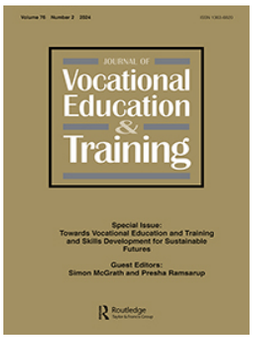

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Oil, transport, water and food: a political-economy-ecology lens on VET in a climate changing world

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ABSTRACT

In this paper, drawing on an extensive research project across three countries (VET Africa 4.0 Collective 2023), we produce an emerging argument that it is necessary to rethink and reframe VET logics and approaches in a warming future dominated by informality and mass unemployment. Currently,neither the formal VET college or workplace are adequately set up to provide the type(s) of VET that are in demand or needed for just transitioning and sustainable futures. We acknowledge the importance of political economy accounts in developing a richer understanding of VET, but suggest these are not sufficient for dealing with the existential and practical crisis of the climate emergency. We note that many scholars have sought to address this tension in the academic literature by adopting a political ecology account that reframes the theoretical and political challenge. This leads us to call for a political-economy-ecology account of VET. Although we acknowledge the limited nature of our approach here, we offer some thoughts for VET analysis with reflection on these theoretical issues applied to four cases studies from Uganda and South Africa of VET provisioning in oil, transport, water and food (which materially shape our cases).

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Political-ecology; political-economy; vocational education and training; just transitions; sustainable futures

Introduction: VET in a climate changing world

It is increasingly implausible that we can stop global warming below 2°C. In 2021, the Intergovernmental Panel on Climate Change (IPCC 2021) issued a 'red alert' for humanity, noting climate change to be one of the most severe challenges facing human societies for decades and potentially centuries to come. Building on swathes of research on climate change, there is much talk about a new 'geological epoch', named the 'Anthropocene', in which human activity related mainly to fossil-based pollution, is impacting earth system

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stability, ushering in completely new conditions for human activity and development (Steffen et al. 2011; Steffen, Crutzen, and McNeill 2007), with devastating effects on existing life as we know it. While all continents are facing the impacts of climate change already, Africa (not unlike those other contexts where poverty remains a persistent reality for many) is particularly vulnerable, with more extreme and intense weather becoming far more frequent, and also destructive of infrastructure, lives, homes, and development gains.

These challenges arise partly from centuries of development and political economy thinking that has failed to adequately recognise or include political ecology and incorporate it in associated VET models and trajectories. It is the latter issue that we address in this paper.

There are numerous calls for 'concerted action', and multiple studies at national, regional and international levels continue to confirm the seriousness of the impending impacts of climate change and ongoing ecological degradation, many of which are already visible to communities, cities and governments. Responses being conceptualised range from setting global sustainable development goals, investing in mitigating socio-technical transitions, and social movement action focused on how to ensure that transitions to sustainability are just, leaving no-one behind. These macro trends have implications for VET, but as yet, responses from the VET sector are largely reactive, piecemeal, and 'add on' in nature, rather than more systemically substantive, a perspective that was confirmed in our research as will be discussed below (VET Africa 4.0 Collective 2023).

The IPCC is warning that short term adaptation strategies and add on approaches may not be enough and that longer term thinking and deep transformation is needed to fully consider the impending implications of overshooting the 1.5° and 2°C targets. This is because adaptation measures may prove to be inadequate and complete transformations to new livelihoods that are suitable for a 2°C+ world may be needed. How should VET reframe in such a context? This is the question we broadly consider in this paper. In so doing, we need to be explicit that this is an area requiring much more thought and much more empirical work. What we offer here are some initial provocations that build on our initial empirical work but also serve to highlight the limitations of that work as well as the field more generally.

The current engagement from VET literatures

For more than a decade, there has been a skills policy literature that has focused on greening growth. This has had two main strands. First, a focus on green jobs and skills (e.g. Cedefop 2012; International Labour Organisation 2011; OECD 2011; United Nations Environment Programme 2011). Second, a focus on greening public VET providers, most closely associated with the UNESCO-UNEVOC International Centre (e.g. Fien, Maclean, and Park 2008; Majumdar 2010; Pavlova

2018). Though this work is largely reformist rather than transformational, it is nonetheless a genuine and positive set of attempts to infuse an environmental concern into a VET system that has largely ignored such imperatives.

However, a parallel academic literature has been slow to develop. In its first 75 years, the Journal of Vocational Education and Training published only two articles with titles including sustainab* and both are narrow (Coll, Taylor, and Nathan 2003; Liu et al. 2020). Green skills appear neither in JVET titles or in keywords (but are discussed in McGrath et al. 2020) and appear rarely in other leading journals. This is the heart of the rationale for this special issue and this paper.

From the education for sustainable development side, on the other hand, there has been little engagement with questions of skills and VET, the focus being much more on schooling and higher education, reflecting VET's often marginal place in the educational research literature.

However, our recent books (Rosenberg, Ramsarup, and Lotz-Sisitka 2020; VET Africa 4.0 Collective 2023) mark an attempt to deepen the engagement between VET and ESD traditions and begin a more substantive discussion of VET's role in addressing the climate crisis.

In this paper, we are concerned with building on those books (the latter in particular) and trying to move the debate on VET and climate responsiveness to a more theoretical level. In doing so, we should acknowledge the work of Anderson (2008) who argued for reframing VET away from a productivist narrative alone to include an ecologist narrative more explicitly. It is a failing of the VET literature that this challenge has been largely ignored.

Our aim here is to build an account that considers what the rise of political ecology literature might mean for thinking about VET. In so doing, we will look at the points of intersection between political ecology and political economy and the construction of a political-economy-ecology lens.

Of course, a political economy tradition is one of the most prominent strands of the existing VET literature (McGrath and Yamada 2023; McGrath et al. 2020). This literature has focused both on the institutional arrangements that shape national skills formation systems and how this is interrelated to firm-level decisions about work organisation and hence skills utilisation (e.g. Busemeyer and Iverson 2014; Soskice and Hall 2001; Thelen 2004). However, it has not had a significant ecological dimension. Indeed, in its historical and comparative concerns, it has been largely an account of modernisation, industrialisation and development as conventionally understood, with some attempts to explain the underdevelopment of national skills regimes, particularly as it has expanded to the global South. Moreover, in its modernising mode, it is overwhelmingly focused on the formal sector, on the urban space, and the industrial sphere. Whilst some scholars have begun to talk of the colonial legacy and the extractive basis of Southern industrialisation (e.g. Allais 2022; Swartz 2016), this is still underdeveloped.

Nonetheless, this literature is vital in emphasising the ways that systems evolve historically and reflect the complexities of national political-economic configurations in ways that reflect the foundational influence of Marx on this approach. Against simplistic faith in capitalism, the market, or naïve policy transfer, the approach stresses the need to look into system dynamics for the obstacles and opportunities that will shape the likely success of innovations designed to make VET more inclusive and sustainable. Historically, this literature has been more focused at the macro level but there are signs of a growing awareness that the approach needs to be more multi-level. As we will suggest below, there is also potential for a greater engagement with political ecology concerns.

However, presently, in these VET literatures there is very little sense of the ways in which the wider global political economy has resulted in what Malm (2016) calls 'fossil capitalism' or its particular extractivist logic as it impacts upon the global South. To put it bluntly, VET has been complicit in these processes (McGrath and Russon 2023), and we need new approaches that help break out of this.

The absence of a more critically constituted engagement on the role of VET in fossil capital, extractivism, and commodification of public goods, may be because the former colonies, now so-called 'developing economies' are largely defined by dominant geopolitical powers as 'natural resource economies' with the often taken for granted assumption being that these resources should be exploited for extraction and exportation in order to fuel a 'catch up' model of development, even in so-called 'sustainable development' forms. Such development logically requires skills that can support the extraction and exportation of natural resources, with one of the most explicit examples being the oil industry, but the same logics also shape the mining and biodiversity extraction industries.

The locally experienced commodification and privatisation of natural resources such as water and forests is also beyond the focus of the mainstream VET literature. Rather, conventional VET is more comfortable in discussing what skills are needed to extract, process, and transport oil (Dietsche 2020), manage water at the municipal level (Ochieng et al. 2015), or how to fell and process trees effectively (Kelly and Brown 2019). Even then, such work is more likely to be found in sector-specific journals rather than the VET mainstream, with its strong focus on secondary and tertiary industry. Where it does tackle issues such as sustainability, its focus is most likely to be on improving skills to reduce waste, rather than ask more critical questions about extractivism or fossil capitalism. Indeed, the silence of the political economy of skills tradition here is marked, with only (Evans and Stroud's 2016) article on 'varieties of capitalism and the "greening" of skills' offering a small pointer towards combining the two discourses.

Nonetheless, a political-economy-ecology convergence is more apparent above the level of the skills debate. Here, authors, such as Ciccantell and Patten (2016), reflect on the ongoing dynamics of more than 500 years of extraction from the global South via colonial and neocolonial political economies. They chart how such practices have become habituated and normalised along with their negative social and environmental impacts through discourses of apparent development gains. They note that dirty industries in the North have also largely been 'moved offshore' to 'developing' economies who bear the brunt of pollution and social and health impacts of polluting industries.

Due partly to skewed power relations in global geopolitics and political economies, engaging with such issues is not easy. Merino (2020, 58) points to 'how neoliberal and post-neoliberal strategies under the political economy of resource extraction define the developmental trajectory of national regimes'. He argues that extractivism and neoliberalism in Latin America are 'shaped, reproduced and defended in government spaces' which produces a cynical if not contradictory state, which at the same time promulgates environmental regulations that are not upheld, or are largely ignored. He argues with some salience that, in such contexts, states become 'cynical' because

> despite progressive regulations and political discourses, everyday actions of governing elites reinforce institutional and ideological constraints on the effectiveness of rights. The promises of pro-indigenous and environmental social reforms are limited from their very formulation because the practices and imaginaries of governing elites are embedded in extractive structures. (Merino 2020, 58)

Admitting political ecology into the discourses governing and framing VET requires a fundamental reframing of VET away from provision of skills for extraction and commodification of public goods, and advancement of polluting and extraction industries (including offshore), to a form of VET that foregrounds more positive social and environmental impacts and contributions than has been the case to date. It requires a broadening of VET discourse beyond the current 'powerful employer' as frame for VET, to inclusion of both formal and informal economies, and more explicit engagement with ecological issues and political ecology contradictions that manifest in VET. A debate on political economy 'meeting' political ecology in VET may help to advance discussions on how VET could be/ought to be steered in times of climate change.

Addressing the gap

To address this gap, we consider historical and contemporary views on the connections that are emerging between political economy and political ecology, in the context of four cases in our research that focus on oil, transport, water, and food in African VET contexts (cf. Table 1 below). Our intention is not to offer a comprehensive review of this area, or to undertake detailed case

Table 1. Summative view of the four empirical cases (adapted from VET Africa 4.0 Collective 2023).

Features of the cases	Skills development set up
CASE FOCUS: TRANSPORT **PLACE**: eThekweni, Durban, South Africa **AREA**: Metropolitan area, eThekwini, population of c3.5 million people; fourth busiest harbour in the Southern Hemisphere **ECONOMIC SECTOR FOCUS**: Industries around the harbour, with emphasis on transport and logistics as influenced by new developments notably the Structural Infrastructure Programme (SIP) 2 of the post-apartheid government, targeting infrastructure for the 'Blue Economy' (named Operation Phakisa) **POLITICAL-ECOLOGY FOCUS**: Operation Phakisa was mandated to balance employment and environment imperatives. **OUR RESEARCH INTEREST**: How are VET skills being developed for the Operation Phakisa maritime transport and logistics sector in this context?	**CONTEXT: Urban industrial** **HISTORY**: colonial and apartheid history with racial and access inequalities in the skills system, a dominant paradigm of serving industrial skills, and neglect of informal sector skills; undervaluing of VET skills and sector **CHANGES**: new complex skills system put in place after 1994, but it is suffering from co-ordination challenges, and characterised by dysfunctionality **INSTITUTIONS**: eThekweni has numerous public education and training institutions, but none offer training in maritime logistics. Important actors in the maritime transport and logistics skills system include the parastatal Transnet, and the transnational company Grindrod, both with their own in-house training academies. A new public Maritime Academy set up in 2019 as a centre of excellence at the uMfolozi TVET College in Richards Bay, 100km north of eThekweni. This has been offering a suite of new maritime studies courses, accredited by the South African Maritime Safety Authority, since 2019.

(*Continued*)

Table 1. (Continued).

Features of the cases	Skills development set up
CASE FOCUS: OIL **PLACE**: Hoima, Uganda, located in the Bunyoro Kitara Kingdom of Western Uganda; far from far from the major economic and political centres of East Africa **ECONOMIC SECTOR FOCUS**: Little economic or educational development with a heavy reliance on subsistence farming and fishing, supplemented by remittances. However, in 2006, commercially exploitable oil reserves were identified in Lake Albert, with multiplier effects in the economy as a whole. Significant investments from oil and gas sector. Despite conflicts and delays, early work on an oil refinery has commenced, an airport is under construction and major roads into the area are being upgraded from their previous unpaved state. **POLITICAL-ECOLOGY FOCUS**: Multi-national oil interests and their relationship to the local political economy and ecology, including farmers and fishers; and Uganda's climate change mitigation imperatives. **OUR RESEARCH INTEREST**: How are VET skills being developed for the emerging oil industry in this context?	**CONTEXT: Predominantly rural, with emerging urban development** around the oil find; in 2000 Hoima was granted city status **HISTORY**: As of 2000 there were not major public educational institutions in the area. **CHANGES**: Ugandan government, the oil companies and aid donors have all being trying to bridge the gap between local skills development in the region and the requirements for employment in the new sector, which is vast. New programmes and institutions are being set up by all parties. VET policy changes have also been underway, following donor-led models, with high dependence on external donors. **INSTITUTIONS**: In 2014 Gulu University started a small branch campus in Hoima. Public vocational institution built in 2016. A number of small private and church-based vocational providers, offering a broad range of conventional vocational subjects (construction trades, motor mechanics, tailoring) to relatively small classes and with modest resources, geared to domestic, subsistence and small scale economic activity. Ministry of Energy and Mineral Development commissioned a British consultancy firm to produce a workforce skills development strategy for oil and gas (MEMD 2015), emphasising Intermediate and High Skills from Uganda, leading to building of the Uganda Petroleum Institute Kigumba (UPIK), with World Bank support, as one of six new centres of excellence under the MoES (2019). The sector is dominated by the use of international qualifications. International oil companies were not convinced by the MEMD plan; leading to the Skills for Oil and Gas in Africa programme (SOGA) co-funded by the British, German and Norwegian governments with a focus on building skills for employment (provided mainly by NGOs in business development and construction trades, the latter to international curricula and resulting in international certification) and subcontracting elsewhere in the value chain.

(*Continued*)

Table 1. (Continued).

Features of the cases	Skills development set up
CASE FOCUS: WATER **PLACE**: Alice in the Raymond Mhlaba Municipality, Amathole District, Eastern Cape (one of the poorest provinces in South Africa). **ECONOMIC SECTOR FOCUS**: Smallholder farming oriented towards commercialisation and transformation of the agricultural sector; Local Economic Development focus on black small holder farmers as larger citrus industry and game farming industries (largely white owned farms) fail to include large populations, who remain dependent on grants and the land for their livelihoods. Limited scope for growth in scale in the local economy due to intense supermarketisation and water access challenges. State expenditure, public sector employment and monthly social grant payments (for children, the elderly and those with disabilities) constitute key further pillars of the local financial economy. **POLITICAL ECOLOGY FOCUS**: Colonial Land Act of 1913 set up the area as labour reserve on marginal lands; smallholder farming marginal activity. Small-scale farming of livestock, mixed crops and home gardening undertaken largely on communally-owned land. Relatively abundant water resources in the area, but these are monopolised by the citrus industry; vast majority of small scale farming activities are carried out without irrigation, leaving farmers to rely on the region's summer rainfall for production. Increased droughts and erratic rainfall (climate change impacts) creating more pressure on the small holder farming economy. Farmers struggling to get water to their lands. **OUR RESEARCH INTEREST**: How are VET skills being developed for the emerging smallholder farming economy in this context?	**CONTEXT: Rural, former 'Bantustan'** [separatist development under apartheid area] **HISTORY**: In the education sector, Alice is home to the historically prominent institutions of Lovedale School and Fort Hare University. Bantu Education influenced both quality and access to education in former homeland areas. Educational attainment is uneven, and high level of youth unemployment (59%). **CHANGES**: Policy change is requiring the Agricultural Training Institutions to become more oriented towards serving local economies. Currently they are focusses on large scale agriculture and high end irrigation. There is need to orient more towards a balance of this type of farming and commercialisation of smallholder farming. Neither college lecturers or extension services are well equipped for this demand. **INSTITUTIONS**: Besides Lovedale and Fort Hare University, the area also has a public tertiary agricultural skills provider, the Fort Cox Agricultural and Forestry Training Institute (FCAFTI), under the Department of Agriculture, Forestry and Fisheries, and a public TVET college under the Department of Higher Education and Training. There are also state and non- state actors (NGOs, farmers associations etc.) engaged with skills development oriented towards smallholder farming. Rhodes University's environmental learning research centre also active in the area. A learning network, *Imvothu Bubomi* (Water is Life), was established by multiple actors including farmers in 2014 to support farmers develop rainwater harvesting and conservation knowledge and practice, and to advance agro-ecological food system practices in response to land and water quality and access issues.

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Table 1. (Continued).

Features of the cases	Skills development set up
CASE FOCUS: FOOD	
PLACE: Gulu, in July 2020 it received city status, and is major urban centre in Acholiland in northern Uganda. Until 2006, Acholiland was ravaged by 30 years of civil war, notorious for the use of child soldiers, with much of the population forced to live in internal displacement camps.	**CONTEXT**: Predominantly rural, recently urban (city status in 2020), post-conflict zone
ECONOMIC SECTOR FOCUS: Mainly agriculture but other small scale enterprises emerging (e.g. tailoring, cooking etc.). Economic activity primarily driven by agriculture but this is hampered by long distances from the major markets of East Africa. Local markets for agricultural goods are limited, as are opportunities to export nationally and internationally. A push by government and NGOs for supporting self employment.	**HISTORY**: History 30 years of war eroded education and training institutions in the area. Youthful population (c70%youth) and unemployment rates are very high.
15 years after the war, there is a real sense of transformation as people adapt to postwar settings. Lives are being rebuilt, businesses are growing, roads are being paved and streetlights put up. Gulu is growing.	**CHANGES**: Young people from rural areas are making their way to Gulu, driving boda boda (motorcycle taxis), and generally hustling as they create pathways in their pursuit of decent livelihoods and sustainable futures. Vibrant ecosystem of seemingly chaotic and entangled working, learning and living exist.
POLITICAL ECOLOGY FOCUS: War caused significant change from traditional communal and clan-based system to a situation in which much of the land was privatised and many lost access to the land. Those with little access to land are, unsurprisingly, farming unsustainably. A largely illegal market in charcoal is encouraging deforestation, further exacerbating land degradation.	War and its aftermath brought large numbers of humanitarian agencies to the region, with a large number of programmes aimed at skills development and agriculture development – a push for self employment.
OUR RESEARCH INTEREST: How are VET skills being developed for sustainable agriculture and other forms of self employment in this context?	**INSTITUTIONS**: A few formal VET institutions in the region, both public and private.
	Complementing these is a vast array of nonformal training programmes and a large informal sector, with young people learning through apprenticeships at small businesses, in NGO programmes, on YouTube, and from each other
	The most important postschool institution in the region is Gulu University, founded in 2003. Its motto is "for community transformation", and it is increasingly promoting organic farming and sustainability through its Faculty of Agriculture. Many of its graduates are looking to adopt sustainable farming and food practices. Gulu University has a *UNESCO Chair in Lifelong Learning, Youth and Work* that plays a key role in animating a network between youth, civil society organisations (including the traditional authority, the Ker Kwaro Acholi), donors, NGOs and nonformal training providers.

analysis, but rather to open debate on the relationship between political economy and political ecology in VET research. We seek to do this with empirical examples that summatively illustrate the concerns as found in our contexts. The cases were developed as part of a more extensive study of VET histories and emerging practices that we undertook in a recent three-year research project involving a collective of 20 researchers at four universities in Uganda, South Africa and England (VET Africa 4.0 Collective 2023). Our focus was to examine VET practices emerging in relation to oil, transport, water and food in these contexts as we figured this would allow us to consider the ways in which VET was or was not responding to issues relating to climate change, social and environmental justice concerns, and sustainable development. The project used a mixed method approach and included a long-term historical sociology of VET where we identified three dominant generations of VET in Africa (VET 1.0–3.0) all of which were shaped by colonial interests, early development state formation and more recently neo-liberal expansionist interests reflective of the trajectories of global capitalism. We named our project VET Africa 4.0 to begin to differentiate an alternative to these trajectories that takes the connection between political economy and political ecology more seriously than we had found to be the case in the colonial period and in subsequent VET 1.0–3.0 periods (McGrath et al. 2020; VET Africa 4.0 Collective 2023).

Extensive empirical investigation of the four cases of VET emergence summatively introduced in Table 1, involved face-to-face and online interviews and focus groups (with learners and staff in vocational institutions, employers in the formal and informal sectors, civil society actors and youth); participatory action research and boundary crossing expansive learning research with community groups and vocational college staff and university teams in what we termed a social skills ecosystem framing (Wedekind et al. 2021; Ramsarup, Lotz-Sisitka, and McGrath 2022; Ramsarup, McGrath, and Lotz-Sisitka 2023; VET Africa 4.0 Collective 2023; cf. Spours' paper in; Spours 2024). We also undertook analysis of social media interactions in learning networks (cf. Lotz-Sisitka et al. 2021); surveys of lecturers; analysis of policy texts; and critical reflections on team members' work as policy and practice actors. This allowed us to consider how oil, transport, water and food (which materially partly define the cases in our study) are intimately embroiled in the challenge of rethinking VET logics and approaches mentioned above, for their historical, contemporary, and future relationships to climate change.

To interpret these cases against the gap in VET literatures outlined above, we needed to develop theoretical perspectives that could offer tools for case analysis, which we present next. We start with literature-based views on political economy and political ecology and their connections and then consider literature focussing on just transitions. This helped us to develop a political-economy-ecology lens for interpreting our cases (cf. Table 2 below).

Table 2. Political-economy-ecology views on our four case studies (cf. VET Africa 4.0 Collective 2023 for further details on the cases).

Case Study Focus	Evidence of political-economy-ecology engagement in VET setting
WATER system transitions Alice, Eastern Cape, South Africa: *Multi-actors in a local food economy, with local agricultural college, seeking ways of integrating water harvesting and seed security into development of smallholder farming food sovereignty programmes, and training offered by the college.*	**Type of change**: There is intent from those at the heart of the VET systems interventions to be transformative but this is hampered by the long histories of reformist change since the fall of apartheid. Changes remain quite localised. **Political-economy-ecology framing/s**: There is still a dominant discourse of skills for employment/employability and the wider productivist account in key institutions who tend to focus more on the large scale farming systems and large scale irrigation, although there are pockets of work that is emphasising the environment and sustainable livelihoods, mainly driven by NGOs and activist groups. There is a gap between the formal and large scale and the small and informal, between promoting the unsustainable (e.g. large scale irrigation in a water scarce context) and more sustainable (more relevant water solutions for small holder farmers). There are pockets in which people are seeking out 'real utopias'/alternative economies which include bartering, seed saving in local economic contexts, as well as access to markets (there are also some emergent markets interested in sustainable/organic products). However, limitations are caused by the dominance of food markets by supermarket chains and agribusinesses, and dominant logics of the VET system. Across all scales and forms of agriculture the growing impact of climate crisis, water shortage and land degradation are evident, though necessarily more concentrated in small scale settings given the long term effects of colonial land appropriation. **VET trajectory and orientation**: Whilst the local public VET college is poorly articulated to the network, there is participation from a public Agricultural Training Institute, local universities, NGOs and community groups, and the Local Economic Development office of the Municipality. In this, attention is being given to advancing the small scale farming economy, and supporting their expansion in the local economy. Indeed this support to the informal economy by multi-actor groups, is producing narratives, trajectories and VET learning networks that are providing a source of innovation into the formal Agricultural Training Institute curriculum, which is becoming more oriented towards smallholder farmers and sustainability-oriented farming practices (e.g. water harvesting, seed saving, organic production). It is also bridging formal and informal VET environments, thus being more inclusive.

(*Continued*)

Table 2. (Continued).

Case Study Focus	Evidence of political-economy-ecology engagement in VET setting
TRANSPORT *(especially maritime)* *Durban and Richards Bay, KwaZulu Natal, South Africa*: *Multiple multi-actor networks with limited overlap – state (national, provincial, metropolitan) project of infrastructural development with skills largely not prioritised; private sector-dominated maritime sector with high levels of global connectivity and core large firms, including in-house training provision concerned with maintaining productivity and competitiveness; public VET college system including new sectoral centre of excellence in Richards Bay seeking to support entry into the sector for African students.*	**Type of change**: focused on large-scale state-led development of big air/port infrastructure and connections to the hinterland. It is focused on deepening/accelerating carbon intensive development, not transitioning. **Political-economy-ecology framing/s**: this is entirely based in a productivist view with a heavy dependence on carbon and extractivist industries (inc. coal, oil and metals). It is economic development through a state-led megaproject of infrastructural development. As such it is highly formal sector oriented. In our case, there is a traditional view of the maritime economy, which is in tension with environmental considerations around the harbour and coastline, even though these are meant to be part of the Operation Phakisa mandate, creating a contradiction for the intervention which is largely ignored. **VET trajectory and orientation**: there is an existing private sector intermediate skills ecosystem, which is dominated by large-scale multinational firms and their in-house training provision. In contrast, public VET colleges in Durban are largely marginal to the sectoral skills formation system. On top of this largely endogenous private skills ecosystem, there has been a new national initiative to establish a public centre of excellence for maritime skills. However, this is located in the secondary port of Richards Bay (100km north), and lacks a focus on transitioning to sustainability. With respect to the wider state-led infrastructure initiative, skills appear largely to be an afterthought, even though the Department of Higher Education and Training was involved in the formulation of the wider set of such spatial initiatives. The public system vocational system has a strong focus on inclusion (in terms of race and gender) that reflects a key political imperative but which is not the primary motivation of the private sector (though it is keen to be seen to be meeting equity targets). Nonetheless, the public vocational system remains tightly focused on formal sector employment rather than community or informal sector opportunities, in spite of the limited absorptive capacity of the formal sector or the scale of needs and opportunities in other economies. Just transitioning discourses on transport systems appear to be absent in this context, along with attention to environmental concerns.

(*Continued*)

Table 2. (Continued).

Case Study Focus	Evidence of political-economy-ecology engagement in VET setting
OIL prospecting and preparation for large-scale exploitation. Hoima, Uganda *Complex web of actors preparing for a carbon-based transformation of a remote rural area. This includes mega firms (both international oil companies and their engineering, procurement and construction contractors) engaged in their core activities; a major multi-donor skills project trying to maximise local skills content, and a web of local skills providers (state, church, NGO facing radical change to their operating environments.*	**Type of change**: transformational but along a trajectory from rural underdevelopment to rapid and profound oil-based change, including radical changes to local employment, environment, economy and infrastructure. From an environmental perspective, this transformation is very much in the wrong direction. **Political-economy-ecology framing/s**: deeply embedded in the complex political economy of oil extraction including the relationship between megacorporations and an already authoritarian state. Also there is the presence of a major international development project that is simultaneously seeking to support private sector development (and in the British case, increasing its own exports), address poverty reduction, and offer at least lip service to environmental concerns. However, environmental concerns clearly are marginalised by all major actors. **VET trajectory and orientation**: there are big questions where there is room for local skills the oil skills system. The Ugandan government has established a new public sector centre of excellence but this is weakly related to employers, who continue to draw on international workers with high levels of industry experience for mission critical roles. It is also poorly aligned to donors and their network of public, church and NGO providers, which are mainly focused down the value chain in areas that will service production or respond to the multiplier effects of production (transport, hospitality, construction [non-oil]). Here the focus is primarily on skills for poverty reduction, with a strong gender lens, reflecting wider donor priorities rather than those of government or employers. The research revealed the inability of the existing skills providers to imagine what segments of the not-yet arrived economy they can target. In all of this there is no meaningful focus on environmental skills or just transitioning to a low carbon future, despite national climate change policies.

(*Continued*)

Table 2. (Continued).

Case Study Focus	Evidence of political-economy-ecology engagement in VET setting
FOOD and LIVELIHOODS Gulu, Uganda *Region where major international humanitarian interests are winding down in a postconflict settings but many of the NGOs (and those skilled by them) remain present and psychological effects of the past remain. Far from regional markets but with a dynamic university seeking to be a developmental catalyst, driven by a community-development philosophy.*	**Type of change**: transformative in intent but also with concerns about continued healing following prolonged civil war including major issues regarding conscription of child soldiers, systematic programme of rape, etc. **Political-economy-ecology framing/s**: this is an area with major issues of land shortage and degradation but little non-food system employment even in the informal economy. There is a drive by local actors (especially the traditional authority and the university - the latter echoing older notions of the developmental university) to promote sustainable livelihoods and sustainable agricultural practices reducing land degradation. Growing numbers of university graduates are looking to exploit higher value niches in the informal economy, but are also contributing knowledge from the university to trajectories such as sustainable development. **VET trajectory and orientation**: Public (and church-based) VET provision is characterised by very small institutions with little opportunity to engage with industry and very limited capacity for transformation. To these can be added a growing number of innovative producer-trainers in the informal sector, often with support from the university. There is a focus on new food niches including in organics, a circular economy in plastics and moving up the fashion value chain. Here livelihood opportunities are closely intertwined with environmental improvements and transitioning where these are possible in the post-conflict context. These are also mediated by a multi-actor network of VET providers in learning networks.

Views on political economy and political ecology (and their connections)

Given the general absence of a political ecology interest in VET systems and histories, we turned to the considerable body of work emerging in the social sciences that provides historical and contemporary vantage points on the deep-seated connections that exist between political economy and political ecology (e.g. Bond 2002; Forsyth 2003; Malm 2016; Moore 2016; Scoones 2016; Satgar 2018; and earlier work by; Gorz 1989; Bookchin 1990). For example, Leff (2015, 33) explains that political ecology emerged as 'a social response to the oblivion of nature by political economy', with subsequent forms of eco-Marxism uncovering a 'second contradiction of capital', namely the 'self-destruction of the ecological conditions of sustainable production'. This and other work brings political economy into conversation with political ecology.

There is an emerging body of political-economy-ecology work, which we think has new implications for VET and how it is shaped and constructed. For example, Burawoy (2013) describes three 'waves' of Marxism, those of capital-labour (1795–1914), production-exchange (1914–1973) and production-environment (1973-present). Burawoy argues that there is a need to 'search out real utopias that can galvanise the collective imagination but also interrogate them for their potential generalisability' (Burawoy 2013, 48). Any such generalisation needs to be contingent and co-constructed with those most affected. Importantly, for our argument in this paper (also put forward in our book, VET Africa 4.0 Collective 2023), Burawoy insists that this brings the role of civil society into focus, especially its role and contribution towards defending humanity against a growing ecological crisis that emerges from the commodification of nature and which takes the form of 'privatisation of water, land or air' (cf. also Shiva 1994, and others on the commodification of the commons). The role of civil society can be seen in the diversity of skills system actors in Table 1 in response to the political-economy-ecology challenges, especially in the food and water cases, less so in the oil and transport cases.

To this, we add inclusivity of those excluded from mainstream notions of economy, work and VET, since we noted patterns of exclusion (especially large numbers of unemployed youth) in all of our cases (cf. Table 1). Relevant to our approach is Burawoy's (2013, 47–8) argument that this shift will emerge through the building of what Wright (2010) calls 'real utopias': 'small-scale visions of alternatives such as co-operatives, participatory budgeting, and universal income grants that challenge on the one hand, market tyranny and on the other, state regulation'. Such analysis, Burawoy (2013, 48) argues, should focus on "their conditions of existence, their internal contradictions, and thus their potential dissemination', offering a means of keeping alive the possibilities of alternative capitalism which he describes as not abolishing markets or states, but which rather 'subjugates them to the collective self-organisation of society'.

Raworth (2017) applies similar arguments to a rethinking of the economy suggesting that we need to include the home, market, state and the commons as four distinct, but related realms of the economy. VET, in Africa and elsewhere, tends to consider the market only, and to a declining extent over time, the state. Work that serves the commons and home-based or subsistence work for livelihoods is most often excluded from VET (VET Africa 4.0 Collective 2023). We note these forms of work being included in three of our case contexts (oil, water and food cases in Table 1), in each case demanding a wider range of VET providers.

From an environmental or commons perspective, the historical-materialist political-economy-ecology work of Martínez-Alier (1997, 2003, 2013) on 'environmentalism of the poor' (see also Leff 2015; Scheidel et al. 2018), which explores power relations that emerge from society-environment relations and materially grounded analyses of unsustainable forms of modern rationality, can be helpful for considering contradictory and more complex implications of considering a political-economy-ecology perspective as framing for a transformative and transformational VET (McGrath 2012). This extends the perspective of Burawoy above. Martínez-Alier, Guha, and Leff's work challenges the notion that environmental interest and action stems from affluent societies and their 'post-material' concerns. They draw attention to the significance of historically and structurally constituted ecological distribution conflicts as drivers of environmental concern. As stated by Tetrault (2017, 12), in the global South, such conflicts

> prototypically pit subaltern groups (with their allies in civil society) against private companies and governmental actors. The latter promote capital-investment in the expansion of extractive activities, polluting industries, and environmentally destructive mega-development projects; while the former struggle to protect their territory, productive natural resources, recreational spaces, and cultural landscapes, all of which form the material and symbolic basis for sustaining livelihoods, healthy living environments, and cultural diversity. [as seen in the oil case particularly in Table 1]

Ciccantell and Patten (2016) discuss colonial and neocolonial extractivism through a theory of 'raw materialism' which reformulates world systems theory and historical materialism in ways that focus on 'the contradictory roles of raw materials extraction processing and consumption in shaping the long term evolution of the capitalist world-economy and its constituent national economies, as well as the socio-economic and ecological impacts of its evolution'; drawing attention to the 'multiple roles of raw materials in shaping the past five centuries of the capitalist world economy' (n.p). They note this is also called 'new historical materialism' in attempts to avoid environmental determinism and maintain continuities with classical political economy of Marx and world systems theory (cf. Wallerstein 1974).

A similar story emerges in Africa. The independence wave in African countries brought the hope that governments would be more accountable to local

populations and would end the centuries of foreign domination of African economies and government policies, which also influenced VET (cf. Allais 2022; McGrath et al. 2020). Cheru explains that this hope, represented and championed by some early liberation movement leaders, had the support of workers, trade unionists and the growing radical student movements, as this was also 'essentially a strategy for more equitable appropriation of the productive forces under a democratic system of government' (Cheru 2016, 1271). There was important progress in this regard, particularly around health, education, and communications infrastructure. However, as Cheru notes, nationalist leaders felt impelled to continue extractivism due to the need to fund development internally. This had the perverse effect of locking Africa into this model.

Ciccantell and Patten (2016) propose a focus on commodity chains (e.g. oil/coal) and their impacts and implications to social life and living, working and learning including alternatives to the dominance of these commodity chains (cf. Orihuela 2013, on the possibility of unlearning mineral dependence). From a VET perspective, this takes us to emerging discourses on Just Transitions to Sustainability, discussed further below as a new narrative that focuses on commodity chains linked to reframing of energy, food, transport, and water systems and value chains. As will be discussed further below, Just Transitions is a political ecology narrative that seeks to leave no-one behind in addressing environmental and social justice challenges in response to the long durée of the impacts of extraction and ecological degradation that have led to climate change and new risks for societies the world over (e.g. food system, transport, infrastructure development shifts, etc. cf. also Table 1 for these risks emerging in each of our cases). It also drives us to broaden views on VET away from formal provisioning solely to intersections with informal and non-formal vocational education (VET Africa 4.0 Collective 2023). As we note elsewhere, these did form an important part of the emphasis of what we call VET Africa 2.0, but have been marginalised over the past quarter-century.

In short, we found from this review of these literatures that reframing political economy to include ecology (i.e. a political-economy-ecology lens) provides new challenges for the foundational narratives that drive VET emerging from this history, especially the now 'worn' narrative of human capital theory that serves relatively narrow views of what VET is for, but also the political economy of skills discourse, which 'left out' the relation between power, economy, production, and nature, largely turning nature into a 'resource' to be mobilised into the productionist narrative (Moore 2016). Importantly, Leff (2015, 33) states 'political ecology goes beyond the proposal for conservation of nature … and policies of environmental management … to inquire on the conditions for a sustainable life in the ecological stage of economic and technological hegemonic domination.' It is from this vantage point that we continue the discussion on reframing VET in times of climate change.

'Just transitions': connecting political-economy-ecology in shaping VET

Just transitions is a rapidly emerging political-economy-ecology discourse that connects climate change policy with economic inequality considerations in global attempts to move towards a low carbon future (Newell and Mulvaney 2013). Originating from the labour movement (Young 1998) and with later engagement from the climate justice movement (Wilgosh, Sorman, and Barcena 2022), just transitions discourses have also recently been taken up by global policy structures such as the World Bank, and those involved in socio-technical transitions (e.g. Newell and Mulvaney 2013; Swilling and Annecke 2012; Swilling, Musango, and Wakeford 2016). In general, they seek to foreground inclusion, distributional, procedural and restorative justice as low carbon initiatives are planned for and implemented.

One of the challenges with this discourse, however, is that it assumes that justice results from formalised application of policy intentions via linear top-down reform trajectories (Jasanoff 2018), including into the skills system (Bray, Montero, and Ford 2022). Notwithstanding the importance of good and timely policies to address the climate and inequality challenges of our times, there is also a need to focus on the complexities of realising such policy ambitions. Political ecology raises the need for critical analysis of longer term nature-society relations and power dynamics of these relations (as seen also in the cases in Table 1), and political economy raises the need to interrogate long term structuring of inequalities and power relations associated with labour and work. As stated by Ward (2018), there is need to 'navigate the fault lines' in just transitions work, including its principles, processes, and practices, which includes skills development principles, processes, and practices associated with just transitioning ambitions.

One of the complex 'fault lines' that need to be navigated with a deep concern for justice is the general problem in just transitioning that relates to projections of jobs being lost (e.g. in the coal value chain) which puts communities already living precariously at more risk of job losses, income, and livelihood security. One of the solutions being put forward in the just transitions planning literature is reskilling and upskilling of these workers into more 'climate friendly' jobs and value chains as articulated for example by the ILO (2015) and the South African Presidential Climate Change Commission (2022). However, it is also recognised that this is not a direct 'match-up' process, and what it means in reality is that some will lose jobs while others may gain jobs in new value chains (e.g. renewable energy value chains). Thus, discourses of social protection are also included in this deliberation (PCC 2022). The International Labour Organisation have also become an influential player in shaping the discourse of just transitions, and in 2015, the ILO developed and ratified *Guidelines for a Just Transition towards Environmentally Sustainable Economies and Societies for All* (ILO 2015), noting that,

> A just transition for all towards an environmentally sustainable economy . . . needs to be well managed and contribute to the goals of decent work for all, social inclusion and the eradication of poverty.

However, just transitioning is not just a management issue. Researchers are articulating some of the problematique of just transitions discourses and trajectories as limited by management trajectories in the here and now. As stated by Cock (2011):

> A 'just transition' could involve demands for shallow change focused on protecting vulnerable workers, or deep change rooted in a vision of dramatically different forms of production and consumption. In this sense the ecological crisis represents an opportunity: to not only address the unemployment crisis in our society, but to demand the redistribution of power and resources; to challenge the conventional understanding of economic growth, and to mobilise for an alternative development path. (Cock 2011)

As stated in Ward (2018, pg. 8, citing Cock 2018),

> A shallow just transition emphasises 'reformist change with green jobs, social protection, retraining and consultation', a position Cock argued is evident in the International Trade Union Confederation and the International Labour Organisation (Cock 2018) . . . . A deep just transformation views the current climate crisis and other environmental issues as a 'catalysing force for massive transformative change with totally different forms of producing and consuming. . .'. (Cock 2018, 222, our emphasis)

A 'transformative transition' approach which 'argues that the current political economic system is incapable of achieving the changes required to deal with the environmental [and social] challenges' (Goods 2013). Such an approach is ultimately radically reoriented towards economic, social, and environmental justice and points to the deep transformation perspective articulated by Cock (2018, cf. Cock 2019; Ward 2018). Note that the languages shifts also from 'transition' to 'transformation' flagging a need for deep analysis and shifts in the status quo. Allowing space for emergence from one trajectory to another, Ward (2018) argues that the approach put forward by COSATU in South Africa 'may be useful, in terms of acknowledging both the need for some short-term contributions to better job opportunities in a "greening" economy through knowledge and skills development BUT with a clear eye on the long-term transformations required' (18). In our view, this offers important orientation for VET and skills development for just transitioning and would seem to be what is called for in the context of all of our four cases. In other words, there is need to rapidly upscale green skills and skills needed for just transitioning in the shorter term, but in doing this, to conceptualised such skills development programmes within a wider frame of 'deep transitioning' or long term transformations that are required to adequately address the political-economy-ecology relation which is shaping contemporary employment and societal change landscapes (cf. Rosenberg, Ramsarup, and Lotz-Sisitka 2020).

Ward recommends that there is a need to explore the principles, processes and practices associated with these shifts via various cases so that as societies we can develop more in-depth understandings of the realities of skills development for just transitioning. Notably, Ward (2018) argues for allowing consideration of a 'continuum', in other words embracing an understanding of emergent social change processes while also arguing for potential radical breaks. He states:

> These transitions are going to require new knowledge and skills both within existing sectors and occupations and in emerging sectors and occupations. To understand what these 'skills' transitions may look like as we learn our way from minimal Just Transitions to transformative Just Transitions, from green resilience to green revolutions and from instrumental business cases for profit maximisation to transformative business models for sustainable value creation, it will be useful to explore . . . implications [in] and for particular cases. (pg. 19, our emphasis)

From this, we can consider how we might approach both analysis of, and generative research oriented towards, VET programmes that are engaging with political-economy-ecology concerns. A process-based initial analytical perspective may be useful to consider here and develop further via in-depth case analysis (we demonstrate its potential via a brief, high level review of our four cases below in Table 2).

Applying a political-economy-ecology lens to VET: what do our four cases of VET in Africa reveal?

As indicated above, part of our research was to reflect on four case studies in Uganda and South Africa that investigate VET provisioning in oil, transport, water, and food (which materially partly defined our cases as shown in Tables 1 and 2). We have offered analytical perspective above from the literature which allows for insight into possible dynamics of a political-ecology-economy lens in VET, and how it also relates to just transitioning discourse which is currently a powerful discourse shaping imperatives for skilling, reskilling and upskilling through VET. We apply this lens to our four cases (at a broad level in Table 2 below), mainly to invite further development and engagement with the framework, rather than definitive insights. Here, we need to be very honest and humble in seeing our empirical work as a first, but very small, step towards our goal of building a rigorous political-economy-ecology of skills analysis.

Table 2 above offers some high level insight into how one might approach the analysis of VET case studies to gain further insight into contemporary VET trajectories when it comes to the integration (or not) of political-ecology-economy into VET systems. It also seeks to show that these developments in societies are not 'neatly framed' when it comes to practice, they are often related, contradictory and emerge in and from significant struggle involving

multiple actors in local contexts, or remain simply absent, despite national and international policies that seek to advance climate change responses, and just transitions. In all cases, there is one or more 'skills project' being pursued by different groups of actors. However, sometimes these are in competition, in conflict or simply non-articulated. Equally, they are sometimes at variance with the wider political economy drivers of state or market. Whilst environment is being framed as an important consideration by some in all cases (e.g. the environmental mandate of Operation Phakisa, the concern with land degradation and water amongst farming communities), environmental concerns are also frequently marginalised (not operationalised in the VET system for Operation Phakisa, or overshadowed by VET provider biases in agriculture), especially when they run counter to the interests of major economic actors and dynamics (more or less ignored in the case of oil). Yet, there are also multiple examples of counter-hegemonic spaces where skills and societal transformations are imagined. In our cases, we noticed that multi-actor networks (food and water cases) seemed to be an important VET mechanism for launching more transformative skills programmes that take political-economy-ecology relations into account in ways that are also inclusive of those generally left out.

The complexities of the skills formation processes in such contexts, reinforces the argument that just transitions should more accurately be described as *just transitioning*, i.e. in process terms that take account of the complex histories that shape current conditions and trajectories, as well as human agency for change, all of which requires formal, informal, and wider forms of social/expansive learning (reference to be included after review), or VET models that can be more substantively supported by, or framed by, deep transitioning discourses.

Jasanoff (2018) notes usefully that one of the limitations in just transitions is methods that connect the *is* and the *ought*. Her argument is for a more inclusive approach on where we should be going as a global community, in other words, this should not be left to experts and professionals, but should include communities, workers, and those affected by the political-ecological concerns of the day. Of interest in our brief analysis in Table 1 above, is that it is in those contexts (water and food) where local actors and activist organisations were working in multi-actor formations with skills system actors that there was 'movement' towards transformative approaches to just transitions, with shifts emerging in the VET institutions (i.e. where home and commons were included or were seeking to transform or be included in state and market economies). Here there were shimmerings of political-economy-ecology relations in evidence as people sought to work towards the 'real utopia's' referred to by Burawoy (2013), with skills development at the core. In the cases where market, and state/mainstream development economies were colluding (oil and transport), political-economy-ecology movements in VET were not evident, despite policy imperatives that ideally should have been driving shifts towards just transitioning. This insight would need further research, but for JVET readers,

this alerts us to *how* we might go about better including just transitioning approaches, ideally within a transformative rather than a reformist orientation into VET systems and research. In raising the question on *how* VET researchers are engaging the political-economy-ecology debate in their work, we join Jasanoff (2018) who states that adopting more humble approaches to just transitions that allow local voices to emerge, may 'give ordinary people confidence that this Earth is *their* Earth, its future *their* future and that we are here embarked on a *common* quest to improve and safeguard *our* common future' (pg. 14, emphasis in original).

Conclusion

The political economy of skills literature has done much to illuminate the complex processes of skills formation and their location within wider political economy processes. But the approach reflects a wider weakness in political economy thinking: that growth, development and industrialisation are desirable and the focus should be on equitable access to their benefits, not on the unequal distribution of the burden of their ecological impact. The growing but much overdue attention given to climate crisis and environmental degradation, and thus the common good and common future of life on our planet, leads to an emerging realisation that the ecological dimension of economic activity cannot be ignored. This means that our debates about skills formation too must take account of the ecological domain.

Hence, we argue for a new political-economy-ecology of skills approach. Like any major shift in the field, this approach will need a number of years to mature. What we offer here is an initial argument for movement in that direction, coupled with some early suggestions of potentially fruitful directions. One important move we make in this paper is to call for a reconceptualisation of the focus of VET, that is transformative within a political-ecological-economy focus on the future. This requires moving beyond dominant foci on mining, manufacturing and motors, and includes a re-orientation of these sectors, while also including land, renewable energy, sustainable food, and water-based sectors. We argue that a broader vision of what VET is and is for will not be easy but it is urgent and vital.

Towards the end of the paper, we offer an analytical tool that, we believe, gives some useful insights into how such an approach can be built. As we note above, the intention here is not to argue definitively for certain propositions but to start a more concrete methodological and conceptual debate about how we build an account of VET in a world of climate change and persistent inequality.

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