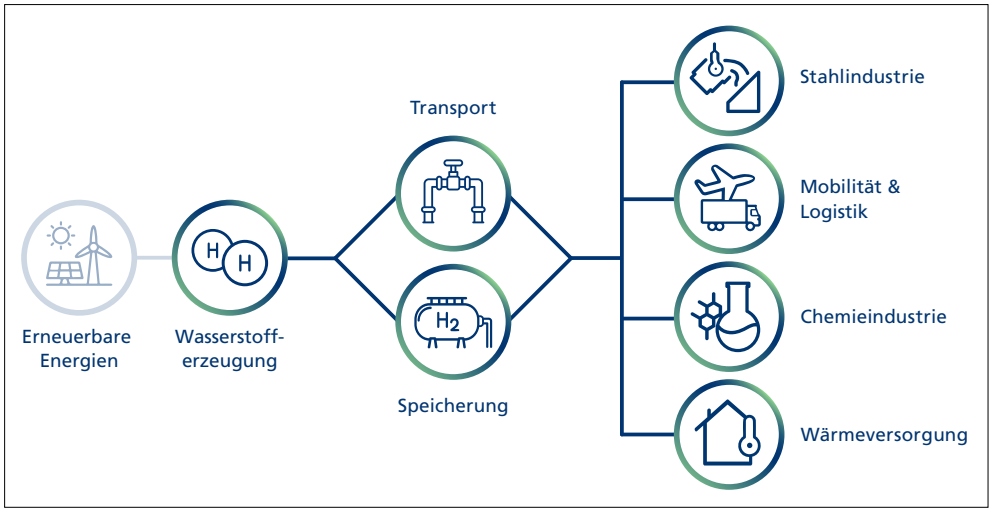
Fields of application, work tasks and training occupations concerned

All training occupations being considered for application are existing ones. The creation of completely new training occupations is not expected.

In a number of work tasks and in occupations used for them, hydrogen is not handled directly. So there will be no major changes concerning the qualification requirements. This applies not only to commercial occupations but also to construction and many industrial-technical occupations that are needed in the construction of corresponding plants and the necessary infrastructure before commissioning. Of particular interest, on the other hand, occupations that are dealing with the production of hydrogen: in operations, maintenance, monitoring and modification of plants or also in the mobility sector; for example, automotive mechatronics technician (focus on commercial vehicles) and agricultural and construction machinery mechatronics technician.

These findings and assumptions are based on sector analyses carried out in a H2Pro project, considering the hydrogen production sectors (see Zinke 2022) chemical industry (Felkl 2022), mobility (see Schneider 2023), steel production (see Schad-Dankwart 2023) and infrastructure/heat (see Hiller 2023) (Figure 1).

Figure 1: Sectors within the H2Pro-BIBB project "Hydrogen as a future topic for vocational education and training"



Source: BIBB, H2Pro

Based on initial results and assumptions of the sector analyses, the investigations are being deepened in the sectors of generation, heat supply and mobility and logistics. In contrast, the production and processing of hydrogen is not new to the chemical industry and well established in vocational education and training (see Felkl 2022). In the steel industry, the future use of direct reduction plants will make a significant contribution to the energy transition and sustainability. The construction of corresponding plants is limited to pilot plants or in the planning and approval phase. An exemplary comparison with possible requirements for skilled workers and the competencies already anchored in training within the framework of the corresponding sector analysis suggests that no fundamentally new qualification requirements will arise in steel-specific occupations (Schad-Dankwart 2023). The number of skilled workers concerned is significantly smaller here than in the other sectors.

Changing qualification requirements

The example of hydrogen production will illustrate how changed skill needs were identified and which skills are needed.

Hydrogen production consists of the following processes: hydrogen production, storage and transport. For all three a distinction must be made between the construction, inspection and commissioning, operation, monitoring and maintenance of plants in the context of skilled workers and the necessary qualifications.

According to this differentiation, "relevant, technical training occupations" (Zinke 2022) were identified within the framework of the sector analysis, work tasks were derived and qualification requirements identified according to assumptions.

The qualification requirements, i. e. the necessary knowledge, skills and abilities, can be assigned to the above mentioned three fields. The first includes in particular knowledge about the significance and function of green hydrogen as an energy carrier and raw material; they are the basis for social and personal competencies. The second field is knowledge, skills and abilities for safe handling of hydrogen during production, transport and storage according to its properties (temperature, pressure, explosion protection). The third field is determined by specific technical knowledge, skills and abilities, depending on the work task and the work environment. The second and third fields are characterised by the necessary professional competence of the skilled workers.

Training regulations

The occupations involved in hydrogen production include, for example, plant mechanics, mechatronics technicians, chemical technicians, electronics technicians for automation technology and the occupation of plant firefighter.

The training regulations for these occupations, like all training regulations regulated on the basis of the German Vocational Training Act, are a nationally applicable standard which, in addition to the training occupation designation, training duration and examination requirements, specifies "the vocational skills, knowledge and abilities which are at least the subject of vocational training (training occupational profile)" (BBiG 2022). Because these are minimum requirements, they are described in a technology-open approach and supply necessary flexibility for the training companies. Hydrogen content can be classified within this flexibility. This means that changes to the training regulations for these occupations are not necessary. The implementation of corresponding contents could be adapted where necessary by in-company trainers and vocational schools.

Further education is necessary

For those already in employment who take on "hydrogen-related" work tasks, employers have to assess which additional competencies are necessary and how these can be acquired. Learning mechanisms could be informal learning, instruction, online videos, training at manufacturers and other forms of further education. For special, safety-relevant tasks, it may be necessary to acquire a certificate. Corresponding regulations are already in place, e. g. through professional associations. Despite all the commonalities, the need for qualification for immediate competence, e. g. for operating a certain system, is special and may require individual instruction and training. These are adaptation training courses, not upgrading training courses. Federal regulations based on the BBIG are not necessary.

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Matching system and implementation: Perspectives from sustainability – Meso level: The institutions and organisations

Roberto Díaz Páez

Best practices to implement dual training in the Costa Rican National Institute of Apprenticeship (INA) during the period 2020–2023

The Costa Rican Dual Training ecosystem is facing challenges to accelerate progress in this item. Two ways to enhance the actions from the Costa Rican National Institute of Apprenticeship (INA) were identified: using the best results in the internal institutional mechanisms and learning from successful international experiences and knowledge in this field. At the internal level, actions were consolidated from INA's superior technical unit: giving a monthly follow-up to measure the progress of the negotiations with companies, municipalities, community groups and NGOs in all the cantons as well as with chambers of commerce and business associations to find niches where to execute school/workplace times of learning. Regarding the international collaboration component, INA conducts three study visits to Bonn, Germany; the report of the first group has already positively affected all the seven components on the "Institutional Strategy for Dual Training 2023–2026".

1. Employment context for young people in Costa Rica

Unemployment for young people in Latin America and the Caribbean is more than three times higher than for people over 25 years old; for example, in Argentina 7.6%, Brazil 8.2%, Uruguay and Chile 8.3%, Colombia 11.3% and Costa Rica 13% (see Statista Research Department 2023). Latin American and Caribbean countries face a double challenge: to design short-term responses to mitigate the negative social and labour impacts of the slowdown and the return to growth with job creation as well as taking measures to address the structural problems of low productivity and lack of productive diversification (see Axmann 2018, p. 8).

In addition to the above, there is evidence of the significant contributions of strengthening public policies in universal education and health services as well as preventive targeted actions, which promote progress favourable to people with greater needs so as to maximise where there are opportunities for job generation or there are business creation possibilities.

Similar to the case of other countries, it is valid to affirm that in Costa Rica the lack of employment opportunities affects primarily women, young people and people with less education when compared to other segments of the Costa Rican population, given that the un-

employment rate is around 13.4% for women and 8.1% for men (see Instituto Nacional de Estadística y Censos 2023).

For many reasons, if vocational education and training are considered as part of the solution to unemployment, the philosophy of "Dual Training" is essential. It's a model well tested in other countries to allow people, especially those younger, to make a softer transition from education to the world of work, in decent jobs that will see improvements in their productivity and competitiveness due to their augmented skills.

Dual training as a response to economic recovery inherently has a potential to counteract the adverse conditions faced by the youth population because it allows them to be trained in the labour market's high demand careers while gaining real experience in day-to-day work environment. This context surpasses even the best simulated learning situations in a controlled environment as can be offered by the vocational training centres (VTC) of the Costa Rican National Institute of Apprenticeship (INA).

This potent opportunity governed in Costa Rica since October 15th, 2019, by Law 9728: Law on Dual Technical Education and Training (see Ley 9728 Educación y Formación Técnica Dual, in Spanish, Asamblea Legislativa de Costa Rica 2019). This legislation has strengthened this educational modality, which allows students to be trained in two learning places: at an educational institution and at the workplace, which uses its material, financial and human resources to enhance learning experiences. This combined model increases the student's probability of being hired either in the company where they do their internship or in another enterprise because at the end of their training process, they will receive a technical diploma certifying they had developed the minimum skills to perform a job.

In this sense, quality learning, or dual training as it is known in Costa Rica, combines: (a) the acquisition of professional experience in the workplace and (b) the learning of applied knowledge and skills that allow apprentices to understand the task entrusted to them, face unforeseen situations, and acquire transferable and higher-level skills. The International Labour Organization (ILO) definition of "quality learning" is based on four pillars: (i) social dialogue; (ii) clear definition of roles and responsibilities, (iii) a legal framework; and (iv) co-financing arrangements. This is a complex learning mechanism based on mutual trust and collaboration between apprentices, employers, workers, government, and Vocational Training Schools (VTS) (see Axmann 2018, p. 10).

The challenge for young people to demonstrate the work experience that companies demand and the significant challenge for companies to ensure that the learning curve is as short and inexpensive as possible are achieved in the set of advantages that Dual Training facilitates: students demonstrate their technical skills, attitudes and aptitudes in a real work environment and, on the other hand, Costa Rican companies can modernise their traditional recruitment and selection systems (see Instituto Nacional de Aprendizaje 2021, p. 5).

In addition, dual model training programmes are a systematic means of creating collaborative practices between Vocational Technical Education and Training (TVET) entities and private industries, companies, and businesses promoting a substantial reduction in the gap that is usually found in business surveys since recent graduates are usually well-trained

but less ready for additional soft skills needed in any workplace setting (see Instituto Nacional de Aprendizaje 2021).

2. Costa Rican dual ecosystem due to Law 9728

For the Costa Rican National Institute of Apprenticeship (INA), this commitment to the country has meant dedicating 2.211.400 Euro of its 2023 annual budget to scholarship students in the dual modality as stipulated by the Law 9728 seeking to contribute to the fulfillment of its general objectives (see Asamblea Legislativa de Costa Rica 2019 Article Two, p. 2), which are:

a. To provide students with the competencies, knowledge, skills, abilities, and attitudes that allow them to incorporate and adapt to a changing world of work.
b. To acquire, by students, professional experience under real learning environments alternating between educational centres and companies or training centres for employability.
c. To generate quality learning processes that provide students with comprehensive training and an adequate transition to the world of work, considering the productive requirements of the country.

The Costa Rican ecosystem that sustains and enhances Dual Training is facing enormous challenges as well as those faced by the National Institute of Apprenticeship to accelerate progress in this area. Two ways to enhance the actions of the INA were identified: to use internal mechanisms that give good results in other institutional projects and to learn from successful international experiences and knowledge in this field.

At the internal level, several actions were consolidated from the Regional Management, a technical unit governing the nine regions into which the country has been divided for institutional administration. Among the first was to give a monthly follow-up to the progress of the negotiations with companies, as well as with chambers of commerce and business associations to find niches where to execute school/workplace times of learning. To have closer communication with the companies, municipalities, community groups and NGOs in the cantons, once the isolation due to the Sars-Cov-2 epidemic was overcome, Dual Training Forums were held throughout the country; this was continued in more than 50 INA training centres.

There has also been a continuous reviewing of the institutional budget for scholarship spending, a valuable progress indicator in the educational programmes' implementation. Since the passage of Law 9728, various work teams have been formed according to specific needs, so personnel from some sections (1) expedited the analysis of target areas of improvement, (2) promoted the Dual Training concept, (3) supported each region's specific needs, (4) searched for legal and financial advice as well as links with other government institutions and the private sector that enhance the ecosystem advancement. One enduring component has been the so-called "Dual virtual café": an afternoon meeting in which the regional and national teams meet to assess the progress, obstacles and opportunities of the previous week and propose recommendations and viable solutions.

3. Best practices to implement Dual Training in the Costa Rican National Institute of Apprenticeship

Regarding the international collaboration component, the authorities promoted a project called "Joint perspectives consolidated for a Dual Training efficient delivery: an improved vocational training for students, based on the experience, knowledge and cooperation of the German Office for International Cooperation in Vocational Education and Training (GOVET) for their incorporation into the National Institute of Apprenticeship (INA)"; through study visits and their subsequent knowledge transfer of the German experience, which allows a more timely, flexible and aligned responsiveness to the labour market needs.

Under this programme, GOVET scheduled three study visits to Bonn, Germany, and neighbouring cities, to identify German dual training best experiences and practices, to systematise and adapt to the institutional and national reality, from the three essential perspectives (the business sector, the trainers, and the public institutions that regulate this matter).

To date, one of the scheduled visits has been carried out. The official group[1] delivered a report called "Value Proposition – Opportunities for Improvement", from which some valuable recommendations were incorporated into the formulation of an institutional strategy for Dual Training.

Regarding the management model, it was recommended:

- Model flexibility and adjustability, integrating Dual Training in all INA processes.
- Guaranteeing business participation from the admission processes.
- Increasing installed capacity to properly respond to companies.
- Offering greater connection between the Dual programmes and the companies' needs.
- Reviewing the Dual Training teacher's profile.
- **On knowledge transmission:**
  - Creating the INA Dual Culture through permanent training at all administrative levels.
  - Hosting active sessions to exchange experiences, learned lessons and good practices from the most successful regions.
  - Providing teaching staff internships to the most developed regions in the Dual Training implementation model.

In May 2023, Costa Rican National Institute of Apprenticeship (INA) approved its "Institutional Strategy for Dual Training 2023–2026" which will allow staff to have a common language and a clear course set under the national approach while respecting regional differences. The Strategy has seven components: work plan management; deep knowledge of dual training in the institutional sphere; available dual courses promotion; dual courses

1 National Institute of Apprenticeship (INA) teaching and administrative staff was Mrs. Corella Camacho, Mr. Díaz Páez, Mrs. Hidalgo Jiménez, Mr. Mejía Céspedes, Mr. Moraga Martínez and Mrs. Ocampo Rodríguez.

generation and programming; stakeholders' preparation for dual training programmes implementation; dual training monitoring and evaluation, and finally, continuous improvement and partner relationship.

Conclusively, a monthly session was defined with the regional dual training teams to follow up on the agreements, instructions and goals contained in the Institutional Strategy and a cloud repository was set up to store relevant information and institutional performance evidence.

We will continue adding good practices in INA because #SomosDual[2]!

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2 #WeAreDual

Nikolas Hubel

Learning settings for future-oriented training – Insight and didactic principles of the training series „KlimaKompetenz" [ClimateCompetence]

Creating effective learning settings for future-oriented training is of great importance, particularly in the context of sustainability. „KlimaKometenz (ClimateCompetence)" is a model project developed 2021 in Berlin, Germany. It aims to strengthen sustainability competencies in vocational training and utilises five key didactic principles: conscious design of inspiring learning spaces, a balance between scientific theory and practical inputs, peer-to-peer learning, co-creation of working materials and dissemination of results as Open Education Resources (OER). The series offers three-day events with various focus topics, allowing participants to develop the necessary competencies to promote sustainable development at work. The materials created are freely available for download, facilitating broader access and adaptation.

The challenge of sustainability in the workplace

In 2021, once again, the Intergovernmental Panel on Climate Change (IPCC) showed to the public that both the steps taken so far and the self-imposed sustainability goals of the UN member states are far from sufficient to limit global warming to 1.5 degrees. Nor are they sufficient to comply with the planetary impact limits (IPCC 2021).

It has become clear that scientifically proven knowledge about threats and existing solutions do not automatically lead to adequate problem-solving-oriented action. So how could the change towards sustainable production, work and living succeed?

Much has already been accomplished at the European, federal and state levels to support and add momentum to the sustainability transformation. In the EU, for example, stricter sustainability regulations for companies were recently created with the Corporate Sustainability Reporting Directive (CSRD) (EU 2022).

The Federal Ministry of Education and Research (BMBF) responded to the challenge in 2020 by introducing the new occupational standard "Environment and Sustainability" already the following August (BIBB 2023). It was thus decided that environmental protection and sustainability would be strengthened and anchored in vocational education and training.

But how do the corresponding competencies reach the vocational trainers? How can it be ensured that environmental protection and sustainability are dealt with in an appropriate, effective, scientifically founded and cross-occupational manner?

Approach – Creating orientation and learning spaces

The implementation of vocational training for sustainable development in terms of content and didactics is complex while the time pressure is growing at the same time. The global CO_2 budget for 1.5 degrees is getting smaller and smaller, other planetary load limits have already been exceeded (Wang-Erlandsson et al. 2022).

Meaningful engagement of sustainability multipliers demands both underlying system knowledge and professional competencies. Continuous training activities with the most qualified professional staff possible are correspondingly important. Vocational training staff therefore need additional resources and support in order to develop the positive effectiveness of education for sustainable development. Continuous, lifelong learning should not only be possible for professionals but part of their lives, and highly appreciated and supported by management levels.

The complexity of the situation requires that vocational education and training staff in particular are given sufficient time and space to deal with new as-is situations. They must get opportunities to reorient themselves in the changing work environment and to (re)discover intrinsic areas of interest and creativity (Hubel 2020).

In the following, a model project from Berlin is presented, which has set itself the goal to promote this positive scenario.

"KlimaKompetenz-Camps" – Vocational training series for future professions

Framework of the project

ClimateCompetence – Climate Camps for Future Professions (KlimaKompetenz) is a training series designed by the Institute for Vocational Education Research (IBBF) in cooperation with the Independent Institute for Environmental Issues (UfU e.V.) 2021 and has been implemented since then. The aim of the programme is to strengthen the anchoring of sustainability competencies in vocational training and further education as well as in company practice. Among other things, this aims to support the reduction of greenhouse gas emissions in Berlin and to put the city on a sustainable development path. The training series is aimed at vocational trainers, teachers at vocational schools, sustainability officers and human resources developers in Berlin companies (ibbf 2023).

Within the framework of the training series, about four three-day events with varying focus topics are offered per year. The events are designed for a maximum of 10 participants. Initially, an overview is offered on the topic of the challenge of climate change and sustainable development. An explicit reference to the field of action and impact of vocational training and work is included. Participants are invited to contribute existing knowledge, learning and teaching experiences. Afterwards, the respective focal topic of the event is brought into focus: e.g. regenerative energy technology, sustainable management, digitalisation & ICT. Expert lecturers provide an introduction to the subject in question, and additional

materials are made available for a more in-depth examination of the main topic. Participants get time and space to work out how they can successfully build up the competencies required to promote sustainable development in vocational education and training. In this process, experts are on hand to provide support. Together, first working and learning materials are developed. The materials created will be made available on an online platform, licence-free. They can be individually adapted and distributed among colleagues.

Didactic principles and their implementation

The conception and implementation of the KlimaKompetenz-Camps are based on five didactic principles, which are presented and justified in the following.

1. Choosing and designing the learning space setting consciously

Scheduling: Time is a scarce commodity, and it is not always easy to prioritise further education despite a heavy workload. Nevertheless, the Climate Competence Camps are intentionally offered as three-day events. The reason for this is quite simple: as explained at the beginning, the topic of climate protection and sustainable development is complex. There are plenty of scientific findings and recommendations, but there is no script that clearly describes the exact steps to be taken in order to meet this challenge of the century. It is clear that ecology, societal issues and economy must be brought into harmony with each other. But what that means for strategic decisions and everyday actions is a completely different question. That is why there is a need for sufficient time and space to orientate oneself outside the hectic daily routine and to find solutions for the individual field of action.

Choice of location: although the offer addresses individuals from Berlin, the events are carried out in the rural area surrounding the capital. The chosen seminar locations are accessible by public transport within 60 to120 minutes from the centre of Berlin. In addition, they are quiet, close to nature and should pursue a sustainable management concept themselves. The intentional choice for seminar houses close to nature in the countryside is intended to help the participants to arrive completely in the “here and now” of the training. Professional and family issues of everyday life remain physically and mentally distant. This allows participants to fully engage with the topics of the events and the group.

Figure 1: Choice of location

Source: author/IBBF

Design of the learning spaces: at the seminar location, care is taken to create inspiring, motivating learning spaces for effective working. There is space for inputs and lectures, space for informal encounters and exchange, space for individual professional inspiration and orientation, space for focused, individual or collaborative work and also space for rest, relaxation and regeneration.

Figure 2: Design of learning spaces

Source: author/IBBF

2. Offering both scientifically founded and practice-oriented inputs

The Climate Competence Camps offer both scientifically based theory lectures and practice-oriented inputs. The introductory lectures "Climate Protection & Sustainable Development" and "Communicating Climate & Sustainability Effectively" are presented by experts from IBBF and UfU e.V. For the focus topics, external experts from science or science-related consulting as well as sustainability pioneers from the corporate world get invited. The scientific content serves the objective of ensuring a common knowledge base (system knowledge) within the group for subsequent practical efforts (target & transformation knowledge). In addition, latest innovations and approaches to solutions are presented. The practice-oriented inputs serve to build bridges to everyday professional practice.

Figure 3: Offering practice-oriented inputs

Source: author/IBBF

Pioneer companies in the field of the respective focus topic are invited to introduce themselves and explain their specific strategy for successfully promoting sustainability in a professional context. They can serve as inspiration and role models for the participants' own commitment. The IBBF and UfU networks help to identify adequate speakers. Furthermore, it is important for the organiser to be up to date with the latest developments so that learning objectives can be predefined for the lectures.

3. Enabling peer-to-peer learning

Conceptually, care is taken to give participants enough time and space to learn from and with each other. Even before the event begins, participants get invited to bring their own materials, concepts and experiences and to share them with the group. In this way it is made clear that they are not only understood as learners but also as experts. This shows respect and appreciation for existing knowledge and practical experience. The participants often have different professional backgrounds. This can enrich the learning process in terms of content and also promote the commitment and motivation of the group.

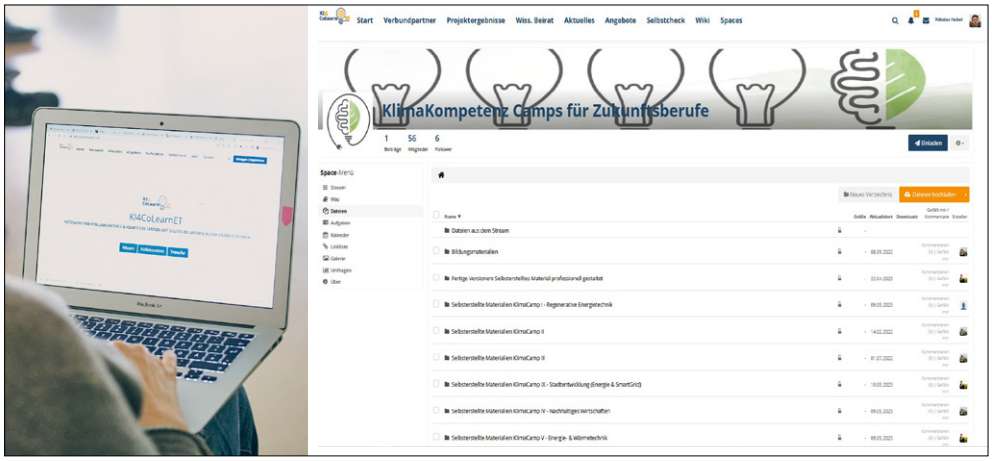
Figure 4: Enabling peer-to-peer learning

Source: author/IBBF

4. Giving space for the co-creation of working materials

Participants receive time and space to create working and/or learning materials for their own professional practice based on the content provided. Each input is followed by a reflection phase on the insights and their relevance for one's own work and how they can be embedded in it. This is meant to ensure the practical relevance and long-term effectiveness of the learning process beyond the training. The implementation of learning content directly in one's own materials serves to preserve the findings and to perpetuate sustainable development at work.

Figure 5: Giving space for the co-creation of working materials



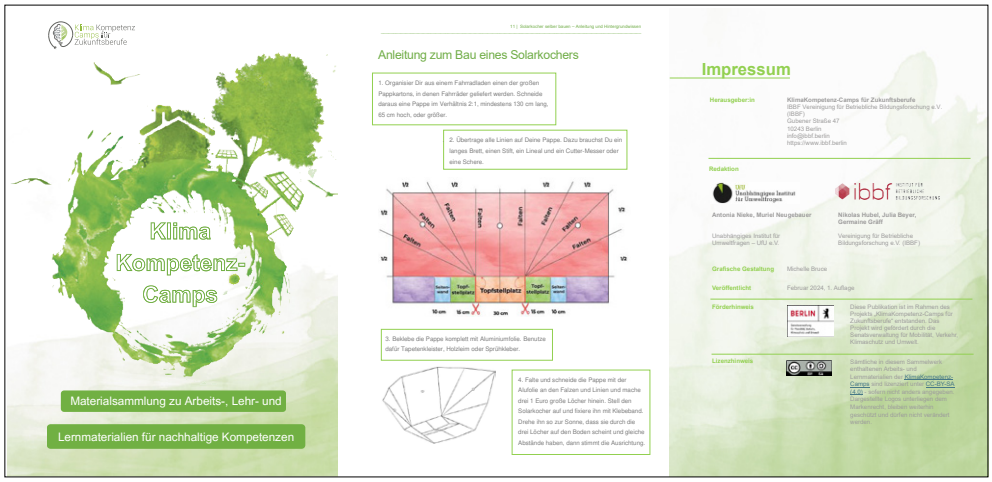
Source: author/IBBF

5. Valuing and disseminating results as Open Education Resources (OER)

The participants' materials are created at the event following the Open Education Resources principles. Once the contents are ready, the materials get converted into an appealing, uniform format by a designer and are published online free of charge for interested parties.

The professional graphic design enhances the clarity of the materials and increases their positive appeal. In addition, the content-related work of the participants experiences even a stronger appreciation by being published. Thanks to the open licensing and free access, interested parties worldwide can use the materials directly for their own work or as an inspiration source.

Figure 6: Dissemination of results as Open Education Resources (OER)



*Source: author/IBBF, **https://ibbf.berlin/assets/images/240312_Sammelwerk.pdf**, Licence CC-BY-SA 4.0*

Evaluation and assessment

The training series has been conceptually developed and initiated in 2021. In autumn of the same year, the first two KlimaKompetenz-Camps took place. Especially at the beginning, it became clear that employers would have difficulty releasing their staff for three days to attend a face-to-face training. Therefore, we had and continuously have to emphasise the added value of the format, especially in comparison to digitally supported blended learning solutions that run parallel to the regular working week. Today, the training is well received and highly rated by the participants. Each course is designed for a number of participants of 10. In 2022, for example, four KlimaKompetenz-Camps had a total of 52 people registered. So far, 19 educational and working materials have been produced, copyright checked and graphically designed within the framework of the training series. They can be downloaded free of charge from **https://klimakompetenz.org/downloads** (some in English). Thanks to the open licence, they can be used freely, individually modified and distributed. The materials were successfully tested and implemented by graduates in their everyday work.

Conclusion and summary

Sustainability transformation is complex. Scientific findings are already available, political goals are defined and corresponding agreements signed. Nevertheless, the sustainability transformation has not yet progressed at the necessary speed.

To succeed, existing routines and normalities of professional practice must be unlearned and new ones learned and normalised. For this purpose, orientation and learn-

ing spaces must be created that pick up the education actors emotionally in their reality, strengthen and motivate them in their field of work.

The five didactic principles presented have proven to be helpful in the context of KlimaKompetenz and are recommended for transformation-promoting learning offers in the vocational context. However, acceptance and appreciation for such offerings are not an automatic consequence. Therefore, the added value of such learning settings needs to be constantly explained and highlighted.

Scaling up the training series would particularly require further promotion of multipliers and a closer cooperation with companies and vocational training institutions.

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Vijayen D. Naidoo

Towards sustainable vocational education and training in South Africa: A QCTO response

This article explores the necessity of positioning Vocational Education and Training (VET) systems to respond adequately to issues of sustainability and just transitions. Whilst the latter part of this paper focuses on the South African context, many of the ideas presented in the first part of the report resonates with issues which are receiving attention in countries across Africa and indeed the world. Countries the world over are "racing against the clock" to find adequate responses to the climate crisis, renewable energy transitions, food security etc. enshrined in the Sustainable Development Goals (SDGs) 2030. This paper emphasises the importance of integrating green skills, green jobs, and green institutions into the TVET sub-system, as well as promoting social justice and sustainable livelihoods. To achieve these goals, several action-oriented measures are proposed.

Introduction

Upfront, it needs to be clarified that this paper is a product of research-based practice and therefore not located within any particular theoretical framework. Barends et al. (2014) provide a comprehensive definition of research-informed practice: "it is about making decisions through the conscientious, explicit and judicious use of the best available evidence from multiple sources to increase the likelihood of a favourable outcome". In their paper "Vocational education and training for African development: a literature review", McGrath et al. (2020) argue that the current major theoretical approaches to VET in Africa are not up to the challenge to respond to the UNESCO position that a transformed VET must be part of a transformative approach to development. My contention is that many "developing countries" with weak market economies attempt to adopt and implement the more established VET systems of strong market economies characteristic of developed "Global North" countries or "Global South" countries with similar developmental challenges. The approach taken by the Quality Council for Trades and Occupations (QCTO) can at best be described as building a system based on good practice gleaned from successful VET systems. As such, the ideas presented in this paper are located in the nexus of research, policy development and policy implementation.

Critical considerations for transformation of vocational education and training

Sustainability in vocational education and training systems will not happen easily. This paper highlights the following three critical elements. Firstly, a fundamental realignment of our education and training systems will be required, as well as a concerted and genuine effort from policymakers, industry, education and training institutions, trainers and students. Secondly, implementing sustainability in TVET will include the development and implementation of qualifications frameworks which are agile to incorporate elements of "sustainability" and "just energy transitions" and labour market requirements in the skills and competencies taught in skills development (including technical and vocational education and training). The third element is the development of qualifications, part qualifications and skills programmes to include compulsory elements related to sustainability and just energy transitions. The provision of education and training in South Africa is governed in terms of the National Qualifications Framework Act (Act 67 of 2008 as amended). Amongst others, this Act provides for the National Qualifications Framework; to provide for the South African Qualifications Authority and to provide for Quality Councils. The Quality Council for Trades and Occupations (QCTO) is one of three Quality Councils responsible for the Occupational Qualifications Sub-Framework (OQSF). In general, the functions of the QCTO include developing policy and criteria for the development, registration and publications, assessment and certification of qualifications and part qualifications registered on the OQSF. It is in terms of this broad mandate that this article provides an action-oriented measures to promote sustainable TVET.

Proposed actions for sustainable TVET

In their paper "Towards Sustainable Vocational Education and Training: Thinking beyond the formal", McGrath and Russon (2023) discuss the need for a shift in vocational education and training (TVET) systems towards sustainability and just transitions and highlight the unsustainable practices of mainstream formal TVET, particularly in Africa, and the growing awareness of the need to address the climate crisis. TVET national curriculum offerings in South Africa are theory "heavy" and curriculum review and development have remained somewhat stagnant at TVET Colleges in South Africa. Admittedly, some re-curriculation (modernisation and curriculum update) has taken place, over the last few years. This has served more to address the criticism of the outdatedness of much of the TVET offerings in the form of the National Education (NATED) and National Certificate Vocational (NC(V)). However, these curriculum updates did not "hold in sight" the SDG Goals, issues of climate change and sustainability and therefore remain largely unresponsive to these issues. Furthermore, the re-circulation lacked a more forward looking approach linked to skills anticipation and the future world of work.

The following proposed actions have been "gleaned" from the article by McGrath and Russon (2023)

1. Expand Research and Collaboration: The lack of research and engagement on sustainable TVET is concerning. To address this, the legislative mandate should encourage increased research, collaboration, and knowledge-sharing among TVET academics, Education for Sustainable Development (ESD) communities, and development actors. This can be facilitated through funding incentives, conferences, and collaborative projects.
2. Curriculum Integration: Embedding sustainability and green skills into TVET curricula is crucial. Develop guidelines and standards that promote the integration of sustainable practices, environmental awareness, and social responsibility across various vocational disciplines. This will ensure that graduates are equipped with the knowledge and skills needed for sustainable employment.
3. Industry Partnerships: Foster partnerships between TVET institutions and industry stakeholders, including private sector organisations, to align training programmes with industry needs and promote sustainable practices. These partnerships can provide opportunities for work-integrated learning, internships, and apprenticeships focused on green industries and technologies.
4. Stakeholder Engagement: Social dialogue, engaging employers, governments, and communities in the development and implementation of sustainable TVET policies. Establish mechanisms for ongoing dialogue and collaboration to ensure that TVET systems address local economic and environmental challenges and promote social equity.
5. Lecturer Professional Development: Enhance lecturer training programmes to equip TVET lecturers with the necessary knowledge and pedagogical skills to deliver sustainability education. Professional development opportunities should focus on sustainability concepts, innovative teaching methods, and industry trends in green sectors.
6. Green Infrastructure Investment: Advocate for increased investment in sustainable infrastructure within TVET institutions. This includes energy-efficient buildings, renewable energy systems, waste management facilities, and green technologies. Such investments will provide real-world learning environments and demonstrate sustainability principles in practice.
7. Support Informal Vocational Learning: Acknowledge the significant role of informal vocational learning, particularly in economies with highly informalised systems. Develop mechanisms to validate and recognise informal skills, providing pathways for skills development and integration into formal TVET systems.
8. Monitoring and Evaluation: Establish a robust monitoring and evaluation framework to assess the effectiveness and impact of sustainability related TVET initiatives. Regular assessments should consider indicators such as environmental outcomes, social equity, graduate employability, and industry uptake of sustainable practices.

By implementing these measures, TVET systems can contribute to just transitions, environmental sustainability, and sustainable livelihoods. This holistic and somewhat hybrid approach will assist TVET systems to adapt to changing societal and environmental needs.

The Quality Council for Trades and Occupations (QCTO) response towards sustainable vocational education and training

The QCTO is established through the Skills Development Act No. 97 of 1998, as amended (Government of South Africa (1998).

Section 26H of the Act outlines the functions of QCTO:

- Subject to any policy issued by the Minister in terms of section 26F, the QCTO is responsible for
  - establishing and maintaining occupational standards and qualifications;
  - the quality assurance of occupational standards and qualifications and learning in and for the workplace;
  - designing and developing occupational standards and qualifications and submitting them to the South African Qualifications Authority for registration on the National Qualifications Framework;
  - ensuring the quality of occupational standards and qualifications and learning in and for the workplace (ibid);

The National Qualifications Framework Act 67 of 2008 establishes QCTO as one three Quality Councils. In terms of this Act, the QCTO must amongst others:

- develop and manage its sub-framework, and make recommendations there onto the relevant Minister;
- advise the relevant Minister on matters relating to its sub-framework;
- with regard to qualifications for its sub-framework—
  - develop and implement policy and criteria, taking into account the policy and criteria, for the development, registration and publication of qualifications;
  - develop and implement policy and criteria, taking into account the
  - policy and criteria for assessment, recognition of prior learning and credit accumulation and transfer;
  - ensure the development of such qualifications or part qualifications as are necessary for the sector, which may include appropriate measures for the assessment of learning achievement; and
  - recommend qualifications or part qualifications to the SAQA for registration;
- with regard to quality assurance within its sub-framework—
  - develop and implement policy for quality assurance;
  - ensure the integrity and credibility of quality assurance;
  - ensure that such quality assurance as is necessary for the sub framework is undertaken;

In line with its mandate, the QCTO re-conceptualised the Occupational Qualifications sub-framework (OQSF) which was subsequently gazetted by the Minister in October 2021. Table 1 below provides an overview of the NQF with the three sub-frameworks viz. namely the General and Further Education and Training Qualifications sub-framework (Schools), the Higher Education Qualifications

Table 1: Qualification Frame Work of South Africa

NQF Sub-Framework/ Quality Council	NQF Level	NQF Sub-Framework and Qualification Type		NQF Sub-Framework/ Quality Council
Qualifications Sub-Framework (HEQSF)/Council on Higher Education (CHE)	10	Doctoral Degree Doctoral Degree (Professional)		
	9	Master´s Degree Master´s Degree (Professional)		
	8	Bachelor Honours Degree Post Graduate Diploma Bachelor´s Degree	Specialised Occupational Diploma	Occupational Qualifications Sub-Framework (OQSF) Quality Council for Trades and Occupations (QCTO)
	7	Bachelor´s Degree Advanced Diploma	Advanced Occupational Diploma	
	6	Diploma Advanced Certificate	Occupational Diploma Advanced Occupational Certificate	
	5	Higher Certificate	Higher Occupational Certificate	
General and Further Education and Training Qualifications Sub-Framework (GFETQSF)/Umalusi	4	National Certificate	National Occupational Certificate	
	3	Intermediate Certificate	Intermediate Occupational Certifcate	
	2	Elementary Certificate	Elementary Occupational Certificate	
	1	General Certificate	General Occupational Certificate	

Source: own illustration by author, according to Government of South Africa (2008)

Framework (Universities which include Universities of Technology) and the Occupational Qualification Sub-Framework. The OQSF now comprises 9 qualification types which share similar nomenclature to the qualifications on the other sub frameworks.

Some of the reasons for the revision of the NQF, incl. the OQSF, include:

Aligning Occupational Qualifications to the qualification names used in other sub-frameworks of the National Qualifications Framework (NQF). This was done to promote parity of esteem between sub-frameworks and contributing towards a single co-ordinated NQF. The previous OQSF only made provision for the issuing of Occupational Certificates on levels 1–8 of the sub framework and therefore movement (articulation) only up the OQSF was possible. This brought into question the equivalence of, for example, an Occupational Certificate at level 6 compared with a Diploma at the same level on the Higher Education Qualifications sub-framework (HEQSF) and whether a learner obtaining the Occupational Certificate at level 6 could articulate into a level 7 qualification on the HEQSF. The qualifications now being developed using the revised OQSF qualification types makes this possible. This will promote Systematic Articulation between TVET Colleges and Higher Education Institutions. Previous articulation was possible only where a TVET College and a University had some form of "institutional agreement". The revised OQSF and by implication the NQF presents a re-alignment of the education system to respond to the needs of a developing economy.

Another driver is to elevate TVET Colleges to become "Institutions of Choice" and to remove the stigmatisation that VET is second class or inferior to a University qualification. This is a strategic move to attract students towards studying an Occupational Qualification at a TVET as University spaces are very limited. It is envisaged that getting more students enrolled for Occupational Qualifications at TVET will address the mid-level skills gap in South Africa as well as reduce the number of youth classified as NEET (not in employment, education or training).

One of the major breakthroughs is the inclusion of the Trades on the NQF for recognition purposes. South Africa has an official list of trades (mainly offered through apprenticeships). Prior to the trades being reworked and registered on the NQF, they were maintained on a separate register. As such trades were not recognised as qualifications and could therefore provide access to work and rarely to further education and training.

Each of the qualifications on the OQSF comprise part qualifications and skills programmes (smaller units of learning). A part qualification or skills programme is defined as "an assessed unit of learning" and is therefore credit bearing. This approach creates learning pathways towards lifelong learning. The part qualifications and skills programmes are designed to facilitate articulations to other sub-frameworks, employment/self-employment, further study and lifelong learning, upskilling and reskilling.

While the above was designed to address the high unemployment rate by providing students with short interventions leading to employment and the choice to enter the formal training system again, it also provides the QCTO with a mechanism to incorporate modules on sustainability, green skills etc. into existing qualifications. The QCTO remains acutely aware of criticisms against such "bolt on" interventions but is of the view that this approach is justified in the context of the South African political economy currently characterised by a weakening economy, high unemployment and the need to respond to issues of sustainability. McGrath et al. (2020) indicate that "a major challenge for imagining new vocational provision lies in understanding the knowledge basis of new programmes, qualifications and

occupations" and the need to move "crude technical approaches to what skills appear to be needed at the surface level, and to consider what knowledge, as well as skills, is required for transformative VET".

Stronger underpinning disciplinary knowledge will be a critical feature of the new Occupational Qualifications being developed by the QCTO. Occupational qualifications are developed in conjunction with QCTO recognised Quality Partners (Sector Education and Training Authorities – SETA's) and their industry chambers. This has proven to be valuable as industry is better positioned to predict and articulate present and future training needs. This informs which qualifications, part qualifications or skills programmes need to be developed. Both the QCTO and SETA's undertake capacity-building initiatives to enable targeted TVET Colleges to offer the new Occupational Qualifications. These TVET Colleges must first obtain QCTO accreditation before they may offer such training. TVET Colleges classified as Centres of Specialisation (CoS) are able to achieve accreditation within a fairly short time as they are much better resourced than most other Colleges. The CoS was a Department of Higher Education and Training (DHET) pilot project where selected colleges were accredited to pilot thirteen of the QCTO developed Occupational Qualifications.

Conclusion

Promoting sustainable TVET requires a holistic approach that integrates environmental, social, and economic considerations into vocational training. By taking action on expanding research, curriculum integration, industry partnerships, stakeholder engagement, teacher professional development, green infrastructure investment, support for informal vocational learning, and monitoring and evaluation, TVET systems can contribute to just transitions, environmental sustainability, and sustainable livelihoods. Implementing these measures will align with the legislative mandate of the Quality Council for Trades and Occupations (QCTO), as outlined in the National Qualifications Framework (NQF) Act, and will ensure that the TVET sub-system adapts to the changing needs of society and the environment. The OQSF represents a framework that is agile to respond to both the quantity, quality and cognitive demand underpinning the theory and practice of a skills formation system able to respond to developing economy.

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Christina Strotmann, Julia Kastrup, Marc Casper, Werner Kuhlmeier, Marie Nölle-Krug, Anna-Franziska Kähler

A model for structuring and describing sustainability-related competencies for trainees in the food crafts and food industry

In order to structurally anchor the guiding idea of sustainable development in the working and professional world, corresponding competencies, which are to be promoted within the framework of vocational training, must be identified and concretised. This paper presents a model for structuring and describing sustainability-related competencies in the food crafts and food industry. The model presents the dimensions of professional action competence (professional, social and self-competence) on three levels: related to decisions made in the work process, on the company level, and on the political or societal level. The 15 sustainability-related topic areas of the model are each backed up with competency goals that can provide impulses for curricular and didactic VET work.

1 Promoting sustainability-oriented competencies in the food crafts and food industry – A contribution of vocational training to sustainable transformation

The sustainable production of food makes a crucial contribution to the sustainable development of our society. Therefore, professionals in this domain have the important task of considering sustainability in its entirety within the scope of their activities. Food processors (food crafts or food industry) are often embedded in global value chains. In order for the skilled workers to be able to fulfil their responsibility in the development, processing and marketing of sustainable food, they need comprehensive vocational action competence, which also includes taking responsibility beyond the boundaries of their own company. Their qualification within the framework of vocational training thus represents a decisive lever for the transformation to a sustainable society.

The importance of the guiding principle of sustainable development has increased in recent years. Sustainability has become an indispensable element of professional action that is changing the world of work. In Germany, this high priority of sustainability has already been taken into account by anchoring the topic of "environment and sustainability" as a minimum standard in the training regulations of the dual vocational education and training system via the modernised occupational profile items (see BIBB 2021). This anchoring across all training occupations must now be followed by occupation-specific

concretisation. With regard to food-processing occupations, it is necessary to identify the occupation-specific competencies that enable trainees, as future skilled workers in these occupations, to act sustainably.

Against this background, the authors derived a model for describing and structuring sustainability competencies in food-processing professions, including the detailed formulation of competency goals. This present competency model for vocational education and training for sustainable development (VETSD) in the food crafts and food industry is one of the main results of the work of the scientific supervision of the pilot projects of the third funding line "Vocational Education and Training for Sustainable Development 2015–2019" carried out by the German Federal Institute for Vocational Education and Training (BIBB). It takes into account the results of the pilot projects and considers their desire for a universal competency structure model. The authors first address the question of which aspects of sustainability are relevant in the working environment of the food crafts and food industry. From this, they derive skills, abilities and knowledge that employees must have in order to be able to act in an ecologically, economically and socially responsible manner in the professional but also in the social and private context. For the systematic representation of sustainability competencies, the universal dimensions of human action competence according to Roth (1971) (professional, social, self-competence) as well as different levels of responsibility of professional action (workplace, company, society) are taken as a basis. In particular, the sector-specific work processes in the food crafts and food industry are taken into account in the modelling. At the same time, this involves the premise of treating sustainability as an immanent component of professional activity and not as an additional topic (see Melzig et al. 2021).

In the following, the procedure and results of the modelling of sustainability-oriented competencies are described in Chapter 2. Chapter 3 presents the detailed target formulations for the promotion of sustainability-related competencies for professionals in the food crafts and industry. Possible applications for the competency model are discussed in Chapter 4.

2 Modelling sustainability-oriented competencies for professionals in the food crafts and food industry

The following questions are answered within the framework of the modelling:

- Which aspects of sustainability are relevant in the training programmes of food processing professions in the food crafts and food industry?
- How can competencies that (future) professionals in food processing professions need to help shape their jobs in terms of sustainable development be identified?
- How can the competencies be systematically presented and described so that sustainability-oriented competency goals can be formulated on this basis?

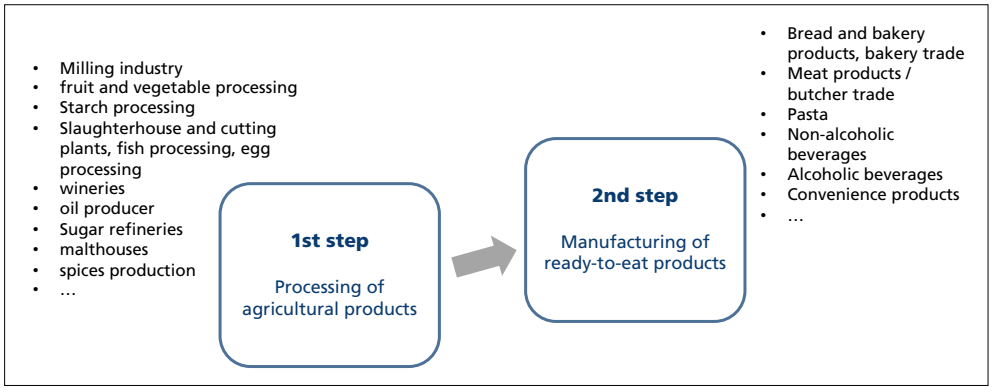
With these questions in mind, a structural model of competencies for training in food-processing professions was developed on the basis of document analyses, the findings from the pilot projects and expert workshops. The development took place in six steps, which are explained in more detail below:

1. identifying relevant work processes for the professions in the food crafts and food industry,
2. determining the fields of action and dimensions of sustainability-oriented vocational action competence,
3. identifying sustainability-relevant aspects of the work activity,
4. structuring and assigning the identified aspects to the domain-specific competency matrix,
5. formulating competency goals and
6. validating the competence model.

Step 1: Identifying relevant work processes for the professions in the food crafts and food industry

The field of activity in food-processing professions is versatile (see Fig. 1). On the one hand, the agricultural products obtained in primary production are processed in companies such as flour mills, malting plants, sugar factories, oil mills or slaughterhouses. On the other hand, these raw materials gained in the first processing stage are used to further process them in crafts or industrial businesses into ready-to-consume food, such as bread and baked goods, beverages, dairy products, ready-made meals or confectionery.

Figure 1: Fields of action of food-processing professions

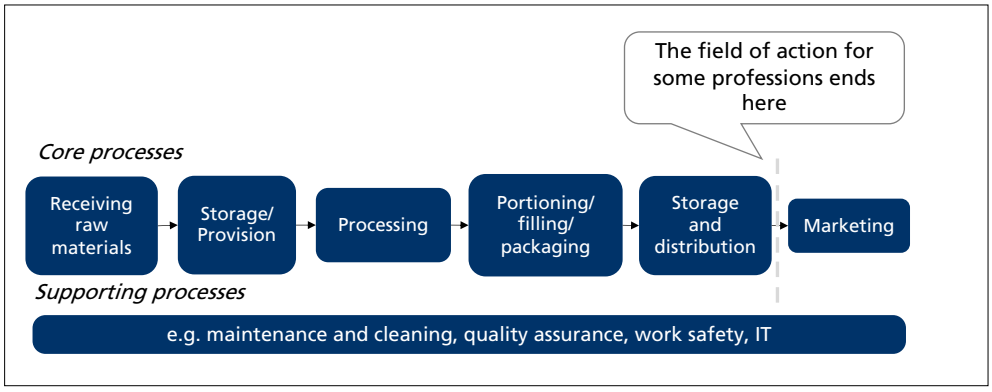


Source: own illustration based on Hamatschek 2016, p.16

In the first step of the model development, the question arose as to which similarities and differences the various food-processing professions have in terms of their fields of activity

and how these are reflected in vocational training. This question was pursued with the help of an analysis of the training regulations. It became clear that despite all the differences, be it with regard to the raw materials processed and products manufactured or with regard to their assignment to crafts or industry, the professions deal with similar activities, which can be differentiated according to core and support processes (see Fig. 2). Core processes are directly related to value creation in the company, while support processes include overarching tasks, such as carrying out maintenance work or quality assurance measures. Both core and supporting processes are necessary in order to produce food. These begin with receiving and inspecting the quality of raw materials on delivery, include their storage and preparation for the processing step, and also comprise the portioning and packaging of the food produced, as well as the subsequent storage and distribution activities. Some professions also include activities in the context of marketing the end products, such as the occupation of wine technologist.

Figure 2: Core and support processes of food processing professions



Source: own illustration

Step 2: Determining the fields of action and dimensions of sustainability-oriented vocational action competencies

In order to determine and formulate those competencies that trainees should have at the end of their training so that they can contribute to sustainable development, a framework for structuring competencies is needed first. A theoretically sound competency structure model that has been widely received in (vocational) education contexts goes back to Heinrich Roth (1971). He distinguishes between three dimensions of action competency:

- professional competence as the ability to make judgements and act in a subject area,
- social competence as the ability to be capable of judgement and action in social, societal and political contexts,
- Self-competence as the ability to act responsibly for oneself.

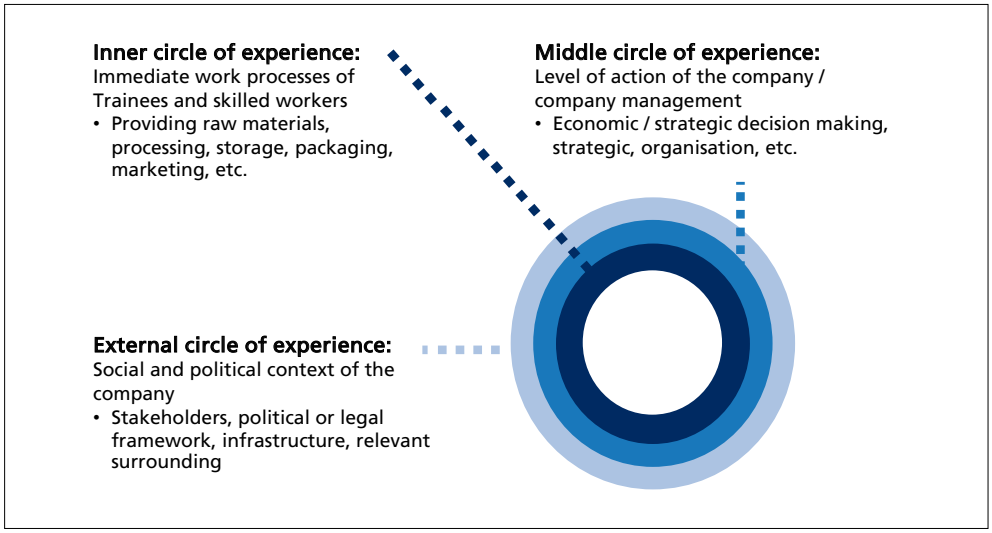
These competence dimensions can be specified for the skills, knowledge and abilities that are relevant for vocational action with the goal of sustainable development. Accordingly, competent vocational action in the sense of sustainability requires that trainees

- are able to act in an informed manner, for example, by assessing the raw materials sourced by their business from a sustainability perspective.
- are able to act in a socially responsible way, for example, by emphasising the health aspects of the food produced when communicating with colleagues and, if necessary, with customers.
- can act in a self-responsible way, for example, by identifying with particular strengths and traditions of their profession and contributing to the preservation of cultural values.

The competence dimensions refer to the trainees' dispositions to act, i. e. to their ability to cope with situations of professional demands in an appropriate, socially responsible and self-responsible manner in the sense of sustainability. This structuring of the dimensions of vocational action competence is compatible with the competence descriptions of the German Qualifications Framework (DQR) and the European Qualifications Framework (EQF).

The scope of employees to make decisions in the sense of sustainable development is often limited. Therefore, in addition to the three competence dimensions, the different levels of responsibilities, represented here as concentrically arranged "circles of experience" (see Fig. 3), must be distinguished (see Strotmann et al. 2020).

Figure 3: Circles of experience and responsibilities for decisions



Source: own illustration according to Strotmann et al. 2020, p. 26; translation by the authors

The inner circle of experience refers to the job-related work processes. There is room for action in which the trainees and skilled workers can help shape the execution of the work. The middle circle of experience concerns the level of action of the company or the company management. The (prospective) skilled workers have only little influence on decisions at this level. Such decisions are largely made by the company management itself. Finally, an external sphere of experience can be identified, which includes the social and political context. This includes, for example, legal requirements that influence the work processes but can neither be changed by the trainees and skilled workers nor are they responsible for them.

The limits of the possibilities of influence and the levels of responsibility must be observed and also addressed in training in order to prevent trainees from being confronted with excessive moral demands on their own actions. However, in the sense of comprehensive vocational training, it is necessary to reflect on these connections and to include them in the competency model.

The connection of the three competence dimensions (professional, social, self-competence) with the three levels of action (job-related work processes, entrepreneurial decisions, political decisions and social developments) finally forms the general grid for structuring a sustainability-related action competence (Casper/Schütt-Sayed/Vollmer 2021). By integrating the previously identified relevant work processes for the food-processing professions into the work-specific action level of the grid, a sector-specific matrix for structuring and describing sustainability-related competencies for the food crafts and food industry results.

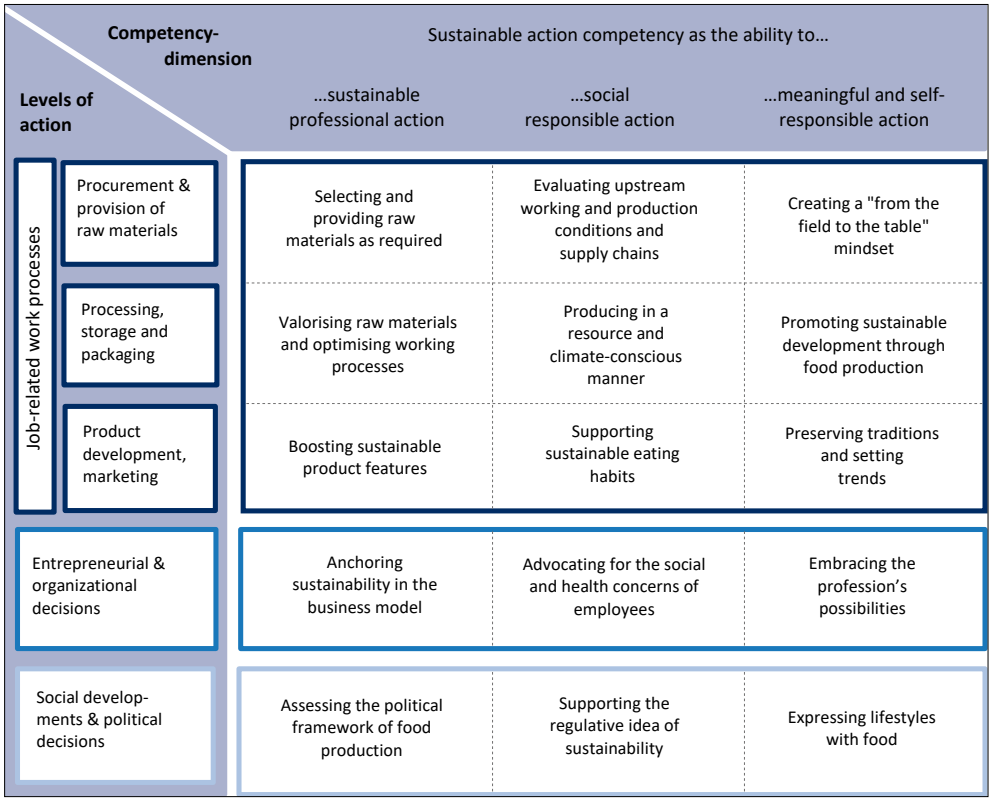
Step 3: Identifying sustainability-relevant aspects of the work activity

The aim of this step is to identify the relevant topics of sustainability in the professions of the food crafts and food industry. For this purpose, the results of the pilot projects of funding line III as well as past pilot projects were taken into account, and existing literature or studies were also included. The result of this research work is a collection of sustainability-relevant topics that are significant across the board for all food-producing professions.

Step 4: Structuring the sustainability-relevant content according to the competence matrix

During this step, the previously identified contents are structured. In the context of the modelling described here, the matrix for the description of sustainability-related competencies in the food crafts and food industry (see step 3) is used for this purpose. The sustainability-relevant contents were assigned to the fields of the matrix and, in addition, a core competence was identified as a heading for each of the 15 fields (see Fig. 4).

Figure 4: Competency matrix for the description of sustainability-related competencies in the food crafts and food industry



Source: own illustration

Step 5: Formulation of competency goals

Finally, to complete the competency model, detailed competency goals must be set for all fields of the matrix, taking into account the following aspects (see chapter 3.1). 3) for all fields of the matrix:

The competency goals ...

- apply to all food-processing professions,
- do not claim to be exhaustive; they are to be understood as examples and suggestions for VET practice,
- contain different levels of performance requirements. They have taxonomic gradations and can thus be assigned to different levels of difficulty,
- take into account the trainees' scope for responsibility and creativity,
- are designed to enable trainees to support the transformation towards sustainable development.

Step 6: Validation of the competence model

In the last step of the model development, it is validated by experts from different fields. In the present case, this took place in two phases. The first evaluation phase was carried out with the participants in the pilot project of funding line III within the framework of a working forum. In the second evaluation phase, an expert workshop was held with participants from the areas of VET research, school-based and in-company training, education administration, the social partners and individual representatives of the pilot projects. These experts were asked in advance of the workshop to evaluate the contents of the model and to assess its pragmatic quality. During the workshop, comments and remarks could be left on a digital pinboard (padlet) at the relevant points of the model. Furthermore, the digital meeting included a discursive part. All comments and suggestions for improvement from both workshops were subsequently reviewed by the scientific support team and taken into account at the appropriate points in the model.

3 Sustainability-related competencies for vocational training in the food crafts and food industry

In the following section, detailed descriptions of competencies for the individual fields of the competencies introduced in Chapter 2.5 (see Fig. 4) are presented. These are divided into the three levels of action of the job-related work processes (Chap. 3.1), entrepreneurial and organisational decisions (Chap. 3.2) as well as political decisions and social developments (Chap. 3.3). The listed competency goals do not claim to be exhaustive; they are to be understood as examples and suggestions for VET practice. At the same time, they partly go beyond the legal requirements of vocational education and training. In this way, trainees are given scope for responsibility and creativity, and thus transformative competence development in the sense of VETSD is promoted.

The application of the competency model has to be adapted to the respective context or to specific professions and their fields of activity. This may be accompanied by a different prioritisation of core competencies. Not all competency goals therefore apply equally to all professions – both scope and requirement can vary depending on the profession. With regard to didactic implementation, Casper, Kastrup and Nölle-Krug (2023) offer tips and impulses for creative and experience-based methods. Moreover, the six participating pilot projects have already concretised the teaching methods for individual professions. Their results can be found on the Website of the BIBB[1].

1 See **https://www.bibb.de/de/85132.php** (Retrieved on 24.07.2023).

3.1. Competency goals on job-related work processes

3.1.1 Selecting and providing raw materials as required

Trainees act according to demand in the ordering and storage process by avoiding food losses, optimising sub-processes, and paying attention to detailed specifications of their typical raw materials. Trainees can ...

- name specific sustainability aspects of their raw materials (e. g. related to economy, environment, society, animal welfare, health and culture), critically question them, and take them into account when selecting raw materials;
- research and document the information necessary for raw material procurement;
- define detailed raw material specifications to avoid incorrect purchases;
- adjust order quantities and delivery dates to warehouse, production and sales planning to avoid over-purchasing.

3.1.2 Evaluating upstream working- and production-conditions and supply chains

Trainees are aware of the position of their company in a longer value chain. They understand that especially the upstream work and production steps can have a considerable influence on sustainable development and thus have an impact on their own company's area of responsibility. They can ...

- use sustainability standards and labels relevant to their sector as a basis for decision-making when selecting raw materials. In doing so, they can critically assess the significance and credibility of these sustainability standards and labels and also explain in customer-oriented language what they mean for the assessment of production and transport conditions;
- research and evaluate the ecological conditions and consequences of the production of raw materials (including their preliminary stages), their storage and their transport (e. g. ecological footprint based on land, water and CO_2 footprint, use of pesticides, transport routes, place of origin);
- research and evaluate social conditions and consequences of the production, pre-processing and transport of raw materials (e. g. compliance with occupational health and safety, health effects, wage justice).

3.1.3 Creating a "from the field to the table" mindset

Trainees understand their responsible position in the long value chain from agricultural production to consumption ("from the field to the table"). They understand that professionals in food crafts and industry are an important link between access to biocapacity (the ecological "consumption of the world") and the physical well-being of individuals.

Trainees can ...

- highlight environmental and social impacts from primary production to disposal and take these into account when making decisions;
- develop pride and professional identity beyond their own work processes by placing them in the context of responsible, sustainable value creation;
- recognise the meaningfulness of responsible raw material procurement and utilisation in terms of justice and represent this externally (also beyond their own company) (as "ambassadors for sustainable nutrition").

3.1.4 Valorising raw materials and optimising working processes

Trainees efficiently use equipment and materials such as raw goods and consumables in the context of refining raw materials. Trainees understand the particular importance of losses, waste and packaging loads for sustainable development and know strategies for avoiding or changing them. They can ...

- select and use processes, machinery and equipment in such a way that resources such as water, raw materials, consumables and energy are used effectively and efficiently;
- compare different cleaning and disinfection measures in terms of sustainability (e. g. with regard to quantities used, agents, procedures, environmental compatibility) and apply them safely;
- select and apply processes to preserve valuable ingredients (e. g. vitamins, antioxidants). If necessary, they can adapt process parameters to the particular processing and storage properties of the respective raw materials;
- establish maintenance plans or apply predictive maintenance concepts for machines and systems to ensure their optimal service life and minimise unplanned downtimes;
- classify packaging components and their different functions (e. g. protective, transport, information, advertising or additional functions) and critically reflect on their impact on sustainability;
- differentiate packaging options in terms of sustainability (e. g. with low environmental impact, alternative packaging materials) and select sustainable packaging;
- determine data on the energy efficiency of plants and processes (e. g. kWh/product unit, share of energy needed per work area). They can critically compare the energy efficiency of plants and processes with values customary in the sector and identify possible causes for deviations;
- develop and implement concepts for increasing energy efficiency.

3.1.5 Producing in a resource and climate-conscious manner

Trainees understand that resource-conserving production is not only a question of operational costs but – in the context of global climate change and social injustice – also a social responsibility. They develop proposals for measures to conserve resources. They can...

- compare the indirect CO_2 emissions caused by energy use in manufacturing, packaging and storage of different energy sources (renewable and conventional). In this context, they can explain the difference between renewable and fossil energy sources, evaluate the effects on the environment and present the consequences of climate change in a global context;
- assess the potential for saving costs and resources (e. g. raw materials, consumables and supplies, water, energy) and explain to what extent operational goals and climate goals coincide or conflict with each other;
- make arguments for an appreciative attitude towards food that go beyond the purely economic (e. g. respect for global biocapacity, social injustice in access to food, abundance versus hunger);
- and explain causes of food losses and waste, assess their impact (local, regional and global) and identify and implement measures to avoid and recycle food losses (e. g. selling as B-goods, passing on to charities).

3.1.6 Promoting sustainable development through food production

Trainees see themselves as process designers in the responsible production of food. They are willing to share responsibility for the safety and quality of food products and base their profession on unconditional respect for life and health ("biological ethics"). They understand that all of their actions in manufacturing can be sustainable or unsustainable. They can ...

- use their leeway in the selection and design of processes for the manufacturing, storage and packaging of food in order to make an active contribution to the sustainable development of our global society;
- demonstrate their contribution to sustainability by choosing certain alternative actions when designing their work processes;
- describe the particular importance of the food sector for sustainable development and to what extent they want to use their personal values and talents to shape their professional role in terms of sustainable development.

3.1.7 Boosting sustainable product features

Trainees know how to contribute to sustainable nutrition by (further) developing products and recipes. They can ...

- select and use appropriate raw materials with the lowest possible climate impact in product development (e. g. plant-based raw materials). They can optimise existing products with regard to their climate impact and adapt recipes (e. g. increase the proportion of plant-based raw materials, replace salt with herbs and spices, use seasonal and local or historically significant raw materials, ...);

- include social aspects of raw material production (e. g. fair trade, global climate justice) as selection criteria when developing new products or revising existing recipes. When using animal products, they pay particular attention to aspects of animal welfare and species-appropriate husbandry. They are familiar with the corresponding labels and certifications;
- identify regional, seasonal and organically produced raw materials and justify if and when their selection is a sustainable option;
- develop marketing and communication measures to highlight sustainable features in a way that promotes sales.

3.1.8 Supporting sustainable eating habits

Trainees are prepared to reflect on their professional actions in the development and marketing of food with regard to sustainable and healthy nutrition and to question unsustainable eating habits. They understand that consumption expectations such as "healthy" and "tasty" can conflict with each other (e. g. salts and fats as common and cheap flavour carriers, but with little dietary value). They respect different consumption styles, but with reference to their professional knowledge and responsibility, they particularly advocate the development of sustainable and healthy foods. They can ...

- emphasise the marketing effect of fair-trade raw materials and climate-conscious products to superiors and colleagues, and communicate with customers in an understanding and responsible manner (including on food-related supply chains and production conditions);
- highlight the contribution of sustainable food to the preservation of cultural diversity and biocapacity as well as to health promotion;
- actively advocate for the health of consumers and emphasise health aspects (e. g. sugar, fat, salt content) in communication with colleagues and customers, determine and communicate promotional arguments for sustainable products;
- reflect on reduction targets (fat, sugar, salt reduction) with reference to the typical dietary characteristics of their own products, assess them against the background of general labels (e. g. Nutri-Score, nutrient tables) and revise recipes for a health-promoting diet.

3.1.9 Preserving traditions and setting trends

Trainees know that the spectrum of their profession can range from satisfying hunger to fulfilling widely differing consumer demands for pleasure. They see themselves as designers and providers of both nutritional and indulgence offers. They use recipes as a medium of cultural sustainability: as knowledge handed down, in which traditions worth preserving are expressed, and at the same time as creative scope for innovation. They recognise regional characteristics, cultural diversity and nutritional trends as opportunities for the development of sustainable products. They can ...

- assess what contribution to nutrition and indulgence they can (and want to) make with their professional actions and the specific products of their business;
- consider indulgence against the background of the regulative idea of sustainable development;
- consciously use special strengths and traditions of their craft or technology to preserve cultural values and intangible heritage (e. g. diversity of varieties and products, German bread culture as a world cultural heritage);
- fulfil their professional role as ambassadors and modernisers of craft and industry, consciously balancing tradition and innovation.

3.2. Competency goals in relation to entrepreneurial and organisational decisions

3.2.1 Anchoring sustainability in the business model

Trainees understand that sustainability and business success are not contradictory (considering the demand for sustainable products increasingly opens up market opportunities, to name one reason). They see the potential to increase turnover and develop unique selling points using sustainable and innovative products and services. They recognise that a range of sustainable products and services are a feature of responsible action and an opportunity to secure the competitiveness and future viability of their business. They can …

- assess what contribution their company is currently making and can potentially make to sustainable development;
- propose how the business model of their company can be further developed along the strategies of "efficiency", "consistency" and "sufficiency";
- identify key characteristics of sustainability-oriented customer groups, consumption styles and trends and use them to co-develop and market sustainable products within their company's business model;
- assess the benefits of reliable relationships with suppliers, customers and industry partners and reflect on how long-term and fair such relationships are in their companies;
- prioritise different corporate measures to promote sustainable development (e. g. reduce CO_2 emissions instead of making compensation payments);
- explain how sustainability-oriented companies fulfil their social responsibility as social actors;
- assess the potential of public welfare-oriented and employee-led forms of enterprise for their sector;
- determine the benefits and challenges of sustainability reporting and corporate social responsibility (CSR);
- derive conclusions for their own business from the requirements of sustainability certifications (e. g. product and management standards);

- evaluate which sustainability communication measures are effective and honest (cf. greenwashing) and draft suggestions for the external presentation of sustainability activities.

3.2.2 Advocating for the social and health concerns of employees

Trainees understand that employee social and health concerns are factors of sustainable development of work and society. They can ...

- identify aspects of workplace co-determination from the perspective of employees, works councils and employers;
- reflect on the extent to which workplace co-determination can be a corrective measure in terms of the exploitation of people and the environment and is in the long-term interest of companies, even if conflicts of interest have to be dealt with or endured in the short term;
- minimise their own physical and mental stress and that of their colleagues by taking health issues and family needs into account when planning their working hours;
- draft and implement suggestions for operational improvements as a contribution to sustainable development in exchange with colleagues and superiors;
- acknowledge occupational health and safety regulations and actively take measures to ensure their physical integrity;
- support health promotion and addiction prevention for themselves and others. They are particularly aware of the dangers of the uncontrolled use of goods they produce themselves (e. g. alcohol addiction, obesity, diabetes). They are aware of specific campaigns in their sector (e. g. "Enjoy consciously", brewer's code of conduct) and are sensitive to dangers and stresses typical of their profession (e. g. postural problems, monotonous stress, allergies).

3.2.3 Embracing the profession's possibilities

Trainees carry out their professional role and current position by actively contributing to their company. They strive to gradually expand their creative scope. They see themselves as part of a professional community that goes beyond their current situation in training and training company. They know and use their own "levers" in the profession, as trainees and as future skilled workers. They educate themselves and others by sharing knowledge and experience and contributing creative ideas. They can ...

- endure contradictions and conflicts in connection with the idea of sustainability if they cannot influence them;
- analyse inconsistencies between the ideals of sustainable development and prevailing work routines from different perspectives and derive long-term, sustainable solutions for their own actions from them;

- develop proposals for change to counteract sustainability-related conflicts of objectives (e. g. cost pressure versus environmental compatibility) and perceive them as design challenges – not as decision-making problems;
- recognise and evaluate the current and future possibilities of shaping their professional activity for sustainable work. They perceive professional work and entrepreneurial decisions as opportunities to help shape and sustainably change society;
- set long-term professional goals, also beyond training, and develop their own entrepreneurial perspective if necessary.

3.3. Competency goals in relation to social developments and political decisions

3.3.1 Assessing the political framework of food production

Trainees understand that their professional actions and the actions of their company are influenced by social and political frameworks. They recognise to what extent decisions in different policy fields (e. g. consumer, health, economic and social policy) can promote the transformation to a sustainable society and improve their working conditions. They know the relevant positions and activities of the different political actors as well as of professional and industry associations. They recognise their own opportunities for participation and make use of them. They can ....

- name political decisions that affect their profession and their company and take a position on them;
- distinguish and assess positions and initiatives of professional and industry associations on sustainability-related topics;
- name the possibilities and limits of their own company to act in a socially responsible manner;
- derive external costs (costs caused by the company but borne by society, e. g. health costs, costs of environmental damage) caused by their own production along the value chain and assess the relationships between production costs, external costs and the price of a food product;
- describe the disadvantages of monopolistic structures – both for sustainable development and for a social market economy.

3.3.2 Supporting the regulative idea of sustainability

Trainees know the guiding principle of sustainable development and the corresponding global sustainability goals of the United Nations and are able to apply these critically and constructively to their actions in the company. They can ...

- explain the main features of the idea of sustainable development (e. g. Brundtland definition, sustainability dimensions, planetary boundaries);

- reflect on individual sustainability goals for their sector, their own company and their own professional actions, recognise the need for action and translate these into options for action;
- explain the particular importance of climate targets to reduce climate change. They understand why greenhouse gas emissions lead to climate change and can also differentiate between the ecological and social consequences of global warming worldwide (inequality between "Global North" and "Global South");
- and apply the guiding principle of sustainable development to private consumption decisions and political action. They see themselves as agents of change even beyond their professional activities.

3.3.3 Expressing lifestyles with food

Trainees understand that nutrition has an existential importance in everyone's life and is experienced very differently, from biological necessity to lifestyle ideology. They understand that professionally designed food environments such as salesrooms, markets and cafés/restaurants, but also packaging and other marketing tools, have a strong influence on consumer behaviour. They recognise that the responsibility for sustainable eating habits therefore does not lie solely with the individual consumer. They know that food is more than purely commercial goods and are aware of the different value dimensions of food (e. g. as cultural goods that create identification, as renewable raw materials, as a human right, as creative expression, as a social focus when cooking and eating together). They also reflect on these values against the background of their own nutritional biography and eating habits. They can ...

- recognise the different values attached to food in their own business. They can critically reflect to what extent these values are in line with sustainable development. They understand that excessive commercialisation is a cause of non-sustainable developments. They know arguments and measures for strengthening non-commercial aspects of food (e. g. for a target group-oriented customer approach, lifestyle services such as cooking/baking courses/recipes);
- critically assess the extent to which consumption and lifestyle patterns and trends impact on personal well-being and sustainable development. They acknowledge the importance of sustainable and responsible consumption for themselves and in a global context and can present this argumentation to others;
- assess their professional contribution to shaping the lives of consumers and draw pride from the awareness of how meaningful and consequential professional action can be in their profession.

4. Application of the model in vocational training

The present competency model systematically presents starting points for the promotion of vocational action competence in order to support a sustainability orientation of food-processing professions. The demands of the model partly go beyond the legal requirements of vocational training. This opens up further scope for responsibility and design for the trainees, which promotes transformative competence development in the sense of VETSD. At the same time, limits of responsibility and influence should be addressed during the training in order to avoid overtaxing the trainees.

The fields of the competency matrix serve to structure relevant sustainability competencies and are not to be considered in isolation but in a reciprocal context. The three underlying dimensions for sustainability-oriented vocational action competence (sustainably professional, socially responsible, meaningful and self-responsible) ensure the connectivity of the model to the understanding of competence of the German Standing Conference of the Ministers of Education and Cultural Affairs (KMK), to the DQR, and to the EQF. Thus, the model can be used within the framework of VETSD qualifications for different target groups.

In order to take into account the demands of sustainable nutrition (cf. Ritter/Strotmann 2023), a context-specific adaptation of the competency goals is possible, both in terms of scope and demand as well as priority, because focused fields of activity, raw materials used or products produced vary in the different professions of the food crafts and food industry.

The following options to use the competency model are possible in the context of vocational education and training: it can serve as a basis for the didactic conception and the design of teaching/learning processes in the sense of VETSD (cf. Casper/Kastrup/Nölle-Krug 2023). In addition, the model provides impulses for vocational classification work and can thus be incorporated into reclassification procedures for corresponding training programmes (cf. Strotmann et al. 2020 for the occupation brewer and maltster; Bretschneider/Casper/Melzig 2020 for the occupation home economist, Casper/Schütt-Sayed/Vollmer 2021 for commercial occupations and many more). Furthermore, it can be used to draw up company or school training plans and exams.

The practical application of the model will show whether and to what extent the model will be helpful in curricular and didactic work to identify sustainability-oriented points of contact in the respective vocational action situations. Whether and to what extent the structure of the model or its development approach can also be transferred to other professional domains is to be examined.

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Michael Rothe

Daily bread – Sustainability as a driver for change in the craft of baking

The craft of baking is facing a skilled labour shortage in Germany, which requires companies to adapt their operations, utilise resources efficiently, and provide individual support for trainees. Sustainability is becoming increasingly important, and companies must align themselves with the market and communicate this to attract future applicants.

German bread – Immaterial cultural heritage – Sustainable from the beginning

In the craft of baking, the growing impact of skilled labour shortage requires a shift of mindset for companies to adapt their operations, utilise resources efficiently, and provide individual support for trainees. Trainees today face multiple challenges and require support in various aspects of their lives to focus on vocational training, particularly in school-based competencies.

With a total turnover of 14.89 billion euros and 240,800 employees, the bakery craft is one of the important economic factors in Germany, but it is facing major challenges. The number of apprentices in the bakery craft has more than halved in the last ten years. To counteract this, the branch is increasingly focussing on the integration of young people with lower educational qualifications, young people with a migration background and young refugees. These target groups require a strong focus on needs and individualised support in order to ensure that they successfully complete their training. The sustainable development and securing of skilled labour is therefore highly relevant in the bakery craft. For businesses, this means taking a holistic view of the company and considering economic as well as ecological and social aspects.

Although a lot has already happened in recent years and there has largely been a rethink in the sector, we are still at the very beginning of what can and, above all, must be done.

The obligation of the crosscutting occupational standards when reviewing the training ordinance is already a good start, but we would like to see these become mandatory for all occupations in the near future – regardless of a reviewing process. We are convinced that greater importance should be attached to revising the training framework plans. In our opinion, these should be regularly updated and modernised on a mandatory basis. Technology is changing rapidly. It is our duty to regularly and sustainably adapt our training content and the methods of didactics accordingly. Sustainability is becoming increasingly important. Thinking and acting sustainably as a company is becoming a must-have for fu-

ture training applicants in order to be able to seriously compete with other companies on the labour market.

The shortage of skilled labour is increasingly taking its toll, and only those who want to survive on the market and continue to train skilled workers must align their company strongly and sustainably to the market and communicate this to the outside world.

Operational processes clearly need to be adapted, resources must be utilised sensibly and on a personal basis, individual support for trainees is becoming increasingly important.

Trainees today often suffer from multiple problems and need support in many areas of their lives in order to be able to concentrate sufficiently on their vocational training. An increased need for support is also often seen in school-based competencies.

Fred Kyei Asamoah

From strategy to implementation: Developing institutional greening plans for TVET institutions

A key requirement of the 5-year strategic plan for TVET transformation in Ghana (2018 until 2022) was Greening TVET. This paper discusses the development of institutional greening plans in Ghana, greening concepts and the five pillars for greening TVET. The Commission for Technical and Vocational Education and Training (CTVET) is leading the introduction and implementation of the Greening TVET effort in our institutions.

The paper indicates that, as part of the processes of developing the Greening Plans, a stakeholder engagement is organized to finalise and validate the developed Institutional Greening Plans (IGPs) into a working document to be implemented at the various TVET institutions across the country.

After the stakeholder engagements with both public and Private TVET institutions, the strategies as outlined in the document were developed as processes to follow to ensure sustainability in the TVET institutions in Ghana.

1. Introduction

Technical and Vocational Education and Training (TVET) is the strategic entry point for ensuring a world of work that contributes to social cohesion and promotes environmentally sound sustainable development. TVET for sustainable development has to contribute to developing, strengthening and disseminating ways of sustainable thinking and acting. Workers should be able to use their knowledge and their qualification to identify the social, economic and ecological challenges facing modern societies and to develop ideas and strategies for sustainable development.

2. Background

The government of Ghana as part of its efforts toward transforming and advancing Technical and Vocational Education and Training (TVET) set the key goal of transforming Ghana's labour force to enhance productivity and employment. To this end, the government in 2017 conducted a SWOT analysis of the TVET landscape and a comprehensive needs analysis of over 200 TVET institutions as part of efforts to reform the TVET sector in Ghana. These activities culminated in the development of the 5-Year Strategic Plan for TVET Transformation (2018 to 2022) which had 5 strategic goals.

These goals were: Governance and management of TVET; Increased access; Improving quality; TVET financing; and environmental sustainability.

3. Development of Institutional Greening Plans

TVET does not only impact technical and specialised knowledge but also develops conceptual and systematic thinking and acting. In addition, TVET stakeholders need to assess which new fields of work and new technologies and the new green economy deliver, and on this basis, they need to develop new green job concept to include the idea of sustainable development in contributing to the economic growth and national development within the framework of equity, fairness, security and dignity. Stakeholders must also incorporate these new occupations and concepts into TVET processes. The skill needs for the emerging green economy in Ghana includes skills targeting areas such air pollution, climate change, energy production, management of waste, water supply, flood management and biodiversity. To this end, we must protect the environment and ensure a sustainable environmentally-friendly future. In our quest to achieve our objective of creating a robust TVET sector in Ghana, the Commission for Technical and Vocational Education and Training (CTVET) is leading the introduction and implementation of the Greening TVET effort in our TVET institutions.

4. Concepts of Greening TVET

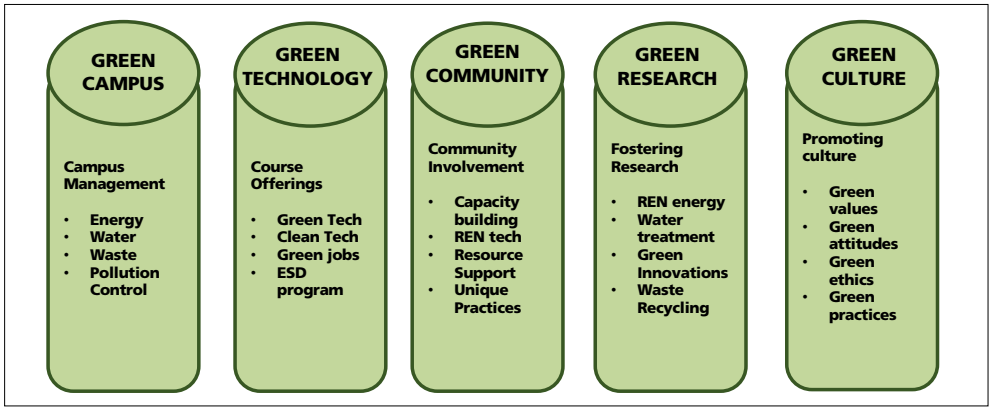
Greening is the process of pursuing knowledge and practices with the intention of becoming more environmentally-friendly, enhancing decision-making and lifestyle in a more ecologically responsible manner that can lead to environmental protection and sustainability of natural resources for current and future generations. Greening TVET is understood as an incremental and systematic process of supporting education and training systems towards greening societies and economies in an ecologically-sound, participatory and sustainable manner. This is a journey; not a destination.

The following concepts served as a basis in developing a greening approach in TVET:

- Green Jobs are jobs that contribute to preserving or restoring environmental quality while also meeting longstanding demands and goals of the labour movements, such as adequate wages, safe working conditions and workers' rights. (see UNEP et al., 2008).
- A Green Economy is one 'that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities' (UNEP, 2011). This is crucial if we are to move towards sustainable societies.
- Green Skills are the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society (CEDEFOP, 2012).

5. The Approaches to Greening TVET

Figure 1: Five Pillars for Greening TVET



Source: own illustration after United Nations Educational, Scientific and Cultural Organization and UNESCO-UNEVOC International Centre (2017)

Below is a summary discussion on the important approaches to pursue sustainability in TVET institutions from UNESCO-UNEVOC and the conditions that lead to adapting them in a particular setting. Each of the approaches are supported by examples of tools and instruments that can be consulted or reviewed in order to initiate concrete interventions on the part of the institution. This formed part of the key materials we relied on as a UNESCO-UNEVOC member to develop the Greening TVET Plan in Ghana. In essence, this approach served as the source material from which the Institutional Greening Plans for Ghana was modeled along.

5.1 Greening the Campus

Aim: Manage the campus to strengthen operational sustainability mechanisms.

- Greening the campus is all about creating an institution where sustainable, healthy and safe conditions exist, which provides opportunities for students – of all social groups, religious beliefs, genders and students with disabilities – to learn technical skills and obtain the knowledge, skills and attitudes that lead to formal qualifications, and help them to achieve sustainable work and a sustainable lifestyle.
- Greening also entails making the campus a better place to live and work, with good air quality and daylight to facilitate learning processes and improve learning outcomes.
- It includes greening a broad range of physical features – buildings, landscape, maintenance procedures and campus services mainly to reduce the costs associated with resource usage such as energy, water and waste, and to reduce and better manage the institution's GHG footprint.

- It entails adapting relevant contents and training so that knowledge and skills imparted satisfy the needs of current structures, technologies and job tasks in the labour market.

5.2 Greening the curriculum and training

Aim: To integrate sustainability into existing curriculum and training

- It also involves ensuring that the process and outcomes of training are evidence of the acquisition of practical skills that can be used to perform jobs in a more sustainable manner or introduce new concepts for the greening of occupations.
- It is crucial to address what is taught to the students in both institution-based and work-based settings.
- 'Greening' the mind is facilitated through identifying the short-term skill needs and the changes over time that will prepare students to play a role in a dynamic and greening economy.

5.3 Greening the research

Aim: Using and applying sustainability in research philosophies, content and standard

- Greening research is about investigating concepts, beliefs and theories on how to better manage the greening of operations, products, student/trainee/community outcomes and the correction of unsustainable patterns of consumption and production.
- It stimulates the commitment of both teachers and students to carry out research on matters that contribute to discovering practical solutions to problems.
- Greening research is an integral component of the institutional culture.

5.4 Greening the community and workplace

Aim: Engaging industries, enterprises and the wider community in the institution's greening programmes

- Greening of the workplace focuses on what TVET education can contribute to influencing the greening of work environments or businesses.
- It is about preparing students with the fundamentals of sustainability within the workplace in which they find employment and within communities where skills are valued as an integral part of local or community- based development.
- It is promoting good practices that contribute to reducing the environmental impact of business practices and, where possible, jointly developing sustainability programmes and projects to address local issues.

5.5 Greening the institutional culture

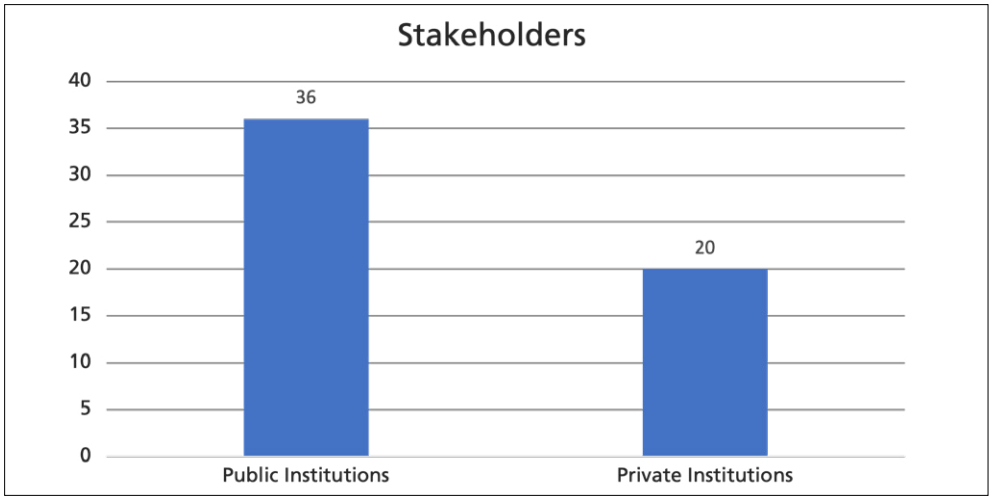
Aim: Embedding sustainability into all aspects of the institutions

- It is the practices and culture on campus that set the tone and expectations of all those who work and learn in the institution.
- It is about the ethos or philosophy of the institution and this corresponds to the curriculum and the overall institutional greening plan (IGP) and other initiatives.
- This will reflect the institutional vision through hiring and promotion procedures, evaluation schemes, rewards and celebrations, and should also be present in the everyday behaviour of the managers, the teaching personnel, other workers and students.
- It eventually informs the institution's branding and reputation, making it easier for graduates to attain better jobs while better serving the community's citizens and enterprises.

Below are Institutional IGP's developed by some institutions during a working session organised by the Commission to develop Institutional Greening Plans

6. Participating TVET institution

Figure 2: Graph of TVET institutions participating in the workshops on IGP development



Source: own illustration

The above diagram shows public and private TVET Institutions that participated in the development of the Institutional Greening Plans (IGPs). 36 Public TVET Institutions were present and 20 Private Institutions also represented. In all, 56 TVET Institutions were present at the working session for development of the IGPs. This number represents 23.7% of all TVI's that are accredited by the Commission as of December, 2023.

7. Process for developing Institutional Greening Plans (IGP)

7.1 Drafting IGPs

The Commission for TVET organised a workshop on the development of Institutional Greening Plans (IGP's). The workshop which was organised in March 2022 brought together 56 heads of Technical and Vocational Institutes (TVI's) to discuss and understand the greening concept to enable them develop Institutional Greening Plans (IGP) and the need to practice Greening in TVET Institutions. They were taken through various steps and processes of developing the intuitional greening plans. They were put in groups and furnished with a template to develop their intuitional greening plans that will suit them.

7.2 Orientation importance of greening

The principals were taken through orientation that will enable them to acquire knowledge, skills and competencies to help them implement the greening plans in the TVET institutions to help individuals contribute to the development of a green economy as well as practice sustainable actions in other areas of their life. Hence, greening TVET Institutions, benefits not only the workers/learners but also society as a whole. This will develop competent workers who are well equipped with appropriate skills and applied technologies to create a green economy to enable green jobs.

7.3 Validation and finalisation

A stakeholder engagement was organised to finalise and validate the developed IGPs into a working document to be implemented at the various TVET institutions across the country.

The following table illustrates the results from the stakeholder engagement. The areas covered in the IGPs were:

1. Greening the campus
2. Greening the curriculum
3. Greening research
4. Greening the institutional culture
5. Greening the community and workplace

8. Development of Institutional Greening Plans

The participants in the workshop were divided into three groups to come up with institutional greening plans. Each group developed one set of plans. These plans are outlined below in the tables. Thus, each table represents the results from each of the working groups. At the end, these plans were validated by stakeholders and thus form the basis for institutional greening plans in Ghana.

8.1 Institutional greening plan group 1

Table 1: Greening plans for TVET institutions

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening the campus								
Poor ventilation & lighting	Improve ventilation and lighting system	All opening should be kept open	▸ No opening, no activity in the facilitation and workshop rooms open ▸ Routine cleaning ▸ Provision of fans ▸ Use energy saving bulbs ▸ Provision of sky roof	▸ Policy enforcement ▸ Routing maintenance ▸ Regular inspection ▸ Appointment of maintenance officer	Friendly environment	▸ Maintenance officer appointment letter ▸ Cleaning and inspection reports ▸ Fans procured	Jan 2022	Dec 2022
Waste management	Serene Environmental cleanliness	Generate revenue, energy, compost through segregation of generated waste	▸ Provision of labelled waste bins ▸ MOU with waste management company ▸ Posting signages	▸ Provision of labelled waste bins ▸ MOU signed ▸ Signages visibly pasted	Clean working environment	Visible display of labelled waste bins and signages	Jan 2022	

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening the curriculum								
Green clubs lacking	To create green CLUBS	Green CLUBs inauguration	▸ Appointment of green CLUB patron ▸ Inauguration of green CLUB leaders	Development of activity plan, implemented, monitored and evaluated	▸ Green Clubs in place ▸ Leaders appointed ▸ Availability of reports from the clubs	▸ Pictures ▸ Minutes etc.	Jan 2022	
Greening research								
Lack of research in TVET greening	Sensitise community members on TVET greening	Use of zoom meetings and electronic media to disseminate information	▸ Cluster the school community and sensitise them ▸ Produce flyers and distribute to key stakeholders	Meeting held and hand books developed	Sensitisation done	▸ Handbooks ▸ Flyers ▸ Pictures	Jan 2022	Dec 2022
Greening the community and the work place								
Non-existence exist some communication tools but not on greening	To include the concept of greening technology into members of the community and workplace	To identify interest groups and upscale their knowledge and skills on greening technology	To develop and communicate the concept of greening technology	▸ Communication tools on green tech developed and communi-cated ▸ Knowledge and skills of interest groups upscaled in green tech-nology		▸ Communica-tion tools ▸ Interest groups	Jan 2022	Dec 2022

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening institutional culture								
No office in charge of greening and no documentation on greening technology	To document and sustain institutional culture on greening	To document and sustain institutional culture on greening	▸ To set up an office with a dedicated team on green tech ▸ To document consistently concepts and ideas on green technology	▸ Funds to set an office space ▸ Consultant and team members		▸ Documentations ▸ Office space	Jan 2022	Mar 2023

Source: own illustration

8.2 Institutional greening plan group 2

Table 2: Greening plans for TVET institutions

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening the campus								
Improper waste management	Ensure proper waste management	▸ Improvement in sanitation. ▸ Curb sanitation-related diseases e.g. Malaria, Cholera etc. ▸ Drop in hospitalization of trainees. ▸ Improve productivity, attendance ▸ Create some economic benefits	▸ Provision of multiple bins at vantage points. ▸ Segregation bins well labelled and encourage segregation of waste ▸ Educating the trainees, staff and community on proper waste management ▸ Provide well laid drainage systems	▸ Increase trainee attendance. ▸ Money saved due to waste managements. ▸ Hospital visits	▸ Reduced hospital visits ▸ Reduced absenteeism ▸ A cleaner campus ▸ A substantial amount saved.	▸ Seeing dustbins at vantage points. ▸ Seeing a cleaner environment ▸ Seeing a proper drainage system. ▸ Complimentary remarks from staff, trainees and community	Jan 2022	Infinity

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Disability Infrastructure	▸ To create a disability friendly environment. ▸ Increase enrollment of persons with disability.	▸ Increment in the enrollment of persons with disability. ▸ Curb/reduce stigma to persons with disability	▸ Provision of disability pathways. ▸ Provision of disability enabled washrooms, workspaces and classrooms	Measure enrollment of persons with disability	Increment in the enrollment	See increment in the enrollment	2022	2023
Greening the curriculum								
Inadequate skilled staff	To have adequate skilled staff	▸ More practical experience to be gained by students. ▸ Increase psychomotor of students. ▸ Increase interest and motivation of students. ▸ Increase in enrollment	▸ Provide training of trainers programme for staff ▸ Provide exchange programmes ▸ Provide workshops	Number of training of trainers programme and workshops	At least 5 trainers of trainers programme a year	Regular assessment of trainers	2022	2023
Lack of circular economy in the curriculum	Circular economy embedded in the curriculum	Circular economy should be included in curriculum development	Building a curriculum that includes	Alternative income generation livelihood training should be implemented	Implementation of livelihood training	Handbook, report	Jan 2022	Dec 2022

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening research								
Unstainable agriculture	Sustainable livelihood	Students should be encourage to conduct: sustainable livelihood research.	Workshops for stakeholders	Funds set aside for research	Research done to ascertain sustainable livelihood	Quarterly report	Quarterly	
Greening the community and the workplace								
Improper waste management	Sensitising the community on proper waste management	The community must be admonished to keep proper waste system	Proper waste management systems must be put in place	▸ Media ▸ Community radio ▸ Fine for offenders		Sensitisation done		
Improper use of tools and equipment	Trainers and staff should be trained on proper use of tools and equipment in workshop to reduce damages and accidents	Organise train of trainers on the use of those equipment	Proper safety measures should be ensured at all times	Get manuals and workbooks to facilitate learning		Report developed	Jan 2022	Dec 2022
Greening institutional culture								
Inadequate trees	Establishing routine tree planting and cleaning exercises in and around the institution	Routine tree planting cleaning exercise in the institution	Organise learners for the exercise	Acquire seedlings for plans		Pictures of tree planting exercise	Jan 2022	Jan 2023

Source: own illustration

8.3 Institutional greening plan group 3

Table 3: Greening plans for TVET institutions

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening the campus								
Weedy compound	Identify a more environmentally-friendly means of clearing weed	Clear weed without harming the environment	▸ Purchase mower ▸ Train personnel	Mower purchased and persons trained	▸ 12 times annually ▸ Plant ornamentals ▸ Add garden chairs	Before and after photos	Jan 2022	Dec 2022
High Energy Consumption	Cut down consumption by at least 30%	▸ Energy conservation ▸ Reduced budgetary allocation on utilities	▸ Green Procurement ▸ Sensitisation and attitudinal change ▸ Adoption of alternative energy sources such as solar energy	▸ Lower consumption rates ▸ Lower expenditure on utilities ▸ Awareness on the part of staff/ students	30% cut on expenditure on energy	Utility bills	2022	2023

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening the curriculum								
Use of a lot paper for academic and admin purposes	Go paperless	▸ Reduced expenditure ▸ Less paperwork ▸ Reliance on technology	Adopt School, learning & performance management and collaboration software	▸ Paperless system ▸ Staff and student portals for learning ▸ Communication and collaboration	Reduced by half expenditure on stationery	Evidence of digitised processes	Jan 2022	Dec 2022
Greening research								
No research works not greening	To inculcate green researches in the institution	Most research works not greening	Investigate greening concepts	Research proposal and publication in greening issues	Greening concept developing	Publications and journals	Jan 2022	
Greening the community and the work place								
No segregation of waste	To have a clean, healthy environment, recycling, revenue generation	Differently labelled containers	▸ Procure bins ▸ Sensitise staff/ students	▸ Cleans environment ▸ Well-labelled bins at vantage points	▸ Clean healthy environment ▸ Increasing number of bins	Before and after photos	Jan 2022	Dec 2022

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening institutional culture								
Poor maintenance culture	Follow comprehensive maintenance plan	▸ Increase lifespan of tools and equipment ▸ Achieve a behavourial change towards maintenance ▸ Improve health and safety standards	▸ Sensitisation of staff and students ▸ Develop maintenance plan ▸ Put rewards and punitive measures ▸ Have incident log book	▸ Implement maintenance plan ▸ Improved attitudes towards maintenance ▸ Reduced incidents of accidents, etc. ▸ Safe working environment	Reduce by half number of reported cases of accidents in the first year	Reference to Log book	Jan 2022	Dec 2022

Source: own illustration

8.4 Institutional greening plan – consolidated version based on the working groups

Table 4: Greening plans for TVET institutions

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening the campus								
More trees needed	To green the environment	Environment Improved	▸ Liaise with forestry commission ▸ Obtain trees for planting ▸ Monitor growth of trees	Number of trees planted	500 trees	Pictures and videos of physical trees	Jan 2022	Dec 2026
Flooding (no landscaping)	To beautify the environment	Environment beautified	▸ Identify beautification needs ▸ Conduct beautification exercise	Painting and construction of the landscape	10 lawns and 10 buildings painted	Pictures of physical building	Jan 2022	Dec 2026
Inadequate training facilities	To improve quality of skills and training	Skill training improved	▸ Identify facility gap ▸ Design facility gap ▸ Identify source funding for projects ▸ Construct facility	Architectural designs and written proposals.	2 buildings	Pictures	Jan 2022	Dec 2026
Absence of energy saving bulbs	To save cost and conserve energy	Energy conservation improved	Identify the types of bulbs that saves energy	Energy saving bulbs to be purchased	Depending on classrooms and offices	Receipts	Jan 2022	Dec 2022

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Inadequate dustbins for waste segregation	To improve waste disposal and recycling	Sanitation and safety system improved	▸ Organise procurement meeting ▸ Order for waste bins ▸ Place them at vantage points	Prepare procurement order for purchase	20 waste bins acquired	Pictures and receipt	Jan 2022	Dec 2022
Greening the curriculum								
Institutions not accredited leading to facilitators not certified in competency-based training (CBT)	To enable the institution run CBT-related programmes	CBT related programmes successfully institutionalised	Inculcating greening into the CBT curriculum	Develop greening plans into the CBT curriculum	Greening plans developed	Implementa-tion/report	Jan 2022	Jun 2022
Institutional facilitators and staff need information and communications technology (ICT) skills, knowledge and training periodically	To equip staff and facilitators to solid knowledge in ICT	Staff and facilitators knowledge in ICT enhanced	Training must be done periodically for facilitators and staff	Developing training manuals to be used	Training done	Periodic report	Quarterly	
Non-existing CBT curriculum on greening jobs	To facilitate the development of greening curriculum	Development of greening jobs curriculum facilitated	CBT curriculum must be embedded with green jobs	Inculcating greening plans in the CBT curriculum	Greening plans developed	Green curriculum, report	Jan 2022	

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening research								
Lack of adequate information on greening technology	To boost knowledge base on greening technology	Knowledge base on greening enriched	▸ Identify consultant for training ▸ Conduct training ▸ Monitor effect of training	▸ Develop handbooks ▸ Contract consultants to conduct the training	Handbooks developed and training done	Report and pictures	Jan 2022	Sept 2022
Absence of funding or allocation of budget on greening	To secure funding for greening activities	Availability of funds to undertake greening activities	Writing to donor agencies for support	Funds obtained to facilitate greening initiatives	Funds available to undertake at least one greening initiative	Funds transfer into accounts of the commission		
Lack of in-depth research on waste management and greening topics i. e. energy conservation, biogas generations etc.	▸ To improve upon research activities related to greening technology ▸ To develop more programmes in waste management	Research activities on greening enhanced waste management boosted	To develop more programmes into waste management	Research on greening activities done	At least one research project conducted on greening and waste management	Research reports available	Jan 2022	
Greening the community and the work place								
Lack of education within the institution and community on best greening practices.	To increase the knowledge base of the institutions and community on best greening practices	Knowledge base of best practices on greening improved	To create awareness on best greening practices in our community and institutions	Develop flyers and media sensitisation programme	Sensitise the community on best greening practices	Attitudinal change	Jan 2022	

Existing situation in your institution	Objective (what do you seek to achieve	Expected outcome	Activity (actions to be taken)	Key performance Indicator (KPI)	Annual target	Means of verification	Start date	End date
Greening institutional culture								
Challenges in information sharing (Digitalisation)	To improve information sharing	Information sharing improved	To improve the dissemination of information through digital channels	To digitalise information for easy dissemination and access	To make sure information is well disseminated	Digitalised platforms		
Difficulties in adaptation and adoption in new systems or changes in system	To rally the adaptation and adoption to new systems in green culture	Adaptation and adoption of new system improved	To encourage the adaptation and adoption of new systems to save the environment	Reduction in energy consumption Reduction in the use of papers	To achieve the purpose of change in the system	Conservation of energy	Jan 2022	

Source: own illustration

9. Conclusion

It is not only sufficient to train professional skills but also to raise awareness of the environment and to encourage a shift in the mindset of all – teachers and students – TVET organisations must also become green. Once a TVET institute adopts a greening process and integrates it to their business model, it not only becomes a role model for eco-friendliness but also a real inspiration, an innovative provider of training and an acknowledged strategic partner for their region's sustainable growth.

Most of the institutions that took part in the workshops have indicated that they have started implementing the institutional greening plans. The next step for the Commission is to undertake an extensive monitoring of the institutions to assess the level of implementation.

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Eduardo Ulate Alpízar, Karla Astorga Castro

Applications of Costa Rica's national bioeconomy strategy into vocational training by the Costa Rican National Institute of Apprenticeship

This paper systematises the information collected from the Costa Rica's National Bioeconomy Strategy 2020–2030 and its implications on the processes and products of the vocational training of the Costa Rican National Institute of Apprenticeship (Instituto Nacional de Aprendizaje [INA by its acronym in Spanish]). The methodology involved a document review, followed by consultations with national organisations associated with the strategy. Results are obtained on the relationship of the main concepts associated with the bioeconomy with the production processes of the Environmental Management Subsector and the identification of the binding lines of action between the National Bioeconomy Strategy and the Subsector. In conclusion, there is an opportunity for INA to integrate the bioeconomy and circular economy aspects into vocational and technical training.

The national bioeconomy strategy and education development at INA

The National Bioeconomy Strategy 2020–2030 (Estrategia Nacional de Bioeconomía [ENB by its acronym in Spanish]) aims to consolidate Costa Rica with a sustainable production of high added value in all its regions. This strategy emphasises the fair and equitable utilisation of Costa Rica's rich biodiversity, promotes the circularity model for biomass utilisation, and fosters advancements in biotechnology within the nation (see Ministerio de Ciencia, Innovación, Tecnología y Telecomunicaciones [MICITT] 2020).

The Costa Rican National Institute of Apprenticeship upholds its strategic commitments related to this topic, particularly, the Institutional Strategic Plan for the period 2019–2025, which includes an objective that seeks to "Prioritize attention to key sectors of the national and regional economy, through training, capacity building, and certification programs that promote employment opportunities, enhance the skills of individuals associated with productive processes, and foster improved competitiveness, productivity, and sustainability" (see INA 2018).

One of the cross-cutting axes of the ENB is "Education and Capacity Development", establishing a clear relationship with INA's mission. Meanwhile, the correspondence with the technical area of Environmental Management is evidenced by the fact that one of the principles governing the ENB is "Sustainable Development and Climate Action". The strate-

gy aims to foster productive transformation by applying knowledge and providing the necessary foundations in the field of Environmental Management.

The Environmental Management subsector operating within the Technology of Materials Department at INA. This subsector provides specialised services to both public and private organisations seeking to enhance their environmental performance through training and capacity-building services on Solid Waste, Water Resources, Carbon Neutrality, Environmental Management Systems, and Wastewater Sanitation. Its primary goal is to assist interested organisations in achieving their sustainability objectives and adopting environmentally responsible practices.

In INA, strategic monitoring processes involve observing, capturing, and analysing environmental information that allows the evaluation of knowledge towards decision-making regarding technical education curricular products.

The methodology employed for this study involved a comprehensive review of relevant documentaries, followed by engagement with national organisations associated with the strategy.

Concepts of Bioeconomy related to productive processes of the Environmental Management Subsector

As the first result of the monitoring, the primary concepts of Bioeconomy were related to the productive processes of the Environmental Management Subsector. These processes serve as the foundation for the development the training programmes and technical-professional education. The thematic axes underlying these programmes are as follows:

- Pollution prevention
- Resource valorisation
- Waste treatment
- Remediation
- Sustainability management

The following table compiles the main concepts and their association with the processes of the Environmental Management Subsector.

Table 1: Main concepts related to bioeconomy and with the environmental management subsector processes

Concept	Definition	Environmental management subsector process associated
Biodesign	Integrates the inherent characteristics of living organisms or past life forms into various human-oriented domains and industries.[1]	Pollution prevention
Circular Bioeconomy	An efficient and resource-effective economy with low carbon emissions that promotes smart, sustainable, and inclusive growth, where the byproducts of one process are used as raw materials for subsequent processes, thereby eliminating waste and maintaining the value of various system components for as long as possible.[2]	Resource Valorisation
Residual and/or Industrial Biomass	It is generated as a result of any process that involves the consumption of biomass, and it is produced in agricultural, forestry, or livestock operations, as well as organic waste generated in industries and urban areas.[3]	Resource Valorisation
Biomaterial	It refers to a wide range of materials used for biomedical applications.[4]	Pollution prevention
Biobusiness	Economic process, aimed at increasing tangible and intangible value, through which suppliers and demanders (both public and private) of knowledge and products related to biodiversity and biotechnology are identified, interconnected, and interact. It encompasses individual applications as well as entities and production chains, contributing to the tangible and intangible value enhancement in a country.[5]	Sustainability management

Source: Bioeconomy Observatory 2023; all links in the table retrieved on 15.11.2023

1 See also: **https://www.designsociety.org/publication/40514/CLASSIFICATION+OF+BIO-DESIGN+APPLICATIONS%3A+TOWARDS+A+DESIGN+METHODOLOGY**
2 See also: **https://raccefyn.co/index.php/raccefyn/article/view/650/486**
3 See also: **https://revistas.udes.edu.co/innovaciencia/article/view/1849/2016**
4 See also: **https://revistas.tec.ac.cr/index.php/tec_marcha/article/view/1432**
5 See also: **https://www.redalyc.org/pdf/776/77653191006.pdf**

Regarding this initial finding, it is recommended to integrate the circular economy model into the training programmes and technical-professional education of the subsector. This strategy goes beyond the current scope of the subsector, allowing for alliances with technical areas such as agriculture, food, wood industry, textiles, construction, among others.

Furthermore, the binding lines of action between the National Bioeconomy Strategy (ENB) and the subsector were identified.

Lines of Action between the National Bioeconomy Strategy (ENB) the Environmental Management Subsector

The ENB outlines a set of action plans for each of its strategic axes. Beginning with "Strategic Axis 1: Bioeconomy for rural development", the strategy aims to enhance the efficiency and environmental management of production processes through the following lines of action: "Sustainable and decarbonized agricultural production" and "Sustainable fishing and aquaculture". These actions include increasing the adoption of bioremediation solutions for waste and effluent management, the implementation of soil improvement and restoration programmes, and promotion of circular economy processes. These initiatives are directly relevant to the production processes within the Environmental Management Subsector, especially in waste treatment, remediation, and sustainability management. It is worth highlighting the explicit incorporation of the circular economy concept as a means of enhancing and optimising the subsector's processes.

In "Strategic Axis 2: Biodiversity and Development", we find "Promotion of Ecosystem Services" as a line of action. Costa Rica stands out for establishing protected areas and implementing a biological corridor system, but the ecosystem services provided by these areas are often overlooked. These services include greenhouse gas emissions mitigation, water protection, biodiversity conservation, scenic beauty, nutrient cycling, soil formation, and regulatory services such as pollination, biological control, and erosion control. Disseminating this knowledge and applying it to reduce production pressures on protected areas can be addressed through productive processes such as pollution prevention, resource valuation, and sustainability management. Leveraging the available digital technologies at INA for environmental education presents a remarkable opportunity for achieving these objectives.

Biomass waste generated by productive activities, whether in liquid or solid form, often causes environmental pollution problems; to address this issue, the ENB proposes "Strategic Axis 3: Residual Biomass Biorefinery", which promotes the adoption of biorefinery model for comprehensive utilisation and valorisation of biomass. By focusing on the lines of action "Bioenergy Production" and "Production of Bioinputs and Biomaterials", waste management can be improved, and its utilisation can be maximised. These actions contribute to the reduction of reliance on fossil fuels and chemical fertilizers, aligning with the objectives of the National Decarbonization Plan. These axes are related to the processes addressed by the subsector, specifically "pollution prevention", "resource valorization", and waste treatment. In terms of service offerings, the vocational training programme "Technical Specialist in Wastewater Treatment" is available at INA. It is lasts 696 hours and is

at the first level of the qualification framework. In the period 2015 to 2022, a total of115 men and 50 women graduated in this programme. It is considered an opportunity to create complementary offerings regarding the use of biodigesters, either to produce biomaterials and/or biogas from biomass or to reduce the environmental impact of sludge generation from wastewater treatment.

Rapid and poorly planned growth often leads to various environmental challenges such as inadequate waste management, river and air pollution, depletion of drinking water sources, and increased pressure on protected areas that, as mentioned before, provide ecosystem services. The "Strategic Axis 5: Urban Bioeconomy and Green Cities" of the National Environmental Plan includes the implementation of "Sustainable Management and Valorization of Urban Solid Waste" as a line of action. Encouraging waste separation and classification aligns with the processes of "pollution prevention", "resource valorization", "waste treatment", and "sustainability management". The Environmental Management Subsector supports these initiatives and provides an opportunity to raise public awareness about the concept of a biocity. This concept is mentioned in the line of action "Urban Design Inspired by Biological Principles, Processes, and Systems", promotes the adoption of circular economy practices for materials and energy usage while emphasising the reduction of emissions and waste generation, among others.

Finally, there is an opportunity for INA through the Environmental Management Subsector to integrate of the bioeconomy and circular economy aspects into vocational and technical training. This can be achieved by embracing new approaches and economic models that align with the principles of sustainable development, thus fostering sustainability.

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Making sustainability possible – Micro level. Perspectives from VET schools

Klaus Pellmann

Sustainability projects at the Peter Lenné School

The Peter Lenné School in Berlin has excelled in projects aligned with the SDGs, focusing on regenerative energies, water management, and educational initiatives. Notably, recent endeavors include the ecological redesign of the school garden, implementing an economical and ecological irrigation system, and creating new greenhouses. Collaborative projects with institutions like the Humboldt University and the Deutsche Bundesstiftung Umwelt aim to develop educational modules on biodiversity for vocational training. The school is selected as a "Beacon school" for vocational education and training in sustainable development, aiming to integrate the topic into the curriculum.

The Peter Lenné School is particularly distinguished by its successfully implemented sustainability projects in the sense of the *SDGs* in recent years. In addition to the *projects in the field of regenerative energies* (BELARE bioenergy laboratory for regenerative forms of energy, Smart House, photovoltaic systems, etc.) and *water management* (rainwater management with cisterns, wells, infiltration systems and multifunctional water system, as well as wastewater treatment with a "constructed wetland"), several educational projects in the field of sustainability were carried out in cooperation with extracurricular institutions and universities. Starting with the *"Urban Gardening" project* in cooperation with the Gemeinnützige Gesellschaft für berufsbildende Maßnahmen (GFBM mbH, Non-profit company for vocational education) and the Humboldt University Berlin (HU), a project on *"Resource Use with Vegetable Charcoal (Terra Preta)"* with the Free University of Berlin (FU) and the project *"Vocational Education on Climate-Adapted Green Space Maintenance"* with the HU Berlin were successfully implemented in the last three years.

And despite the restrictions imposed by Corona, further new sustainability projects have been initiated in recent school years:

Ecological redesign of the school garden

The focus was particularly on the *ecological redesign of our school garden*, which was financed as a user-specific measure by the Berlin Senate Department for Education, Youth and Family of about € 25,000. On the one hand, this measure includes the *"redesign of the school garden to promote ecological planning, building and planting in garden and landscape design"* with new dry stone walls, ecological path surfaces and plantings to create small biotopes. A second focus is the *"installation of an economical and ecological irrigation system"* in parts of the school site. The construction of the dry stone walls has already begun, the

planting work and the spreading of seeds to increase biodiversity on the grounds will be carried out this autumn and completed in spring 2022.

The irrigation materials have been procured so the system can be installed together with our students, and the time-consuming watering of the extensive vegetation areas will hopefully be a thing of the past thanks to smart control and regulation technology.

Multifunctional water system in the school garden – new greenhouses for plant cultivation

"Communal, species-rich and well-kept – Vocational training and further education for the promotion of biodiversity using the example of two model parks in Berlin" (duration 2020 to 2022)

In this project – funded by the "Deutsche Bundesstiftung Umwelt" (DBU, German Federal Foundation for the Environment) – educational modules in the context of *vocational education for sustainable development* on the topic of "biodiversity" are developed, tested and implemented in cooperation with the HU Berlin. In addition to the Peter Lenné School, other partners are the Lehr- und Versuchsanstalt für Gartenbau und Arboristik e. V. (LVGA, NGO Experimental Station for Horticulture and Arboriculture,) in Großbeeren, the Berlin University of Applied Sciences (BHT), the Berlin Senate Department for the Environment, Transport and Climate (SenUVK), the Zentralverband Gartenbau (ZVG, Central association of horticulture), the district office of Berlin Marzahn-Hellersdorf and other partners.

The task of the Peter Lenné School, together with the HU Berlin, was to develop *modules on the topic of "biodiversity" for gardening and landscaping trainees"* in their first and third years of training. Modules are also to be developed with students of the school (future master craftsmen of GaLabau – Horticulture), which are to be tested and used specifically in the further training of master craftsmen and technicians.

On the basis of the *two model parks in the Berlin district of Marzahn*, the transformation of a lawn into a species-rich meadow area was professionally accompanied and evaluated in cooperation with the district office.

The first *internal training sessions with the multipliers* have already taken place in the spring and summer of 2021 in Marzahn, and the following topics were at the forefront of the considerations:

- "Biodiversity in urban green spaces"
- "Wild bees and pollinators"

The Peter Lenné School participated with selected classes of the GaLabau(horticulture) to develop the *educational modules on biodiversity* using the example of the "Bürgerpark" in Marzahn.

The prospective master craftsmen and women from the technical college supported the project in order to incorporate their knowledge into the curriculum as part of this further training in the creation and maintenance of green spaces.

Vocational education and training for sustainable development (BBNE, duration 2021 to 2023)

The Peter Lenné School was selected as one of *three Berlin "Beacon schools"* for this project by the Senate Department for Education, Youth and Family (SenBJF). In addition to our VET-school, the Georg-Schlesinger-Schule (OSZ-Machinery and Production) and the Hermann-Scheer-Schule (OSZ Economics) are project partners, with technical support from HU Berlin, Institute for Educational Sciences. The *Entwicklungspolitisches Bildungs- und Informationszentrum e. V.* (EPIZ, Education and Information Center in Development NGO) also contributes its expertise in the field of sustainability and global learning to the project with a new brochure on "Global Learning in Horticulture".

Based on a funding application: "Sustainability dilemmas, dealing with uncertainties – promoting cooperation and collaboration for sustainable development", the topic of education for sustainable development (ESD) is to *be consolidated and anchored in schools and curricula of various professions in three phases from project to structure*.

The Peter Lenné School was chosen to implement training as a gardener, specialising in horticulture and landscaping. In the first step, colleagues from the horticulture department will receive further training on the topic of sustainability within the school, in the second year the focus will be on in-depth projects on the topic, and finally the acquired knowledge will be imparted to as many colleagues as possible.

In the new school year, a small team of horticulture teachers determined the school's internal approach. The first step was to *analyse the curriculum for horticulture and landscaping* with the following questions:

- Where are references to sustainability issues recognisable in the learning content of the profession?
- What problems can be derived for the profession?
- What development ideas result from the connections?

The first results for the first year of training in the subjects "Basic Horticultural Knowledge" and "Basics of Landscaping" are available.

In 2022, after the interim results have been presented, the ideas developed for integrating BBNE into the horticultural curriculum will be used to develop *concrete learning situations* that will be made available to the teaching staff for testing. The project is also supported by the *specialist seminar at the school*, so that the new content can also be incorporated into the training of our trainee teachers in a timely manner.

Table 1: Horticulture Training Curriculum

Competencies of sustainable development	IT – expert knowledge long-term ability to act	WE – social competence social responsible acting	ME – self-competence sense and identity creating
daily processes	resources, material, construction mand machinery in aspects of sustainability selecting and steering	protecting, sustaining and caring of natural resources	long-term securing self-health and well being
company context	alternative material, knowing processes and business models and future oriented horticulture "out of the box"	Understand interest of companies, clients, users, customers	working towards a "good" company culture, endure controversies between routine and ideals
in environment and society	importance of soil and water for life on earth	global and social climate effects of horticulture	estimate the own contribution of maintaining/increasing of quality of life with "green" professions

Source: own illustration

Climate neutral school

Like all schools and public buildings in the state of Berlin, the Peter Lenné School should and must make its *contribution to a climate-neutral city* by 2040. The school was analysed by the Berlin Building Management (BIM):

- How can the ecologically and economically efficient conversion and optimisation of educational institutions (OSZs) be incorporated on the path to climate neutrality in such a way that the highest possible CO_2 saving is achieved?

In a *survey, students were* asked about *their user behaviour*, primarily at school. In addition to the temperatures in the school building and the lighting, the personal CO_2 footprint was also the focus of the observations. In the long term, training workshops are to be held to increase the students´ awareness of how to deal with energy and heat but also of other sustainable topics (nutrition, mobility, CO_2 compensation, etc.).

Another point was to *record the current state of the school buildings in terms of heat and energy consumption*. The following measures for the future of the school and the school building can be derived from the investigations:

- Improving the energy balance through further expansion of renewable energies
- Installation of more efficient lighting and heating technology, especially in the new building and the specialist practice building (LED's, heating system etc.)
- Improving the thermal insulation in the new building and the specialist practice building

The *Peter Lenné School* is *well on the way to becoming a climate-neutral school in many areas*. Starting with the *energetic renovation of the old building*, the *pellet heating system for heat generation*, the *solar systems of the Berliner Stadtwerke* on the roofs and other small *structural measures to save energy in the building* (LED lighting etc.) can only be successfully brought to climate neutrality if the users can also be convinced of the meaningfulness of the measures. With the support of the school administration a climate club was founded by the students.

Hannelore Kress, Christian Wittrock

Teaching green content in Berlin VET schools

The increased integration of sustainability-relevant aspects along the regional education ministries (Kultusministerkonferenz) framework in the various occupational profiles during training since 2021 is a central concern and challenge also for VET schools in Berlin.

Permeable regional networks – basis of sustainability

Creation of green jobs is on all agendas of vocational education and training. What is a "green job"? In German vocational training, 14 occupations fall under this category: multi-faceted, technically demanding and close to nature in the agricultural and food sector. In 2021, about 33,207 young people completed training in the "green professions".

Berlin has a very compact vocational training landscape with 46 multi-track centres each with a special occupational focus and different training programmes. The curricula are continuously analysed and adapted with regard to the topic of sustainability, e. g. also including the choice of building materials, the energy-saving use of machines and equipment, or basically the topic of energy consumption in the company.

Combining forces and competencies in a metropolis like Berlin is obvious but not a given fact.

The Peter Lenné Oberstufenzentrum (VET school) is working in association with other Berlin schools on aspects of sustainability like in construction, metal, but also social insurance tackling climate protection and the consequences for the capital; concepts like sponge city and rainwater management are further developed.

At the Oberstufenzentrum with its approximately 1,300 students, two professions are trained in horticulture and forestry. The school calls itself "School for a Green Future… For us, sustainability means a responsible approach to our nature and environment with a special focus on climate protection. Sustainability also includes a strong understanding of democracy and fair treatment of all people involved in our school life". The school itself aims to be energy efficient by 2026. The area includes a smart tiny house, a bio-energy lab and an intensive collaboration with the Berlin University of Applied Sciences (BHT); a direct opportunity to put results of research into practice.

Five years ago, the school conference of the Knobelsdorff Oberstufenzentrum unanimously adopted its school mission statement. This positions the vocational school centre as an institution for sustainable construction in Berlin. The special feature of this school is the vocational school (BFS) for building trades in seven trades of building construction and finishing as well as building services. This form of training is unique in Germany. The school takes over the part of the in-company training, i. e. it is the trainer and at the same time the teacher. The almost 470 students receive full-school instruction in the school's

own workshops or on construction sites and theoretical lessons in the school. The school's own dual training ends with the journeyman's examination before the respective Chamber of Crafts or Chamber of Industry and Commerce. The school's largest department is headed by Christian Wittrock. In this context, he emphasises the continuous qualification of his staff in the field of sustainability, both in the pedagogical and administrative areas.

The increased integration of sustainability-relevant aspects along the regional education ministries (Kultusministerkonferenz) framework in the various occupational profiles during training since 2021 is a central concern. This includes, for example, consulting activities for customers in the use of ecological building materials and environmentally-friendly building constructions. In consultation with its clients, the school attaches great importance to the use of environmentally-friendly building materials. In this context, the use of sustainable building materials in timber frame construction in the carpentry shop is one of the focal points.

Johannes Jäger, a specialist practice teacher and master carpenter, emphasises the common focus of all parties involved in the school on sustainability. The public sector (the state of Berlin but also institutions in the non-profit sector), as the school's main client, is increasingly demanding the use of alternative raw materials such as paper, clay and straw bales. Basically, the construction industry is experiencing increasing complexity whereby, in addition to traditional skills, competencies in dealing with moisture, roof construction and the coordination of different trades are required. The implementation of green roofs takes into account aspects such as plant root development, environmentally-friendly folios, oxygen generation, interactions with plastics and water retention on the roof. Young people who critically examine these aspects are at the heart of education around sustainability.

Christian Wittrock concludes by emphasising that the issue of sustainability and climate change calls for a fundamental change in teaching methodology in theoretical and practical vocational training. The goal of vocational training, regardless of the training occupation, must be to train young people so that they can act in a complex, problem-solving and systemic manner in their professions.

Harald Hantke, Karina Kiepe

Teachers and trainers in dual vocational training as change agents for sustainable development!? – Questions on the professionalisation of in-company trainers and vocational school teachers

This article addresses the role of in-company trainers and vocational school teachers in fostering sustainable development within Germany's dual vocational education and training system. While there is limited pedagogical preparation for in-company trainers, vocational school teachers undergo extensive professionalisation. However, integration of sustainability aspects in their curriculum remains minimal. Both learning venues, vocational schools and companies, pose challenges to their teaching and training staff and to their role as change agents for sustainable development. To enhance the effectiveness, structural changes in resource allocation and sustained professional development are imperative in both settings. State-funded programmes and curriculum reforms are suggested to fortify teacher preparation for sustainable development, vital in shaping a responsible and equitable future.

1. Introduction

Sustainable development is defined by the Brundtland Commission as development "that meets the needs of the present without compromising the ability of future generations to meet their own needs" (see World Commission on Environment and Development [WCED] 1987, p. 87). In essence, sustainable development is about issues of *intra*generational and *inter*generational "equitable distribution of natural resources, economic goods and basic social goods" (see Michelsen/Adomssent 2014, p. 35). Facing increasing ecological, social and economic problems, the question of how sustainable development can be realised is pressing. The economic practice of companies is identified as one central driver of sustainable development (see Schlömer et al. 2017). Under the heading of sustainable management, various strategies are cited through which companies can realise more sustainable action. These range from technology-based solution approaches to increasing resource productivity (efficiency strategy) to the recycling of used resources through closed material flow cycles (consistency strategy) (see a. o. Mcdonough/Braungart 2002) to a cultural path of sustainability (sufficiency strategy), which aims at a profound change of economic, living and consumption styles in the direction of a responsible and just shaping of the future (see a. o. Schneidewind 2012).

Particularly for the implementation of the sufficiency strategy, companies need qualified skilled workers with a vocational action competence that enables them to think in a systemically networked and forward-looking way and to assess the social, ecological and economic consequences of entrepreneurial action (see a. o. Bundesministerium für Bildung und Forschung [BMBF] 2017, p. 6; Haan 2008, p. 32). Comprehensive competence development processes are necessary to qualify skilled workers to do this.

In Germany, dual vocational education and training is considered to be of particularly high importance for the qualification of skilled workers (see a. o. Ebbinghaus 2018, p. 5). In 2022 alone, 380,184 people in Germany successfully completed dual vocational education and training (see BIBB 2022, p. 149). Dual vocational education and training is constituted by the two learning venues of the training company and the vocational school. In the training company, the company trainers are responsible for the learning processes, and in the vocational school the teachers. Both trainers and teachers are seen as having a great responsibility when it comes to enabling trainees to participate in shaping sustainable management. This is shown not only by the discourses within vocational education and training for sustainable development (see Rebmann/Schlömer 2020) but also by the amended standard vocational training position on environmental protection and sustainability, which came into force in 2021. As a binding requirement for all dual training occupations that are modernised and newly developed from then on, it includes non-occupation-specific learning objectives and learning content through which trainees are to be enabled to help shape sustainable development (see BIBB 2021, p. 5ff.). It is the task of in-company trainers and vocational school teachers to teach the contents of the standard vocational training position integratively in the context of vocational tasks and activities and thus to interpret them with regard to the different training occupations. In-company trainers and vocational school teachers are thus assigned the role of change agents for sustainable development. Change agents are individuals who are seen as having a special ability and role to initiate, manage and implement change (see Kristof 2010, p. 38; van Poeck/Læssøe/Thomas 2017). In this regard, the National Action Plan on Education for Sustainable Development states that teachers should act as change agents of sustainable development by acting as "promoters of social innovations, creating new incentives and giving impetus to others for the transformation towards sustainable development" (Nationale Plattform Bildung für Nachhaltige Entwicklung 2017, p. 75). However, it is questionable whether teachers can fulfil this demanding role.

Against this background, the aim of this article is to reveal the status quo of their professionalisation practice and their educational work, both for in-company trainers (chapter 2) and for vocational school teachers (chapter 3), in order to reflect on this basis expectations of them as change agents for sustainable development.

2. In-company trainers

In-company trainers have been formally and legally defined as a group of teachers by the Vocational Training Act (BBiG) since 1969 and represent one of the largest groups of teach-

ing staff in vocational education and training in terms of numbers (see Kiepe 2021, p. 1). There are currently around 628,000 registered in-company trainers in Germany (see BIBB 2022, p. 262). The primary objective of in-company training work is to promote the vocational competence of trainees in order to meet the company's demand for skilled workers. To achieve this, trainers perform a number of tasks. According to the Ordinance on Trainer Aptitude, the main tasks include planning, preparing, conducting and completing in-company training (see Section 3 Ordinance on Trainer Aptitude). To carry out these tasks, trainers must have the necessary technical and personal qualifications in accordance with Section 28 of the Vocational Training Act (BBiG). The personal qualification is given if there is no employment ban for young people and children (see Section 29 BBiG). The professional qualification consists of vocational and pedagogical skills, knowledge and abilities (see Section 30 BBiG). In-company trainers usually acquire their pedagogical skills, knowledge and abilities through a minimum pedagogical qualification. This minimum qualification is set out in the Ordinance on Trainer Aptitude and requires passing an examination. The examination consists of a written and a practical part. The written part consists of multiple-choice questions. These questions refer to typical case situations from training practice. The practical part of the examination consists of a presentation of a typical training situation and a technical discussion (see a. o. Ulmer 2019, p. 62). The minimum pedagogical qualification has been criticised time and again since its inception (see Kiepe 2019; 2021 for an overview). A major point of criticism is that the pedagogical qualification prepares trainers in particular for simple instruction methods. Instruction-oriented didactics dominate (see a. o. Gössling/Sloane 2013, p. 254). Complex methods such as business games, simulations or case studies are hardly dealt with (see Brünner et al. 2013, p. 5). Overall, trainers are not prepared to design sustainability-related learning situations as change agents for sustainable development. A look at the reality of in-company training work also shows that the framework conditions do not favour in-company trainers acting as change agents. For example, no strategic value is usually attached to in-company training in companies (see Bahl 2012, p. 22). As a result, in-company trainers are hardly perceived and are primarily assigned operational tasks through which no change processes can be initiated in the company. Moreover, their authority as well as their material and time resources are not sufficient to be able to develop a strategic value (see Kiepe 2021). Against this background, Ostendorf describes company trainers as "hidden protagonists of workplace learning, a type of informal teachers or facilitators" (see Ostendorf 2012, p. 69).

3. Vocational school teachers

The picture is somewhat different for vocational school teachers. With approximately 78,000 teachers nationwide who teach at vocational schools (see Bundesagentur für Arbeit 2023, p. 2), this group is far inferior in numbers to the group of in-company trainers. According to the educational mandate, the goal of educational work at VET (vocational education and training) schools is, among other things, "to enable pupils to fulfil their tasks at work and to sustainably contribute to shaping the world of work and society in a social-

ly, economically, ecologically and individually responsible manner, especially against the background of changing requirements" (Kultusministerkonferenz 2021, p. 14). With this objective, the vocational school teachers not only have the task – like the in-company trainers – of promoting the trainees' ability to act professionally. Rather, their task goes far beyond qualifying trainees to carry out vocational activities. In the sense of a comprehensive concept of education, it is much more about reflecting on vocational activities in a social context (see Hantke 2020, p. 20ff.). In order to be able to perform this task, teachers acquire extensive subject-specific, subject-didactic and pedagogical skills, knowledge and abilities within the framework of a combined, usually five-year Bachelor's and Master's degree programme and a subsequent, usually one-and-a-half-year preparatory school service (see a. o. Pasternack et al. 2017). If one considers this extensive didactic-pedagogical professionalisation of vocational school teachers, one could assume that future teachers should have good framework conditions to be prepared to design complex and sustainability-related learning situations as change agents of sustainable development. However, an exemplary look at the basic curriculum for the university subject of vocational and business education within the framework of vocational and business education study programmes, which forms a basis for the design of the nationwide study programmes for the teaching profession at vocational schools – i. e. the first five years of professionalisation – reveals that sustainability does not play an explicit role here. The term "sustainability" appears only once in the context that the basic curriculum will provide impulses for a "sustainable improvement of vocational education at all levels and in all areas" (Sektion Berufs- und Wirtschaftspädagogik der Deutschen Gesellschaft für Erziehungswissenschaft [DGFE] 2014, p. 3), without making specific reference to the idea of sustainability described in the introduction to this article. If, against this background, one also considers the concepts of "justice" and "responsibility" behind this idea, one can identify the general demand on learners "to take responsibility for their own actions and for the community, as well as to form judgements and make corresponding individual and community decisions from an ethically legitimised and self-reflexively controlled perspective" (ibid., p. 5). Even if the idea of sustainable development could be located here, it is not specifically addressed. The extent to which a discussion of sustainability is structurally integrated into the study programmes of university teacher training is thus left to the discretion of the individual universities.

4. Summary and consequences

In summary, chapters 2 and 3 have shown that both in-company trainers and vocational school teachers are only partially enabled in the process of their professionalisation to adequately meet the challenges of sustainable development as change agents. While the trainers can only fall back on a minimum qualification, the teachers are professionalised over a period of at least five years. Nevertheless, a consistent and structurally ensured orientation towards the challenges and requirements of sustainable development is missing here as well. In addition, both places of learning – i. e. vocational school and company – are

characterised by logics that correlate only to a limited extent with the goals of sustainable development. The company as a place of learning is strongly influenced by an economic logic that undermines the visibility of company-based training and the provision of time and material resources for training. At the vocational school as a place of learning, the logic of orienting oneself primarily to the economically shaped work and business processes that determine the company as a place of learning dominates. Thus, these can be found mainly in the learning fields of commercial training occupations as well as in the corresponding didactic annual plans of the vocational schools (see Hantke/Pranger, in press).

In short, the prerequisites for designing educational processes that are oriented towards the guiding principle of sustainable development are hardly given at either place of learning. As a result, the framework conditions for being a change agent as a teacher or trainer in dual training can be seen as more difficult.

As a consequence of this finding, at least two things are needed: firstly, the company and school framework conditions should be changed in such a way that more time, material and personnel resources are available. In view of the prevailing and worsening shortage of teachers and the economic challenges caused not least by multiple global crises, the prospects for this are not very good. Therefore, the second priority is to improve the professionalism of teachers and trainers who are already in the VET system or are on their way into this system.

The Federal Institute for Vocational Education and Training (BIBB) has had and continues to have corresponding support programmes for the company as a place of learning, especially since the 2010s extensive support within the framework of pilot projects (see a. o. BIBB 2015). Here, however, the focus is primarily on questions of the continuing education and training of in-company training personnel. Questions of minimum qualifications are not addressed here. Nevertheless, the framework plan of the Ordinance on Trainer Aptitude was recently amended on the recommendation of the BIBB Board of 20 June 2023 and now also includes the guiding principle of sustainable development (see BIBB 2023). Whether and how this will affect the practice of trainer qualification remains to be seen.

For vocational schools, for example, there are approaches for the consistent development of vocational schools into sustainable places of learning (see Holst/Hantke 2023), but there are hardly any explicit funding programmes to elaborate such approaches in practice. Furthermore, a sustainability-oriented professionalisation of teachers at universities and study seminars currently remains in the realm of the voluntary. Against this background, it would be helpful, on the one hand, to set up corresponding state funding programmes for the sustainability-oriented development of the vocational school as a place of learning. On the other hand, it would be helpful to amend the basic curriculum for the university subject of vocational and business education within the framework of vocational and business education study programmes in such a way that sustainable development is a structural component of the professionalisation of future teachers.

Ultimately, in both learning venues of dual vocational education and training, there is a need for what can be called a professionalisation of teachers and trainers, so that they can fulfil their role as change agents of sustainable development despite difficult framework conditions.

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Charles Chikunda, Ruth Mulenga

The change project approach: A response for reorienting TVET education towards sustainability in Southern Africa

The purpose of this paper is to bring to light how the Change Project Approach (CPA) could be applied to enhance TVET education for the purpose of confronting the 21st Century challenges through education (Education 2030). The challenge in TVET institutions is preparing future skilled labour force with socio-ecological knowledge, skills, attitudes and values essential for a sustainable living, by reorienting current unsustainable ways of thinking and doing, and this can be achieved through integrating Education for Sustainable Development (ESD). This paper discusses the critical role that the CPA plays in creating the social transformation processes and actions required to achieve the ambitions of Education 2030. The CPA intervention will be highlighted in the case of the Mwekera Beekeeping Educational Forum of the Zambia Forestry College.

Introduction

Technical and Vocational Education and Training (TVET) is a powerful means by which society can create a more sustainable future. This can happen when TVET teaching, learning and research are reoriented to incorporate the concept of Education for Sustainable Development (ESD) to address many of the current problems associated with human development. Like elsewhere in the world, people and communities in Southern Africa are exposed to a host of vulnerabilities because of rapidly degrading social, economic, and ecological environments, characterised by poverty, social decadence, increased droughts, desertification, and the more frequent occurrence of extreme weather events such as mass flooding. Climate change and climate change induced disasters demand us to reflect on the current quality of TVET education Given the quality of TVET education accessible to the majority in Southern Africa, people have not been empowered to sustainably adapt to, mitigate and cope with the complexity of emergent issues in their environments.

Background and context

The implementation of the global Sustainable Development Goals (SDGs) in Southern Africa seeks to connect development priorities to a comprehensive policy agenda in a way that creates synergy and establishes a more effective response to global, regional and national challenges. Issues of poverty, health, sanitation, climate change, energy, employment, economic growth and environmental protection are addressed in this framework.

According to the African Union Agenda 2063, Africa (including Southern Africa) aims to establish a prosperous region characterised by sustainable inclusive growth, peace and good governance. The region's growth path shall be led by increased agricultural productivity, sustainable industrialisation, investment in infrastructure development and renewable energy. Conservation of biodiversity, sustainable and fair and equitable use of genetic resources, clean air and water, and better adaptive capacity to climate change are crucial dynamics of the sustainable development agenda in this region, as is the achievement of quality education for all.

The Sustainability Starts with Teachers (SST) Programme

With this background, the Sustainability Starts with Teachers (SST) programme (2019–2023) was designed as a capacity-building programme for teacher and TVET educators on ESD. UNESCO Regional Office for Southern Africa implemented the programme in 11 Southern African countries including Botswana, Namibia and Zimbabwe in 2019; Lesotho, South Africa and Zambia in 2020; Eswatini, Malawi and Tanzania in 2021; and Angola and Mozambique in 2022. Funding was provided by the Swedish International Development Cooperation Agency (Sida).

Transformative, change-oriented learning is at the heart of the SST programme. Transformative pedagogy support TVET instructors to create innovative learning processes that empowers learners and engages them as whole persons in participatory and collaborative activities, that contribute to their sense of self, purpose, belonging, interconnection and agency. The pedagogy is an active process involving thought, feelings, and disposition. Transformative pedagogies are commensurate with a variety of learning domains:

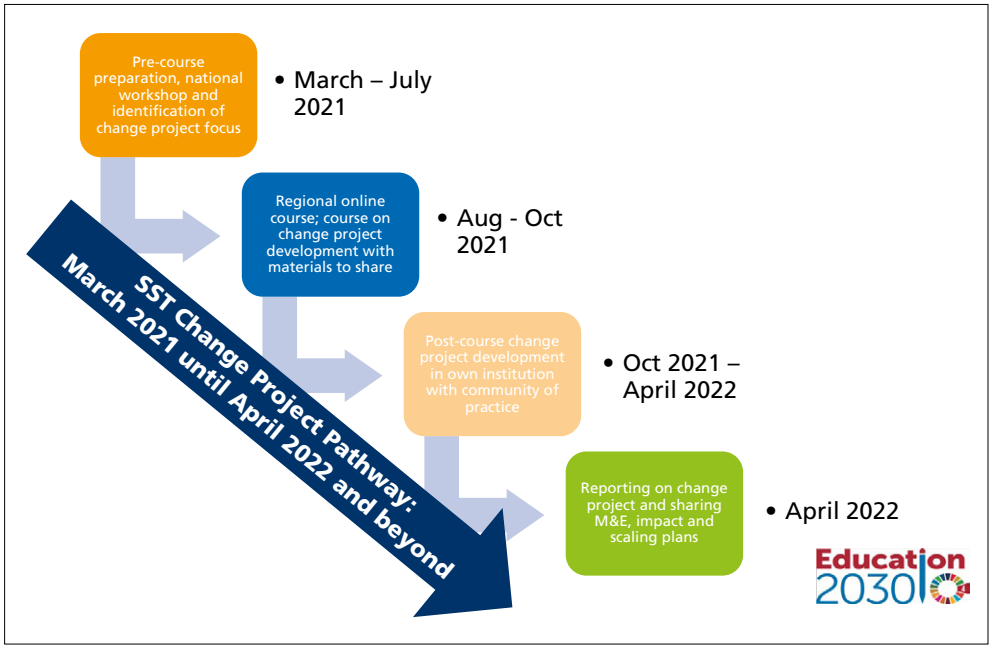
- Cognitive learning objectives, mostly through fundamental content knowledge.
- Social-emotional learning objectives (value based including critiquing well established practices. Learning should nurture sustainability competencies such as inclusivity, collaboration, equity, inter-cultural understanding and tolerance, self-respect and respect for others. Ubuntu/Unhu/Vumunhu).
- Behavioural or action-oriented learning outcomes which include applied evidence of values (often shown through active learning and engagement with issues and concerns).
- Transformative social learning outcomes, which involve engagement with communities and action-oriented programmes that result in wider changes.

The SST programme therefore adopted a transformative learning model called the Change Project, which is a self-defined institutional change initiative that includes curriculum innovations, pedagogical innovations, whole-institution innovations orientated towards sustainability, and many more. The programme focused on integrating sustainability principles into education and training environments; enhancing the ESD capacity of TVET institutions via an advanced ESD regional training course and reinforcing ESD national and international education policies; strengthening ESD professional networks in southern Africa.

The Change Project Approach

The SST programme adopted the Change Project model to guide institutional transformative learning. Change Projects are self-chosen and situated projects that are focused on curriculum, innovation and change, community engagement and policy development. They are developed by SST programme participants with institutional support in local communities of practice over time. They are the 'core' of the capacity development process. Fig. 1 below shows the Change Project Approach support process.

Figure 1: Change project support pathway



Source: own illustration according to UNESCO (2023)

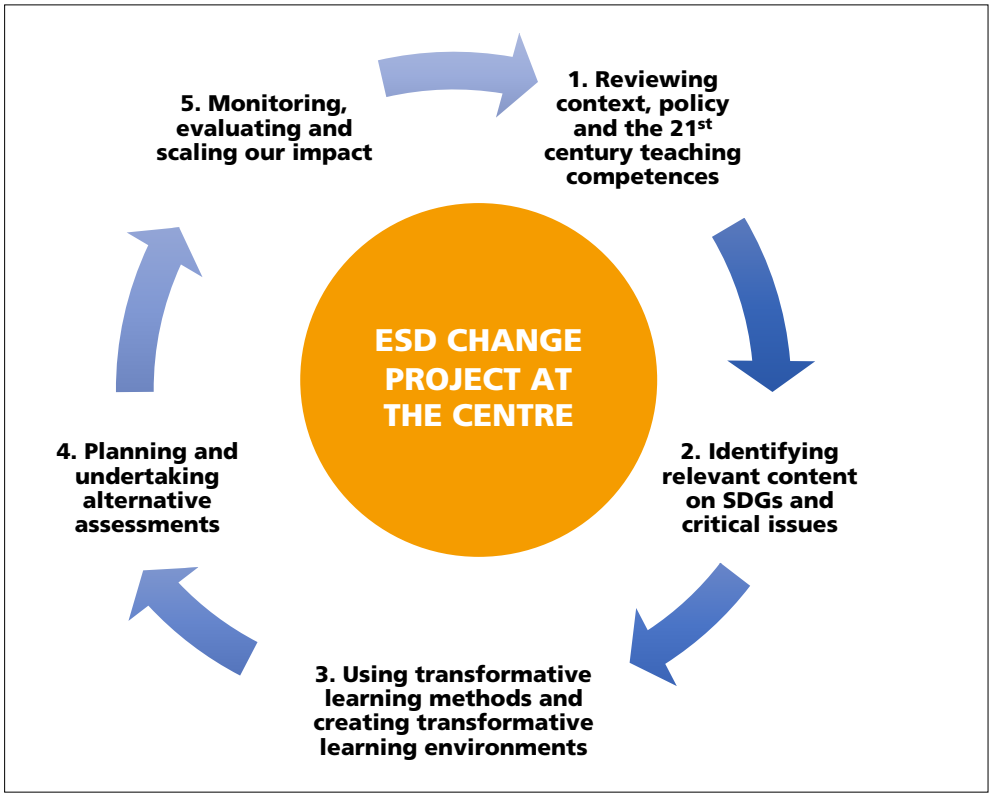
To initiate the Change Projects, SST participants were supported by learning steps that included the precourse assignment, startup workshop, the regional course, continuous in country support from national coordinators and community of practice members and policy dialogues. Startup workshops were held in all the countries to initiate the SST programme. As a learning action in the transformative learning process startup workshops focused on three main outcomes: 1. Analysis of ESD context in current TVET curriculum practices, 2. Framing conditions for a desired future in terms of curriculum transformation and 3. Identifying leverages in a country that facilitate TVET curriculum transformation.

This process used pedagogic devices like sharing of ESD baseline survey results, engaging national policies and curriculum frameworks, reflections on assessment frameworks and sharing ESD good practices from other institutions. ESD surveys were conducted by

a group of local ESD experts in each country prior to the start-up workshop. The same experts also conducted an ESD scan of the national TVET curriculum and learning material as well as mapping of ESD good practices in the country and in the region. Some of the gaps identified and shared during start-up workshop went on to shape initial Change Project thinking in most countries.

The SST regional course was the next learning action to support CP. The Course Curriculum was designed to follow a five-step action learning programme framework as shown in Fig 2.

Figure 2: Five-step action learning programme framework



Source: own illustration according to UNESCO (2023)

The purpose of the course was to enrich participants understandings of ESD, and to offer them time and space to reflexively review their initial plans for their ESD Change Projects, to be further developed after the course in their institutional contexts. Course materials, organised as follows, provided the main content for the course:

- Introduction and Orientation Text; Change Project Guidelines Text;
- Learning Action 1: ESD Policy, Context and Competencies Review;
- Learning Action 2: Sustainable Development Goals and Critical Issues;
- Learning Action 3: Transformative Learning and Learning Environments;
- Learning Action 4: Design and Try out Assessment of Significant Learning in ESD and
- Learning Action 5: Monitoring, Evaluation and Scaling for Impact

The Zambia Change Project: Mwekera Beekeeping Educational Forum

Zambia Forestry College is one of the 14 TVET institutions which participated in the SST programme. One lecturer (TVET instructor) attended the start-up workshop and participated in the course. Midway in the course she built a community of practice by involving other members of the department to plan and implement the Change Project. The college principal participated in policy dialogues both at national and regional (SADC) levels.

In the past, the college was working independently without involving the community and other stakeholders. A lot of unsustainable livelihoods support activities like charcoal making and trading were rife in the community. The college therefore decided to come up with a CP that focused on improving quality and relevance of TVET at the same time supporting communities with sustainable livelihoods activities. This saw the birth of the Mwekera Beekeeping Educational Forum that brought different stakeholders together e. g., Forestry Department, Local Community and Mwekera combined primary school.

Through the Change Project, the college revised its modules to include elements of climate-smart education through integrating elements of climate change and green growth. The Change Project also introduced a new module that ensures that knowledge is transferred to local communities to support the adoption of green recovery, circular economy, renewable energy production and promotion of green growth. Specifically, the Mwekera Beekeeping Educational Forum Project achieved its goals of promoting skills development in apiculture, enhancing forest ecosystem protection, reducing poverty levels, and encouraging tree planting in the community. The Change Project adopted a curriculum diversification strategy by introducing a level three module (currently in progress and set to be translated into local languages) that integrates practical field-based learning, interactive teaching techniques, and assessment of learners' hands-on proficiency.

Conclusion

The Change Project model has proved to be catalytic in mobilising curriculum transformation in participating institutions as well as in advancing ESD in national policies. Implementing transformation through communities of practice around change projects has proved to be an enormously cost-effective capacity development model. It is also evident that ESD change projects have the potential to empower transformation beyond teaching

and learning, including economic transformation of institutions as well as inspiring a sense of self-reliance of individuals and communities of practice.

While it is satisfying to note that several change projects managed to integrate ESD into key elements of education (institutional policies, pedagogies, assessment, and capacity development of fellow teacher/TVET educators), there is, however, a need to scale them beyond departments and institutions. With additional resources, change projects have the potential to be extended to other institutions in countries. The basis of these Change Projects could also be used to raise funds for scaling activities.

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Making sustainability possible – Micro level. Perspectives from training companies

Mareike Beer, Dietmar Frommberger, Helmut Steinkamp

Sustainable management and training – Approaches to qualifying trainees and in-company vocational training staff in the dual system

Based on the findings from the pilot project on vocational training for sustainable development in the dairy industry, this article draws general conclusions on the didactic design of sustainability-oriented vocational training. It shows which methods were used to anchor sustainability as a topic in vocational training in the dairy industry. Based on this example, general considerations and approaches from the pilot research on the design of teaching-learning arrangements for the promotion of sustainability-oriented educational processes are outlined in order to thereby be able to give further general indications on the questions of transfer and cooperation of the stakeholders and institutions.

1 Introduction to the topic

Dual vocational education and training in Germany comprises more than just learning or imparting labour market-related, directly usable skills and knowledge. Its objectives go beyond the individual and internal qualification function and include the claim to enable learners to actively participate in and help shape the world of work and society. It includes the promotion and reflection of attitudes, inner attitudes or values according to which professional action is guided. In this way, company needs are linked to societal educational demands based on the specialised vocational work in the respective occupation.

This is where pedagogical-didactic concepts of vocational education and training for sustainable development (VETSD) come into play. The sector-typical core processes and value chains and with them the respective sector-typical key problems are identified and made into starting points for sustainable and action-oriented teaching and learning processes – both at the level of occupation- and sector-specific skilled work and with regard to the development potentials of education for sustainable development in vocational action.

The basic didactic concept of VETSD goes far beyond a solely positive basic attitude towards ecological topics or social-societal issues. Sustainability-oriented skilled work encompasses all production and value-added processes in the company, and entrepreneurial action always includes basic ecological, social and ethical principles in economic decision-making processes (see Mayer 2020, p. 25).

However, the demand for *more sustainability* often cannot be easily and directly translated into binding and unambiguous vocational action, as the vagueness of the term sus-

tainability and the high degree of abstraction of the guiding principle of sustainable development make it difficult to implement sustainability-oriented vocational training processes (see Kastrup et al. 2012, p. 119). Nevertheless, sustainability can and should be understood as a cross-cutting issue that accompanies all vocational training and entrepreneurial action.

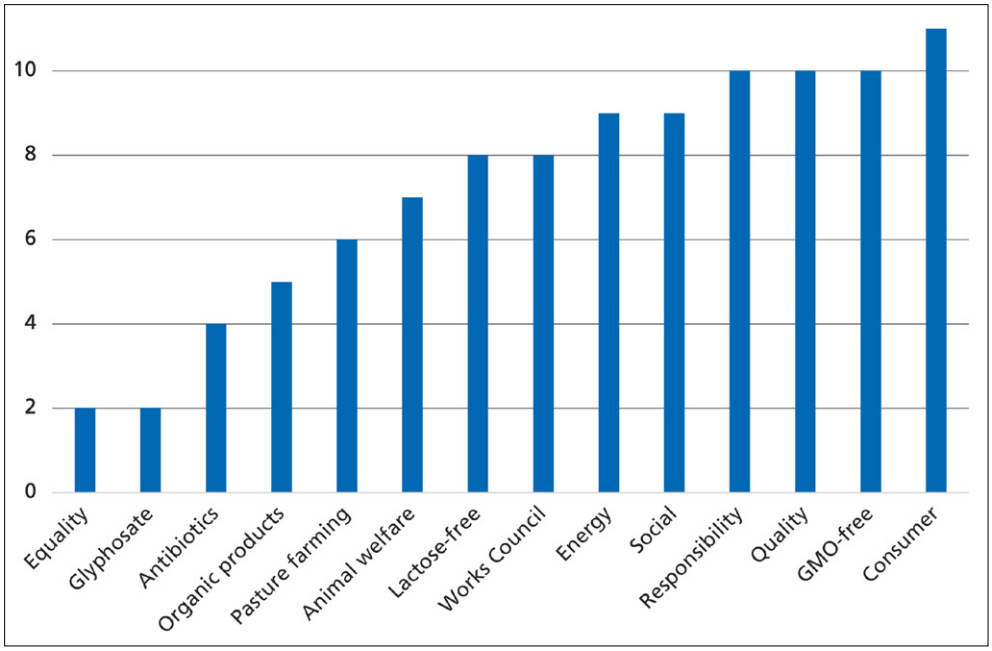
This paper shows which methods were used in the two pilot projects NaMiTec and QuaNEM to anchor sustainability as a topic in vocational training in the dairy industry. Based on this sector-specific example, considerations and approaches from the pilot project research on the design of teaching and learning arrangements to promote sustainability-oriented educational processes are outlined with a focus on the company as a learning venue. This is because the aim is to be able to make transferable statements about conditions for success for the implementation of VETSD aspects in dual vocational training to other sectors and occupations.

2 Vocational training for sustainable development (VETSD) in the dairy industry – The NaMiTec and QuaNEM pilot projects

The dairy industry is the second strongest sector in terms of turnover in the German food industry and ranks behind the meat industry. Nevertheless, relatively few young people start training to become dairy technologists: only just under 250 trainees start this dual training each year. The training content includes processing raw milk into drinking milk, milk powder, yoghurt, curd, ice cream or cheese, operating the machines and monitoring the entire production processes in the dairies. The training is rather industrial, but nevertheless it belongs to the so-called "green professions" and falls under the responsibility of the Chambers of Agriculture. The trainees learn and work at the learning venues dairy and vocational school. Due to the low number of trainees, the vocational school lessons for most trainees take place in block form. As in many training occupations in agriculture or the skilled trades, the third learning venue is the inter-company vocational training centre in the dairy training centres.

Many companies in the dairy industry already regularly check their processes for their impact on the environment and society. They have integrated sustainability into their mission statement and pursue their own sustainability strategies in their business activities. As part of the NaMiTec pilot project, 12 sustainability reports from large German dairies were evaluated and the most frequently mentioned topics were identified, see Figure 1.

Figure 1: Topic areas in the sustainability reports of German dairies



Number of mentions in the sustainability reports of the companies considered (n=12)
Source: own representation after Steinkamp *et al. 2018, p. 18*

In the sustainability reports, consumers are most frequently mentioned as buyers of the products produced.

The demand for responsibly produced dairy products is steadily increasing and this development is often associated with a change in the dietary behaviour of citizens (see Information service of the German Economic Institute, IWD 2022; Hossfeld 2021, p. 1). The growing supply of milk substitutes reinforces this assumption. For example, sales of plant-based milk alternatives based on oats, soy, almond or rice doubled between 2018 and 2020 (see Ahrens 2023), while at the same time per capita consumption of drinking milk fell. Despite the industry's efforts towards more sustainability and improved communication and marketing strategies, it reached its lowest value since 1991 in 2021 with a per capita consumption of 47.8 kilograms (see Bundesanstalt für Landwirtschaft und Ernährung – Federal Office for Agriculture and Food 2022, p. 28). Above all, ecological aspects and animal welfare play a major role for consumers, but they are often also interested in generally high product quality and safety. Consumers expect this above all from sustainably produced and organically certified products (see Hossfeld 2021, p. 7). The sustainability reports of the dairies illustrate that the companies are aware of this change in purchasing and nutritional behaviour.

Also due to these developments, companies in the dairy sector often expect their employees to act more professionally and with greater sustainability competence. In addition,

the demands of employees are increasingly linked to expectations of environmentally and socially compatible management and are brought to the companies by the employees. The changed work requirements influence the competence development of the skilled workers in the companies and require the permanent structural and content-related adaptation and further development of dual training.

In a broader understanding, the acquisition of comprehensive vocational action competence can be named as the guiding objective of VETSD, in which operational requirements are linked with social educational demands. In this way, a contribution can be made to overcoming the frequently observed break between environmental awareness and environmental action (cf. Bliesner-Steckmann 2018, p. 19f.) – this also applies to the dairy industry. Vocational education and training includes the empowerment of individuals to actively participate in and shape the world of work and society. It includes the promotion and reflection of attitudes, inner attitudes or values to which vocational action is then aligned (see Beer/Frommberger 2022, p. 77). How this can be achieved was tested in the pilot project "Development of a training and further education concept to increase the contribution to sustainable development in dairy technology – NaMiTec" and the transfer project "Qualification for sustainable development in the dairy industry – QuaNEM".

The project partners LUFA (Landwirtschaftliche Untersuchungs- und Forschungsanstalt – Institute for Agricultural Analysis and Research) North-West and the University of Osnabrück worked together on both projects. LUFA North-West is involved in the project with the Dairy Education Centre of the Institute for Food Quality, the central inter-company training centre for Lower Saxony, Bremen and North Rhine-Westphalia for dairy technologists and dairy laboratory assistants, as well as the training centre for dairy masters. At the University of Osnabrück, the Department of Vocational and Business Education at the Institute of Educational Sciences is supporting the pilot project and the transfer project primarily from the perspective of vocational education and didactics. In addition to LUFA North-West and the University of Osnabrück, the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT was also involved in the NaMiTec pilot project. The two projects NaMiTec and QuaNEM were concerned with the development of education and training concepts and associated teaching and learning materials as well as their implementation in vocational training structures to increase the contribution to sustainable development in dairy technology.

First of all, the regulations and curricula were reviewed and analysed in order to identify links to sustainability and VETSD. In addition, typical vocational action requirements and competence expectations for trainees and other skilled workers in the dairy industry were worked out in close exchange with trainers and other representatives from company practice. The aim was to be able to develop competence-promoting teaching and learning arrangements with close references to training practice and the curricular principles in the training occupation of dairy technologists. The products include teaching and learning modules for the trainees, the topics of which were selected according to the following criteria:

- The topics include ecological as well as economic and social aspects and offer many connection points for a vocational field-specific VETSD ("sustainability reference").
- There is a close connection to the curricular basics of the vocational training as a dairy technologist ("occupational reference").
- The tasks and contents are expected to promote competencies relevant to the occupational field ("competence orientation").
- Trainees should have the opportunity to work in a multidisciplinary and problem-oriented way ("multi-perspectivity").
- The topics tie in with the current and/or future situation of the trainees ("everyday life and lifeworld reference").
- The selection of topics also promotes cross-occupational competencies that have a general educational character ("holism") (see Beer 2020, p. 72).

In addition, a pedagogical booklet for the vocational training staff, an in-service modular qualification with a practical project as well as a three-day training as a recognised educational leave according to the Lower Saxony Educational Leave Act were developed. The materials and educational concepts are intended to strengthen the sustainability awareness of the trainees and the training staff and to enable them to convey their knowledge in an authentic and professionally sound manner or to be able to apply it professionally.

All materials and qualifications are therefore closely related to skilled work in the dairy industry. However, based on this sector and the insights gained, generalisable statements can be derived on the question of what the conditions for success are for integrating VETSD content into training structures and curricula. These are presented in the following chapters. A distinction is made between aspects of content and didactics and aspects of science communication.

3 Didactic considerations for the promotion of vocational action skills with references to sustainability

Connectivity: Materials and content should be placed in the training context and interlinked with training content.

VET teaching and learning materials with a reference to sustainability should not be used additively but must be interlinked with the specifications of the general training plan, the framework curriculum and other specifications (for example, for keeping the report book or similar). VETSD aspects should be understood as cross-cutting issues of vocational action; in this sense, the materials should not represent additional work for the trainees.

Irritation as an occasion for learning: Picking up on typical vocational questions and problems

VETSD teaching and learning materials should be closely related to the questions and problems typical for the profession and should be designed in a clear, understandable and practical way. Arguments, objections and questions should be taken up that trainees encounter in everyday life or in daily professional practice. Above all, the confrontation with dilemmas typical of the profession can serve as an occasion for learning. Here, the didactic means of irritation can be used – in the sense of Schäffter, irritations as "disturbance of the familiar (...) offer connection possibilities for cross-context appropriation processes (...). Irritation as a border experience makes one's own not-seeing visible." (Schäffter 1997, p. 695f.)

Practical relevance: Depiction of professional actions as complete as possible

As far as possible, VETSD teaching and learning materials depict complete (training) activities with reference to the company and have close links to both in-company training and the contents of vocational school lessons. In addition, it should be ensured that the current state of research and the latest developments in VET are taken into account when developing the materials – the material should thus be "state-of-the-art" when published.

User-friendliness: Attractively designed material

The materials should contribute to cognitive processes conducive to learning through their graphic design. This can be achieved through user-friendly decisions regarding font size, formatting, line spacing and the use of graphic elements such as different font colours or set-off text boxes. Good VETSD materials should also make appropriate use of occupation-specific technical language and use domain-specific technical words, but at the same time the material should be designed to be as "barrier-free" as possible (e. g. by explaining foreign words and technical terms in footnotes or separate sections).

Activation: Stimulation of learning processes through task design appropriate to the target group

Good learning material should promote independent and collaborative as well as active learning, it should be understandable for the target group, build on the previous knowledge of the trainees and enable individualised learning (see Müller et al. 2015, p. 34). The promotion of vocational action competence is always the overarching vocational pedagogical objective. This includes enabling the individual to actively participate in the world of work and in society. In addition, the material should meet the requirement of reflecting social and workplace diversity and be "neutral with regard to gender, religion, nationality, etc." (Müller et al. 2015, p. 34). The processing of VETSD materials should therefore be possible to a large extent independently and self-directed by the trainees. The sustainable learning processes stimulated in this way should promote the self-efficacy of the learners, allow for personal initiative and scope for action, be oriented towards concrete problems and company or sector-specific needs, take previous experiences into account and include

opportunities for interaction (see Weiss 2018). The tasks should be closely related to the learning objectives and the contents of the training in the respective occupation.

OER: Low-threshold availability of materials as Open Educational Resources

The materials developed should be made available to interested user groups with as few barriers as possible, for example, as an Open Educational Resource (OER) for free download. OER offer free access to the didactically prepared VET educational materials and enable user groups such as trainers in companies or inter-company training centres as well as teachers in VET schools to duplicate the material or combine content and tasks with other materials. In this way, the materials are disseminated and can be used as needed. Furthermore, OER make it much easier to further develop and adapt teaching and learning materials to different target groups and their competencies.

4 Stakeholder dialogues and science communication as success factors for implementing VETSD content in vocational education and training

The provision of developed teaching and learning materials, for example, as Open Educational Resources, is necessary but cannot be considered sufficient on its own because the "information on pilot project end products alone does not change company practice" (Novak 2017, p. 56). Stakeholder dialogues and good scientific communication are indispensable for implementing and sustainably anchoring the results of the pilot work in the structures of vocational education and training.

In order to implement VETSD in VET structures, a general willingness to change should exist or be generated among the responsible actors. This can be positively influenced if the transfer products offered cover an actual need and have a high potential for benefit. From the point of view of the company representatives, there is an appropriate relationship between effort and return as a result of the changes initiated, and ideally the model test results can be integrated into current or future organisational development processes of an institution. The triad of knowledge transfer, knowledge utilisation and knowledge production can be understood with Schemme as an expression of learning systems that develop dynamically and point to the future (Schemme 2017).

Relevant stakeholders are the bodies responsible for vocational education and training, such as the Chambers of Agriculture, but also the members of the examination boards, the trainers in the companies and in the inter-company vocational training centres, as well as the Human Resources managers and the representatives for sustainability or quality management in the companies. Furthermore, the teachers in the VET schools should be mentioned, along with the interest groups for the respective vocational sector. Last but not least, the direct target groups of the VETSD activities, such as trainees, must be in the focus of the activities, as they work with the materials and concepts. These stakeholders should be involved in the development processes at an early stage and regularly consulted – this serves,

on the one hand, to align the materials closely to the needs of the sector, and on the other hand, this procedure also increases the acceptance of the activities and the later products in the field of vocational didactic VETSD work, which contributes significantly to the implementation in the VET structures. Through such participatory formats designed for transfer, knowledge should be generated not only of internal scientific validity but also of social robustness (see Felt et al. 2003, p. 5; FactoryWisskomm 2021, p. 53). Socially robust knowledge is generated by drawing on a variety of perspectives and techniques in the process of acquiring knowledge or insights, and by involving different experts, stakeholders, but also laypersons in the process. The attribution of legitimate expertise to non-scientific persons is associated with an expansion of the expert space (see Felt et al. 2003, p. 81).

The challenge, especially for the academic partner in the pilot project work, is to perceive and weigh the different interests and goals of the parties involved and to constructively use the field of tension that arises between the two poles of research and practice or theory formation and theory application. It is the responsibility of the scientific partners to initiate and accompany changes in vocational education practice in the sense of an innovation partnership between science and practice (see Hemkes et al. 2017, p. 2), and also to contribute to scientific discourse in vocational education research through their work in the pilot project. The transfer of knowledge gains particular importance in this research field, as social transformation processes are initiated, which is why it should be strategically planned from the beginning (see Schuldt-Baumgart/Lux 2022).

In addition to knowledge transfer, science communication is understood as an important component of research work. This often refers to the generally understandable and dialogue-oriented communication of scientific topics and content to non-scientific target groups (see BMBF – Federal Ministry of Education and Research 2019, p. 2). These include children and young people inside and outside schools as well as people who are distant from science, close to science and sceptical about science, disadvantaged groups and the general target group of the so-called general public (see Ziegler/Fischer 2020, p. 24). If it is assumed that science communication can contribute to bridging the gap between the expert and lay public (see Weitze/Heckl 2016, p. 1), then in the sense of the scientific literacy paradigm it is ascribed a pictorial, instructive and enlightening character.

In the NaMiTec and QuaNEM projects, for example, blog contributions were published on various platforms, such as the blog of the cooperation partner LUFA North-West, on the homepage of the Federal Institute for Vocational Education and Training (BIBB) and on EPALE, the Electronic Platform for Adult Education in Europe, a Europe-wide community for professionals in the field of adult education such as teachers, trainers, researchers or politicians. In addition to scientific publications, scientific journalistic articles were published and many opportunities were used to publicise the contents and results of the project work at conferences, congresses and other education and transfer events.

However, Felt et al. emphasise that even in participatory processes, the scientific partners play a central role and the non-scientific and interested public appears quasi as a context (see Felt et al. 2003 p. 6). Using and shaping this context as a space of opportunity in the sense of the project goals in VETSD transfer is both an opportunity and a challenge.

The task – currently and in the future – will be to support quality development in science communication and to investigate the conditions, limits and effects of science communication, in the understanding of a "science communication science" (Weitze/Heckl 2016, p. 274). It can be assumed that due to the close proximity to knowledge transfer, new and relevant insights can also be gained for transfer research.

5 Conclusion and outlook

Based on the results of two pilot projects, this article draws general conclusions on the didactic design of sustainability-oriented vocational education and training. In addition, from the experiences of the scientific monitoring, further general information is given on the questions of transfer and cooperation between the stakeholders and institutions, which aim to jointly develop innovative approaches and bring them into the breadth of vocational education and training.

The topic of sustainability is a good example of the ability of vocational education and training to change. The pronounced practical relevance of in-company vocational education and training in the dual system means that it is directly related to current needs. In this respect, in-company vocational education and training is constantly changing in direct relation to technical requirements. This is a distinct strength of this form of vocational training. However, the high degree of specialisation in the companies and the tight order binding make it necessary to develop and implement standards that go beyond the narrow requirements of individual companies in order to ensure a broad occupational reference. At the same time, it is necessary to give young people undergoing vocational training the opportunity to comprehensively understand what they are doing. This meaning of "vocationality" combines skills and knowledge and leads to a shaping ability with which the young adults can not only cope with their vocational reality but also develop it qualitatively. This transformation potential of dual VET, which combines economic needs and societal demands lies between practice and theory, between specialisation and generalisation, and finally in the connection of learning processes at different learning venues. At the same time, we know that the reality of VET does not guarantee these high quality standards for every young person who chooses dual VET. We must continue to work intensively on this development task, which is also related to the conditions of in-company learning.

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Joachim Raschke

How ESD gets an impact in VET and human resources development – lessons learned from the ANLIN² project

Since August 2021, a general regulation in German vocational education and training has required companies to teach sustainable development topics systematically and in an integrated manner in all training occupations throughout the entire training period. This is in line with a key objective of the German National Action Plan for ESD: to embed Education for Sustainable Development (ESD) in the education system.

The practical implementation of ESD in in-company vocational training is primarily the responsibility of the trainers. The project ANLIN² aimed to prepare trainers and to impart knowledge, skills and methods to encourage trainees to act reflectively and independently. However, much more is needed to create a sustainable learning environment and to achieve a lasting impact in the company. This article identifies the challenges and requirements and describes solutions.

Figure 1: ESD Kick-off with trainees of the logistic company nox NachtExpress in the Frankfurt football museum. September 2022

Source: © Schüle Filme, Schömberg – nox NachtExpress, Langenfeld. Frankfurt 2022

About the ANLIN² ESD project[1]

ANLIN² (a German acronym for: vocational education and training (VET) promotes sustainable learning environment in industry) is a Vocational Training Programme for Sustainable Development in the Workplace of Companies, developed and tested in two project phases from June 2016 to March 2019 and further continued in the period of 2021 to 2022.

ANLIN² was a project made possible by funding from the Federal Ministry of Education and Research (BMBF) and the Federal Institute for Vocational Education and Training (BIBB). The project was designed and executed by the partners Provadis GmbH, Frankfurt and the Nuremberg Chamber of Commerce and Industry for Middle Franconia.

In the first phase, the training programme was specifically aimed at training personnel and trainees in the chemical industry. In the second phase, the programme was extended to other sectors, the training of trainers was further developed and different design variants were tested.

In this phase of the project, particular attention was paid to the conceptual requirements in the different sectors and how to ensure sustainable dissemination of the training activities beyond the end of the project. During the period of ANLIN², approximately 250 persons were trained.

Important insights were gained into how ESD can be effective in VET in line with the UN goals for Sustainable Development (SDG) (see United Nations 2015).

This article outlines the key success factors from practice experiences. Using ANLIN² as an example, the article also shows the framework conditions and success factors under which train-the-trainer courses can contribute to achieving SDG 4.7 and UNESCO's Global Programme of Action on Education for Sustainable Development (ESD) (see UNESCO 2017; National Action Plan (NAP) on ESD. BMBF 2017).

1. Objectives and frameworks

With sub-goal 4.7 of the SDGs, the United Nations defined ESD for the first time in 2015 as a separate area of action.

SDG 4.7 defines the goal: "By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development" including the indicator of 4.7.1. "Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (*a*) national education policies; (*b*) curricula; (*c*) teacher education and (*d*) student assessment". (United Nations 2017)

The National Action Plan (NAP) for Education on Sustainable Development postulates in chapter "Technical and Vocational Education and Training" "Establishing workplaces

1 The Project-website of ANLIN²: URL: **https://www.nachhaltige-lernorte.de/**
Short Review of the ANLIN²-Project on website of the Federal Institute for Vocational Education and Training (BIBB): URL: **https://www.bibb.de/de/171022.php**

and vocational schools as sustainable learning spaces" and the "Implementation of TVET for SD in curricula and teaching" (see Nationale Plattform Bildung für nachhaltige Entwicklung. BMBF 2017).

In the German VET system, ESD has been mandatory for dual vocational training since August 2021 and can be found in various framework curricula of vocational schools and in the updated German "minimum cross-occupational standard position", which define the content of framework curricula for vocational and in-company training as interprofessional standards. These contents must always be integrated into the training in connection with the respective vocational skills, knowledge and abilities. New or revised is the area of "environmental protection and sustainability", which describes and concretises practical skills and development competencies in all dimensions of sustainable development throughout the entire training period, usually over 3 years.

This approach not only raises the legitimising question of the why of ESD but also implements ESD as a mandatory aspect of VET. Both are of great importance when it comes to reaching and motivating the target group of companies with their training personnel.

2. How to reach the target group of trainers: Timing and design

The project experience shows that the willingness of companies to release training staff for further training is rather low because their time availability usually seems to be very limited. This applies regardless of whether costs are involved (ANLIN² was a free training offer); the decisive factor is the time required, i. e. the absence of the trainers from the work processes in the company.

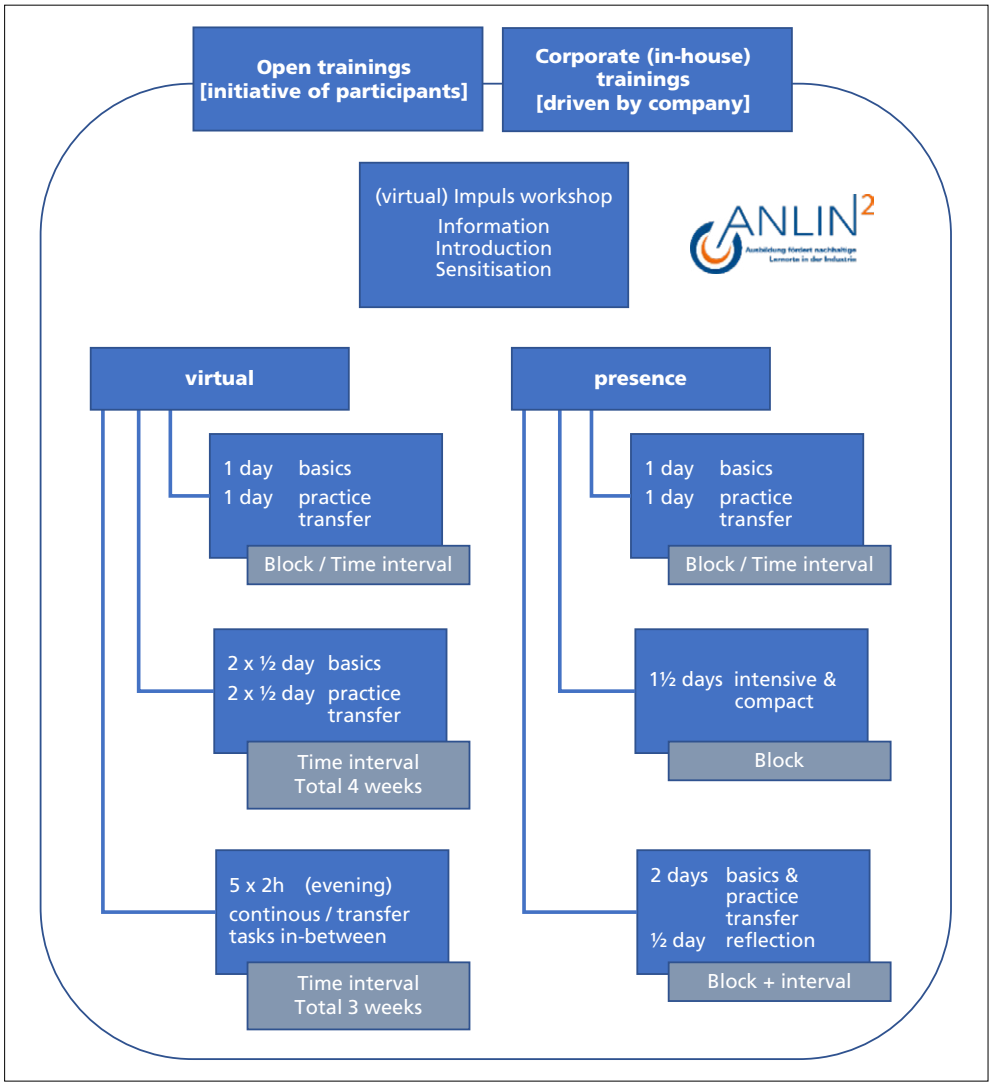
In concrete terms, open training courses were advertised and offered via various platforms and business partners such as chambers of commerce and industry, which did not meet with a significant response. Similarly, the vast majority of direct application interviews with potentially affected companies training young people were unsuccessful. The time required was mostly considered too long, regardless of the benefits and the urgency of the issue.

Therefore, within the framework of ANLIN², several alternative compact teaching and learning models were developed and tested in flexible variants, which should offer the best participation possibilities.

The different combinations of training forms shown in the following illustration consider

- open courses with groups of participants from different companies
- closed groups with several participants from one company (in-house)
- a modular structure
- face-to-face and virtual/online, also as a mixture of blended learning

Figure 2: ANLIN²: Tested various combinations of different training models



Source: Raschke, Joachim: ANLIN² project documentation. Nürnberg 2023

In this way, a variety of alternatives and combinations were available to meet the different time and operational requirements of the companies and their training staff. In the least time-consuming option, with five times two evening sessions, the workshop elements were placed as homework between the modules to be completed individually or in small groups. The "total workload" for this methodology remained the same as for the other, longer forms of training. Offering flexible training options was a key success factor in reaching potential participants and companies with different needs and capabilities.

3. How to involve trainers in creating a sustainable training practice: Methods and didactics

In the large and complex field of sustainable development, it was particularly important to find a good balance between depth and breadth of content within the short time frame of the training courses and, above all, to motivate and sensitise the trainers to the relevant and (personally) tangible topics of sustainable development.

It became clear that the training concept developed in the chemical industry was also suitable for other sectors and different training occupations. Rather than adapting the training concept for each sector and occupational profile, it was important to take the variety of different training occupations found in a company into account and to link them to specific common sustainability themes.

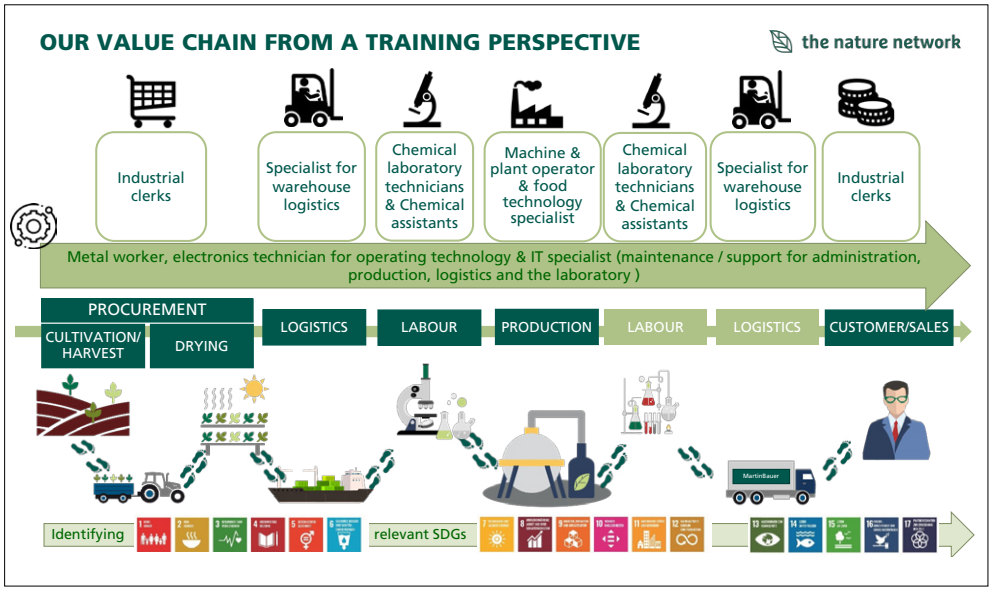
In the technical basics, it was also important to focus on practical relevance, concrete implementation aids and impulses for creative design in order to enable the independent continuation of sustainable training design in the companies.

ANLIN[2] made extensive use of workshop elements and activating tasks, which enabled the participants to develop very individual, appropriate results. The practical relevance was determined by the participants themselves.

The following example shows the value chain of the globally active company Martin Bauer Group: the nature network with headquarters based in Vestenbergsgreuth (near Nuremberg, Bavaria), and producing teas and herbal extracts (see corporate website). The first step of a workshop task was to assign the relevant training occupations to the working steps of the value chain. In a second step, these working steps were linked to relevant sustainability goals, risks and also ideas for improvement measures in the company. In this way, an individual approach for different occupations could be achieved with a general, overarching task.

As a further result, this individualisation method was used to think about typical training situations from a sustainability perspective. The approach described as an example makes it possible to take job- or task-specific issues as well as sector- and company-specific situations into account.

Figure 3: Value chain and relevant training occupations, SDGs should be individually assigned



Source: THE NATURE NETWORK: Training Documentation ANLIN². Vestenbergsgreuth 2022

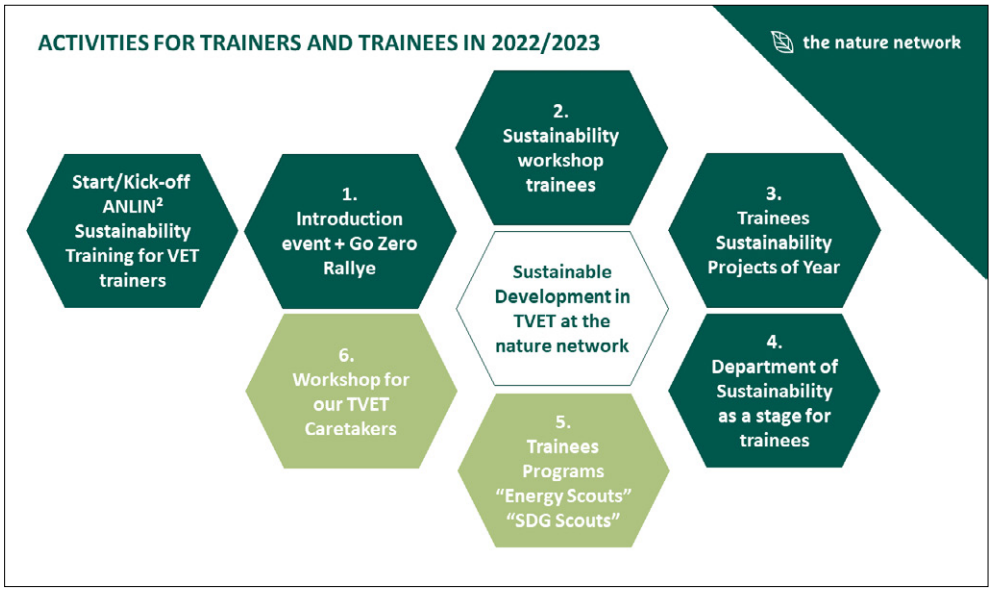
4. How to move on in the company: Structures for continuous development

The training of trainers for ESD in VET can only be effective if the findings and results of the workshops are systematically integrated into the companies' structures. If implementation depends on the trainers' own initiative, no sustainable results can be expected. The only way to ensure that training contents and processes are continuously developed in the sense of sustainable development is to systematically integrate and document them in the training plans.

This also requires the systematic integration of sustainable development issues in training and personnel development throughout the company and for all employees. Training staff are usually affected in two ways: both as specialists and managers in their department and as role models and instructors for the trainees.

In all the ANLIN² series of company-related in-house training courses, appropriate training plans have been drawn up and development processes were initiated, usually in connection with special kick-off events for the trainees. A very good example of this is the development of a sustainable training design at the Martin Bauer Group, as shown in the graphic below (the measures shown in brighter green colour are in current development [end of 2023]).

Figure 4: Activities for trainers and trainees at the nature network, started with ANLIN² Training



Source: THE NATURE NETWORK: Presentation of Sustainability in TVET. Vestenbergsgreuth 2023

5. Sustainable corporate strategy matters!

Above all, a corporate sustainability strategy or, even better, a sustainable corporate strategy needs to be established, in which the VET for SD is directly linked to the corporate reality in a development plan with concrete objectives in the area of corporate responsibility, and in which the participation of training staff and trainees is promoted and empowered to contribute ideas for improvement. This strategic approach should, in turn, have a direct impact on the sustainable development of human resources at all levels and thus naturally develop training in the company as a sustainable place of learning.

Figure 5: Gisbert Braun | the nature network with ANLIN² Project Manager and Author Joachim Raschke (l.)

Source: neues handeln AG

"Since the training initiative of the ANLIN² project, we have been communicating our sustainability goals and measures in line with our corporate strategy to our trainers, who incorporate this into their practical work with the trainees and and take it forward constructively.

This has been a missing element in our personnel development and recruitment programmes, helping us also to attract and retain engaged young talents."

Gisbert Braun – Head of Group Sustainability

Figure 6: Overview Strategy of Sustainability in supply chains at © Martin Bauer, part of the nature network

Source: Martin Bauer, part of the nature network: Presentation of Sustainability in TVET. Vestenbergsgreuth 2023

Conclusions

Vocational education and training, with its nationwide uniformity in Germany, offers excellent potential for the permanent and supra-regional introduction of ESD for occupational groups in a systemically integrative and practice-oriented manner.

In the area of vocational education and training, this has already been initiated by corresponding regulations. ESD is an obligatory task and at the same time an opportunity for corporate development, which requires and promotes a leading, sustainable corporate strategy and the qualification and development of human resources in a holistic manner.

ANLIN² offers a compact and flexible qualification programme for training staff. Under the conditions described here, it can make an effective contribution to the design of sustainable learning spaces in companies.

It is to be emphasised, however, that ESD programmes such as ANLIN² can only have an impact in the area of in-company technical vocational education and training and for the company as a whole if they are part of a holistic human resources development for sustainable development and follow a sustainable corporate strategy – sustainable management is an add-in, not an add-on!

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Authors

Moritz Ansmann
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Senior Adviser
Email: **Ansmann@bibb.de**

Dr Fred Kyei Asamoah
Ghana: Commission for TVET in Ghana, Director General
Email: **fred.asamoah@ctvet.gov.gh**

Karla Astorga Castro
Costa Rica: National Institute of Apprenticeship [Instituto Nacional de Aprendizaje, INA], Materials Technology Group, Master's in Sustainable Community Development, Environmental Manager, Environmental Management Lecturer
Email: **kastorgacastro@ina.ac.cr**

Bruno Backes
Kenya: Delegation of German Industry and Commerce for Eastern Africa, Head of Vocational Training
Email: **bruno.backes@kenya-ahk.co.ke**

Mareike Beer
Germany: Osnabrück University [Universität Osnabrück], Department 3: Educational and Cultural Studies, Institute for Educational Sciences, Department of Vocational and Business Education, Research Assistant and Doctoral Candidate
Email: **mareike.beer@uni-osnabrueck.de**

Dr Marc Casper
Germany: Humboldt-Universität zu Berlin [HU Berlin], Faculty of Cultural, Social and Educational Sciences, Institute of Educational Sciences, Research Associate
Email: **marc.casper@hu-berlin.de**

Dr Charles Chikunda
Zimbabwe: UNESCO Regional Office for Southern Africa, Harare, Zimbabwe, National Programme Officer – Education for Sustainable Development
Email: **c.chikunda@unesco.org**

Constanza Correa Sarmiento
Colombia: German-Colombian Chamber of Commerce and Industry – AHK Columbia, Integrated Expert for Education and Strategic Development, Business Scout
Email: **constanza.correa@ahk-colombia.com**

Roberto Díaz Páez
Costa Rica: National Institute of Apprenticeship [Instituto Nacional de Aprendizaje, INA], Regional Management, Trainer for the Labour Market
Email: **RDiazPaez@ina.ac.cr**

Prof Dr Hubert Esser
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], President
Email: **info@bibb.de**

Kirsten Freimann
South Africa: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Career Path Development for Employment Project, Project Director
Email: **kirsten.freimann@giz.de**

Prof Dr Dietmar Frommberger
Germany: Osnabrück University [Universität Osnabrück], Department 3: Educational and Cultural Studies, Institute for Educational Sciences, Department of Vocational and Business Education, Professor of Vocational and Business Education
Email: **dietmar.frommberger@uni-osnabrueck.de**

Julia Giebeler Santos
Brazil: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Head of Project GIZ Brazil
Email: **julia.giebeler@giz.de**

Niklas Günther
Germany: Helmut Schmidt University/University of the Federal Armed Forces Hamburg [Helmut Schmidt Universität/Universität der Bundeswehr Hamburg], Faculty of Humanities and Social Sciences, Chair of Work, Human Resources and Organisation, Research Assistant
Email: **niklas.guenther@hsu-hh.de**

Prof Dr Harald Hantke
Germany: Leuphana University Lüneburg [Leuphana Universität Lüneburg], Junior Professorship for Social Science Education, in particular Business Didactics
Email: **harald.hantke@leuphana.de**

Barbara Hemkes
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Head of Division 4.2 Innovative Further Education, Permeability, Pilot-Projects
Email: **Hemkes@bibb.de**

Dr Ralf Hermann
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Head of Division 3.4 German Office for International Cooperation in VET (GOVET)
Email: **Hermann@bibb.de**

Nikolas Hubel
Germany: VDI/VDE Innovation + Technic Ltd. [VDI/VDE Innovation + Technik GmbH], Department Demography, Clusters and Foresight, Scientific Consultant foresight and labour
Email: **nikolas.hubel@vdivde-it.de**

Dr des Anna Franziska Kähler
Germany: University of Hamburg [Universität Hamburg], Institute for Professional Education and Life-Long Learning (IBW), Research Assistant
Email: **anna-franziska.kaehler@leuphana.de**

Prof Dr Julia Kastrup
Germany: Münster University of Applied Sciences [FH Münster], Münster School of Vocational Education (IBL), Professor for the Didactics of Nutrition and Home Economics
Email: **kastrup@fh-muenster.de**

Prof Dr Karina Kiepe
Germany: Paderborn University [Universität Paderborn], Department 5: Business Education, Professor for Vocational and Business Education, in particular Education for Sustainable Development
Email: **karina.kiepe@uni-paderborn.de**

Dr Hannelore Kress
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Senior Adviser
Email: **Kress@bibb.de**

Prof Dr Werner Kuhlmeier
Germany: University of Hamburg [Universität Hamburg], Institute for Professional Education and Life-Long Learning (IBW), Professor of Vocational and Business Education
Email: **werner.kuhlmeier@uni-hamburg.de**

Jennifer Liehr
Germany: Helmut Schmidt University/University of the Federal Armed Forces Hamburg [Helmut Schmidt Universität/Universität der Bundeswehr Hamburg], Chair of Work, Human Resources and Organisation, Research Assistant
Email: **jennifer.liehr@hsu-hh.de**

Precious Mushiba Lisulo
Zambia: Ministry of Technology & Science, Assistant Director
Email: **Precious.Lisulo@mots.gov.zm**

Gerda Magnus
South Africa: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Career Path Development for Employment Project, Component Manager
Email: **gerda.magnus@giz.de**

Christian Melzig
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Senior Adviser
Email: **Melzig@bibb.de**

Ruth Mulenga
Zambia: Zambia Forestry College, Lecturer
Email: **ruthmulenga2020@gmail.com**

Dr Vijayen D. Naidoo
South Africa: Quality Council for Trades and Occupations. Johannesburg, South Africa, Chief Executive Officer
Email: **naidoo.v@qcto.org.za**

Marie Nölle-Krug
Germany: Münster University of Applied Sciences [FH Münster], Münster School of Vocational Education (IBL), Research Associate
Email: **noelle@fh-muenster.de**

Julia Olesen
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Senior Adviser
Email: **Julia.olesen@bibb.de**

Klaus Pellmann
Germany: Peter Lenné School, Head of Department Environmental Management
Email: **Klaus.Pellmann@peter-lenne-schule.de**

Dr Presha Ramsarup
South Africa: University of the Witwatersrand, Johannesburg, Centre for Researching Education and Labour, Director
Email: **presha.rasamrup@wits.ac.za**

Joachim Raschke
Germany: VESD partner at Nuremberg Campus of Technology
Email: **j.raschke@bne-partner.de**

Michael Rothe
Germany: Academy German Bakers North non-profit Ltd. [Akademie Deutsches Bäckerhandwerk Nord gGmbH], Director
Email: **mr@adb-nord.de**

Gerrit Rüdebusch
Germany: Helmut Schmidt University/University of the Federal Armed Forces Hamburg [Helmut Schmidt Universität/Universität der Bundeswehr Hamburg], Faculty of Mechanical Engineering, Laboratory of Production Engineering, Research Assistant
Email: **ruedebusch@hsu-hh.de**

Prof Dr Tobias Schlömer
Germany: Helmut Schmidt University/University of the Federal Armed Forces Hamburg [Helmut Schmidt Universität/Universität der Bundeswehr Hamburg], Faculty of Humanities and Social Sciences, Professor for Vocational and Occupational Education
Email: **schloemer@hsu-hh.de**

Maria Schwarz
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Senior Adviser
Email: **Maria.Schwarz@bibb.de**

Dr Helmut Steinkamp
Germany: LUFA North-West [LUFA Nord-West], Head of the Institute for Food Quality
Email: **helmut.steinkamp@lufa-nord-west.de**

Dr Christina Strotmann
Germany: Münster University of Applied Sciences [FH Münster], Institute of Sustainable Nutrition (iSuN), Research Associate
Email: **christina.strotmann@fh-muenster.de**

Eduardo Ulate Alpizar
Costa Rica: National Institute of Apprenticeship [Instituto Nacional de Aprendizaje, INA], Materials Technology Group, Chemical Engineer, Environmental Management Lecturer
Email: **eulatealpizar@ina.ac.cr**

Emmanuel Winkler
Mexiko: German-Mexican Chamber of Commerce and Industry – CAMEXA, Head of Staff Unit "Sustainability and Dual Training"
Email: **e.winkler@ahkmexiko.com.mx**

Dr Gert Zinke
Germany: Federal Institute for Vocational Education and Training [Bundesinstitut für Berufsbildung, BIBB], Senior Adviser
Email: **Zinke@bibb.de**

Abstract

The publication highlights the global prioritization of integrating sustainable development into technical education and vocational training (TVET). It documents the evolving discourse on sustainability in TVET and emphasizes the diversity of approaches among countries while recognizing common goals. GOVET's (German Office for International Cooperation in VET) initiatives include organizing study tours and bilateral workshops, facilitating exchanges on sustainability in vocational education, and international research activities. The publication emphasizes the relevance of sustainability in addressing global challenges like climate change and it aims to provide a platform for international discussions, encompassing macro to micro levels of TVET, showcasing experiences and best practices from Brazil, Colombia, Costa Rica, Ghana, Kenya, Mexico, South Africa, Uzbekistan, Zambia, Zimbabwe and Germany.

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Federal Institute for Vocational Education and Training
Friedrich-Ebert-Allee 114 – 116
53113 Bonn

Phone +49 228 107-0

Internet: www.bibb.de
E-Mail: zentrale@bibb.de

ISBN 978-3-8474-2832-9