



UK COMMISSION FOR
EMPLOYMENT AND SKILLS

Technology and skills in the Construction Industry

Executive Summary
September 2013

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'Technology and Skills in the Construction Industry' details the findings of a study into the role of technology in driving high level skills needs in the construction industry, with a specific focus on offsite construction.¹ The construction industry is one of the most important sectors to the UK economy, with 12 per cent of construction taking place offsite (Taylor, 2010).

This report is one of a number of studies commissioned with the purpose of understanding the skills needs of Government priority sectors.² This is essential in order to ensure appropriate responses in relation to tackling skills gaps and shortages, so that the UK is best placed to compete in a global marketplace.

The research used a mixed approach of depth interviews with academics, industry representative bodies, employers, trade associations and professional institutes, combined with a literature review and roundtable discussion events.

Offsite construction

Offsite construction is a method of building used for thousands of years that can be traced as far back as Roman times but is perhaps most commonly associated with post-war rebuilding, in the form of pre-fabricated building.

Today offsite construction, one of a number of 'Modern Methods of Construction' (MMC), is increasingly technology driven. Currently, there exists no universal definition of offsite construction but it is widely recognised as comprising four main types of assembly which range from small scale items such as light fittings; large scale modules and panelised systems; units of fully enclosed space (i.e. individual rooms); to complete buildings.

The concept of offsite is closely associated with manufacturing and draws on principles which seek to achieve improvements in quality, reductions in waste and improvements in the efficiency of the overall build process.

¹ This study uses a broad definition of high level skills, based on national qualification levels: level 4 and above of the Qualifications and Credit Framework in England and level 8 and above of the Scottish Qualifications and Credit Framework.

² Construction is a priority in the Department for Business Innovation and Skills' Industrial Strategy; Finance and Business Services (architecture element) is a Scottish Government Key Sector; Construction is a Welsh Government Key Sector.

Profile and importance

Due to the lack of a universal definition of offsite, estimating the scale and value of the offsite sector is extremely challenging. The most recent estimates put the value of offsite construction at around £1.5bn, with a potential to achieve as much as £6bn. Projections for 2013 (developed in 2009) suggest the current value of the sector as likely to be 7 per cent of total construction output (Gambin *et al.*, 2012). In total, the construction sector currently contributes nearly £90bn to the UK economy (BIS, 2013). A share of 7 per cent would equate to over £6bn.

The offsite market is mainly split between small, innovative developers typically based around a particular technology or product, and large construction companies.

The current geographic distribution of offsite construction is uneven, with regional 'hubs' of expertise and activity: Scotland is recognised as a major hub of timber frame assembly (most notably in the house-building sector), along with parts of Wales; a large concentration of offsite construction is to be found in the South of England, mostly on large-scale infrastructure projects such as schools, hospitals, hotels and student accommodation. In the latter region there is generally greater take up of offsite construction methodologies; more so for infrastructure projects, commercial buildings, schools, hospitals and student accommodation than perhaps large scale domestic builds.

The potential uptake and growth of offsite construction is heavily influenced by a number of factors some facilitating, and others impeding the level of market demand.

Currently, weak demand has suppressed the market for offsite, combined with some wider industry reluctance to adopt certain innovative technologies, with resistance from financiers and insurers to invest in what are seen as new, untested technologies. Factors such as national/regional differences and related local demand, availability of materials, access to skills and training, foreign competition and capacity to bring products to market all have, and will continue to have, an impact on growth, and its rate. Fully harnessing the potential of offsite construction relies on achieving the critical mass required to realise arguably the most attractive benefits of time and cost savings.

There are however notable drivers influencing the uptake of offsite technologies, particularly in relation to the need for higher volume output in home building and the impetus of the low carbon agenda. Offsite is an opportunity to more tightly control costs, respond to government targets for Building Information Modelling (BIM) and energy efficiency, increase efficiency in the build process and improve quality (including site health and safety).

One of the key advantages of offsite construction is the greater efficiency and quality of the build process. The fit out of buildings can be done in the factory setting, modular steel or timber frame systems can be adjusted for performance and cladded offsite.

The use of offsite technologies can encourage a greater diversity of people into the sector, including more young people, due to weatherproof working conditions and a reduction in the use of manual labour.

It is extremely challenging to forecast exactly when growth in the offsite sector might happen, over the short, medium or long term, and when demand for certain skills and job roles might be realised and in what quantity. Nevertheless, there are very real opportunities for the sector to compete globally in an already buoyant international arena (currently dominated by Germany and Austria), with legitimate export potential.

Furthermore, there is encouraging scope for economic growth in the manufacturing sector. The obvious links between manufacturing and construction in relation to offsite may offer greater potential for the construction sector to benefit from such growth.

Skills and knowledge for offsite construction

The greater uptake of offsite construction is likely to have a gradual impact on existing skills and job roles although the requirement for appropriate training and qualifications is likely to be more immediate.

Core, higher level skills and knowledge needs for offsite can be categorised as:

- collaboration between disciplines;
- marketing and business case development;
- project management;
- information technology (including BIM skills and knowledge of automated design tools);
- planning and design;
- a whole life approach, considering the whole life cycle of the building including repair and maintenance requirements.

There is debate within the industry surrounding the potential of offsite construction to reduce skills demands and needs made by the construction process, as the extent of demand for traditional skills is reduced (or arguably displaced) by manufacturing and assembly activities.

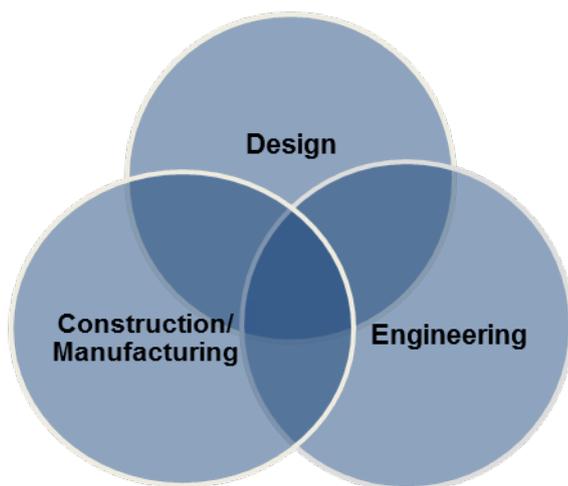
The introduction of what is essentially a manufacturing process into the construction operation has led to a debate over the extent to which this transition may result in either a multi-skilling or de-skilling scenario for the existing workforce. At a lower level (for example traditional 'trade' roles such as carpentry and plastering), it is suggested that skills will likely remain unchanged, but the context in which they are applied will be different; essentially, a shift to both an onsite and offsite construction environment.

The most significant change is predicted to occur for those in higher level roles, with the skills profile of professional occupations evolving over the medium to longer term to embrace multiple different skills and areas of knowledge. This will necessitate a change from traditional 'silo-based' approaches to skills and professional disciplines.

Progressively closer integration between core disciplines and skills sets is predicted over the medium to longer term, underpinned by a requirement for a mutual understanding and appreciation of other roles and their contribution to the build process.

As the offsite build process becomes more integrated with manufacturing, the management of that process and of the interface between the offsite and the onsite environments becomes ever more critical. Skills in design and an understanding of engineering principles also become more important. The diagram below sets out the predicted increased integration between design, construction, manufacturing and engineering disciplines:

Figure A: Predicted increasing integration between different disciplines



Occupations and job roles in offsite construction

Currently, job roles in offsite can be categorised into three groups: primary, secondary and tertiary.

- Primary job roles encompass those involved in the design and delivery of offsite projects, such as project management, logistics, marketing and sales.
- Secondary roles comprise typically 'trade' specific disciplines involved in assembly.
- Tertiary job roles associated with providing supporting functions (but of no less importance than primary and secondary roles) include the provision of finance, insurance and procurement, for example.

Project management roles, schedulers, design staff and engineers are currently most in demand for offsite; Computer Aided Design (CAD) specialists and quantity surveyors are also sought after. The use and prevalence of architects is somewhat less usual in offsite than in traditional onsite construction, with a preference for design engineers, also bringing in skills in IT, predominantly in CAD and BIM.

Over the medium to long term, job roles are anticipated to evolve rather than undergo a radical switch, although this does not imply that existing roles will be unaffected. Design and architecture roles; engineering; BIM modelling and supervisory/project management roles are considered to be the most important and most liable to change.

Qualifications and training

The current training and qualification offer for offsite is considered to be largely inadequate due to a range of factors that have resulted in fragmented provision and a situation where employers create their own, bespoke, in-house training. There are many reasons for this, research participants attributed it to:

- a general disconnection between industry and training providers, and industry and academia;
- the bespoke nature of many offsite systems which makes the development of consistent provision extremely challenging;
- a range of cultural issues faced by employers, such as lack of time and money to invest in training, coupled with a limited understanding of where skills and knowledge gaps in offsite lie.

Deficiencies within the current training offer, in terms of content, have been identified as 3D drawing; site supervision; logistics; BIM and an understanding of design technologies and materials used in offsite.

The table on the following page summarises some of the main influencing factors on offsite construction, along with the associated impacts on future skills, knowledge and qualifications as well as job roles. The content of the table has been drawn together from an analysis of the research findings and is not intended to be exhaustive.

Drivers/influencers on the uptake of offsite	Opportunities of offsite	Threats to the use of offsite	Impact on future skills, knowledge and training/qualifications	Future impacts on job roles
<p>The energy efficiency and sustainability agenda</p> <p>The housing shortage – in both private and social housing</p> <p>The economic climate – reducing costs</p> <p>UK Government commitments:</p> <ul style="list-style-type: none"> • Use of BIM on all centrally procured Government contracts from 2016 • Priority sector in England, Scotland and Wales • Improvements in export <p>Ageing workforce</p> <p>Emerging technologies</p>	<p>Attracting young people into the sector due to weatherproof working conditions</p> <p>Competing in a global market</p> <p>Contributing to environmental and sustainability targets</p> <p>Responding to housing demand</p> <p>More widespread acceptance of offsite methods for commercial projects (largely in the South of England)</p> <p>Realising cost savings through reduced build time</p> <p>Improving quality</p> <p>Improving health and safety</p> <p>Increasing efficiency and reducing costs in the construction process</p> <p>Integration of roles and collaborative working</p>	<p>Negative associations amongst the public with 'pre-fabricated' structures</p> <p>Weak market demand</p> <p>Gaining accreditation and recognition of new technologies</p> <p>Timelag in new technologies reaching the market</p> <p>Lack of collaboration between academia and industry</p> <p>Fragmented training provision</p> <p>'Patchy' geographical distribution of offsite industry</p> <p>Achieving the critical mass in production to realise cost-savings</p> <p>Risk averse financiers/ investors</p> <p>Reluctance of wider industry to adopt MMC/offsite</p> <p>International competition</p> <p>Difficulties in forecasting growth and uptake of offsite technologies</p>	<p>'Hubs' of expertise and inconsistent training offer nationally (UK-wide)</p> <p>Technologies need to be 'mainstreamed' in order to develop consistent training packages</p> <p>Requirement for high level skills in marketing, technical sales, influencing and negotiating</p> <p>Better understanding of the design/manufacture/construction interface</p> <p>Highly developed skills in project management, scheduling and planning</p> <p>Wider adoption of a 'whole life approach' to structures</p>	<p>Greatest impact of offsite on existing job roles is expected to concern:</p> <ul style="list-style-type: none"> • Site Supervisor • Designer • Architect • Structural Engineer • Planner • BIM Modeller <p>Future demand for: Schedulers, Site Labourers, Project Managers, Quantity Surveyors, Design office staff including BIM Modellers, Engineers, CAD Specialists</p> <p>Hybrid roles may result in overlap between managerial and professional levels; a technical sales role will require an overlap between commercial and technical skill</p> <p>All disciplines increasingly expected to work collaboratively.</p>

Implications for government and the sector

Closer collaborative relationships

Greater collaboration between industry and academia, notably in relation to influencing the design of training and qualifications, could enable these to become truly industry-led. In the short-term, consideration could be given to creating an Offsite Skills Network bringing together academia, research institutes and industry with the purpose of sharing knowledge and establishing an interface between innovation and commercial application.

Stimulating demand

Trade Federations and Professional Bodies may wish to work collaboratively on programmes to educate investors, industry stakeholders and home-owners. There is an appetite and interest in technologies amongst consumers. The development of positive case studies could help counteract any negative perceptions in relation to offsite and stimulate consumer demand.

Training and qualifications

A culture of 'multi-skilling' could be embedded at training stage. For instance, training could seek to equip students with a broader skills and knowledge base about offsite enabling application of these core skills and knowledge to different settings, materials and systems. Training and education providers could consider approaches to offsite training provision in Austria and Germany and identify good practice which can be transferred to the UK.

Careers information

Careers information, advice and guidance to those seeking opportunities in the construction sector that includes consideration of offsite construction job roles could help offer clear pathways to higher level occupations as well as promoting offsite to a greater diversity of people, including young people.

Continuing Professional Development

Continuing Professional Development (CPD) could be a potential solution to top up gaps in skills in the short time. The construction industry is more likely to be able to take advantage of CPD that can be delivered flexibly (for example via webinars outside of core working hours), and that is not cost prohibitive.

Evidence Reports present detailed findings of the research produced by the UK Commission for Employment and Skills. The reports contribute to the accumulation of knowledge and intelligence on skills and employment issues through the review of existing evidence or through primary research. All of the outputs of the UK Commission can be accessed on our website at www.ukces.org.uk

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