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Towards a Just Labour Transition: Exploring the Role of a TVET Hybrid Centre of Specialisation for the Green Hydrogen Economy

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Introduction

South Africa faces many economic challenges including declining GDP, rising unemployment and persistently high levels of inequality. These challenges have been exacerbated by the COVID-19 pandemic and the prospects for economic growth in short- to medium-term are bleak. The effects of the pandemic are already being felt in key industry sectors, including manufacturing, retail, tourism and hospitality, and have a knock-on disruptive effect in businesses across supply chains. The most immediate outcome is that South Africa's unemployment rate has increased, placing pressure on the state to mitigate the risks to livelihoods while seeking to reignite the process of reindustrialization and economic recovery that was intended prior to the onset of the pandemic.

Young South Africans are particularly vulnerable to the aftershocks of the pandemic. With ongoing contraction of GDP and restrictions on economic growth in the medium-term, there will be fewer entry level opportunities for the large number of young people that exit the schooling and post-school education and training (PSET) system each year, resulting in higher levels of exclusion form meaningful economic activity. This context is exacerbated by a number of failures in the supply of, and demand for, skilled labour, and a persistent disconnect between vocational skills development (VSD) and economic development strategies.

Whilst tackling the economic challenges, South Africa is simultaneously having to tackle the significant risks associated with climate change and the need to transition to low carbon society. In the context of high level of inequality and poverty, this transition needs to be managed in a way that is inclusive and does not perpetuate the structural challenges which limit sustainable growth.

The government's Economic Recovery and Revitalisation Programme (ERRP) highlights a number of priority intervention areas, including green economy, energy security, and industrialisation through localization. It identifies skills development as one of the key enablers for these interventions in the short term but also for sustaining these interventions into the future.

The processes of economic recovery, combined with the imperative of a green transition, for innovative skills solutions that can fundamentally address some of the persistent weaknesses in the PSET environment, and threat that this presents in terms of ensuring both the recovery and the green transition are just and inclusive.

The skills development context for green transitions

The decarbonization of the South African economy is critical to mitigating the dire consequence of climate change, both locally and as part of a global community. The development of a Green Hydrogen Economy (GHE) is viewed as a key part of the strategic shift towards increased use of renewable energies and reduction in reliance on coal-based power generation. This shift to renewables will not only be highly beneficial in creating more sustainable, low-carbon energy sources for South Africa, it is also necessitated by the pressures from global trade partners who are setting ambitious transition goals and will seek to impose carbon taxes in the future. The renewable energy manufacturing value chain, as well as the value chains more specifically associated with Green Hydrogen production, offers both upstream and downstream employment opportunities in new industries.[1] [2]

The realization of these opportunities is dependent on a conducive post-school education and training system that aligns to, and supports, the development of an appropriate skills base. At present, however, there is little evidence of a framework for skills development within the range of policies and strategic documents that have been developed over the past decade and are meant to guide the transition to a green economy (ILO, 2018)[3]. In addition, while policy documents make reference to job creation in the green economy, the nature of these jobs or the skills needed to realise these jobs are not defined. Furthermore, incorporation of green skills into sectoral skills planning by many SETAs has not necessarily resulted in earmarked funding for green skills interventions.[4] As a result there is little evidence of translations of the range of "green" policies into large-scale employment (ILO, 2018).

As of 2013, Organising Framework for Occupations (OFO), which guides sector skills planning through the various SETAs as well as the development of qualifications through the Quality Council for Trades and Occupations (QCTO), has included the identification of "new green occupations" (which are categorised as "scarce skills") as well as new "green skills" (categorised as "critical skills") in existing occupations. As a resulted, 90 new occupations and a range of new skills were identified by 2015, but there are persistent challenges in finding coherence in the representation and definition of occupations and occupational tasks. This manifests through "confusion between green skills, the skills required of environment-based occupations and the skills which overlap South Africa's traditional economy and a future, green economy." (ILO: 218, p46) The characterization of green skills as "scarce or critical skills" indicates their status outside the core framework for occupational analysis. This further restricts the capacity of SETAs to clearly capture clear data on employment demand that can guide planning.

A recent study by GreenCape[5] found a range of clearly defined blue-collar occupations in high demand (both skilled and semi-skilled) across the renewable energy value chain, as defined through desktop research and industry surveys but with no reference to the OFO. These occupations range from standard, recognised trades and occupations to new and more specialized skills in the wind and solar industries. The various industry informants that were surveyed and interviewed for this study emphasized the challenges associated with finding sufficient supply of skills and the lack of alignment of the skills produced by both Higher Education Institutions and Technical and Vocational Education and Training

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[1] Bambili Advisory (2021) The South African Hydrogen Economy: A TVET-Industry Skills Gap Analysis

[2] Tips (2021) Industry Demand for Green Hydrogen Technician and Artisan Skills

[3] ILO (2018) Skills for Green Jobs in South Africa. Geneva: ILO

[4] Rosenberg et al. (2021) Biodiversity Human Capital Development Strategy Mid-Term Review 2020-2021. Commissioned by The Lewis Foundation and The South African National Biodiversity Institute (SANBI)

[5] GreenCape (2021) Assessment of local skills for the South African renewable energy value chain. Report prepared for Technology Innovation Programme of DSI / Energy Secretariat at SANEDI

[6] Gewer, A (2019) Strategic Note: Employability and Learning Pathways in the Green Economy. Johannesburg: JET Education Services.

(TVET) colleges and the needs of industry. They recommended greater involvement of industry with the development of curriculum and the need for increased workplace training.

There is little evidence of green curricula in TVET Colleges and the DHET highlighted limited uptake of green skills electives within the core college curricula, which has largely rendered these subjects redundant. As a result, many colleges no longer offer these subjects. When combined with the shortcomings in SETA prioritization of funding for green skills, there is little scope for meaningful vocational skills development interventions, particular for SMMEs that have the potential to generate demand for entry-level skills. Evaluations of small pilot programmes implemented by GIZ and NBI, demonstrated the significant skills gaps in the plumbing industry in both foundation plumbing skills as well as more specialized solar water heating installation skills, for both TVET students and workers in SMMEs.[6] The pilots emphasized the high demand for solar water heating installation skills amongst SMMEs but also demonstrated the limitations in the capacity of TVET Colleges to provide the required skills to meet this demand, despite the availability of infrastructure and equipment. Sustainable funding for such programmes through SETAs has also been a key constraint for sustaining these skills interventions. This presents a microcosm of the broader challenges in the vocational skills development environment, as further explored in the section below.

Challenges in the scope and scale of vocational skills development

While most entry points into the green economy are represented by highly skilled professionals, mostly requiring postgraduate qualifications, this paper places its focus on the development of intermediate or medium-skilled occupations (defined as NQF levels 4-5[7]). Medium-skilled occupations have registered the highest employment growth between 2009 and 2019, when compared to low-skilled and high-skilled occupations. Asmal et al argue that there is a need to take cognizance of this shift towards medium-skilled occupations in skills planning, or more specifically, the rate of increase of unemployment for individuals with TVET qualifications during this period, ws lower than for those with HE qualifications. This is further supported by Allen et al. (2021) and Bhorat et al. (2020), who argue that such a shift is important for employment and economic growth, particularly in sectors that demonstrate high growth potential.

Table 1: Changes in skills shares in the employed population by occupational skill level, Q2 2009–Q2 2019 (Asmal et al, 2020)

	Proportions (%)			Change Over Q2 2009 – Q2 2019 in:	
	Q2 2009	Q2 2014	Q2 2019	Percentage Points	Numbers ('000s)
	Primary				
High-skilled	7.2	6.7	5.0	-2.3	-18.9

[7] Asmal et al (2020) Skills Supply and Demand in South Africa.
https://www.dhet.gov.za/SiteAssets/The%20Report%20on%20Skills%20Supply%20and%20Demand%20In%20South%20Africa%20-%202020.pdf

Medium-skilled	39.7	38.5	34.9	-4.8	-10.1
Low-skilled	53.1	54.9	60.1	7.0	150.4
Total	100.0	100.0	100.0	0.0	121.4
	Secondary				
High-skilled	17.3	19.1	18.1	0.8	19.7
Medium-skilled	64.2	61.5	63.1	-1.1	-62.5
Low-skilled	18.5	19.3	18.8	0.3	3.8
Total	100.0	100.0	100.0	0.0	-39.0
	Tertiary				
High-skilled	28.5	28.7	26.7	-1.8	319.6
Medium-skilled	42.2	42.8	44.8	2.6	1093.4
Low-skilled	29.3	28.4	28.5	-0.8	455.7
Total	100.0	100.0	100.0	0.0	1869.9

Source: Authors' own calculations, QLFS Q2 (Stats SA, 2009, 2019b)

However, while there has been a decline in the number of young people in the South African labour force holding primary or lower education, the labour force still remains predominately low skilled, and this poses a risk for realising long-term growth opportunities.

TVET Enrolment

The Public TVET College sub-system has not reached the level of growth that was anticipated in the White Paper on PSET or the National Development Plan 2030. As of 2019, there were a total of 673,490 enrolments in TVET Colleges, compared to a target of 1,500,000 by 2030.[8] While the Gross Enrolment Ratio for TVET colleges more than doubled between 2010 and 2015 from 3.8% to 8% (358 393 enrolments to 737 880 enrolments), with a particular spike in enrolments in 2012, the enrolment numbers began to decline to 705 397 in 2016. From 2016 to 2019 there was a further decline of 4.5% to 673 490 enrolments.

[8] DHET (2021) Statistics on Post-School Education and Training in South Africa: 2019. Pretoria: Department of Higher Education and Training.

Table 2: Enrolment in TVET Colleges, 2010-2018

Qualification Category	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NC(V)	130 039	124 658	140 575	154 960	166 433	165 459	177 261	142 373	131 212	138 912
Report 191 (N1-N6)	169 774	222 754	359 624	442 287	286 933	519 464	492 026	510 153	482 175	494 070
Occupational Qualifications	23 160	20 799	62 359	19 000	19 825	20 533	13 642	10 969	20 106	22 886
Other	35 420	32 062	95 132	23 371	29 192	32 424	22 468	24 533	23 355	14 025
PLP									285	3 597
Total	358 393	400 273	657 690	639 618	502 383	737 880	705 397	688 028	657 133	673 490

Sources: Statistics on Post-School Education and Training, 2018 TVETMIS 2019, data extracted in December 2020

The main contributor to the decline in enrolments has been the three-year NC(V) qualification, while the semester/trimester-based Report 191 programmes continue to attract large numbers of enrolments. There has simultaneously been a substantial shift in the age profile of TVET College students – whereas around 25% of enrolments in college were between the ages of 15 and 19 in 2013, this age group represented 11,5% of enrolments in 2019. This suggests that far fewer young people are enrolling in colleges as an alternative to the senior secondary schooling system.

A key factor in this age shift, as well as the reduction in NC(V) level 2 enrolments, is the reality that school leavers, and particularly those that exited prior to completing a Grade 12, struggled to cope with the demands of the NC(V).

The number of college students enrolled in occupational programmes has fluctuated over the last decade, hitting a low of 3% in 2018 compared to 9% in 2012. Given the expectation within the National Plan for PSET that occupational training will become the primary offering of TVET colleges, the low level of occupational training at present is concerning and is indicative of the persistent disconnect between TVET Colleges and workplace-related training being funded through the SETA system.

Funding for occupational training in colleges is ad-hoc and variable from year to year. In addition, colleges tend to run DHET-funded programmes and occupational programmes as separate operations, thereby creating two different organisational structures within a single institution. As a result, many colleges de-emphasise their occupational training, both in terms of strategy and planning.

TVET Graduation and Throughput

The initial massive growth of the TVET College sub-system between 2010 and 2015 brought with it declining completion rates. The decline in enrolments in the more recent years has also seen an improving in completion rates, particularly for N3 and N6 students, with a marginal improvement in NC(V) completion rates. As indicated in the table below, there has been increased output of graduates from N6 while N3 and NC(V) has largely stagnated.

Table 3: TVET graduates by certificates 2010 - 2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N3	7 808	2 909	2 902	18 383	23 411	31 023	39 102	46 641	34 793	37 863
N6	13 885	2 428	3 724	15 268	24 396	46 569	60 642	112 508	73 377	113 393
NC(V)	3 715	7 638	6 018	8 114	7 624	10 465	11 716	11 377	11 837	10 920
	25 408	12 975	12 644	41 765	55 431	87 900	111 460	170 526	120 007	162 176

Source: Statistics on Post-School Education and Training 2010-2019

The large majority of graduates from TVET colleges have business-related qualifications / part-qualifications, while only around 24% of N6 students and 19% of NC(V) graduates have graduated from engineering programmes in 2019. Unlike the N3 or N6 certificate, the NC(V) is a three-year qualification resulting in a National Certificate at NQF Level 4. The graduation numbers are low relative to other programmes and to the number of people who enrol in the NC(V).

While there has been general improvement in completion rates, an analysis by DHET indicates throughput rates of students from the NCV programme at Level 4 of 9.2%.[9]

Table 4: NC(V) throughput rate

Number of students enrolled for NCV Level 2 in 2016)	Number of students who completed NCV Level 4 in 2018	Throughput rate (%)
88 771	8 135	9.2

Sources: TVETMIS 2016 and National Examinations Database, November 2018

These throughput rates are influenced by high drop-out rates at NC(V) L2, which calls into question the student support and selection processes that guide enrolments. Anecdotal indications are that a portion of young people are not well informed about which programme they are best suited for and

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[9] Khuluvhe and Mathibe (2021)

are instead incentivised by the availability of NSFAS funding rather than the career pathways offered by the programme. In addition, young people who have not done well in maths and science at school struggle with the NC(V) curriculum (particularly engineering and IT). This, despite the shift in age profile to older learners which would suggest that learners have had the opportunity to reflect on their career goals.

Due to inefficiency in the sub-system, particularly given the poor throughput, the average cost of producing an NC(V) graduate is high and the funding mechanisms currently disincentivise improvement in performance in that colleges are funded upfront on the basis of an approved enrolment plan with no clawback due to poor performance.

Labour Market Absorption

There have been a range of tracer studies of TVET college students over the past 2 decades with variable response rates and variable measures of labour market absorption. The results of more recent tracer studies have generally found just over half of graduates were employed within a 3–6-year period, with low level of earnings.[10] The most recent tracer study in 2019, commissioned through the EU-funded Capacity Building Programme for Employment Promotion (CBPEP) programme, found an absorption rate of roughly 40% if the percentages of completers in work-based learning programmes, self-employment and employment from the figure below are added together. A high percentage of graduates were in work-based learning (learnerships, apprenticeships etc.). Engineering graduates were more likely to be employed and earning more than business studies graduates, although a larger number of business studies than engineering studies graduates were working in a role that is relevant to their field of study.

Funding

The level of funding available to TVET Colleges has been a key factor in limiting growth. While the funding base initially incentivised growth, there has been a persistent funding deficit in real terms. TVET enrolments have largely been capped since 2015 and colleges are expected to fund the gaps from other sources. In 2016, the DHET reported to the Presidential Commission on Higher Education that, based on the fully costed funding norms, only 429 638 of the 664 748 enrolments in the TVET College sub-system at the time were funded. The 2019/20 approved TVET enrolment plan had a funding deficit of R1,027billion. The Covid-19 pandemic has brought about an anticipated funding cut of 9% over the MTEF period (2021/22-2023/24), translating into a TVET headcount reduction of approximately 139 000 enrolments over the MTEF.

In general, college allocations for enrolment are not fully covering all planned enrolment into the ministerial approved programmes. NSFAS bursary recipients have tripled in number from 114 968 in 2011 to 346 270 in 2019, representing 54% of enrolments in ministerially approved programmes (NC(V) and Report 191).

Artisan Development

The development of artisans has been of critical concern to government over the past decade to address some of mismatches between skills demand and skills supply to meet economic growth and job creation objectives. The NDP has set a target of developing 30,000 artisans per annum by 2030. Government views TVET Colleges as a key mechanism for delivering on this target and initiated the Centres of Specialisation (CoS) programme as a means to transforming TVET Colleges to work with

[10] Gewer (2010), SSACI (2016), IPSS (2017)

industry to implement a demand-led approach to skills development through a dual apprenticeship model.

The impetus for artisan development forms part of the focus by government on developing industrial strategy that can respond to rising unemployment and weak economic growth in the aftermath of the global economic crisis of 2009. The Labour Market Intelligence Programme of the HSRC found skilled trades in high demand throughout the period 2015-2019, particularly in the context of changing technology, although the scale of such demand is difficult to quantify. In addition to demand from the private sector, the development of artisans is also necessitated by government's Strategic Infrastructure Projects (SIPs) to address national infrastructure and improved service delivery.

The development of artisans has been hampered by high inefficiencies in the system, including low throughput, weak system administration, poor engagement of public TVET Colleges, weak grant administration by SETAs and multiple, confusing routes to artisan qualifications.

An analysis of throughput by DHET found that only 37% of those enrolled in artisan programmes in 2011 completed their training in three years, while 38.9% completed their programmes after four years and 42.2% completed in five years.[11] It is estimated that the amount allocated for artisan training over the five years was about R13 billion. This implies that 57.8% of apprentices did not complete their training at the end of five years. The cost of delayed and non-completion was calculated at R3.6 billion.

Table 5: Artisan development cohort analysis

Quarter entered	Completion after 3 years	Not completed after 3 years	Completions after 4 years	Not completed after 4 years	Completed after 5 years	Not completed after 5 years	Total completed by end 2015/16	Not completed by end 2015/16
2011/12 Q1	33,3%	66,7%	40,7%	59,3%	42,2%	57,8%	42%	75%
2011/12 Q2	45,4%	54,6%	52,3%	47,7%			52%	73%
2011/12 Q3	46,9%	53,1%	49,0%	51,0%			49%	93%
2011/12 Q4	27,5%	72,5%	30,6%	69,4%			31%	57%
2012/13 Q1	21,3%	78,7%	25,7%	74,3%			25%	46%
2012/13 Q2	30,0%	70,0%					31%	59%

[11] National Skills Authority (2018) Evaluation of the National Skills Development Strategy (NSDS III) 2011-2016.

2012/13 Q3	34,3%	65,7%					34%	66%
2012/13 Q4	29,5%	70,5%					28%	52%
2013/14 Q1	25,3%	74,7%					25%	47%
	31,7%	68,3%	38,9%	61,1%	42,2%	57,8%	35,1%	64,9%

Source: DHET QMR from SETAs 2011/12 to 2015/16

The total number of artisans issued with national trade certificates by SETAs and INDLELA during the 2019/20 financial year was 18 319 (DHET, 2021). The number of artisans registered every year has remained relatively static with some variation Out of the total certificates issued over the 6-year period, one third were issued by MERSETA, followed by INDLELA (20%).

Table 6: Number of artisans certificated by SETAs and INDLELA, by economic sector, 2014/15 - 2019/20

SETA		2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
AGRISETA	Agriculture	190	186	219	193	277	234
CATHSSETA	Culture, Arts, Tourism, Hospitality and Sports	-	1	1	-	-	
CETA	Construction	479	582	1 058	1 500	1 427	1 279
CHIETA	Chemicals	572	861	1 020	917	1 314	2 013
ETDPSETA	Education & Training	-	-	-	-	-	-
EWSETA	Energy & Water	964	1 170	993	666	1 202	1 969
FOODBEV	Food Processing	2	-	14	63	69	106
FP&MSETA	Fibre Processing & Manufacturing	98	106	106	111	189	449
HWSETA	Health & Welfare	16	79	73	116	59	175
INDLELA	Non-SETA Candidates	4 983	3 791	3 692	4 381	3 277	2 405
LGSETA	Local Government	486	98	233	415	442	566
MERSETA	Manufacturing & Engineering	6 890	6 600	7 061	6 108	6 320	4 182
MICT SETA	Media, Information and Communication	-	-	-	-	-	-

MQA	Mining and Minerals	1 876	2 056	1 974	1 963	1 978	1 734
PSETA	National & Provincial Government	-	29	14	36	15	11
SASSETA	Safety & Security	12	21	133	168	260	245
SERVICES	Services Sector	1 685	928	1 271	1 246	1 272	1 639
TETA	Transport	1 028	1 402	1 541	1 212	1 250	1 312
W&RSETA	Wholesale & Retail	-	-	3	5	4	-
Total		19 281	17 910	19 406	19 100	19 355	18 319

Source: Statistics on Post-School Education and Training, 2018; National Artisan Development Support Centre (NADSC) – National Artisan Recommendation for certification data management system, 2020

Tracer studies have found high levels of labour market absorption for qualified artisans. A tracer study conducted by SSACI in 2016, found that 79% of newly qualified artisans found employment, most finding employment easily, and 58% of which were in permanent employment.

The Centres of Specialisation programme

The Centres of Specialisation (CoS) programme is a response to shortages in the supply of skilled artisans across 13 priority trades[12], to service the implementation of the Strategic Infrastructure Projects (SIPs). It sought to the low production of artisans which was well below the 30,000 annual target set by the NDP, by addressing:

- Systemic weaknesses in apprentice training (limited career guidance, fragmented qualifications, poor quality assurance, complicated registration systems, inefficient grant disbursement and delays in trade testing), and
- The poor quality of apprenticeship training as a result of institutional and capacity weakness in TVET colleges and a misalignment of the curriculum with the needs of the sector.

The CoS is a faculty or department in a well-functioning TVET college dedicated to the delivery of the knowledge component of the specified trade, in response to identifiable demand. The CoS programmes provides a mechanism for TVET Colleges to develop expertise and credibility in the delivery of particular trades in a manner that is in line with employer requirements. This entails the successful adoption of a dual-system apprenticeship model, similar to those offered in countries such as Germany, Switzerland and Austria. The dual-system apprenticeship model is characterised by seamless integration of institutional and workplace-based learning, requiring apprentices to apply their theoretical knowledge within an authentic workplace setting. This integration ensures that the apprentice becomes exposed to the workplace culture and expectations early on and thereby become more easily integrated into the demands of the workplace.

The introduction of the CoS programme has been accompanied by the development of new trade qualifications through the Quality Council for Trades and Occupations (QCTO) which are more aligned to industry requirements and provide colleges with the appropriate curriculum to meet industry expectations, a National Occupational Curriculum Content (NOCC) for each trade, as well as streamlined processes of working between industry and college. The NOCC translates the qualification into a syllabus in a manner which enables the effective integration of theoretical, practical and workplace instruction. Industry roleplayers have participated in the development of the curriculum and learning materials, and there are Occupational Teams for each trade comprising all social partners to shape and monitor the roll-out of the programme.

The DHET used a set of 8 criteria in determining a short list of colleges that were viable candidates to establish a CoS:

1) Financial management capacity
2) Willingness to take up the CoS roles
3) Learner enrolment and success rates (across (NC(V), NATED, Learnerships)
4) Proximity to SIP labour demand (or location to SIP projects)
5) Proximity to workplace learning opportunities
6) Availability of facilities (infrastructure, equipment and tools)
7) Partnerships with employers, SETAs, professional bodies

[12] The 13 priority trades are as follows: Boilermaker, Bricklayer, Carpenter and Joiner, Diesel Mechanic, Electrician, Fitter and Turner, Mechanic (Automotive Motor Mechanic), Mechanical Fitter, Millwright, Pipe Fitter, Plumber, Rigger and Welder

8) Presence of a trade test centre.

The DHET elected to select two sites per trade and the final 19 colleges, and 26 sites were approved in October 2017 through certificates of recognition from both the Minister of Higher Education and Training and the relevant employer associations.

The mid-term evaluation[13] found that the success of the CoS is highly dependent on the buy-in from the college executive. It found that colleges with strong management buy-in and support have been successful in the implementation of the CoS model. While there was general consensus amongst stakeholders that the CoS programme has been properly conceptualised and designed, there are a number of important insights emerging from the evaluation that have relevance for a proposed Green Hydrogen CoS in the future.

The evaluation raised important concerns with the manner in which selection took place. In the first instance, there are challenges related to the number of employers within a reasonable radius of the selected college that are willing and able to participate. In addition, some of the chosen sites were not the most favourable for delivering the trade but were selected because the favoured site had already been awarded another trade and a rule was applied by which each site could only have one trade.

To achieve a full state of readiness for implementation, the CoS colleges were required to establish:

- a reference group, comprising the employers and other key stakeholders (SETAs, trade unions etc.).
- a CoS Project Manager and administrators.
- workshop infrastructure, equipment and tools that meet the requirements of the trade, and
- qualified and experienced facilitators (two facilitators for 30 students, the meet the ratio of 1:15).

Colleges experienced challenges in each of these areas, although this varied from college to college. The reference groups were found to be the most useful as they bridged the relationship between industry and the college. Particular challenges have been experienced in the appointment and retention of strong project managers and administration teams, the timeous procurement and installation of workshop infrastructure and equipment, and the recruitment and training of suitably qualified facilitators, who are willing to work longer hours.

The CoS programme was expected to enrol 780 candidates in the first year (30 apprentices per site). After some delays, 732 candidates had been enrolled by March 2020, partly due to the difficulties in securing employer commitments. The securing of employer participation was driven by the Occupational Team Convenors (OTCs), who are persons nominated by industry associations, and the TVET Colleges themselves. The role of SETAs in this regard has been limited. The OTCs were found to be best placed to sell the programme and get employers on board.

In order to grow the number of participating employers, allowance was made for the introduction of "lead employers" and "host employers", which particularly suited smaller companies that could not accommodate the administrative burden associated with apprenticeships. In the plumbing industry,

[13] JET Education Services and Trialogue (2021) Centres of Specialisation Programme Midterm Evaluation Evaluation Report.

IOPSA adopted the role of lead employer because the plumbing companies, who are all SMEs, were unable to take on the requirements of the programme.

This does however present some challenges in terms of meeting the standards for workplace-based learning and holding host employers accountable for the breadth and depth of workplace training. There was also a significant gap in the provision of training for workplace mentors which undermined the importance of workplace mentorship. This is subsequently being addressed by GIZ but is an area of critical concern.

Successes

Overall, while still in early stages, the implementation of the CoS programme has highlighted important principles in the design and development of demand-led skills training.

- Placing industry associations (OTCs) in the driver's seat. The OTCs play an important role in mobilising workplace learning opportunities, strengthening the partnerships between colleges and industry, ensuring facilitators are adequately trained, and overseeing the readiness of the college to deliver

- There is a strong integration of institutional and workplace learning through a structured rotation process. The rotational structure may differ depending on the sector and the trades concerned.

- Colleges were required to recruit qualified artisans for the trades concerned and ensure their training workshops met industry standards. Part of the challenge that colleges have faced in the past has been underqualified training staff and ill-equipped workshops. This has undermined the effectiveness of the practical training provided, heightening the level of distrust of employers with regards to quality of college training. The CoS programme assisted the colleges to overcome this.

Most significantly, there has been a shift in the culture in the colleges towards adopting a demand-led culture of delivery. The CoS programme has been viewed by colleges as elevating their status and they have used it to promote their college to the public.

Challenges

The introduction of the CoS model is an important step towards greater alignment of college and workplace provision, creating pathways for TVET students into apprentice training, and building social partnerships to drive these programmes. However, the current model adopted is not necessarily a scalable solution for economic inclusion. The programme is funded through a combination of fiscus funding, skills levies and tax incentives. The first intake in the programme was 732 across 26 campuses. This is in comparison to the number of students enrolled in engineering qualifications, which is in the range of 200,000-300,000, across the system.

As a result, only a very small proportion of TVET students will gain access to this programme. The large majority of TVET students will continue to not gain access to apprenticeship opportunities, and such training will continue to operate in parallel to the TVET system.

The DHET is working towards institutionalising the CoS model as part of the intended shift towards occupational qualifications as a mainstay of college offerings. At present there is a disconnect between fiscus funding through the funding norms for the college component of the apprenticeship and the skills levy funding / tax rebates for the workplace-based learning component. This creates some level of fragmentation in the way that funds are allocated and applied across different SETAs.

There has also been variable levels of commitment from SETAs, with some SETAs treating the CoS as a special project rather than as part of its core suite of funding solutions.

Other related key concerns includes:

- The true costs of the programme needs to be clearly articulated to facilitate better budgeting and planning.
- The increased shift towards occupational qualifications and the phasing out of some of the core national qualifications will have some implications for operations of the colleges. The CoS programme to date has illustrated the level of resource and effort needed to successfully implement new demand-led programmes in an effective and sustainable manner.
- Having sufficient local workplaces to host and train apprentices. Transport costs are a significant barrier if candidates have to travel too far to the workplace and/or the college.

Lessons from other programmes

The Bambili GH Pilot

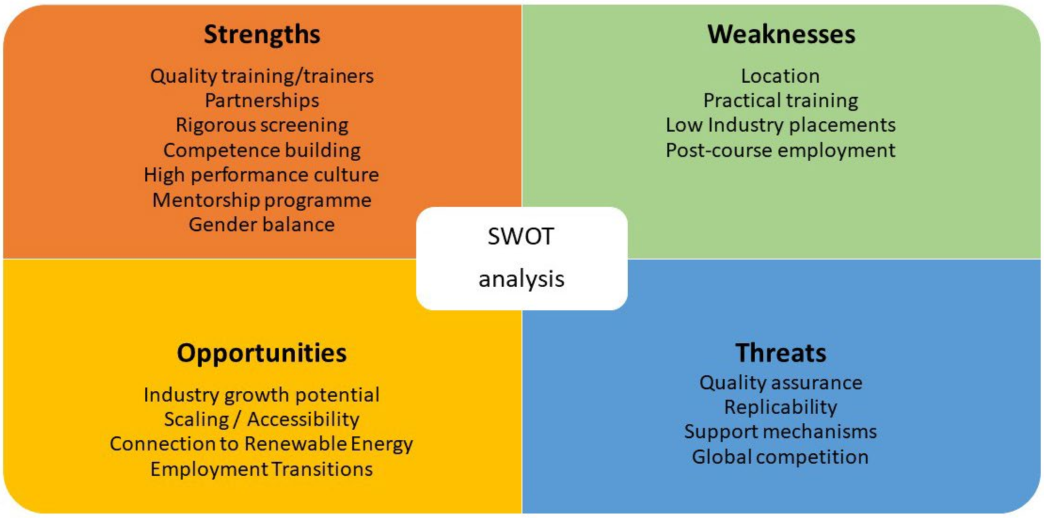
In 2020, Bambili Advisory was appointed, in partnership with Pretoria University, to conduct a skills training program aimed at TVET level, on how to install, refuel and maintain stationary FC systems. The proof of concept training was completed in December 2020. As stationary FCs are expected to play a significant role in providing energy to buildings and in off-grid electrification in South Africa there is an urgent need to address sector skills demand in the Hydrogen Economy as identified in the South African Hydrogen Society Roadmap.

A Just Labour Transition for the Hydrogen economy relies on human capital development to ensure the supply of local skills to install, operate and maintain FC systems and that there is a balance between the supply and demand for trainees.

In order to overcome some of these challenges, Bambili Advisory and University of Pretoria, created a proof-of-concept training programme. This entry level course covered a range of technical skills, as well as additional competences related to COVID-19 Safety, Health and Safety, Global Energy and Carbon Dioxide Trends, Hydrogen Fuel Cell Components, Integration Modules of Hydrogen Fuel Cell Systems, Site Inspections, Load Management and Deployment Planning, Site Installations, Hydrogen Fuel Cell System Operations, Fuel Testing, Refueling of Hydrogen Fuel Cell Systems, Hydrogen Fuel Cell System Maintenance, Hydrogen Fuel System Monitoring. The minimum qualifications needed to enroll for the course is an N4 qualification in Electrical or Chemical engineering.

The main strengths, weaknesses, opportunities, and threats associated with the programme are summarised in Figure 1 below.

Figure 1: SWOT analysis of Bambili/UP training pilot



Source: Compiled by the authors

Strengths

In terms of the quality of training and trainers, Bambili staff received training from international partners currently active in the Hydrogen space. The training was therefore up-to-date with current thinking and technology. Industry trust is also developed through partnerships and involvement in the curriculum. This allows industry partners to ensure that the technical training is relevant and matches their needs. Students also had the opportunity to work on demonstration systems to enhance practical training.

Furthermore, the pilot programme involved a number of key partnerships including: i) a knowledge partnership with the University of Pretoria further bolstering the rigour of the programme; ii) an industry partnership with Ario Meta Power where field work would be conducted and a limited number of internships offered; and iii) finally strategic partnerships with a number of government agencies, for example the DSI which assisted in promoting and championing the development of the course and EWSETA which played a major role in funding and attracting candidates to the pilot.

In seeking quality candidates, a rigorous screening process took place in order to ensure that applicants were both qualified and competent, thereby improving the likelihood of successfully completing the course and improving their opportunities for gaining employment. During the screening process however, it became apparent that although many of the applicants were qualified, they lacked certain soft skills that could impede their employability. To overcome these challenges, the programme incorporated several strategies to improve candidate employability while enhancing industry trust, including: i) introducing soft skills, such as how to present themselves during an interview, ii) digital skills (computer) training, which is a vital aspect of 4IR skills and necessary for maintaining and reporting on the FC systems; iii) establishing a high performance culture, whereby students had to achieve a pass rate of 80%; and iv) introducing a mentorship programme to assist students in adjusting to the demands of the programme and develop their competences. Although these additional measures, led to the programme being extended by two weeks, the results were highly positive in capacitating students and preparing them for the rigour of real-world employment.

In terms of access and equity, the programme actively pursued female candidates to ensure a fair gender balance, and youth representation (ages 24 to 34).

Weaknesses

Weaknesses associated with the pilot mainly stem from the fact that this was an initial experiment. The location of the pilot, based in Pretoria, which meant that the majority of students had to travel great distances and receive much financial assistance in order to attend the course. Feedback from students indicate that although there was opportunity to work on demonstration models, the course could be enhanced with further practical training in terms of troubleshooting and fault testing. Of the cohort of 20 students, only three were selected for internships. This is partly due to the limited number of spaces available for industry uptake; however, a database has been established to connect students with future internships as they arise. Employment of these students, for the moment, remain low until the sector develops and there is greater demand for these skills.

Opportunities

The pilot programme serves as a successful model which could potentially be replicated as the industry develops and grows. Students that have completed this course are ready to be absorbed into internships or employment opportunities. As the demand for these skills grow, and as more industry partners come on board there is potential to enhance the accessibility of the course, initially along the Hydrogen Valley, and eventually across South Africa. The duration of the programme (6 weeks) means that it could be developed as part of a range of skills connected to renewable energy, for which a number of centres already exist, as well as a method for upskilling employees in the fossil fuel industry and equipping them with the necessary skills for the transition to more green energy, thereby contributing to a Just Labour transition.

Threats

While there are numerous opportunities associated with new and innovative technologies, such as the GHE, the novelty of the sector also poses certain risks. For example, if the demand for these skills outpace delivery of quality programmes and candidates, there is a risk of scaling too quickly without the necessary quality assurance taking place. The Bambili pilot was very well resourced, in order to deliver a world-class training programme, however the question remains whether the same level of resources would be available to TVET colleges in order to replicate the success of the programme. The GHE currently enjoys a range of support mechanisms due to the potential benefits identified elsewhere in this report, however these benefits are yet to be realised, this during a period of global financial strain which may lead to changing national priorities. Furthermore, the current global interest in GH is producing a number of competitors including Namibia and Australia, racing for competitive advantage and lucrative contracts. Depending on how well South Africa is able to position itself in this race, certain value chain activities, processes or products may become less lucrative or competitive to produce on home soil compared to other nations, causing contraction of the market and a reduction in the demand for GHE skilled TVET learners locally.

The NBI Plumbing Hand / Solar Water Heating programme

The Green Skills TVET programme, implemented by the National Business Initiative (NBI) together with a range of partners, seeks to intervene at the interface between the supply and demand for skills, unlock opportunities for dual training (integrated institutional and workplace training) and employment in the industrial economy, and address the disconnect between TVET provision and skills demands in the workplace. The programme forms part of the broader Installation, Repair and Maintenance (IRM) Initiative.

Between Jan 2019 and October 2020, the NBI in partnership with Mesopartner (on behalf of GIZ's SD4GE II programme), the Institute of Plumbing (IOPSA) and Ekurhuleni East TVET College, and through combined funding from the Nedbank Foundation, the GIZ Skills Development for Green Economy

Programme (SD4GE II) and the Confederation of Danish Industries, implemented a programme to expand opportunities for young TVET college students to enter into employment and learning pathways in the plumbing industry, with a specialised focus on solar water heating installation and repair. The programme represented the second iteration of this plumbing industry partnership which first started in 2017.

The programme introduced a new occupational role – the "Plumbing Hand" – which could be used as a steppingstone on the path towards becoming a qualified plumber. The plumbing hand skills programme was registered with the QCTO by the plumbing industry. The programme is structured as follows: 3 months of project-based theoretical and practical training in the college followed by 6 months of structured workplaced-based learning in a plumbing SME. Following the workplace learning component the candidates return to the college and undergo a summative assessment which is overseen by IOPSA. On successful completion of the summative assessment, the candidates are registered with the Plumbing Industry Registration Board (PIRB) as Technical Operator Practitioners and are on course to work towards becoming a qualified plumber with two years of further work experience.

The programme adopted a number of key success factors[14]:

- The critical role of IOPSA, as the industry body, in the selection of the TVET College, the mobilisation of employers (Plumbing SMEs who are IOPSA members) and the quality assurance of training delivery.

- Rigorous selection and matching of youth for the programme. Candidates should have some technical knowledge either obtained through a TVET College or through a Technical High School, they match to the workplace role, they should reside close to the workplaces in which they will be placed so that they don't incur high transport costs, and they should be unemployed.

- The role of NBI as the lead employer, thereby removing the administrative burden from SMEs which acts as the host employer. The NBI is played a critical role in capacitating and supporting the college to deliver the plumbing hand curriculum, the training of workplace mentors within the SMEs and the monitoring of the workplace-based learning.

The programme addressed the frustration of employers in the plumbing industry with respect to the quality of TVET responsiveness, which has resulted in them choosing to rather recruit school leavers and train them on the job. It provides plumbing SMEs with a well-equipped talent pipeline that also has specialised solar water heating skills. The programme also offers existing workers in plumbing SMEs the opportunity to upgrade and formalise their skills, thus enhancing their productivity and improving their chances of becoming qualified plumbers.

The programme is built around two important principles. In the first instance, it must be demand-led. Employer demand is secured before candidates can be selected and teaching can commence. This not only ensures there is a workplace available to train and potentially employ the candidate but also that the candidate matches appropriately to the workplace. The second principle is cost-effectiveness. The programme seeks to offer a scalable pathway towards the plumbing trade for a large base of youth who may typically not be given access to such pathways, and at a fraction of the cost of the full apprenticeship. The initial cost burden has to date been covered through combined funding by the private sector and development partners. The anticipated funding model for the programme is a

[14] Gewer, A (2021) Strategic Note: Expanding inclusive entry pathways into the Green Economy. Johannesburg: National Business Initiative

combination of private sector (through SETA grants and CSI) and government fiscus funding as the need for shorter, more demand-led TVET training increases.

Considering a Centre of Specialisation for Green Hydrogen

The development of an appropriate skills strategy to align with South Africa's decarbonisation programme will be a key determining factor on whether the transition to a low carbon society is inclusive and just. The Green Hydrogen Economy is expected to expand demand for technical and other skills across the Green Hydrogen value chain. The push for the development of a TVET Centre of Specialisation for Green Hydrogen responds to the strategic importance of Green Hydrogen for the country. It builds on the Centres of Specialisation programme which has become a central feature of government's intent to bring TVET colleges and industry closer together and ensure that programmes being offered respond to industry demand.

The CoS programme has sought to project the potential demand for skills by aligning with the SIPs. The 13 priority trades represented the perceived trades in highest demand to meet the skills requirements of the SIPs. While the demand for skills in the areas of wind and solar technology are starting to take shape[15], albeit still nascent, the green hydrogen value chain is in an early stage of development and the level of market demand is not yet well established. As a result it is difficult to meaningfully project the pipeline of skills needed. It is anticipated though that the market demand for green hydrogen will increase exponentially as South Africa progresses down its hydrogen society roadmap.

Defining Green Skills and Green Jobs

As indicated above, there is no globally accepted definition of a green job. Green jobs may vary from those that are involved in the design and production of goods or provide services that benefit the environment (green buildings, clean transportation, renewable energy, sustainable food); to those that contribute more environmentally friendly production of any product or service (water or energy efficiency, recycling).[16] Changes in employment as a result of green transitions can take place through the emergence of green industries as well as in the shifts within industries towards more environmentally-friendly production processes.

The Greenskills project, based at Rhodes University[17], outlines four occupational categories that require further research if the a clearer understanding of the nature of green jobs and green skills:

- Core Green occupations – already concerned directly with green issues such as air pollution analysts or environmental managers.

- Changing occupations - emerging environmental challenges and opportunities are resulting new skill sets that differ significantly from those required for more traditional work in these occupations (e.g. plumbing with solar water heating installation)

- New skills needs across occupations that do not have a focus on environmental issues but require supplementary skills to deal with environmental issues such as energy or water usage in facilities management

- Newly emerging occupations requiring people with new skills in roles that are still emerging in

[15] Greencape (2021) Assessment of local skills for the South African renewable energy value chain.
[16] Asikainen et al (2021) The future of jobs is green. Luxemburg: European Commission.
[17] Building Capacity for a Sustainable Future (2022) *Green Skills*, https://www.greenskills.co.za/

respond to new technological demands.

Understanding these different types of green occupations will inform the extent of skills changes that will be required as the economy transitions, and the types of skills interventions that are needed to equip people for these changes.

The demand for Green Hydrogen skills

There is a generally accepted and shared belief that the increasing market demand for low carbon / renewable energy production will result in increased demand for technical and related skills, including maintenance technicians, installers and manufacturing professionals. However, there is not a clear disaggregation of these roles and the associated education and training requirements. The challenges raised above around the occupational classification system (OFO) also makes it challenging to define and disaggregate these roles.

Bezdeck (2019: 3) [18] indicates that there are "jobs that will be created across a new continuum of employment, skills, responsibilities, and earnings. Notably, many of these jobs do not currently exist and do not have occupational titles…." This makes it difficult to assess skills requirements. Bezdeck produced a list of 42 new occupations that the hydrogen economy will produce as well as expected earnings and entry requirements, 19 of which were found to require either high school degrees, general education development, on-the-job-training, trade school, apprenticeships, or associate degrees. The list indicates many jobs that do not require a university degree. However, as these technologies are still evolving, it is still challenging to accurately project the skills that will be required. Despite this, the author asserts that engineering and science education needs to adapt to better prepare young people for hydrogen economy careers.

Using a value chain approach, TIPS[19] assesses the future demand for skills at the input manufacturing (membrane electrode assembly, catalysts, electrolysers, and fuel cells), production and downstream market stages. The analysis does not take account of other inputs such as renewable energy generation and water supply.

At the input manufacturing stage, demand for skills is highly oriented to highly skilled labour to support system and process design, while the demand for technicians and artisans – linked more to assembly and production – is not yet manifest given the state of input manufacturing. However, this stage will invariably involve new occupations and new sets of skills. According to TIPS, input manufacturing firms were positive about working together with the TVET system to co-create the necessary skills and capabilities for artisans through learnership and internship programmes. Specialised technology training currently takes plan in-house and this is likely to continue given the proprietary nature of this technology, but industry does believe the TVET system can provide the necessary theoretical and practical skills which can be further honed and developed on-the-job. The TIPS report outlines the skills requirements for different input manufacturing occupational roles, that can be covered by the TVET Colleges.

While there is currently no commercial green hydrogen production in South Africa, it is anticipated that, similar to the input manufacturing stage, higher level skills will be in demand. However once operations have commenced, demand for technicians and artisans will increase given their roles in operations of systems. The demand for artisan and technician skills in hydrogen production include roles in mechanical, electrical, logistics, production and warehousing.

[18] Bezdeck, R (2019) *The hydrogen economy and jobs of the future*. Renewable Energy and Environmental Sustainability, 4, 1.
[19] TIPS (2021) Industry Demand for Green Hydrogen Technician and Artisan Skills

There are furthermore no current markets for green hydrogen downstream products in South Africa currently. Based on literature sources, TIPS identifies a number of emerging roles in the downstream market but emphasises that new roles will emerge across value chains as the market develops further.

While not core to the value chain analysis conducted by TIPS, the Greencape study referred to above outlines a range of skills in demand in the solar and wind power generation industries. Linking skills strategies with rapid labour market transitions

The disconnect between skills planning and broad industrial strategy has been a key weakness in the development of employment-oriented skills strategies. Reliance on narrow occupational titles and static qualifications entrenches the disconnection of vocational education from the realities of the labour market and limits the ability of the skills system to contribute and respond to changing technological demands. It is increasing the risk of sustained exclusion from labour market transitions as occupational roles evolve and competence requirements change. As technology evolves so will occupational roles. In the face of an 'overabundance of labour'[20] and labour market uncertainty, the challenge is ensuring a capable (as opposed to competent) workforce that is able to keep pace with evolving industry. This requires a strong focus on disciplinary knowledge and application within occupational domain, rather than specialised competencies for narrow occupational roles.

The capabilities approach to vocational skills development is aligned to the realisation of a just transition. The key challenge is ensuring that young people are equipped with the capabilities to navigate the labour market as it evolves in line with the transition to a low carbon society. This reduces the reliance of narrow skills planning for specific occupational roles that are emerging or may emerge in the future. In line with the notion of a dual VET system, the majority of specialised training for young people takes place in the workplace and is linked to the particular technology that the company concerned operates. The critical role of TVET is to prepare young people with capabilities that will empower them to engage and benefit from on-the-job training and mitigate the risk of workers becoming redundant as a result of technological change.

Implications for the development of a CoS for Green Hydrogen

This section raises a number of challenges around the conceptualisation of a CoS model for Green Hydrogen.

In the first instance it raises challenges around the framing of green hydrogen occupations and skills within a broader framework of green occupations and green jobs. The development of a CoS for Green Hydrogen is caught within the inherent weaknesses of the OFO in relation to the evolving labour market. Given the lack of clarity around this broader framework, much work is needed to align the occupational classification system to make provision for evolving green occupations (current, emerging and future). Only then can clarity be achieved on how green hydrogen skills can be located within the broader vocational skills development system. If this is not achieved, then green hydrogen skills becoming viewed in a very narrow competency framework and limit the scope for TVET delivery which will have limited effect and will not be sustainable.

At the same time, the section makes the argument for broader capabilities approach to vocational skills development, focusing on job families rather than narrow competencies, so that young people can navigate through the evolving green economy and more easily access and respond to emerging opportunities from the Green Hydrogen Economy. This would call into question the notion of a Centre of Specialisation for Green Hydrogen, rather looking at how jobs families are evolving along with green

[20] Buchanon, J (2019) Skills Planning for South Africa: Getting the questions right. In Kruss, G, Wildschut, A & Petersen, I. *Skills for the Future: New Research Perspectives*. Pretoria: HSRC Press

transitions and how college programmes can be adapted to accommodate changes to existing occupations as well as emerging and new occupations.

In tackling these challenges, the key issue will always be the concern over ensuring that the development and delivery of vocational programmes in college are demand-led. This has both a spatial and scale dimension.

The CoS model adopts a particular model of demand-led curriculum development – using the SIPs as the starting point and the OFO framework to measure current demand (as opposed to future demand) through the skills planning mechanisms. This locates the CoS model with a framework of aggregated rather than local skills demand – anticipating that the development of the artisanal pool across the 13 trades will result in increased employment because there is reported demand across various industries. The adoption of a dual apprenticeship model supports a more effective model for vocational skills development which is in line with industry needs and hopefully increases the prospects for employability. The 13 trades are generic in nature and are transferable across multiple industries across geographic locations. The difficulty therefore is not necessarily the scale of demand (although this is not clear for all trades) but rather the spatial challenges of delivering a dual apprenticeship model where there are insufficient local workplaces that can train apprentices.

The nature of demand for green skills more broadly, and green hydrogen more specifically, is unclear and is more spatially defined as the operations related to renewable energy are emerging in particular geographic areas of the country. This raises a number of challenges in respect to the viability of a CoS for Green Hydrogen. There are questions around what the scale of demand will be, when will it manifest (unlike the current CoS model where demand is immediate) and where will it be spatially located. There are also questions around the nature of skills to be developed, depending on what approach is taken – the narrow skills approach or the broader capabilities approach. Invariably, the CoS dual VET delivery model is still highly effective – the intergration of theory, practical and workplace-based learning is not questioned – the decision around the scope of the programmes to be offered will define how this model is realised.

Recommendations

Drawing on the detailed analysis provided above, the following recommendations are made around the planned establishment of a TVET CoS for Green Hydrogen.

1. Leverage off the existing CoS framework

The CoS project has made significant strides in demonstrating a model that brings vocational skills training closer to the needs of the workplace, links colleges and employers in a constructive relationship and better equips young people to transition into the labour market.

Beyond the current 26 CoS sites, the DHET has emphasised that the CoS model should become the blueprint for the implementation of occupational qualifications and programmes going forward. The delivery of 3-year dual occupational qualifications is not a scalable solution though, and the CoS model should rather be used in a more flexible manner to allow for a broader range of programmes and qualifications beyond the trades.

Most colleges in the country already have campuses that specialise in one or more fields of study. These campuses have been operating in this manner for many years. If the CoS model does become the blueprint for future roll out of occupational programmes and qualifications, colleges will have the leeway to elevate these campuses and position them more strategically to engage with industry demand. This includes shifting the programme mix for that campus towards a stronger focus on occupational qualifications and programmes. This will require additional resourcing and capacity, and should be done off the back of a sound business plan. Therefore, similar criteria should be adopted those used for the current CoS sites.

The broader introduction of CoS sites at various campus through a structured planning, resourcing and capacitation process provides the key mechanism to introduce the Green Hydrogen and other green technology CoS sites (solar, wind etc.) at appropriate sites. The Green Hydrogen CoS site would be an add-on to an existing CoS in a complementary field of study (Electrical and/or Mechanical Engineering).

Invariably the selected site for the Green Hydrogen would need to demonstrate a strong track record in managing and delivering dual system programmes and qualifications in one of these engineering fields. Therefore having first been certified and operating as a CoS within the field of engineering would be an important filter for proving fitness to operate a Green Hydrogen CoS.

2. Geographically locate close to demand through a flexible model

A key lesson shared by stakeholders with respect to the CoS programme is the importance of locating the CoS close to demand. This is key to the successful delivery of the dual training model as it increases the opportunities for on-the-job training as well as increasing chances for employment.

The location of the Green Hydrogen CoS could be linked to the anticipated Green Hydrogen Hubs that form the backbone for the Hydrogen Valley, stretching from Mogalakwena in Limpopo to Johannesburg (with potential spokes in Rustenburg and Pretoria) to Durban and Richards Bay.

These 4 hubs each offer viable options in terms of college sites that could be developed into Green Hydrogen CoS sites. At present, none of the college listed below are part of the 26 current CoS sites. Umfolozi TVET College, Esikhaweni campus is on the verge of become a CoS for plumbing.

- The Limpopo hub would be close to Waterberg TVET College which has an engineering campus in Lebowakgomo

- The Richards Bay hub would be located close to Umfolozi TVET College which has an engineering campus in Richards Bay.

- The Johannesburg hub could be linked to a number of potential TVET sites, depending on where green hydrogen production will be located. This includes the Sebokeng campus of Sedibeng TVET College in the Vaal, multiple campuses of Ekurhuleni West TVET College (Kempton Park, Germiston and Katlehong), the Doornfontein campus of Central Johannesburg College, or the Roodepoort West or Molapo campuses of South West Gauteng College. In addition to geographic locality, the selection of the Johannesburg site would depend on which have established a CoS site for engineering.

The next question that emerges from this is whether to establish one or more CoS for Green Hydrogen to ensure full coverage of the hydrogen valley. The proposed CoS model referred to above places less restrictions on the choices of one or more sites. As there may be multiple Centres of Specialisation for solar and wind technology, there are no significant restrictions on the creation of multiple Centres of Specialisation for Green Hydrogen (outside of cost), as long as there is sufficient demand for these skills. This is because the green technology CoS is an add-on to an existing CoS rather than a stand-alone CoS in its own right. It assumes that colleges already have the capability to operate and manage a CoS in a manner that services industry demand and provides for further specialisation based on particular local demand for these skills.

This provides some guidance and flexibility in the selection of appropriate sites but also reduces the restriction on the number of sites (again, as long as there is sufficient demand to warrant the establishment of the CoS). It also means that the roll out of the Green Hydrogen CoS can be more clearly aligned to the evolving demand for Green Hydrogen and the increasing production thereof across the Hydrogen Valley. It also allows for flexibility in the shape and function of the CoS at each site, relative to the operational investments in the green hydrogen value chain at different sites. Therefore, the CoS can be shaped to service different types of demand across different sites.

The important underlying assumption is the proven capacity of the college to provide trade-related occupational skills to industry standard that can then form the foundation for more specialised skills in green hydrogen and other green technologies.

3. Sufficient support to colleges

Another key lesson from the CoS programme to date has been the level of support needed for many TVET Colleges to plan and implement the CoS, and to facilitate the linkages between the college and industry. This was primarily done through establishment of occupational teams, and convened by the industry association. It would be important to put a similar structure in place to create the conducive environment for college-industry engagement and overcome any trust issues that may emerge. The industry representative should play a supportive role to the college in ensuring their readiness to deliver the respective programmes. This would ensure that the planning, inception and initial implementation phases lay the foundation for sustainable operation of the CoS. It would include ensuring the necessary infrastrucure and equipment to meet industry standards.

The industry representative should also support the college to recruit appropriately skilled facilitators and to fill in any gaps in the facilitators' knowledge given the evolving nature of the technology involved. The latter would include immersing the facilitators in the industry's production facilities so they could have a strong first-hand account of the technologies and operational demands.

Finally, the OTC and occupational team provides the important role of supporting the college to design and develop appropriate curriculum content and learning materials. Through the occupational team, industry can more clearly define the knowledge and skills that the college should provide to best prepare the candidate for the workplace where more specialised skills will be developed.

4. Multiple but coordinated funding streams

The CoS programme has been funded through multiple streams, which have not been well coordinated. The mid-term evaluation illustrated the fragmented manner in which funding has been managed, particularly the contributions from the different SETAs. The evaluation recommends the need for clearly articulated funding streams and processes.

From the side of the TVET Colleges, the integration of the CoS programmes into the college funding norms is a critical step towards stabilising and sustaining the funding base for the new programmes. The challenge, however, is that this integration is not done off through additional funding allocations but out the voted funding base that is appropriated to TVET Colleges each year (including the NSFAS allocation). This is an important challenge in the context of static and even declining enrolments in colleges as illustrated above. The funding model assumes that 80% of the actual costs for delivering the occupational qualification is covered by voted fund appropriations. The challenge is seeing how far this funding can be stretched to reach the largest pool of youth possible.

The shift to occupational programmes and qualifications will require a relative reduction in enrolment in the current ministerial programmes to accommodate new occupational programmes and qualifications over time. Colleges will be required to plan the introduction of occupational programmes and qualifications based on their available allocations and manage the phasing of new programmes accordingly. This must be guided by an expansive strategy to optimise the funding pot, rather than restricting the scale of access further. This will critical for the planning of the introduction of the CoS and ensuring the college structures are brought along to manage the transition, given the impact that this has on the scope of programmes and how these will be delivered. The costing model also assumes an allocation for maintenance of infrastructure and equipment. This assumption must be properly tested to ensure the sustainability of the programme

The costing from SETAs for the stipends must be clarified and standardised upfront, regardless of which SETA the employer (levy-payer) belongs to. The SETA funding should allow for various forms of occupational training – those for qualification purposes such as learnerships and apprenticeships, as well as skills programmes that require workplace learning to ensure the skills acquired are fully applied within an authentic workplace setting and are in line with the requirements of the employer. The Bambili and NBI pilots provide some indication of how this can work effectively. The provision of skills for Green Hydrogen occupational roles will not necessarily require a candidate to embark on a full three-year qualification. In more likelihood, the skills required will be additive to an existing trade qualification or may be not demand a protracted period of training for entry level roles. The SETA funding should accommodate workplace learning in all of these contexts if the principles of the CoS model are to be realised more broadly.

The funding model should therefore cover different types of programmes and qualifications – as part of a broadened CoS strategy – to allow for integrated college-based and workplace-based learning, be it through a full qualification, part-qualification or skills programme.

As with the broader CoS programme, there will need to allocation made from the skills levy to support the establishment of the Green Hydrogen CoS at the target college(s). In the current CoS programme, the National Skills Fund provided funding for infrastructure and curriculum development (in addition to subsidising salaries and project management fees for the initial pilot period). A similar arrangement will be needed to ensure the colleges are adequately equipped to implement the CoS to the standard required by industry.

Conclusion

The increased pressure on South Africa to push forward its transition to a low carbon society, and to do it in a manner that is just and equitable, provides an important moment for TVET to position itself to support this transition. The country has embarked on an ambitious strategy to transform the vocational skills development system to be more in line with the realities of the workplace and industry skills demands. The work to date on the CoS programme, combined with the work by Bambili and NBI, has generated a number of lessons that can inform the approach to vocational skills development that will support a just transition. This report outlines these lessons, contextualises them within the need to prepare for future jobs in the green economy, and provides a proposed model for building off what exists and evolving along with the demands that manifest from emerging technological development and market opportunities.

While this provides a framework, further work is needed to unpack the detailed implementation approach. However, this cannot be optimally done while two factors have not been clarified – the appropriate classification and definition of green skills and occupations that reflects labour market realities but also allows for effective skills planning, and the scope and scale of demand for skills that will manifest through the green transition. Both are difficult, but the latter will only evolve over time and will inform the former. Therefore, any skills planning associated with the green transition will need to be fluid and flexible so that it can adapt to changing demands. At the same time the report emphasises the need to not be too narrow in our conception of green skills and rather look at broader capabilities that equip young people to effectively navigate through and access opportunities that emerge through the transition process. This will enhance the possibility of such transitions being truly just and equitable.

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