Greening steel work: Varieties of Capitalism and the 'greening' of skills

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Introduction

The institutional contexts of nations vary widely and such diversity shapes Vocational Education and Training (VET) systems and frameworks, as well as the outcomes of workplace learning (see Bosch and Charest, 2008). The dominant institutions impact, moreover, upon the capacity of VET systems to respond and adapt to wider policy (and industrial) initiatives on skills and occupational development. A policy direction currently gaining impetus both globally and regionally is the green jobs and skills agenda. In Europe, this is being driven by the European Union's (EU) aims of sustainable economic growth and the parallel cultivation of and transition to a low-carbon, resource-efficient economy (European Commission, 2010). This transition requires the 'greening' of extant occupations and competences, as well as the creation of appropriate skills within sectors and across occupations (CEDEFOP, 2010a).

For the EU's goal of a green economy to be realised, the cultivation of appropriate 'green' skills – i.e. the knowledge, abilities, values and attitudes needed to develop and support a society that reduces the impact of human activity on the environment (Dierdorff et al, 2009) – is required. The specific pressure on VET systems is responding to the sustainability/green agenda and embedding the skills necessary for the 'greening' of work within training programmes. However, the extent to which member states have embraced environmental protection *per se*, and more specifically, endeavoured to 'green' jobs and skills, and VET provision, is variable (ECORYS, 2010). Institutional frameworks (including VET systems) and the way they are organised, provide the context within which firms might engage with the green agenda, particularly in relation to skills development at the member state level.

Drawing on case-study evidence from a project conducted on the European steel industry, this paper examines how, and to what extent, institutional contexts – specifically those in Germany and the UK – impact upon company-level environmental policy, training policies and practices, with a particular focus on apprenticeships. The steel industry constitutes an interesting focus for analysis, given the high impact of environmental policy on the industry. Furthermore, apprenticeship programmes are a particularly salient focus of study – such programmes traverse the boundaries of both external VET systems and internal

company processes, thereby facilitating examination of the intersection between institutional contexts, sector and employer imperatives.

The green skills agenda requires enhanced apprenticeship provision and training at company level. However, our argument is that firm-level policies and practices in these areas are mostly determined by dominant institutional frameworks, including the organisation of VET (see Bosch and Charest, 2008). Distinctive patterns of institutional variation mean that the greening of the labour process (and company environmental policies) develops in different ways in different places, with contrasting trajectories evident in Co-ordinated Market Economies (CMEs) and Liberal Market Economies (LMEs) (Hall and Soskice, 2001).

Our evidence, in what follows, suggests that the implementation of change is much more dynamic in the context of CMEs, such as Germany. Here, change is shaped by wider processes of innovation on the environment, and cultivated by long-term, developmental orientations encouraged by extant institutional configurations. Further, such orientations are compatible with, and conducive to, the implementation of sustainable development and environmental protection policies at both macro and micro-economic levels (Lydenberg, 2009). In contrast, in LMEs such as the UK, there are significant barriers to the vision for, and investments in, the skills necessary for comprehensive greening of the labour process, with an extant development paradigm that is driven by short-term benefits and a limited focus on securing environmental compliance (Kemp and Loorbach, 2006; *Name deleted to maintain the integrity of the review process*).

The European Steel Industry

The European steel industry has transformed in recent decades, 'becoming increasingly global in its activities' (*Name deleted to maintain the integrity of the review process*). It has moreover, become progressively oriented towards diversified product portfolios and higher value-added products, which entailed the modernisation of production, changes in work organisation and an increased emphasis on technological innovation (ESTEP, 2010). These factors, in conjunction with a shift from high labour-intensity, and an unprecedented situation in terms of the age and skill profile of the European workforce, mean that questions of workforce development have become increasingly significant (*Name deleted to maintain the integrity of the review process*). More recent pressures on the industry are EU policy aims of

sustainable economic growth and the cultivation of a green economy, which necessitates both technological innovation and more efficient ways of working – with clear workforce development implications (European Commission, 2010).

The environmental protection and sustainability agenda presents particular challenges for the industry because steel production is intensive in a number of ways (e.g. with regard to energy and raw materials) with high carbon emissions. It also generates significant levels of waste, some of it hazardous. Such challenges require addressing, as a matter of corporate social responsibility (CSR), but also because environmental regulation, and sanctions for breaches, is increasing in prominence. The industry has to comply with extensive environmental legislation, much of which emanates from the EU. As steel producers are principal emitters, the sector is also covered by the provisions of EU Emissions Trading System (ETS), despite industry arguments that this policy is jeopardising production in Europe. However, whilst the sector has pledged its commitment to sustainable steel production, meeting environmental and economic challenges, and 'greening' the workforce in line with such processes (ESTEP, 2010), it is far from clear that the necessary workforce development structures are in place to support the 'greening' of skills across the EU industry.

Liberal and Co-ordinated Market Economies: VET, Apprenticeships and Green Skills

Hall and Soskice's (2001) influential 'Varieties of Capitalism' (VoC) typology, which distinguishes between LMEs and CMEs, identifies significant variations in the institutional and cultural patterns specific to these types of capitalism. The different national systems associated with these dichotomous types have entailed important divergence in the VET systems, including the apprenticeship schemes, 'embedded' in these institutions (Bosch and Charest, 2008).

Co-ordinated Market Economies

Although markets and hierarchies are important in CMEs like Germany, such economies are characterised by strong networks of social institutions that regulate economic action within markets. Here, markets are 'deeply embedded in an array of co-operative, redistributive and regulatory institutions' (Streeck, 1992: 6). In Germany, these institutions include powerful employer associations, strong trade unions, networks of cross-shareholding, as well as regulatory systems that encourage collaboration (Hall and Soskice, 2001). Moreover, and of

significance, the financial system is less market-based and firms raise capital on a long-term basis through regionally based banks as opposed to the stock market (Tylecote and Conesa, 1999). Close links exist between lending banks and firms and this results in the provision of 'patient capital'. Such structuring of financial markets within CMEs plays a crucial role in encouraging goals of sustainable development and environmental protection at the micro-economic level, as firms are able to adopt longer-term, developmental orientations that focus on future potentials as opposed to immediate earnings (Lydenberg, 2009).

Long-term orientations facilitate capital investment, technological innovation and strong workforce skills development (Hall and Soskice, 2001). Indeed, the German 'skills' system is renowned for high levels of industry-specific, engineering and technical skills, cultivated within firms and in the wider VET system. Germany functions with a 'high-skill equilibrium', where mutually reinforcing institutions encourage firms and workers to invest in skill acquisition and development (Hall and Soskice, 2001). The costs of training are shared – the state funds high quality vocational schools, whilst firms pay for all company-provided training. Individuals contribute through, for instance, acceptance of low wages whilst training as apprentices (Steedman, 2005). German VET programmes are perceived as principal contributors to industrial competitiveness, given the quality of provision and the responsiveness of the schemes to industrial innovations and changing employer demands for skills (Bosch and Charest, 2008). Robust frameworks for incorporating such changes into training provision and qualification structures exist, namely the institutions that support sector dialogue between social partners (CEDEFOP, 2010b). The Federal Institute for VET (Bundesinstitut für Berufsbildung – BIBB), for example, works closely with the partners in updating the training regulations that govern the curricula of formally-designated occupations.

The German 'dual-system' apprenticeship is established on this 'occupational model' (Brockmann et al, 2010). As such, training is delivered as a coherent whole, comprised of occupational knowledge and competences, as well as broader general and civic education. The latter meets both social and economic goals through the cultivation of cultural, social and identity capital, as well as citizenship behaviours in learners (Hoskins, 2008). Such outcomes have obvious significance for wider society, but also impact at the organisational level. Performance is enhanced through the engendering of desirable conduct at work i.e. organisational citizenship behaviours and the harnessing of the external, non-

market benefits of VET (e.g. Huang et al, 2012). Citizenship behaviours and the formation of strong social/identity capital are of particular salience in considerations of environmental protection, with organisational policy and practice inextricably linked to wider societal values (Sagiv and Schwartz, 2007) and the associated configuration of the prevailing institutional framework (Evans and Stroud, forthcoming).

Under the German system, training regulations exist for, and underpin, each of the recognised occupations. These regulations govern compulsory subject material, which is incorporated into the framework curricula pertaining to each occupation (Ryan and Unwin, 2001). The training regulations also govern company training provision and thus, guarantee uniform national standards across firms. There is not, however, an overarching state-driven green skills policy, but occupational competences and training regulations have been greened – as industrial sectors restructure and respond to extensive environmental legislation (CEDEFOP, 2010a). Environmental protection has been at the centre of public policy for decades, a reflection of the strong environmental movement, the high environmental awareness of the German polity, the political success of the Green Party, and the subsequent integration of environmental issues into other parties' policies (Blühdorn, 2009). Further, environmental policies have long been perceived as a source of innovation and a market opportunity for domestic firms (CEDEFOP, 2010a). Environmental protection issues have been integrated into all initial and continuing VET regulations through collaboration between BIBB and the social partners – effectively greening the VET system (ibid.). This process of organic collaboration stands in sharp contrast to the top-down attempts to drive this agenda in the UK.

Liberal Market Economies

Within LMEs such as the UK, the market is the dominant co-ordinator of economic action (Hall and Soskice, 2001). Regulation focuses on ensuring that market forces prevail and this encourages the formation of short-term, low trust relations both within and between firms. Moreover, LMEs are organised around a stock market-based financial system, and financial institutions in the UK offer capital to industry on the basis of high returns and short payback targets (see Gospel and Pendleton, 2003); factors which have been identified as inimical to longer-term goals of sustainable development (Lydenberg, 2009). The dominance of shareholder values means that profits are generally not re-invested and go disproportionately into dividend payments. Such demands, in conjunction with other

institutional factors (such as the predominance of low-wage, low-skill labour), combine to produce an extant development paradigm that is 'locked-in' to trajectories driven by short-term benefits (Kemp and Loorbach, 2006).

The LME model is seen as conducive to high risk processes of radical innovation, with a focus on a fluid labour market, a reliance on general skills and the production of goods requiring lesser skilled but lower cost labour (Hall and Soskice 2001:39). Consequently, at firm level, there are significant implications for both technological investment and workforce development – long-term projects with uncertain levels of return. The UK, in particular, has been described as functioning with a 'low skill, low pay, low productivity' equilibrium (see Keep et al, 2006), and 'voluntarist' market-based training systems mean that there is little legal compulsion for employers to engage in skill enhancement. Similarly, weak regulation of employment protection contributes to high levels of employee turnover, all of which constitute systematic disincentives for workforce development (Lloyd and Payne, 2002).

In particular, whilst acknowledging that the devolved parts of the UK adopt different terms for and approaches to apprenticeships, the UK has been more generally criticised for the poor quality of provision, with vocational education generally perceived as being inferior to academic pathways (*cf.* Bosch and Charest, 2008). There are two principal criticisms of apprenticeships across the UK. First, as opposed to Germany, it has not been governed by legislation until very recently and as such, there is a wide variation in provision, content and duration across sectors and localities (Hogarth et al, 2012). Second, the reliance on the National Vocational Qualification (NVQ) in England and Wales as the central form of training and assessment has been widely condemned (Grugulis, 2003). NVQs conform to the task-based qualification model, focusing on 'narrow specialisation as opposed to occupational capacity' (Brockmann et al, 2010). This contrasts sharply with the emphasis on imparting broader, underpinning theoretical knowledge found in the German occupational model (Boreham, 2002).

The Apprenticeships, Skills, Children and Learning Act (ASCL) of 2009 established a statutory basis for apprenticeships and aimed to address some of the deficiencies of the system through the creation of minimum standards in England and Wales. For example, apprenticeships must now include a minimum of 280 'guided learning hours'. Delivered at a minimum of two hours per week off-the-job, this is low compared to many European

countries where apprentices study for at least one day per week (often two in Germany) in a vocational college, in addition to on-the-job training. Indeed, there is no minimum duration for apprenticeships in England and Wales, with the decision left largely to the individual employer – on average an apprenticeship is completed in one year, compared to an average of three to four years in German-speaking countries (see Fuller and Unwin, 2012; Steedman, 2010).There is moreover, a lack of elaboration as to the content of apprenticeship, in contrast to the German context where the proportions which will be devoted to general education and vocational subjects are specified in detail. The UK system has yet to remedy the deficit in intermediate-level (Level 3) and technical skills in the UK, with a large number of apprenticeships undertaken at the basic/foundation level (Brockmann et al, 2008; Dolphin and Lanning, 2012).

As Bosch and Charest (2008: 429) suggest, such inadequacies are foregrounded by LME contexts, which have destabilised intermediate level vocational training whilst demarcating graduate occupations. The consequence is a weakening of the VET system and its responsiveness to new demands e.g. green skills. Evidently, the need to cultivate green economic growth had started to permeate the UK Government's agenda from 2008, when a 'green skills' base was identified as vital to a low carbon transition (BERR, 2009). There was, moreover, recognition that such skills provision was lacking within the VET system, largely due to the exclusive reliance on employer demand to stimulate this and that such demand was not forthcoming (Jagger et al, 2012). However, the intention to implement a remedial green skills strategy has ostensibly been abandoned by the current government, and wider environmental policies are increasingly being attacked (Harvey, 2011). A recent study has identified that the UK has the largest green skills deficit across nine EU countries, and that apposite VET provision has still to develop (IES, 2012). Significant barriers at firm-level to the vision for, and investments in, such skills is compounded by prevailing social norms in the UK, which have meant that 'green' issues tend not to be seen as offering credible market opportunities and have frequently been viewed as an unnecessary restriction on business, or at least as a secondary consideration (European Commission, 2009).

The type of 'pathway determinacy' within national economies that is described above is subject to complex and nuanced readings (see Crouch 2001). Indeed, on CME arrangements specifically, some commentators have pointed to their breakdown and put forward 'convergence/liberalization' arguments (see, for example, Howell 2003). However, there is

an evident difference between the extensive 'greening' of the CME-orientated German VET system and the way the green skills agenda has emerged relatively recently in the UK in an incipient top-down and state-centric form, which has failed to gain traction in any meaningful way. The evidence we present confirms a distinctive variation of approach towards green innovation and skills across our case study companies in Germany and the UK. The argument is that these differences are principally attributable to the institutional contexts in which the companies are located, rather than generated as part of managerial philosophy independent of political and economic context.

Methodology

The (*Name deleted to maintain the integrity of the review process*) project was commissioned under the Strategic Research Agenda of the European Steel Platform (ESTEP), which aims to support a competitive and sustainable European industry and stimulate innovation to these ends (ESTEP, 2010). One objective is the development of skills within the sector and the (*Name deleted to maintain the integrity of the review process*) project was launched in 2010. The project examined the extent to which environmental aspects are already incorporated into technical VET across participant member states (i.e. Germany, Italy, Poland, UK) with a view to developing such provision. The study focused on the apprenticeship programmes of two occupational groups, mechanical and electrical engineering technicians. The industry continues to rely on apprenticeships to provide it with the necessary stream of intermediate level technicians. Moreover, these technical apprenticeships were deemed an apt focus of study because there are significant environmental aspects to their work.

Data from two of the case study companies – Tata Steel in Wales, UK and ThyssenKrupp Steel Europe (TKSE) in Germany – form the basis of this paper. The research was conducted in 2011 and guided by two principal research questions, which focused on exploring: i) the industry's 'green' training and skill needs, and ii) current industry/company strategies on green skills training and environment policy and practice. The UK fieldwork was carried out at the Llanwern and Port Talbot sites in South Wales. The Port Talbot site is an integrated steelworks, producing hot-rolled, cold-rolled and metallic-plated strip products. The plant has 3000 directly-employed workers, and another 3000 sub-contractors. The Llanwern site has a finishing capacity only, employing 1200 people. The TKSE plant is located in Duisburg. This

is an integrated plant employing approximately 13,000 people. It has the world's cleanest coking plant and produces a range of hot-rolled and cold-rolled products.

In the first stage, semi-structured interviews were carried out with personnel from the Environmental and Health & Safety departments at all sites. Thereafter, ten group interviews were conducted on-site with Tata apprentices, line managers responsible for apprentices and specialist training personnel. Equivalent focus groups with apprentices were organised in Germany. Teaching staff from the relevant vocational school were interviewed in Germany also, as well as representatives from BIBB and the regional (i.e. Länder) chamber of commerce. In the UK, teaching staff from the further education college and two representatives from SEMTA (the Sector Skills Council for Scientific, Engineering and Manufacturing Technologies, and responsible for the Framework for Engineering Apprenticeships) were interviewed. The interview data was augmented with documentary evidence from company reports and policy documents.

The Greening of Steel Work

In what follows, we provide a comparative account of efforts to 'green' activities in the case study companies and discuss the extent to which the strategies developed overlap with training provision, particularly with regard to apprenticeships. We start by outlining the more general approach taken by each company to environmental matters, including training in this area, before we move on to discuss the apprenticeships at the two plants.

Orientation to the Environment

There are significant variations in environmental policy and practice at the two plants. TKSE's environmental performance is viewed as a 'key driver for innovation', leading to 'continuous improvement of the economic, environmental and social performance of the company' (TKSE, 2011: 9). Various TKSE reports describe legislative compliance on the environment as a 'given', detailing the plethora of voluntary measures that go beyond such prescriptions (TKSE, 2011: 60). Tata, in contrast, states that 'its first priority is to remain compliant and meet legislative requirements' (Tata Steel, 2011: 18). This compliance-driven approach was confirmed by a number of interviewees, but it was also revealed that compliance is not always attained. Indeed, the comparative difference in orientation towards

the environment is one of compliance at Tata and innovation at TKSE (see *Name deleted to maintain the integrity of the review process*).

The basis of respective company performance on the environment is a reflection of approaches to and attitudes towards environmental protection. Tata Port Talbot, for example, has a 'small' Environmental Department established fifteen years ago, which has a principal focus on legislative compliance. A small sub-team focuses on 'innovation' through capital expenditure projects, but it is quite limited in focus - principally aimed at improving compliance or enhancing process efficiency. Indeed, despite recognising that workforce development on environmental matters might help the Department move away from its current approach of 'reactive, fire-fighting', an environmental manager stated:

> 'If I had a guaranteed sum of money, I wouldn't spend it on training. It just wouldn't be a priority.' (Tata, Port Talbot, 2011)

Interviewees from the Environmental Department argued that such environmental matters are beginning to 'move up the [company's] agenda', but outside of this department, cynicism was expressed, revealing a widespread perception that economic goals, such as cost and output, are the key drivers. Indeed, the company's focus on environmental issues was described as mere 'green CSR spin for customers' by a Technical Manager, and limited and rudimentary environmental auditing processes confirm this.

At TKSE, environmental policy is said to be of central importance, with a 'long tradition' (2011: 5). It describes its performance as far superior to that of competitor companies and this was confirmed by interviewees at Tata Steel, who described TKSE as having implemented pioneering environmental technology. The company's approach to the environment is largely attributable to an overarching, Group-level sustainability management system, driven by the parent company, ThyssenKrupp AG. The system is overseen by a sustainability management officer and interdisciplinary sustainability team. At company level, this is supported by a long-established Environment Department, with a team of section-based environmental representatives who report to the parent group. These representatives conduct daily environmental inspections and administer green skills audits. They are accountable to line management in their respective areas, but have autonomy regarding the environmental inspections, reporting directly to the parent group, a system described as 'highly effective'.

The clear distinctions in approaches to the environment at company level are replicated in the different orientations towards skills development (encompassing green skills) at the two companies. TKSE places a high priority on developing employees, with each employee receiving an average of three days of formal training per annum (Interview Notes, Trainer, TKSE, Duisburg, 2011). Moreover, all employees participate in a developmental performance management system, with a mandatory interview conducted annually. With regard to formal environmental training, there is compulsory training for all managers, and if employees require training in a particular environmental topic they contact the HR Department:

> 'One of the main instruments to keep the employees up to date is an occupational qualification plan assessing systematically what issues are relevant and which qualifications are needed in the various work areas ... The plan covers, for example, legal mandatory qualifications and requirements that arise in the context of commissions…. Therefore regular votes are taking place in the enterprise [involving the department managers and employees] in order to organise additional training.' (TKSE, Environmental Protection, Duisburg, 2011)

For further specialised training over a wide range of environmental topics the company commissions the relevant professional association. Moreover, regular environmental training updates are provided by the Prevention Officer for Environmental Protection and disseminated across the plant at all levels. Significantly, employees are closely involved in processes of environmental improvement and, as such, seminars are regularly offered to the entire workforce.

At Tata, there is no dedicated environmental training programme. Standard operating procedures, which specify correct and safe ways of working for all tasks, are in place and accessible so as to direct behaviour and work performance. Operators are shown by experienced workers how to work in accordance with these protocols meaning that environmental aspects are implicit within the procedures, rather than explicitly articulated. In terms of more formal training, there is a two-day induction for all new employees and this incorporates an introduction to environmental issues, particularly on the financial costs of non-compliance. Thereafter, environmental issues might be covered on 'Journey Days' (a UK-wide, cross-plant culture change programme), or as part of section managers' 'Toolbox

Talks' (designed to inform and instruct operatives about issues arising specific to work areas). However, operations management 'do not always buy in to environmental concerns', and so the latter might not constitute a high priority. Further, whilst environmental staff explicitly acknowledge that it is operators who require rigorous environmental training, it is managers that have access to training on such matters, including opportunities to pursue professional qualifications – if they 'buy in' to this agenda.

Apprenticeship Training

The apprenticeship programmes under study here (i.e. mechanical and electrical technicians) in both Germany and the UK are three years in duration. In the latter case, this constitutes a relatively long period of study and is a reflection of the tradition of apprenticeship in this sector, which in turn, has manifested generally in higher quality of provision (e.g. Hogarth et al, 2012). This particular 'path dependency' was further reinforced in the 1960s and 70s, when the UK developed and displayed many of the features associated with co-ordinated economies (Thelen, 2009). However, there are distinct differences in how apprenticeship training is delivered at the two companies, including within the vocational schools, or FE colleges. More specifically, there is significant variation in the provision of training and education on environmental aspects within the two systems.

Germany

Within the German system, the public vocational schools provide technical training, as well as general education. The large amount of classroom provision is required by law (Boreham, 2002). The schools are responsible for the delivery of framework curricula, devised by the BIBB, to students (CEDEFOP, 2010b). Framework curricula exist for every recognised training occupation and are harmonised with the training regulations. The curricula are composed of 'learning fields', each focused on different job-specific content, and these fields encompass subject content, time allocations and targets for achievement. The framework curriculum for industrial mechanics comprises fifteen learning fields, whilst that for electrical technicians is comprised of thirteen (Interview Notes, Trainer, TKSE, Duisburg, 2011). There is no dedicated learning field for environmental protection in either curriculum, but these aspects are incorporated into the relevant job-specific topics. Specific 'green' skills and their applications are explicitly identified in nine of the fifteen learning fields for industrial mechanics and in seven of the thirteen fields for electrical technicians. Moreover, both curricula contain general instructions as to environmental protection. Vocational schools

identify the 'environmental threats' that might arise in the course of the apprentices' work and furthermore, provide advice as to how such risks might be avoided and prevented. The curricula for the two occupations also stipulate that students are to be educated about environmental law and regulations.

Teaching staff from the vocational school described their aim as the inculcation of general environmental awareness and understanding of sustainability in the apprentices, which is indicative of the broader civic education that German apprenticeships offer (Brockmann et al, 2010). From this base, the focus becomes more specific, identifying how apprentices' actions at work impact on the environment. Particular environmental techniques, such as Life Cycle Assessment, are taught. Environmental aspects of the technician role, such as emissions control, waste management and resource efficiency are also taught in the classroom, with the aim of:

> 'changing behaviour, through sensitizing students to a broader and underpinning environmental perspective, thereby empowering them to take appropriate action in the workplace.' (Teacher, Vocational School, Duisburg, 2011)

There are formally assessed environmental projects and moreover, the external examination held at the end of the programme, which must be passed if the apprentice is to achieve their skilled worker certificate, contains five compulsory questions on the subjects of environment and sustainability.

Before moving into a planned programme of rotation around a number of departments, TKSE's apprentices spend the first eighteen months of the programme in the company's dedicated and well-resourced technical training centre, working on company and occupation-specific projects. The company aims to develop apprentices who are 'capable of thinking and acting independently' and who can:

> 'participate and think in terms of real processes at work and apply their technical knowledge to solve problems.' (Trainer, TKSE, Duisburg, 2011)

Training staff stated that they aim to impart a level of understanding, to the extent that trainees are able to:

> 'analyse the working process, be aware of and understand the possible impacts of their actions… and to ultimately increase their autonomy.' (Trainer, TKSE, Duisburg, 2011)

TKSE trainers stressed the importance of developing 'work process knowledge' (Arbeitsprozesswissen). This is comprised of holistic knowledge of the work process in the enterprise, including understanding of the labour process, the production process and the inter-relations between the various departments and functions (see Boreham, 2002). Such knowledge is obviously deeper than that required to underpin a single job and the cultivation of this broader understanding is argued to lead to an adaptable workforce, capable of responding quickly and effectively to new work demands (see Boreham, 2002).

Of course, environmental aspects constitute one area of changing work demands, with one trainer arguing that

> 'environmental, climate and safety regulations have affected the daily work enormously' (Trainer, TKSE, Duisburg, 2011).

TKSE apprentices receive specific tuition on relevant environmental topics and are given work-related environmental projects to complete. The company trainers state that these are designed so as to 'illustrate how legislation applies in practice.' The apprentices agreed that this practical application was what they valued:

> 'I learn best through the practical exercises we're given at college and in the workplace. It is important to be able to have the space to learn by actually undertaking a project and then having guidance on any mistakes made.' (Industrial mechanic apprentice, TKSE, Duisburg, 2011).

The ultimate aim is the development of staff 'capable of critical thinking and autonomous action' regarding environmental protection, and this practical 'learning by doing' approach cultivates this independence of thought and action. All of the German apprentices interviewed stated that they were very keen to receive extensive education on the subject of environmental protection and indeed, pursue additional qualifications. For example, one

trainee stated that he wished to pursue a Masters level qualification in the area, and that this interest had been stimulated by the content provided on the apprenticeship programme.

All participants were able to offer comprehensive definition of what constitutes 'green skills' and moreover, accurately distinguished between the key environmental aspects of their roles (e.g. management of waste and hazardous materials, control of particulate emissions) and those of lesser import in their particular positions (e.g. resource and energy efficiency issues). The trainees had sufficient background knowledge to identify where they wished further input on environmental aspects:

> 'More input on frequency converters, control engineering and the treatment of oils and hydraulic systems would be helpful.' (Industrial mechanical apprentice, TKSE, Duisburg, 2011).

The German apprentices unanimously reported that they had 'very high levels of environmental awareness' and attributed these, in part, to their 'personal backgrounds and upbringing', as well as the education received at secondary school, where environmental aspects are high on the agenda (ECORYS, 2010) – which may be seen as a reflection of the wider cultural and societal value placed on environmental protection in this CME context (e.g. Sagiv and Schwartz, 2007).

The United Kingdom

The experience of the Tata apprentices differs significantly from that of their German counterparts. As in Germany, there are no dedicated modules or classes pertaining to environmental legislation, sustainability issues, technical skills, or particular environmental techniques. However, whereas training on the environment can be explicitly identified within 'learning fields' in Germany, training content on the environment is notable by its absence within the UK apprenticeships. All of the apprentices interviewed were unanimous that environmental legislation and topics were covered in the most cursory of fashions in the education they received off-the-job in college. Apprentices' comments ranged from 'No, we haven't covered anything' to:

> 'I think it was briefly mentioned in college at the beginning of the course, but I can't tell you what was covered.' (Industrial mechanic apprentice, Tata, Port Talbot, 2011)

Apprentices commented that a significant emphasis is placed on workers' health and safety, both in college and in the workplace and that they are instructed how to conduct risk assessments as to their personal safety, but connections with environmental protection are not drawn. Indeed, prior to commencing the workplace phase of study, the 'engineering apprentices' completed a workbook entitled 'Employee Rights and Responsibilities', which assessed their knowledge of legislation relevant to their work (such as health and safety), but this did not include environmental legislation.

At the workplace, Tata apprentices stated that there had been no specific, formal off-the-job training on environmental issues, aside from induction and one Journey Day. For apprentices, as well as operators, there is a heavy emphasis on task-based, experiential learning – such practices are also evident within TKSE and reflect historically based sector practices and organisational features on workplace learning (see Stroud, 2012). However, less formal development methods, such as 'learning by doing', can facilitate the passing on of 'bad practice' and the potential for the establishment of erroneous ways of working, particularly where – in contrast to the German plant – experienced workers are not certified trainers (see Gibb, 2011). Moreover, the onus is placed on the apprentices to ask questions based on their observations, leading to a variable quality of learning experience:

> 'It depends on who's showing you what to do, how organised the department is and how much time they've got for you.' (Electronic technician apprentice, Tata, Llanwern, 2011).

When asked about the environmental aspects of their roles, the interviewees only identified waste disposal and this was limited to placing materials in appropriate bins – none of the apprentice interviewees could define 'green skills'. One stated:

> 'It's probably not taken that seriously [by apprentices] because of that tree-hugging image'. (Industrial mechanical apprentice, Tata, Llanwern, 2011).

The apprentices did recognise that environmental aspects are part of procedure and stated that as long as they follow the operating instructions and know the 'way to do the job properly', environmental protection will be achieved. However, as a number of apprentices stated:

> 'I know what I've got to do, but I don't know why I've got to do it like that… I don't know what the consequences would be if I didn't follow the instructions.' (Electronic technician apprentice, Tata, Port Talbot).

This statement reflects the philosophy and practice of the NVQ. NVQs themselves replicate the dominant production paradigm in the UK of Taylorist mass production (Lane, 1995) i.e. strict division of labour, narrowly task-focused work, lack of training and standardised, repetitive, production processes. Within NVQ structures, learning is principally work-based, courses are assessment-driven, assessments consist of compiling evidence of competence in the workplace, and the theoretical content has been reduced to the minimum deemed necessary to 'underpin' performance (Boreham, 2002; Grugulis, 2003).

It has been strongly argued that such limited task-based competence and strict procedural adherence, reinforced by the NVQ model, results in a lack of problem-solving ability and restricts the capacity of workers to respond to changes and new situations (Mason, 2005). Potentially, the latter could include changes reflecting environmentally-friendly and sustainable ways of working, but SEMTA suggests developments in this area are limited (Interview Notes, SEMTA representatives, 2011). In an attempt to emulate the German apprenticeship model and address emerging deficiencies, the previous Labour administration introduced technical certificates as a required element in higher-level apprenticeships in 2002. It was intended that the technical certificates would impart broader understanding of theoretical principles, which policy-makers believed were equipping German apprentices with the capacity 'to undertake a wider range of tasks and to respond more quickly and effectively to new work demands' (DfEE, 1998: 10). Optional in 2005, certificates were re-introduced as a requirement under the ASCL Act, although critics continue to point to the deficiencies of the UK system (e.g. Steedman, 2010; Fuller and Unwin, 2012). Indeed, Tata apprentices from across all three years of study, including those that had completed their technical certificates, confirm a continuing deficiency of deeper understanding, particularly where environmental aspects are concerned.

Discussion

Sustainable development and the regulation of environmental issues is a relatively recent policy direction for the EU, but it is growing in importance and scope (see European Commission, 2010). The various EU directives and regulations on the environment (and other

related ones e.g. health and safety) eventually filter through to company policy and practice by way of member states and their distinctive policy imperatives and regulatory frameworks. Complying with environmental regulation (and training to meet regulations) is a company's minimum obligation, and this is generally manifested where directives/regulations penetrate operations. However, innovation on environmental issues is focused by investment and this might happen in a number of ways; through capital investment, but also the investment of resources in the greening of the labour process. Clearly, our evidence suggests Tata and TKSE approach environmental issues in quite different ways. Each company exhorts CSR regarding the environment, but there is a distinct variation of approach towards the environment and green skills across the two cases.

In the German context, institutions such as the structure of the financial system and provision and availability of capital, social partnership and high skill levels have, in general, facilitated a more developmental, longer-term perspective. Being situated within this context facilitates TKSE's high value-added strategy, which is based on technological innovation and a highly skilled workforce who are capable not only of responding to change but actively contributing to it, through continuous improvement activity. It is moreover, equally applicable to the firm's environmental agenda. The long-established political strength of the green party, extensive environmental legislation, and high levels of environmental awareness in the wider society provide support for environmental protection. Subsequently, environmental regulation, and the consequent need to improve environmental performance, is viewed as an economic opportunity to innovate through further investment in new technology and crucially, complementary skills.

Thus, the inclusive approach to employee development evident at TKSE encompasses the environmental aspects of workers' jobs and apprenticeship provision, with high quality training comprehensively provided. Such training aims to develop knowledge and attitudes that enable workers to use their autonomy and apply their problem-solving abilities, thereby securing continuous improvements. At TKSE, company training is complemented by high-quality VET and apprenticeship systems – the relationship between company training and the VET system is governed by the training regulations that exist for each designated occupation (see Bosch and Charest, 2008). Companies must have training plans, which are structured by these training regulations, and the latter have been modified and updated to include environmental aspects, across all occupations. This greening has been driven by organic

collaboration between the social partners (CEDEFOP 2010a), meaning that the German VET system both shapes and responds to employers' training needs. Indeed, the high levels of in-firm training, the supportive VET system and the reliance on the participative efforts of the workforce within TKSE, in conjunction with strong (environmental) legislation operating as a 'beneficial constraint' (Streeck, 2004) seems to suggest continuity of CME arrangements, and resistance to 'liberalization' (*cf.* Hassel, 2012).

There is a clear contrast with the situation at Tata where a short-term financial perspective dominates that company's decision-making processes, characteristic of LME contexts (Kemp and Loorbach 2006). The focus here is on compliance with regulation and where innovation is evident it focuses on immediate cost reductions, rather than longer term strategies such as those focused on investment in workforce development. The latter is further undermined by institutional frameworks that dis-incentivise such developments. The green agenda is perceived as a restriction on business, rather than opportunity, which reflects the extant value orientation of the wider polity (see *Name deleted to maintain the integrity of the review process*; Sagiv and Scwartz, 2007). Economic goals take precedence over environmental aspects at Tata and although there are benefits to be gained from such efficiency drives, without embedded recognition that pursuing long-term environmental goals can only be beneficial, any behavioural changes are likely to be externally imposed and therefore short-lived, signified by the Environmental Department's description of their approach as one of 'reactive fire-fighting' or trying to enforce compliance with regulations. Our evidence suggests that such deficits extend to (engineering) apprenticeships provision.

In general, there are systematic disincentives for greening workforce development within the LME context of the UK (Hall and Soskice, 2001). Endemic short-termism and a heavy emphasis on assured, definitive financial payback undermine long-term human-capital development projects. Moreover, and by reflection, the VET system has long been criticised for its deficiencies. To focus specifically on green skills, the VET system has failed to 'green' extant provision and incorporate apposite environmental content (Jagger et al, 2012; IES 2012). This shortcoming in public educational provision – itself a reproduction of a lack of employer demand – was identified by all the Tata apprentices. Our data shows that the lack of formal training and concomitantly, the heavy emphasis on task-based learning for apprentices, means that these trainees have a limited understanding of the implications of their actions (or inactions) and the potential impact upon the environment. The stress on rigid

adherence to standard operating procedures, in which environmental aspects are implicitly incorporated, can curtail workers' problem-solving ability, their ability to adapt to novel situations as well as inhibiting the proposal of suggestions as to how improvements might be made. Of course, steel-making is a potentially hazardous occupation and safe working procedures must be specified and should be adhered to, but unbending conformity to 'one best way' of working, fostered under the dominant production paradigm of Taylorist mass production, can stifle responsiveness to changed working practice (Mason, 2005).

Conclusion

The EU's transition toward sustainable economic growth is likely to be uneven across member states. Our analysis shows that without clear objectives to create and promote green skills, within the paradigm of transition to a low carbon economy, it will be unlikely that such goals will be fully realised. The value of the VoC typology is that it allows a specification of the relationship between state, labour and capital in relation to innovation on the environment and the greening of skills. In particular, it seems the CME environment is more conducive to stimulating and enabling change. The German case demonstrates the importance of broader engagement on skills and training – particularly where VET systems are concerned. Here, as industrial sectors restructure and respond to extensive environmental legislation, a collaborative infrastructure – supported by public policy focused on environmental protection – penetrates managerial philosophies and articulates environmental policy as a source of innovation and opportunity, thus facilitating the greening of occupational competences and training regulations at the level of the firm. This process of collaboration stands in stark contrast to the LME environment, where there is a more general absence of direction from the state on the greening of the economy, and beyond efforts to comply with regulations, little engagement on the greening of skills at firm level. Evidently, it is much more likely that EU ambitions (and sector pledges) will be realised where member states in collaboration with others play a central role in formulating and developing (VET) strategies that are focused on transition.

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