Preparing England's Further Education System for Zero-Carbon Construction Skills

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Introduction

The construction industry is commonly highlighted in public policy discourses as being essential to the UK's net zero ambitions (eg EAC, 2021). A particular focus is often placed on the affordances of emerging 'green' technologies and the implications this will have for the nature of construction work and the skills required in the sector (BEIS, 2021). However, such skills are frequently only vaguely defined (ILO, 2016) and there is a tendency to focus solely on technical skills (linked with new technologies) and skills explicitly associated with STEM disciplines. While STEM skills are needed, they are not sufficient on their own; also needed are skills associated with sustainability values and employability skills that will support the workforce in navigating an uncertain labour market in the longer term (Killip, 2020). Similarly, skills discourse tends to focus on topic content of curricula, not on the construction sector's readiness to learn, nor on the education and training (E&T) sector's capacity and capabilities to deliver. Little attention has yet been paid to the practicalities of skilling the construction work force, the preparedness of the existing education and training (E&T) system for meeting these demands, and the challenges the E&T system is likely to face.

Therefore, in this paper, new technology deployment in construction is approached from a skills and E&T perspective. Within the construction sector, the focus is on the changing E&T needs of onsite construction trades in England as this offers a clearly bounded part of the sector at the forefront of net zero technological developments. Professional and higher education is not the starting point here. Instead, it is the vocational education and training (VET) within Further Education (FE), which is the main training pathway for onsite trades. This study examines the ways in which the E&T system is (or is not) prepared to equip the onsite trade construction workforce with the skills needed to deliver a zero-carbon built environment, and the challenges the E&T system faces in delivering these skills.

These questions were explored in a qualitative study that brought together relevant stakeholders with experience at the intersection of technology deployment and the E&T system, including E&T organisations, academic researchers, industry representatives, public sector organisations (outside E&T) and a small number of others. These aim was to investigate, in an exploratory way, two key elements that are often ignored in both academic and policy literature. Firstly, it enables the foregrounding of the tripartite relationship between technology deployment, broad skills needs, and

the shape of the skills formation system. Secondly, it addresses the institutional arrangements and preparedness for delivering these skills in a way that can positively affect mainstream industry practice and culture.

Context

A brief description of two contextual factors serves to situate the discussion that follows: firstly, the prevalence of design-performance gaps in construction projects and the importance of quality in delivery to minimise those gaps; secondly, the widespread implicit assumption that skills issues can be solved simply by providing new courses, rather than seeing E&T as a system, closely linked to workplace practices and industry culture.

In research on energy in buildings, there is a measurable gap between what the designer intended and what monitoring reveals about real-life building performance. A review of over 100 studies in new housing in the UK identified three underlying causes of the design-performance gap:

- Poor technical understanding
- Unclear boundaries between roles and responsibilities on project teams
- Poor communication

(Zero Carbon Hub 2014)

Equally, there is evidence that projects built to meet Passive House standards show a much smaller design-performance gap than conventionally built projects (Johnston et al., 2016; 2020). The evidence from the UK suggests ‘quality assurance of design and construction is the major cause of deviation’ (Johnston et al., 2020: 1627). Turning now to the question of skills, McGrath (2012) identifies several important ways in which vocational education and training (VET) is under-theorised in academic research. Citing Anderson (2009), McGrath summarises two important underlying assumptions in what he calls the ‘dominant orthodoxy’ of productivism:

1. Training leads to productivity, which leads to growth (‘training for growth’)
2. Skills lead to enhanced employability, which lead to work (‘skills for jobs’)

McGrath identifies several limitations of the productivist orthodoxy, which are relevant to the focus of this paper. He argues that it is:

- too individualistic in its assumptions regarding employability, ie it ignores structural issues in the education system, labour markets and wider socio-economic context
- too short-term in its focus on immediate employability rather than lifelong processes

- too focused on delivery by public institutions, ignoring the complexity of forms of delivery and acquisition of vocational learning
- too centred on formal learning in educational institutions rather than informal learning

(Adapted from: McGrath 2012, p. 625)

Some of the structural issues (ignored in the dominant orthodoxy) are key to the debate on education and training for a zero-carbon built environment. Firstly, a narrow focus on skills supply (new courses) ignores the question of whether there is real demand for the skills being taught; and, even when there is a healthy demand for training, there is no guarantee that the acquired skills will be used in the workplace (Keep, 2016). Secondly, the positive connotation of 'skills' leading seamlessly to more and better jobs can be misplaced. The construction sector has many of the attributes of a 'low-skills equilibrium', a stable socio-economic structure in which low skills are aligned with low wages, low prestige and low job security (Green, 2016). Higher skills are possible, of course, but they are aligned with a higher degree of professionalism, which would entail structural change in labour markets as well as higher orders of competence (Killip, 2020). The important point is that new courses do not in themselves stimulate demand for higher competence in the workplace.

Methodology

The research question was addressed through a deliberative workshop design with invited expert stakeholders. Five concurrent discussion groups brought together key stakeholders from across the construction industry (including trades, and sector representatives), construction related E&T, academia, and public sector bodies (other than E&T). See Table 1 for numbers of participants by category. The workshop was held online and led by members of the research team. Discussions were deliberately open in nature, but structured around a series of key prompts closely linked to the research questions. Headline findings were published in a report (James Relly et al., 2022), but not the detailed analysis behind the findings. This paper fills that gap.

All workshop sessions were recorded and transcribed. Data were analysed thematically using deductive and inductive approaches to generating codes and themes. The thematic analysis provides the sub-headings in the Findings section.

Table 1. Numbers of workshop participants by sector category

Category	Number
Academic researcher	16
E&T organisation	14

Industry	3
Public sector (not E&T)	3
Other	4
Total	40

Findings

The findings are presented in a way that aims to draw out the complexity of the tripartite relationship between technology associated with net zero, emerging skills needs, and the shape of the skills formation system, highlighting particularly how prepared the E&T system is to deliver new skills. A broad sector category (Table 1) is given with each quote to help the reader understand the different perspectives present.

Defining 'green' buildings, jobs and skills

It may not be possible to find a single, consistent definition of 'green' or 'sustainable' that can apply equally to buildings, jobs and skills. While the means exist to measure the energy consumption and emissions associated with the operation of a building, it is a different challenge to attribute technical performance in use to the quality of skills and jobs that went into creating the building in the construction phase. Nonetheless, participants' experiences led them to argue that quality of outcome is linked not just to content, but also to higher orders of learning across technical and non-technical subjects:

'The main measure for me would be the outcome [...] and to enable an outcome to come about you need a really [...] well educated workforce that doesn't just have the technical skills, but also understands the wider context.' (E&T organisation)

Workshop participants identified creativity, technical understanding, communication skills and teamwork as all being important. The problem was perceived to be as much about coordination and management of different professions as it was about technical aspects:

'We need to train the entire planning, design and delivery team. Everyone in the sector needs to understand how this works. [...] The trades need to interrelate. Everyone needs to be communicating better and not working in silos as we have been in the past.' (E&T organisation)

The longer-term question of a person's career path also arose in workshop discussions. It was acknowledged that future skills needs are unknowable in advance. An openness to continuing education was identified as important, which in turn requires humility and self-evaluation in the individual:

'they need to be ready to have a mindset that says […] "I am aware that my skillset will need to shift in response to changes in the workplace, so I have to be receptive and ready for my need to upskill."' (E&T organisation)

Such self-reflexive decisions and actions need to be embedded in 'dispositions', individual habits or customary practices, which are developed more through experience, observation and reflection than through formal training:

'A lot of dispositional learning comes from observations and they can be positive or negative. […] It's not about telling people stuff. It's about finding ways of engaging people to think about these issues and [make changes] to their practice' (Academic researcher)

In summary, good technical understanding is a necessary, but not sufficient, component of 'green' skills. Other components include so-called 'soft' skills: communication, team-working and creativity. A commitment to CPD is needed to keep up with changing circumstances, along with dispositions for self-reflexivity in the workplace as well as in the classroom.

Market context

The jobs-skills link

The question of real demand for skills in the labour market came up repeatedly. Several examples were given of time and money being wasted in developing new skills and facilities without sufficient attention paid to the lack of real demand:

'until we've got the demand [for this kind of work] the discussion about what the courses should be is kind of academic' (E&T organisation)

'Colleges invested millions into producing fantastic on-site facilities to deliver this qualification. They had no take-up whatsoever.' (E&T organisation)

The issue here is two-fold: firstly, there is plenty of work available for people with no training at all, so there is no purposive incentive to train; and secondly, the training represents a double financial penalty in terms of course fees and lost income:

'in terms of getting self-employed people to get engaged with training […] any time they are training they are not working. They are losing income as well as having to pay the cost of training.' (E&T organisation)

In other European countries, where the VET system has a broader industry focus and the views of employers are negotiated with other social partners (eg unions, educationalists), the problem of low course take-up simply does not arise, as this German participant explained:

'one thing the German model does afford is we don't have the discussion that you have [in the UK] with the FE sector or colleges producing skills that nobody wants.' (Academic researcher)

Consumer/client education and advice

The industry has to remain responsive to client demands, which means that any project involves ongoing negotiation over goals, decisions, time, money, unforeseen circumstances and other constraints. Workshop participants saw a role for the industry in potentially educating clients about building management, technology, controls and data in relation to 'green' buildings. Preparation for this advice role could draw on communication and interpersonal skills, which are also needed to achieve better coordination among project teams:

'it maybe comes back to those core employability skills [… preparing people for] providing direct advice to customers […] How you embed that within existing training structures is I think a critical issue.' (E&T organisation)

Team coordination

The issue of unclear roles and responsibilities on project teams arose in the workshop. There is a need to move beyond narrow task-focused training, so that each member of a project team understands how their work fits with the work of others, and how that might impact on the final quality of the end result:

'how do you bring multiple different occupations together, because it's not enough for one person to understand that; you need the whole team on site to realise how their part of it […] plays into the overall building performance.' (Industry)

Better team coordination takes the discussion beyond training: also relevant are contractual arrangements that reduce the reliance on sub-contracting, and by which common standards of training and practice might be more readily achieved:

'direct labour […] particularly for retrofit, I think that's a solution, somewhere like Glasgow [City Council], which employs 2200 workers in Glasgow City Building, and they do all their training with the FE colleges.' (Public sector)

However, direct labour organisations relate to large organisations with large estates, where there is sufficient ongoing building work to justify employing a dedicated labour force. For smaller estates and privately-owned homes, work is done on a project by project basis using contractors and sub-contractors.

Recruitment & retention

Shortages of skills are compounded by shortages in numbers of workers. Before the workforce can be trained, it first needs to be recruited and, ideally, a way needs to be found to retain people in the industry for a long career. Common to any industry is the tension between how and when to be selective about recruitment and workforce development – with options ranging from very stringent entry requirements (and smaller numbers recruited) through to very lax entry requirement (and smaller numbers retained). The construction sector's approach was perceived to be unsophisticated and not very effective:

'we go through 50 people [...] after a week they're told to get off the site. That isn't a very efficient process, is it?' (Industry)

Another key issue is whether to focus recruitment on young people (school-leavers or college-leavers) or whether to engage people with transferable skills gained from outside the construction sector:

'we need a cultural shift, getting firms to look at a broader recruitment and look at other sectors and how we might transition people [to join the construction sector]. (E&T organisation)

The question of immigrant labour also came up in the workshop, noting that migrants from countries with good VET systems may already have some of the desirable skills and dispositions discussed earlier:

'People are often quite satisfied with the quality of the people [...] sometimes better than the people from home. Perhaps it is linked to the quality of technical education [in their home countries].' (Academic researcher)

In summary, new courses will fail to attract sufficient students if the learning on offer does not match the reality of jobs on the ground. Skills training needs to be better coordinated across different construction occupations, and there is a role for project teams in educating and advising clients. Communication skills are therefore important. Recruitment from outside the industry's existing contacts might help to diversify the workforce and shift the culture.

Policy and strategy

Licensing

The UK operates an unlicensed labour market for craft occupations, which means that there is no entry qualification into the industry, unlike in other countries:

'in mainland Europe […] it really is almost impossible to go on site without a clear – at least level three – qualification.' (Academic researcher)

Licensing can be seen as a complement to technical building standards, creating a market where those working on construction projects have to carry a card showing they have the necessary qualifications (they are 'carded' in industry parlance):

'Building standards need to be higher and low carbon building skills could be "carded" (…) a licence to build could help fix this.' (E&T organisation)

Such regulation relates to industrial strategy rather than education policy, but the two are linked and need to work together. Public sector procurement can also drive demand for ambitious standards:

'The solution is beyond individual colleges – government regulation has to be part of that, procurement requirements too.' (E&T organisation)

Industrial strategy

Workshop participants highlighted the need for consistent, long-term policy in shaping the future of construction work and training:

'the government really needs to step in here and actually take a role in shaping and supporting the development of new markets if they want to have that long-term skill supply and give some assurances to the construction firms that these are the skills that they need to develop' (Industry)

Uncertainty over future technology markets has a direct impact on the E&T system, leading to uncertainty in the technical knowledge that needs to be developed:

'even the government's own strategy says "but we are also investing in hydrogen." What if hydrogen becomes a thing by 2035? Heat pumps could be completely off the agenda.' (E&T organisation)

Education system

Low prestige of VET

A theme that was repeated several times in the workshop discussion is the low prestige of further education compared with higher education. A steady growth in university admissions in recent years is perceived to be to the detriment of vocational training in Further Education:

'If we keep on insisting everybody's a failure unless they go to university we are never going to get the people with the [level] 3, 4, 5 skills that we actually need to fit the heat pumps and deal with the retrofit stuff as well.' (E&T organisation)

The low status of FE and careers in construction is reflected in the priorities of schools and careers advisors:

'schools are massively focused on getting people into universities [...] which is totally understandable from the school's perspective. But if they're not informing people about these careers [...] then that demand is never going to be created.' (E&T organisation)

Fundamentally, and linking back to the idea of a low-skills equilibrium, the real-world employment prospects do not make construction an aspirational career:

'selling it to young people [...] your first port of call is selling it to their parents [...] if you're not able to demonstrate to parents that there is a market need, that their child is going to have a job at the end of this, it's going to be really hard to get buy in.' (E&T organisation)

International comparison

Several workshop participants brought insights from experiences in other countries, which organise and govern their VET systems very differently from the UK. These insights show the importance of coordinated strategic efforts, wider engagement of stakeholders outside industry in shaping E&T provision (eg unions and educationalists):

'We've got a big project with the Canadian building trade union [which has a] major responsibility for training and construction in Canada. And the project is funded by the government. And it's on embedding climate literacy into the building trades.' (Academic researcher)

'in Belgium and Germany the [continuing education and training] builds on the initial vocational education and training system. So there is a substantial degree of standardisation. [But in the UK] by and large it's provided by employers, organisations, private providers, and not standard, and that's where we have a huge problem.' (Academic researcher)

In comparison, the UK's VET provision lacks resources and does not provide higher order skills; nor are those higher order skills really needed in the labour market:

'in the UK [...young people] end up going to do completely underfunded courses [...] where they got taught very basic skills and then just sent into the pretty unregulated workplace.' (Academic researcher)

FE colleges and training trainers

The workshop included several representatives of the FE sector, who were able to set the green skills agenda in the real-world context of other, competing priorities:

'we have a large list of very […] important, very urgent things […] number one priority [is] sexual harassment. […] we have duties around 'prevent' because […] the country's on high alert for terrorist attack. We […] have to instil British values […] we need also to do English and maths […] work experience […] and the list goes on and on […] It's very difficult to train everyone in everything.' (E&T organisation)

Any new training initiative places extra demands on trainers, whose own skills and knowledge may need improving. The resources for training trainers – in terms of people and time – are currently not available:

'[the trainers'] time is under pressure, they have one hour per week which is designated as 'enrichment hours' […] so that's 32 hours a year, of which we can probably only take up a quarter or a third. So we've got maybe seven to ten hours to teach all of this stuff.' (Other)

More generally, and not limited to the issues around green skills, workshop participants describe a chronic shortage of suitable staff to teach in FE colleges:

'we have real [problems] … none of this is new, it is country-wide and it's decades old - getting the right people to come in and teach our learners.' (E&T organisation)

Learning pathways

Formal and informal learning

Some elements of vocational practice can be learned through informal coaching by more experienced co-workers, such as material handling and the dispositions that underpin industry culture. But theoretical principles in technical subjects require some formal education component. Where this formal education is absent, there are risks of poor practice being repeated and reinforced through the transmission of poor practice:

'two thirds of training in Germany and Sweden doesn't take place on site at all […] People have this idea that you can learn by doing in construction, and that's probably the most dangerous thing you can do.' (Academic researcher)

Nor is all formal training equal in terms of achieving learning outcomes and lasting workplace practices. The methodology of teaching is just as important as the technical content:

'There is a pedagogy [question] here; it is not about being didactic. In what ways can we persuade [people] that these practices are worthwhile engaging in? (Academic researcher)

Initial versus continuing education and training

A distinction was made in the workshop between initial E&T (what a person learns before entry into the workforce) and continuing E&T, more normally referred to as continuing professional development (CPD). Both are needed, as is better coordination between the two:

'the standards for apprenticeships need to be updated to incorporate green skills, but we also need ways to support already-trained apprentices to gain those new skills to stay relevant and up to date' (E&T organisation)

CPD was identified as particularly important, because there is a very large existing workforce with gaps in their knowledge and skills:

'the majority of the work will be delivered by existing tradespeople [...] needing an update on their knowledge in terms of understanding the building and the system.' (E&T organisation)

However, the system of provision for CPD was described as fragmented and chaotic, with manufacturers and others developing training as best they can, but with no overall notion of a curriculum designed to teach everything that is needed, using appropriate pedagogy:

'there is no curriculum for continuing vocational education and training [...] you could be doing a couple of hours of training provided by a manufacturer [...] the next manufacturer could be doing something else [...] everybody does it their own way. And this is a huge problem because the standards that are needed are high, and it has to be the same.' (Academic researcher)

Discussion

This research addressed the challenge of 'green' skills in construction craft occupations by eliciting debate among a group of expert stakeholders with perspectives from the E&T sector. This is in contrast with much research on building decarbonisation, where expertise in engineering and economics tends to predominate. Despite the limitation of being based a small number of expert views, the results raise several serious doubts about the preparedness of the E&T system in England to meet the challenge. This topic deserves greater scrutiny and further research.

Issues raised in this initial piece of research can be summarised as follows. For the E&T system, one key challenge of zero-carbon is that it places a strong focus on the outcomes of construction activity, not just the inputs. Building energy performance is influenced by processes and practices across craft trades and design professions, for which there needs to be shared technical understanding and good 'soft' skills, including for communication, creativity, and collaborative problem-solving. Construction is a project-based activity delivered by multi-disciplinary teams, but current E&T provision is mostly

defined by tasks and conventional job roles, with little attention paid to the quality of outcomes in terms of building energy performance. Self-reflexivity can be taught in the classroom but the dispositions to work collaboratively need to be present in industry culture if classroom learning is to have a big influence on practice.

There is currently a very small level of demand for learning these skills, reflecting a very small demand in the work environment for this kind of competence. Construction craft occupations have many of the characteristics of a low-skills equilibrium, in which low skills are associated with low prestige, low wages and low levels of innovation. Countering this situation appears to require a much greater degree of coordination between different areas of policy for climate, energy, building standards, education. A long-term, consistent strategy is needed to give the industry the confidence to invest in making quite profound changes to conventional practice.

The view from the FE college sector shows how ‘green’ skills have not been sufficiently high on their long list of other priorities, many imposed by government diktat. There is not sufficient time or personnel to do everything, and skills for zero-carbon remain largely neglected, despite the clear realisation among all stakeholders that construction skills are important for achieving climate targets in the built environment.

Not all forms of E&T are equal. Distinctions can be drawn between formal and informal learning; and between initial and continuing VET. In the absence of real demand for ‘green’ skills in the labour market, much of continuing provision is left to a wide variety of manufacturers, independent training providers and others, working to their own interests and priorities. The lack of proper standards for CPD means that the provision, while well-intentioned, ends up being fragmented and piecemeal.

Conclusions

On this evidence, the E&T system is largely unprepared to equip the construction workforce with the competence required to deliver climate policy and building performance objectives. The issues identified are systemic in nature, and it seems clear that structural changes will be required, not simply the creation of new courses and training opportunities. A set of inter-connected challenges exist:

- A lack of clear industrial and educational strategy linked to climate policy goals
- he low prestige of FE generally compared with HE among policy-makers, schools, students and parents alike
- too many competing priorities in the FE sector, along with a long-term difficulty in recruiting suitable trainers

- an uncoordinated approach to CPD courses with no agreed standards of provision, so that, despite the well-intentioned initiatives of many training providers, the overall effect risks confusion and fragmentation rather than a coherent, joined-up curriculum
- The demand for skills training needs to be understood in the context of real market demand in the jobs market, which currently shows many characteristics of a system in low-skills equilibrium
- The positive dispositions needed for collaborative problem-solving may be influenced by training, but the diffusion of such dispositions needs a supportive industry culture

International comparison of VET systems suggests that better outcomes are indeed possible, but the scale and systemic nature of the challenge should not be under-estimated. The perspective of educationalists and experts in the current training system needs to be included in future strategic debates about jobs and skills 'gaps' if the construction sector's contribution to climate mitigation is to be effectively achieved.

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