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Skills in the green economy: recycling promises in the UK e-waste management sector

Ödül Bozkurt and Alison Stowell

In advanced economies the 'greening' of the economy is widely seen as promising extensive job creation and upskilling, alongside its other benefits. In popular and policy rhetoric, the growing importance of 'green skills' is asserted frequently. This study critically examines these claims within the context of the electronic waste management sector in the United Kingdom. Drawing on the cases of a non-profit organisation and a small private enterprise in North West England, we observe that despite government support for developing skills in e-waste, both the development and utilisation of skills remain minimal. Critically, the relatively more skill-intensive process of reuse is substantially less profitable than recycling and resource capture. The study concludes by noting that the expectations from the green economy for high-quality jobs need to be assessed within the context of similar, misplaced celebrations of previous transformations of work to avoid recycling the same promises.

Keywords: green skills, repair and reuse, recycling, skills policy, e-waste management, green economy, skills supply and demand.

Introduction

In advanced capitalist economies including the European Union (henceforth EU) and the United Kingdom (henceforth UK) the 'greening' of the economy is widely seen as promising extensive job creation and upskilling. Optimistic views depict this purported 'third industrial revolution' (Dickinson *et al.*, 2011) as able to simultaneously deliver such employment outcomes while ensuring the sustainable use of resources, energy conservation and lower production costs (BIS, 2010; 2011). This study queries such expectations by looking at the supply and demand dynamics for skills in the e-waste management sector in the UK through the comparative case study of a Non-Profit Organisation (henceforth Green NPO) and a small private enterprise (henceforth Green SME). The two organisations illustrate

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the contrast between supply-side policies on skills informing government investment and demand-side market dynamics informing the uptake of skills in the profit-seeking operation of private organisations in the 'green economy'. We observe a sharp disconnect between the popular broad assertions by government and others about the quality of jobs engendered by green sectors as a whole on the one hand, and the actual use and value of skills in e-waste management, comparatively in repair and recycling, on the other. The study contributes to a better understanding of micro-level dynamics of skills and jobs in the 'instantiation in real world economies' (Gregson and Crang, 2015: 234) of a key green economy sector, and reflects on these in relation to broader debates on skills development and utilisation in the UK.

The promised jobs of the green economy

Proclamations that skilled workers are 'desperately needed for the economy of tomorrow' (Lloyd and Mayhew, 2010: 431), and predictions that green sectors like offshore wind and a 'green car revolution' will increasingly create demand for 'green collar' workers heavily comprising of managers, engineers and scientists (Dickinson *et al.*, 2011) are commonplace in popular and political discourse. For example, the (subsequently dismally received and later quietly abandoned) energy efficiency campaign *Green Deal* was a key initiative of the Conservative-Liberal Democrat coalition government at the time of fieldwork for this study. Nick Clegg, then Deputy Prime Minister, launched the scheme claiming 'a quarter of a million jobs may be created' if the business opportunities for the policy were realised. He also argued that offshore wind (industry) would potentially employ an extra 70,000 people by the end of the decade, the 'green car revolution' would lead to peak demand of 'green collar' workers, and the STEM sectors would recruit an estimated workforce of 220,000 by 2016, including 50,000 managers and 35,000 engineers and scientists (Dickinson *et al.*, 2011). Clegg claimed that the UK therefore needed to 'ensure that future generations have the skills they need to take advantage of the opportunities of the green economy' (*ibid.*).

The expectations for skills-intensive jobs in the green economy are voiced across the political spectrum. The Greener Jobs Alliance, a coalition of trade unions and NGOs, focused on the 'green skills gap' in the *Green Skills Manifesto* (2013) and demands government leadership in the coordination with local governments, training the workforce, apprenticeship schemes, and curriculum changes to 'enable a transition' to a low-carbon economy, arguing 'urgent action is needed if the supply and demand sides for skills are going to come together' (*ibid.*: 1). The Alliance's caution that the 'reliance on a "market driven" approach has not and will not deliver the training and green skills required' (*ibid.*) shares the view that a low-carbon economy demands and will utilise higher skills.

Although such proclamations may involve some 'rhetorical masking' (Gregson *et al.*, 2014: 11), admittedly job creation by the greening of the economy has not been *all* rhetoric. Policy and legislation have helped create work through the requirement of certain services and products and been the main driver for certain segments of the green economy, rather than self-sustaining market mechanisms (Pearce and Stilwell, 2008). For example in the UK recent environmental policies have been closely linked to the expansion of apprenticeship places and the development of new qualifications for the 'low-carbon economy' (CEDEFOP, 2012: 32; Evans and Stroud, 2014).

However, it is not clear what a 'green collar' job entails (Greenhouse, 2008; Pearce and Stilwell, 2008; Kouri and Clarke, 2014) or indeed how many of the jobs created in a green economy will be of this type. Different usages emphasise either work performed to reduce environmental impact, associated with STEM occupations, or jobs in industries in reducing environmental impact (Masterman-Smith, 2009). The definition of 'green skills' is likewise variable, at times as broad

and vague as those involving 'the knowledge, abilities, values and attitudes needed to live in, develop and support a society which reduces the impact of human activity on the environment' (CEDEFOP, 2012: 20). The *OECD Classification of Skills at Work* identifies 'green skills' as a separate category, defined as 'specific skills required to adapt products, services or operations due to climate change adjustments, requirements or regulations' (OECD, 2010: 26).

Table 1: *OECD classification of skills at work*

Generic	Oral communication, written communication, numeracy and literacy, general IT user skills and office administration skills ¹¹
Routine	Repetitive, more basic, low-knowledge intensive skills (e.g. packing chocolates in boxes in a factory line, making copies using a simple photocopier machine)
Advanced/knowledge-intensive skills	
Technical	Skills required for problem solving; design, operation, rethinking and maintenance of machinery or technological structures or marketing plans; ICT professional skills, research skills (e.g. work developed by engineers, researchers, marketing professionals) and drafting skills
Management	Skills for business planning, regulations and quality control, human resources planning (recruitment, training and skills development) and allocation of resources (e.g. management of intellectual property, financial management, firm health and safety operations)
Social and communication	Motivation and appreciation of people's characteristics for individual and team working purposes; customer service; appreciation and communication through networks and value-chain partners (e.g. ability to reach consensus and agreements, ability to recognise individual's talent and team's contributions to common goals)
Multi-language and cultural	Ability to communicate in more than one language, appreciation of cultural characteristics of different ethnic groups (e.g. communication by a customer representative selling products/services in different countries, capacity to incorporate cultural differences into negotiations)
Converging skills	
Entrepreneurship	Specific skills required for creating and running new business ventures and innovative projects in existing firms such as risk assessment and warranting, strategic thinking, self-confidence, the ability to make the best of personal networks, motivating others to achieve a common goal, co-operate for success and the ability to deal with other challenges and requirements met by entrepreneurs
Green	Specific skills required to adapt products, services or operations due to climate change adjustments, requirements or regulations (e.g. water purification and site remediation planning/engineering in mining, solar panels installation, wind turbines design, green management, carbon capture and storage techniques)

Source: OECD 2010, BIS Report 2011

This classification, also adopted by the Department of Business, Innovation and Skills for employment projections, markedly emphasises high levels both of complexity and of competence in 'green skills', dimensions central to sociological and occupational psychology definitions of the concept of skill (Green, 2011: 10–11). Less explicitly, by tying 'green skills' to the advanced technologies related to the green economy, and pairing the category with 'entrepreneurship' in an unequivocally hierarchical presentation of skills categories, the OECD definition also presents 'green skills' as high in human capital, the conceptual core of 'skill' as understood in economics, linked to earnings potential (Green, 2011: 9). It has long been recognised that skills are also socially constructed (*ibid.*; Grugulis, 2007), that the complexity, discretion and market rewards associated with specific skills do not inevitably coincide, and that there is no 'simple equation between the possession, exercise and valuation of skill' (Spenner, 1990; as cited in Grugulis, 2007: 15). However, the aforementioned popular portrayals of jobs expected of a green economy are predicated on a coherent upgrading of all aspects at the same time.

The dirty jobs of e-waste management

Waste management is a key segment of the amorphously defined green economy and pivotal in the EU's stated goal to become a 'recycling and recovery society by 2020' (EC 2014, as reported in Gregson and Crang, 2015: 219). Profitability in reuse and recycling depends on the calculation of the extraction of value from the (materials in the) waste stream and the cost of labour to extract it with the available technologies (Minter, 2013: 162). Consequently, in waste management research that is increasingly cognizant of the global scale, labour issues have been much more salient in studies of the Global South, where labour is cheap and extraction activities labour-intensive, with scholars looking at the practices of waste pickers/scavengers as well as the 'ethnically, racially, and gender-segregated labour markets' in the informal economy of waste work (Gregson and Crang, 2015: 153–159). By contrast, research in the Global North, where waste operations are more capital intensive, has been much more preoccupied with the 'social category' of waste, consumption, and consumers (Gregson and Crang, 2015: 156). In the European context, recycling has been widely celebrated for 'stopping wastes being "dumped" on poor countries', 'decoupling economic prosperity from demands on global resources' and 'creating a wave of employment in recycling industries', but to date there has been little inquiry into 'what kind of work has accompanied' its rise within the EU' (Gregson *et al.*, 2014: 1–2). Research on jobs in reuse are sparser still, as repair activity remains severely limited in economies like the UK.

Where employment in waste management has been discussed, the focus has been on the number of jobs rather than the quality of these jobs (e.g. EREP, 2013), with policy documents nevertheless generically asserting the sector 'needs technical competence' and that 'skills are needed throughout the hierarchy of waste management' (BIS, 2011: 22). Growth is indeed strongly expected in sector employment, but an estimated 1.2–1.5 million jobs for the EU are low end (Commission of the European Communities, 2005: 3), as are the majority of a potential 24,500 jobs in the UK (ESA, 2013: 2–5). A Greener Jobs Alliance report proclaims the sector has the potential to create employment in mid-range posts, but forecasts a much higher proportion of low-paid occupations in recycling than across all workers, at 41 versus 21 per cent (Morgan and Mitchell, 2015: 11). A study of refuse processing found only 16 per cent of workers receiving training (CEDEFOP, 2012: 87) and even that mostly unregulated, on-the-job, typically between a few hours and a few days (*ibid.*: 57; Evans and Stroud, 2014). Gregson *et al.* (2014) observe how most trade press or policy documentation is mute on the low-skilled work in resource recovery, with use of adjectives like 'green' and

'clean' obscuring the prevalence of 'low-paid, dirty, monotonous and physically demanding' and even 'physically dangerous' work (*ibid.*: 11), indeed a 'dirtier form of dirty work' than in hospitality and catering (*op. cit.*) and quintessentially 'bad jobs' (Keep and James, 2012).

Repair work should stand somewhat apart in this picture. It is key for waste prevention, which tops the Waste Hierarchy, a preferential ranking of ways of managing wastes on the basis of their environmental benefit, over recovery for reuse and recycling for reprocessing (Gregson and Crang, 2015: 227). Green Alliance envisages that repair activities require comparatively mid-waged occupations and more skilled workers than across all workers, 61–67 versus 31 per cent, respectively (Morgan and Mitchell, 2015: 11). However, the relocation of manufacturing to low labour cost economies leads to the loss of skilled repair workers in the UK, leading to unreliable quality of repair and maintenance services and long-term decline in repair activity in general (Cooper, 2005:60–62). However, it is not clear how much demand there would be in the market, as high proportions of appliances 'in need of repair', rather than 'broken beyond repair', are discarded by consumers because the cost of repair relative to replacement is higher (Cooper, 2005: 60).

Different waste streams have substantially different processing requirements and e-waste management may be expected to be more skill-intensive than waste management in general. This is one of the fastest growing waste streams at around 41.8 million tonnes per annum worldwide (Balde *et al.*, 2015: 8). Given estimations of about six billion pounds' worth of precious metals per the estimated 45.4 billion dollars' worth of original electronics (ESA, 2013), it offers substantial returns in component parts alone. In the UK, the annual e-waste volume is estimated at 1.37 million tonnes, with 25 per cent of discarded electronics eligible for reuse and worth an estimated £200 million (WRAP, 2013). Globally, e-waste volumes are forecast to increase exponentially because of the increasing affluence of developing nations, the number of annually discarded computers expected to go from the 300 million in 2008 (Tanskanen, 2013) to twice that volume in developing countries alone (Sthiannopkao and Wong, 2013).

E-waste is also an 'iconic waste', the target of much environmental justice activism (Gregson and Crang, 2015: 162) and extensive EU environmental policy (Gregson and Crang, 2015: 168), in line with the tendency of 'previously unknown problems associated with the disposal of old electronics' becoming a 'top environmental priority' (Puckett, 2002; as cited in Minter, 2013: 190). Computers are a core category in e-waste and contain non-renewable resources such as copper and gold as well as materials like arsenic, cadmium, lead, mercury and phosphorous, which without proper care are harmful to life and the environment (Gosney, 2009). If not dismantled and recycled in a safe manner these latter pose health risks to those involved in their disposal and beyond (Asante *et al.*, 2012).

Associated legislation especially directed at the 'end of life' phase of products, based on the 'extended producer responsibility' principle, has shaped the sector in the EU (Cooper, 2005: 57–58). The 2003 EU Waste of Electronic and Electrical Equipment (henceforth WEEE) Directive aimed at controlling e-waste through reuse and recycling, and redirecting e-waste as a resource back into production processes, has transformed the sector in the EU and the UK. In 2006 the WEEE was transposed into UK law. New and more stringent waste handling standards were put into place and e-waste producing organisations like electronic goods retailers were required to link up with treatment partners holding the necessary permits. The growing volume, but also both the technical and legal complexity of e-waste management have rendered expectations, indeed promises, that the sector needs and will utilise skills plausible. The empirical study discussed in the next section provides an assessment of such promises.

Research context and methodology

Fieldwork for this study was carried out between 2008 and 2010 in North West England. The two cases discussed are a non-profit organisation and a small private firm operating in e-waste services in the same local economic environment and labour market. The case studies were part of a larger study on the incorporation of the WEEE legislation into organisational practices in e-waste management in the UK. Green NPO and Green SME were selected for an analysis of skills use because they allowed for the most detailed data collection on employment practices. They allowed for a critical comparison in that Green NPO illustrated skills and training made possible through government financial support predicated on envisioned skills use in e-waste management, whereas Green SME exemplified the workings of a private SME, the format of 93 per cent of the firms operating in the sector.

One of the authors worked as a participant observer for 64 hours at Green NPO between April and August 2008, when she also made 18 visits and carried out two formal and 31 informal interviews with the workers, volunteers and managers. Research at Green SME involved seven visits to the organisation's main site between March 2008 and September 2009, during which formal interviews were conducted with five key managers including the CEO and informal interviews with 15 shop floor workers. The researcher also spent 40 hours as a full-time worker in the computer disassembly area. At both sites, formal interviews ranged between one to two and a half hours. They were recorded when allowed, then transcribed or reconstructed from notes. Observations were carried out and detailed notes were kept at the field sites on discussions in meetings, informal conversations with workers and managers, and site tours. The transcriptions and notes were then arranged thematically through joint discussion by the two authors, around the key issues of skills contents of jobs, training, and skills utilisation.

E-waste management policy and the case organisations

Policies on e-waste management and especially the WEEE had created specific opportunities for Green SME and Green NPO. For Green SME, the new legal requirements for e-waste processing created business opportunities in data removal, computer monitor recycling and component sales on E-bay, with the company's annual gross profit averaging 2.9 million pounds. Originally working in the extraction and trade of scrap metal, the firm had from 1998 begun to handle e-waste. At the time of research two of its five dedicated locations and 22 of its 133 employees were in e-waste operations. Hazardous waste management, mainly the dismantling of computer monitors and televisions and the extraction of phosphorous, had become a focal activity partially because the firm already held the requisite permits prior to the WEEE. Forecasting rapid growth, Green SME had invested 1 million pounds in a new warehouse to process up to 96 tons of waste per day with plans to upscale in two to three years to '24/7' hazardous waste disposal requiring multiple work shifts. The company was not new to e-waste disposal, but the WEEE tightened the obligations of non-private persons and manufacturers for disposal and required a greater number of parts and materials to be handled in prescribed ways. Although the volume of incoming e-waste did not radically increase, processing became more intensive and demand for disposal services rose. The extension of the 'hazardous' category particularly increased the volume of business.

The WEEE had significant impact on Green NPO too. At the time of research the charity ran two warehouses, three repair facilities, two dedicated stores, and a fleet of vehicles, employing 31 full-time workers and hosting an average of 90 'volunteer placements' a year. The organisation's focus was on reuse, and its previous experience running back-to-work training schemes in reuse of household goods, including electrical appliances, provided a close fit for multiple key ambitions of the legislation. Its aims to provide affordable goods to low-income households, reduce waste, and offer training to the unemployed for re-entry to

work were highly parallel with governmental support priorities and Green NPO enjoyed enhanced legitimacy post-WEEE.

The charity generated some of the £870,000 it needed from reused furniture sales and private contracts for training in reuse, with waste management consultancy services and training programmes in computer repair bringing in £250,000 in 2012. However, by far the most substantial source for funds was government grants for retraining and reuse projects, including the ones through the Big Lottery and the Young People Services. Green NPO's previous experience helped it gain bids for public funds and it became a preferred organisation for training delivery. Its expertise was also formally endorsed by an article by the local government showcasing their model and their inclusion on the advisory board of the national network on furniture reuse advising policy. One senior manager had even received £12,000 of public funds to research the WEEE legislation. The training schemes fulfilled requirements for a range of public programmes for the long-term unemployed, so the collection, sorting, storage, repair, reconditioning of e-waste and the sales of goods for reuse were carried out predominantly by a trainee workforce that Green NPO did not pay wages. Rather, Green NPO was sustained by public money for its perceived ability to provide skilling relevant for the green economy, an example of how 'green collar' employment in wealthy nations involves sizeable injections of public stimulus funds (Masterman-Smith, 2009).

In the changing e-waste sector, Green NPO illustrated the vision policymakers have of what kind of skills would be useful and worth investing public funds in, whereas Green SME's operations more directly reflected the actual market dynamics of business and skills use. The next sections provide details for their comparison.

Work and skills in green NPO

Green NPO engaged in e-waste management primarily to help the long-term unemployed become employable, rather than for the pursuit of profit. A small group of five to six workers were paid salaries and had permanent administrative or managerial roles. Some had been with the charity since previous reuse activities in furniture and electrical goods, and the main change in their jobs with the expansion into e-waste was relative diversification. Among management roles, only that of the IT Manager's had been directly brought about by the new dynamics. Initially a trainee, this individual's career was the showcase scenario for the promises of jobs in e-waste management through reuse:

[I] had been on the dole for three years and was getting bored...[I] wanted to get on the Internet, which is what spurred [me] to get a computer...When [I] got it home the modem on the computer didn't work. [I] couldn't afford to get a new one so [I] begrudgingly took it apart and spoke to friends to find out what [I] needed to do to fix it...So that was how [I] entered into learning about PC's. [Green NPO] was advertising for staff [I] applied and took the IT courses through them and [I] ha[ve] been there ever since.

The overwhelming majority of Green NPO's workforce comprised of 'volunteers', primarily individuals on public back-to-work schemes but also those serving community service/prison orders, alongside literal volunteers. Their primary reason for working in the charity was to receive training and for most, the alternative was the forfeit of benefits or breach of community service orders. On occasion a worker on a benefit-related scheme would stay on afterwards as a volunteer in the traditional sense. Far more typically the 'volunteer' labour, averaging an annual total of around 547 working days, was paid for by public funds investing in the training rather than wages by Green NPO.

What did the training deemed worthy of public investment involve? Portable Appliance Testing (PAT) was presented as a 'transferable skill', and the main trainer talked about repairing washing machines as potentially able to 'save you

a fortune'. The most advanced skills training was in the IT course, where computers were refurbished for resale. However, the standard training programme was a 10-week 'pathway to work' scheme, delivered almost exclusively on-the-job, and the majority of work was in operations like the delivery and collection of goods and warehouse maintenance. It was possible to obtain qualifications, but these were in day-to-day operations like health and safety training, fork lift truck driving, and fire safety, not at all clearly or specifically linked to employability in 'green jobs'. In 2007–2008 there had been 90 placements and 67 qualifications awarded, with only 11 trainees going on to paid employment.

It was especially notable that even the actual skills and qualifications in IT repair and maintenance did not appear particularly helpful for employment prospects. In the IT Operations Department, where more specialist tasks in the maintenance, repair and resale of computers were carried out, there was evidence of higher skilled work and skills acquisition. Four to six volunteers worked here at any given time, in an area physically set aside from the rest of the warehouse. Although the training was still mostly on the job, shadowing permanent staff, it involved a series of technical tasks after the stripping of a computer to component parts, including component identification, component replacement, data removal, system rebuild, understanding diagnostic errors, software implementation and safety testing for resale. Based on the principle that 'starting with a shell' would enable a deeper understanding, there was no set time frame for rebuilding a computer and in practice this took 'anywhere from one/two days to a week'. This was far more detailed, rigorous and technical training than elsewhere in volunteer positions, and even included some soft skills like teamwork and problem solving. However, there were no specific qualifications attached to the skills linked to repair and reuse and it was questionable that the skills were in demand in the labour market. In one example, a volunteer who had been coming to Green NPO one day a week for many months, noted, '[I did] all the computer courses and could fix computers quite easily but unfortunately [I] could not get a job, because they want experience'. Even experience would not likely have rendered these skills highly marketable, however, as the product produced by the skill, that is a repaired computer ready for reuse, was not in demand itself, or profitable. Green NPO never managed to successfully sell the repaired computers in any substantial volume, its sales in used furniture consistently outstripping the 'recovered' e-waste it processed. The IT Manager elucidated that 'each of the areas in [Green NPO] is needed to make money and [my] job [is] under threat as IT [is] not making so much money', and he was worried enough to have looked at alternative jobs, for example teaching IT in a school.

In short, jobs were not so much created as emulated at Green NPO. Skills in e-waste reuse activity were limited and where they were developed, not linked with greater employability. While there was indeed some skilling in evidence, it was only possible through the support of operations by public funds. Despite being a highly regarded organisation in the sector, the policy view that e-waste reuse could constitute a growing and upskilled field of employment was not borne out by the example of Green NPO. We present the corresponding picture of Green SME to illustrate skills use in the profitable operations of a private firm in the e-waste sector next.

Work and skills in green SME

A comparison of the skills content of tasks carried out by Green NPO and Green SME is shown in Table 2.

The tasks carried out by the two organisations overlapped substantially, both carrying out collection, delivery, booking in consignments, product/component identification, sorting parts, testing, data removal, repair, operating system software installation, customer service, computer sales, stripping, scrapping and forklift truck driving. However, Green SME did not do safety testing, complex repairs

Table 2: Skills content of tasks at green NPO and green SME

Tasks	Skills content according to OECD classifications	
	Green NPO	Green SME
Collection	Routine	Routine
Delivery	Routine	Routine
Booking in consignments	Routine/Generic	Routine/Generic
Product/Component identification	Generic	Generic
Sorting computer and Parts	Routine	Routine
Testing the computers and monitors is operational	Generic	Generic
PAT (Portable Appliance Testing)	Generic	N/A
Data removal	Generic	Generic
Refurbishment	Generic	N/A
Repair (includes problem solving, rethinking and maintenance of machinery)	Technical	Generic (non-complex repairs)
Software installation (Operating system and application)	Generic	Generic (operating system only)
Customer service	Generic (public)	Management (private)
Computer sales	Generic	Generic
Component sales	N/A	Generic
Stripping	Routine	Routine
Chipping	N/A	Routine
Phosphorous removals	N/A	Routine/Technical
Shipping	N/A	Routine
Scrap	Routine	Routine
Forklift truck driving	Routine	Routine
Training	Management	Management
Operations Management	Management	Management
Strategic Management	Management	Management
Consultancy	Management	Management

or software installation, as it did not repair e-waste for reuse and sales like Green NPO. Instead, the focus was on recycling, and especially the treatment of hazardous waste, meaning it carried out the additional tasks of chipping, phosphorous removal, component sales and shipping. Table 2 shows how the skills content of these tasks, except training, fit the OECD categories of 'routine' and/or 'generic' skills. The only task with 'technical' skill, of repair, was completely dropped by Green SME for not being profitable.

The WEEE had created highly specialist jobs in the SME, but only two. The WEEE Compliance Manager overseeing the appropriateness of processes had found the opportunity to develop professionally on the role, in good part through extensive legislation-specific training:

I basically went along to every meeting that was going on WEEE, all around the country. I read all the various documents, the best available treatment, the recycling and recovering techniques, the roles, the WEEE itself, guidance notes, the protocols and I mean it, its, metres thick of work.

Indeed the Compliance Manager role evolved into a Strategic Business Development Manager role, having a much greater say in the overall business. This highly specialist job with considerable discretion, operational authority, and technical depth was the only one encountered in the fieldwork to entail 'green skills' per the OECD categorisation. It singularly represented the 'best case scenario' for upskilled job creation in the e-waste sector. However, even the other managerial post, of Waste IT Operations, was more constrained in its potential development opportunities, confined to overseeing the existing activities in training, customer relations, sales, finances, health and safety, general management and 'communication'.

For the rest, apart from two operative posts that required technical training, jobs involved merely routine or generic skills, through on the job training. Two waste IT operatives needed to be able to identify computers and their components and carry out non-complex repairs, data removal, and dismantling. The skills needed were broadly generic, for instance sufficient to 'perform Google searches on what parts are' or if they had found a piece of equipment 'they could not identify'. The very basic computer build and maintenance skills actually utilised at Green SME had been mostly self-taught, for example by the operative who had spent time at a friend's computing shop where he had learned to 'build a PC and eventually how to trouble shoot problems with system builds and software failures'. These skills were not needed nearly to their full extent in the work carried out at Green SME, the previous knowledge mostly helping make the more basic IT tasks more efficient.

The remaining 19 workers processed the hazardous waste, a job demanding little skill and involving considerable risk. Their jobs required switching the computer monitors on to see if they worked, and if so sorting them for exporting for reuse. Non-working monitors were dismantled, components extracted, and phosphorous removed. The work was done in a traditional assembly line, although for disassembly. This was highly repetitive, manual, and physically demanding work, requiring stamina and considerable force and only very basic skills. The e-waste processed for reuse was negligible and items were discarded at a much lower threshold than at Green NPO when it was deemed they would take too much time and effort to repair. As Green SME concentrated on the market returns of e-waste, it minimised the reuse activities potentially demanding and fostering higher levels of skill, and expanded in the low-skill activities that proved far more profitable. This was a near perfect illustration of the observation by Gregson and Crang (2015: 226) that 'within the UK waste management business the source of revenue has been receiving waste, not reselling it or its products', with especially the higher charges for more problematic material in large quantities being the main revenue generator (Gregson and Crang, 2015:226).

The workforces of the two organisations also offered a contrast with implications for skills use in the green economy. Although both comprised overwhelmingly of young men between the ages of 20 and 30 with mostly secondary education and few or no qualifications, Green SME had only four British workers, one of them a foreman, whereas the rest were recent Polish migrants, in line with the observation by Gregson *et al.* (2014) that much of the 'dirty work' in resource recovery in the Western EU is carried out by itinerant, migrant labour from the second-wave EU member countries. Green SME's IT Waste Operations Manager argued that 'not many people in our country want to do that kind of work for that kind of pay'. The absence of migrant workers at Green NPO could be explained by their different levels of eligibility for publicly funded training schemes. The contrast between the policy-backed resourcing of Green NPO and the market-based resourcing of Green SME corroborates the disconnect we propose between skills policy and use in green sectors.

Discussion

The cases presented here offer several insights into the promises of upskilled employment from a greening economy. Legislation had certainly provided some growth impetus to the waste management sector through the redefinition of the category of e-waste and tighter regulation of processes. However, not all activities in e-waste management were valorised to the same extent, with resource recovery proving far more profitable than reuse. The promises of green jobs, and especially upskilled jobs, need to be assessed with this key point in mind.

The cases of Green NPO and Green SME do not offer definitive conclusions about the overall success of government policy on developing skills for the greening economy and the utilisation of such skills in profitable operations, but they do provide an illustration of how the two do not neatly coincide. Green NPO, its training and its funding were all predicated on the *anticipated* and indeed *desired* nature of consumer demand, but Green SME illustrated how a profit-seeking, private enterprise could *adjust* to the market dynamics by focusing on the least skill-intensive, high yield segment in which demand is ensured, because required, by legislation. The real impact of the greening of the economy on jobs is at least partially obscured through organisations like Green NPO, which remain viable through public funds injection.

Several observations can be made based on our empirical study, as follows: Firstly, precious few jobs involving 'green skills' as defined by the OECD were created in Green NPO and Green SME. These were primarily managerial roles whose remit revolved around legal compliance and so in fact only partially entailed green sector-specific skills. Indeed, the centrality of compliance activity to the creation of seemingly high-skilled jobs in this study raises questions about the very meaningfulness of the notion of 'green skills', which appear more to be about a domain of activity rather than a discernibly specific type of skill. Just two such jobs in each organisation were created, even with a generous interpretation. As the promise of the green economy is meant to be about the volume as well as the quality of jobs, such tiny figures are discouraging even in the case of small organisations.

Secondly, the different activities within e-waste management, typically presented in optimistic lists that rhetorically present the field as rich and multifaceted, are not all equally profitable and commercially viable. Here, computer recovery and reuse simply was not profitable and, without the injection of public funds into training, not sustainable. Green NPO did spend time and resources on generating some skills, but only because the costs were directly or indirectly borne by non-market mechanisms. Green SME had drastically lower thresholds for when refurbishment was considered too complex and time consuming, as these had direct wage costs without creating resale value.

Thirdly, the development and utilisation of skills were not aligned. As a result even where Green NPO's training schemes were successful in their own terms, they did not increase employability in any meaningful way. Green NPO recognised the IT skills gained by volunteers, but prospects of employment in IT-specific jobs remained limited to the point of non-existent. Taken together, the comparison of Green NPO and Green SME raised the question posed by Lloyd and Mayhew (2010) at the aggregate level for UK skills policy: 'If skills were so central to business success, why did firms not simply invest in workforce skills themselves?' (op. cit.: 431).

Fourthly, and rather paradoxically, there were in fact instances where e-waste management benefited from skills, especially previously acquired skills. In Green SME the workers who did the tasks with the relatively higher technical content brought self-taught skills to their work. They had high levels of 'knowledgeability at work' where they knew 'a great deal about the work they do but where tasks

are constrained and discretion limited' (Grugulis, 2007: 13). Their skills were important and in fact necessary for handling the intensified and speeded-up labour process around component identification, selection and retrieval with precision for long stretches of time. However, even while utilised or relied on, these skills were not recognised or, consequently, rewarded.

Two further points are offered by a synchronised look at how the promise of the green/recycling economy played out in Green NPO and Green SME. Firstly, the idealised scenario embodied by Green NPO's focus on reuse completely downplayed the strongest growth area that of hazardous and therefore higher risk work (Gregson *et al.*, 2014). Secondly, the contrast between a domestic workforce trained through public funds in a 'green', NPO versus a migrant workforce employed in a business model based on minimal utilisation of skills highlights that there are likely to be political rationales and political ambitions informing the way the future jobs in a green economy are portrayed, with uncertain links to actual labour market dynamics.

Conclusion

Our observations in the context of e-waste management are regrettably not surprising against the backdrop of the well-documented 'low skills equilibrium' characterising the UK labour market (Finegold and Soskice, 1988; Keep *et al.*, 2006), where investment and employer involvement in vocational training and skills remain much more constrained than in most comparable countries (Payne, 2009, 2012), despite this having been repeatedly identified as a source of a relative productivity lag (Penn, 1999; Grugulis, 2003: 457; Leitch, 2006; Lloyd *et al.*, 2008). The professed greening of the economy does not appear to provide a radical departure in this respect, certainly not in the booming e-waste management segment.

The findings of our comparison between Green NPO and Green SME also concur with the likewise widely noted point that a supply of skills does not lead to improved employment prospects or job quality, absent actual demand. Skills in the individual, skills in the job, and skills in the social setting are not necessarily congruous, much less the same (Cockburn, 1983; Grugulis, 2007). Skills policies based on the assumption that 'the individual attainment of marketable skills, knowledge and credentials is the means by which to overcome traditional forms of social disadvantage' (Wilton, 2011: 86) remain problematic where skills in individuals are not matched by skills in jobs or in the social setting (Wilton, 2011), or where the supply of skills is not met by the demand for skills (Keep and Mayhew, 2010; Keep and James, 2012). Successive UK governments have undertaken supply-side initiatives for boosting skills through training and credentialing (Lloyd and Mayhew, 2010), for example in the rapid growth of mass Higher Education (Keep and Mayhew, 1999; Thompson *et al.*, 2001; Warhurst *et al.*, 2006). In fact poor skills utilisation has increasingly become a problem (Payne, 2013), and not only for the highly skilled (Wright and Sissons, 2012: 5). At the low skilled end of the labour market a skills gap reported by employers (Dickinson *et al.*, 2011) coexists with substantial skills underutilisation (Winterbotham *et al.*, 2014). Our observation of the disconnect between the optimistic expectations for the nature of jobs in the green economy and the kind of employment engendered in e-waste management highlights that the dynamics here do not break away from these larger patterns.

Finally, having demonstrated that in a booming segment of the green economy negligible employment is created involving 'green skills' as defined by the OECD and adopted by a cascade of policy bodies, we propose a much stronger emphasis on a wide range of repair skills in both analysing and defining 'green jobs'. These are just as, if not more, immediate for a substantial greening of the economy, beyond the skills centred around legal compliance as emphasised by the OECD classification, and those focused on product design, as influenced by 'life cycle'

thinking. Admittedly, the valorisation of repair skills is only possible through a paradigmatic change involving the slowing of consumption and a political, social and cultural (indeed ideological) transformation prioritising the reduction in waste, and challenging a production regime propped by the planned obsolescence of household products (Cooper, 2004). Minter (2013: 114) notes that 'people who don't earn enough money to buy new laptops, desktops or smartphones', or 'most of humanity' is still keen 'to use an older computer', but only until affluence disrupts such 'thrifty practices' of developing economies (*ibid.*: 115). Until such thrifty practices are reintroduced to developed economies and the hierarchy of rewarded skills significantly rearranged, the green economy will likely be more about recycling promises rather than a bona fide growth in good, green jobs.

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