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FUTURE of CONSTRUCTION

Constructing an industry for 21st-century UK

The construction industry is replenishing the UK's housing stock, building new infrastructure and helping restore the economy, but challenges remain if it is to attract and retain a forward-looking workforce

◆ **OVERVIEW**

● **JIM McCLELLAND**

Money talks, but people count. Construction contributes £92 billion a year to UK economic output. However, to appreciate the true scale of the industry, it pays to think instead in terms of people and jobs, all 2.1 million of them.

Driving construction to work, every day, would require 262,500 double-decker buses, full to standing. That would be enough to jam a three-lane motorway, nose-to tail, for almost 600 miles.

The same data, however, also explains why construction is concerned about recruitment and retention of talent going forward, making the skills gap a hot topic.

Taking growth job markets in sustainability, as an example, construction, for all its environmental and social issues and impacts, is just not a preferred option, says Dawn Love, head of environment and sustainability at Taylor Woodrow. "The simple fact is that sustainability professionals are not considering construction as a viable career choice. The industry still has an image issue and the innovative work we do doesn't often make the headlines. Most sustainability professionals get into construction by accident," she says.

Relying on happy accidents is obviously not a credible business plan. There are, though, signs of progress, according to Ms Love. "My hope and vision is that the work done on the diversity agenda, which has evolved into 'fairness, inclusion and respect', helps to change the culture of construction. We have come a long way in the last 20 years; however, we have a long way to go in the next 20 to make it somewhere to attract bright, young talents from all walks of life and retain them."

On-boarding new hires is only half the story. Retention, though, is not all about pay and promotion. In a modern millennial-minded working environment, social and cultural initiatives to tackle issues, such as mental health, plus flexibility around personal and family commitments, are key enablers of long-term employment. So, how is construction progressing in its attitude and approach to looking after the health and wellbeing of existing staff?

In January, the Considerate Constructors Scheme introduced mental health assessment into its checklist, with positive feedback according to chairman Mike Petter. "We are starting to see an encouraging response from many sites regarding this matter – some are at the information-and-guidance stage and others are looking at provision of mental health first-aiders."


Getty Images

This represents a new criterion, over and above existing concern for general wellbeing. Mr Petter adds: "Many projects and companies provide general health and welfare information. This might be in the form of awareness posters for various cancers, healthy eating and dehydration. On the very best sites we see the workforce offered literacy and numeracy support and guidance."

> **Collaboration, alliancing, interface engineering and information management will become core skills**

Such considerate behaviours on site are symptoms of an emerging spirit of industry tolerance and inclusivity. In short, construction is learning to care.

This progression forms part of a broader transition that casts construction personnel more as professional problem-solvers, in the business world of 2015 and beyond. The advent of digital working, including building information modelling, with an accompanying increase in automation and offsite construction, will herald a wider shift in skillsets, argues Martin Perks, divisional director at Mott MacDonald. "Stakeholders are likely to become more numerous and more sophisticated, and the commercial complexities more subtle, given the collaborative working involved in digital delivery. End-user expectations will continue to rise, with more voices becoming prominent in the process," he says.

"Collaboration, alliancing, interface engineering and information management will therefore become core skills. We thus see a gradual pivot of our traditional core, more towards analysis, interpretation, interpersonal and 'soft' skills."

This more collaborative, inclusive model for the future of construction supports values of openness and transparency, suitably aligned with corporate social responsibility agendas of corporate clients. It also speaks to a learning culture that is alive to global market opportunities, international relations and the exporting of skills.

Such a worldview, with global capacity and capabilities, is good for business, says John Alker, director of policy and communications at the UK Green Building Council. "Cross-border collaboration and sharing of best practice are key. The UK is a global leader in sustainable design and construction, and exporting its knowledge and expertise not only helps other countries with low-carbon development, but in the case of commercial buildings, could contribute an estimated £1.7 billion to UK GDP," he says.

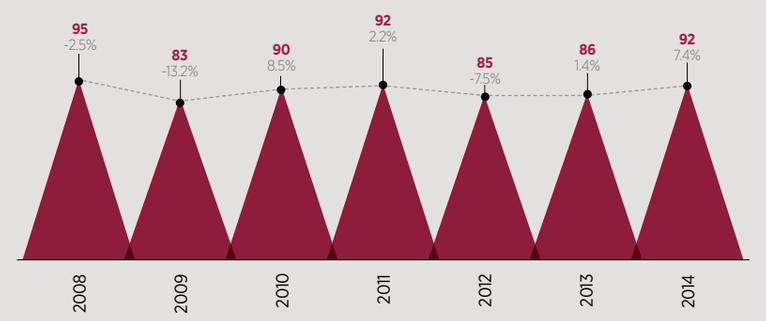
Financial reward is not the only potential benefit to be manifest back home. Reflecting on the LEED Platinum – US green building certification – design for Siemens Middle East HQ in Abu Dhabi, Alan Shingler, a partner at Sheppard Robson, describes the win-win scenarios possible. "Working internationally is a two-way street – UK practices that are hired to export their talents across the world inevitably broaden their range of experience, and in turn import skills and knowledge back into the UK," he says.

"New constraints, objectives and context push you to challenge convention and seek new ideas to improve design performance. Working at Masdar City [Abu Dhabi], with its extreme climate, stringent key performance indicators and design-savvy occupiers, put issues of efficiency and performance into acute focus."

Built environment metrics are also informing a bigger-picture, people-centric context. The Living Building Challenge (LBC), as well as setting stringent standards for water and energy use, also tackles topics including equity, health and happiness, beauty and education. Such a remit clearly adds up in today's markets, according to UK LBC ambassador Martin Brown. "Increasingly, construction is being measured on social outcomes, in addition to financial performance. For many client organisations, utility costs are small in comparison to staff costs, so creating buildings that provide healthy and happy places, free of toxic materials, just makes good sense," he says.

Tomorrow promises not just to be another day, but a whole new world for construction – the future is caring and sharing.

CONSTRUCTION SECTOR'S CONTRIBUTION TO THE ECONOMY (£bn)



Source: House of Commons, June 2015

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COMMERCIAL FEATURE

BUILDING ON A NEW IMAGE

Before the turn of the century, building sites all looked the same – dirty, noisy, even dangerous places that upset local residents and the builders didn't particularly care. Then along came the ***Considerate Constructors Scheme****, which somehow managed to convince the industry that it pays to care*

Edward Hardy
Chief executive

Considerate Constructors Scheme (CCS) accreditation has become the premier validation for construction firms and a standard bearer for an industry that has reinvented itself.

The image makeover for construction began back in 1994 with the government-backed *Latham Report*, commissioned to investigate perceived problems in the industry, which its author Sir Michael Latham described as "ineffective", "adversarial" and "incapable of delivering for its customers".

"Things were bad and they needed to change," says Edward Hardy, chief executive of the Considerate Constructors Scheme. "And change would either have to be brought about by legislation or through a voluntary code of practice."

The industry chose the latter, which in 1997 became the "rock" on which the new CCS was and still is based. The scheme's objectives are simply to improve the image of the industry and encourage best practice beyond statutory requirements.

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It has three categories. The first is the environment, where the onus is on the industry to do everything possible to avoid negatively impacting the green environment and nature.

The second category is the workforce and it is here that, arguably, it has brought about the biggest changes.

"Historically, construction hasn't had the best reputation for looking after its workers," says Mr Hardy. "Sites were dangerous and dirty, they lacked proper facilities, and there was a general disregard for staff wellbeing.

"The last 20 to 30 years have seen a major cultural shift in the business. Healthy lunches and shower facilities have become standard on sites. CCS members are fantastic employers who genuinely care about the welfare of their staff."

The third category is the general public, and here the ethos is to create a positive impact for local communities, direct neighbours and society in general.

In terms of addressing poor public perceptions of construction, the scheme has done its job. Now Mr Hardy believes it is time to take things to the next stage.

He says: "Talking about improving a negative image is by definition a negative statement. We are actually well beyond that stage. With the work that has already been done, we should be promoting the industry's positive image."

And thanks to the CCS, there is plenty to promote. The real key to its effectiveness as a catalyst of transformation lies in its function.

Far from simply being a branded accreditation logo that companies, site operators and individual tradespeople can add to their website, van livery and business cards, CCS accreditation standards have to be reached and maintained through regular site monitoring.

CCS representatives make 15,000 site visits every year. If standards are found to have slipped, the scheme offers practical suggestions for restoring them and striving for continual improvement.

The outcome has been astonishing, yet early on the industry was quite resistant to the idea of an image makeover.

"When the scheme was first launched, it was seen by some as just another layer of red tape. Others were actually insulted by the idea of being assessed as considerate constructors. Now it has come full circle and the vast majority of major contractors register all of their sites with us," says Mr Hardy.

To date the scheme has accredited around 90,000 construction sites, including the lion's share of the UK's largest sites, as well thousands of individual companies and suppliers.

"There is a compelling business case for gaining a CCS membership," says Mr Hardy. "They are winning new business by including our accreditation in their proposals to new clients. It is mandatory for some clients, as is a minimum score. It can also help with the planning process as registration demonstrates a commitment to adding social value and minimising inconvenience for the local communities.

"They are also better able to attract the talent they need. Offering a caring, considerate, and pleasant place to work will lead to more people considering a career in the industry."

Perhaps influenced by the superior working conditions and facilities of CCS accredited sites, a growing number of smaller sub-contractors are also seeking CCS company accreditation.

> There is a compelling business case for gaining CCS membership - it can help win new business and help with the planning process by demonstrating commitment to adding social value and minimising inconvenience

"In a way it is the smaller end of the business that has suffered most from a poor image in years gone by," explains Mr Hardy. "As the market recovers and building activity gathers pace, these smaller firms can also have the validation or proof they are working to standards way above those required by statutory legislation."

And evidence that construction sites and companies are actively promoting the new image can be found in the neighbourhoods and communities in which they work.

Mr Hardy says: "As part of the strategy of promoting a positive image, rather than dispelling a negative one, we started asking construction sites, 'What are you doing for the local community?' Many are now leaving positive legacies when they have packed up their tools and left the site."

These range from revamping community play areas and landscaping local amenities, to open days, and family fun days; things that are remembered in a positive light long after the construction crews have departed.

But the real legacy lies in the future, as the CCS plays a key role in making construction an exciting, challenging and rewarding place to work for the next generation of employees.

Mr Hardy concludes: "Everybody knows how important this sector is to UK GDP – contributing around 10 per cent – and therefore to future economic growth, but the industry is already battling serious skill shortages and has to find a way to attract new talent, now and in the years ahead.

"We are working with the industry, going out to schools and universities to speak to young people, getting the message out there that construction is not just about laying bricks – although that is a vital skill. It's about technology, design, and artisan crafts and trades; it is well paid and, for the best people, the opportunities are endless.

"The construction industry has a big heart and an incredible image. It just needs to get better at telling its story. We are playing our part and our hope is, in the next four or five years, it will all come to fruition."

www.ccscheme.org.uk

Talent can build UK workforce

A negative public image, tough competition from other sectors and "stop-go" government policies have meant the construction industry must now fight hard to attract the best people

◆ **TALENT POOL**

● **ALISON COLEMAN**

Like most industry sectors, construction is fighting for its share of the talent pool as the UK enters an economic renaissance. But it has a problem that has always put it at a competitive disadvantage – a poor public image.

Until quite recently, unless you were male, had a penchant for cement in your tea, eating sandwiches in a cold, grimey van and inadequate toilet facilities, construction sites held little career appeal.

It's an image that the industry is working hard to remedy, but sadly one that the media sometimes seems intent on perpetuating. A plethora of rogue traders-type TV shows have turned the menace of the cowboy builder into popular entertainment, tarnishing a large swathe of the industry workforce in the process.

The cyclical nature of the construction industry has further weakened its ability to attract talent.

Steve Hindley, chairman of construction firm The Midas Group and the CBI Construction Council, says: "We are susceptible to up and downturns, but over the years successive governments have used construction as a turn-off, turn-on mechanism for stimulating economic activity.

"This has led to the industry laying off more than half a million people over the past two recessions as public-sector work has dried up, creating uncertainty for people looking at the industry as a long-term career option."

The joint government and industry *Construction 2025: strategy* document, published in 2013, highlighted the need for fundamental change in how the industry is perceived by the general public, and greater engagement of young people and society at large, as crucial to improving the sector's image.

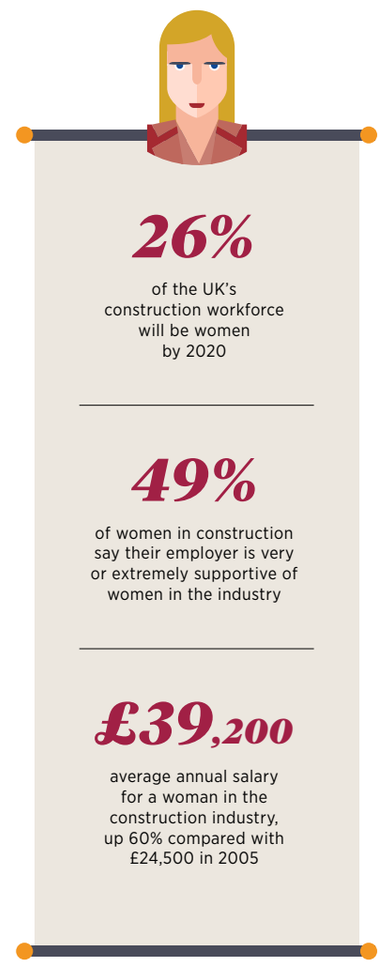
With major housing shortages, vital infrastructure projects and renewed vigour in the commercial property market, the industry now needs to harness talent on a massive scale. To do that it has to polish its professional image and diversify its employee landscape.

A sharp rise in the number of women in the industry suggests that progress is being made. Between 2005 and 2010 the proportion of construction jobs filled by women rose by from 15 per cent to 16 per cent, according to Office for National Statistics data. In the last five years it has increased at four times that rate to 20 per cent in 2015.

Women are also filling more senior roles in construction. Fifteen years ago, just 6 per cent held senior management positions or directorships. Today that figure has reached 16 per cent, according to the latest *Randstad CPE Salary Survey*.

Nevertheless, given the forecasts for global construction industry growth of 70 per cent over the next decade, the sector needs to focus on longer-term talent acquisition and retention.

WOMEN ON THE RISE



Source: *Randstad CPE Salary Survey 2015*

To stand any chance of plugging the existing skills gaps, diversifying the workforce and securing a talent pipeline for the future, more young people need to be persuaded to pursue careers in construction.

Andrew Bredin, managing director of Hays Construction, says: "To make the industry more attractive to school-leavers and graduates, they should be offered incentives and subsidies for pursuing degrees that equip them to work in construction, while incentives for employers will also help encourage more younger people into apprenticeships."

As a route to professional qualifications, apprenticeships have elevated the status of NVQs and helped to broaden the appeal of construction to those who may never have considered it as a career.

And as revealed in the Universities UK and UK Commission for Employment and Skills report *Forging Futures*, employers and universities are collaborating to create more effective routes to the highly skilled jobs crucial to the country's economic future, including those in construction.

The problem with targeting graduate-level talent, of course, is that every other sector is fighting for the same people.

> With major housing shortages, vital infrastructure projects and renewed vigour in the commercial property market, the industry now needs to harness talent on a massive scale

A better way of securing future talent, at the same time promoting a positive industry image and increasing diversity, is to start younger and collaborate more closely with schools, says Claire Gott, design manager at WSP Parsons Brinckerhoff Design.

"We need to work together to explain to primary and secondary schoolchildren how exciting a career in construction can be, why they should consider a career in this industry and what subjects they should be studying to get there," she says.

Historically, one of the challenges has been the position of construction in the UK curriculum.

Alison Watson, managing director of Class Of Your Own, a social enterprise for education in the built environment, explains: "When STEM – science, technology, engineering and mathematics – subjects are at the top of the education agenda, there is little focus on introducing young people to the built and natural environment.

"Yet construction is a continually evolving, technically diverse industry of which STEM is the foundation. Educators require more focused support than the industry is currently providing."

Many of the UK's leading construction, engineering and building services firms are now running outreach programmes in schools, aimed at inspiring future generations of industry professionals.

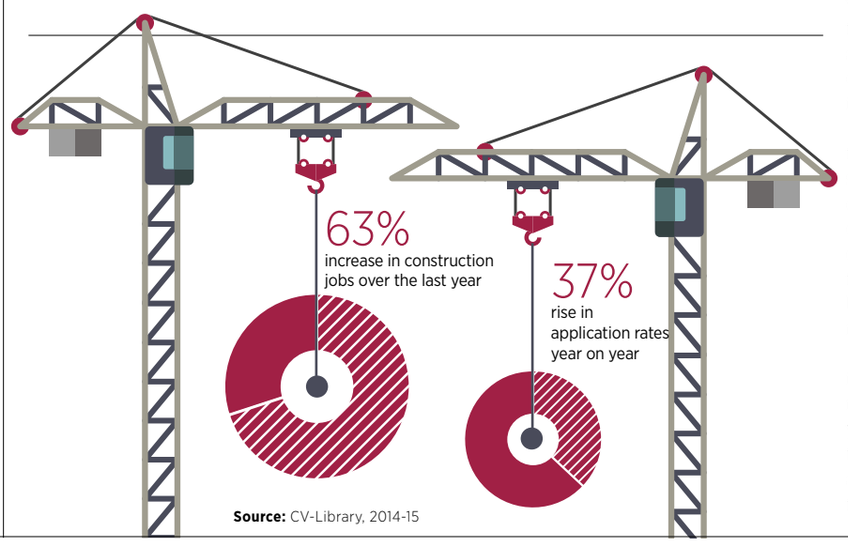
But what of the other end of the scale and the many thousands of small and medium-sized firms that make up the bulk of the construction sector, including the tiny plumbing, plastering and carpentry firms operating in the domestic sector?

Arguably, they have suffered most from the industry's traditional negative image, and therefore face the biggest challenge in attracting and retaining talent.

They have been further impacted by the greater focus that has in the past been placed on attending college and university. This works against the construction industry, as there are fewer courses for trade professions at higher education level. How can the smallest firms recruit the next generation of qualified tradespeople?

"For them, more than any other business in the sector, the answer lies in having a demonstrably good local reputation," says Liz Male, chairman of TrustMark, a government-endorsed scheme for trusted tradesmen in the domestic sector. "That means building a sustained, positive profile for a business in the local area through great work, customer testimonials and the all-powerful 'word of mouth'."

From being the worst hit sector of the 2008 financial crisis, the construction industry is now in the midst of a building boom, with a yawning skills gap. Construction must continue to build on the foundations of what has already been achieved to create a sustainable talent pool for future prosperity.



Source: CV-Library, 2014-15

Satisfying home supply and demand

It's a political hot potato – and building enough new homes will boost the UK's economy as well as win votes

◆ NEW HOMES

● MIKE SCOTT

Britain's housing market is broken and fixing it is high on the political agenda, with the government attempting to stimulate increased supply by boosting demand with measures such as the Help-to-Buy scheme.

Some argue that the solution is to boost supply, but whatever the answer, the fact is that, if the UK is to meet its ambitious house-building targets, we are going to have to build a lot more homes.

In 2004, the *Barker Review of Housing Supply* said that we needed to build about 250,000 homes every year to ensure an adequate supply of affordable homes and to stop house prices from soaring. The target has been consistently missed, often by more than 100,000 homes annually, and there is a shortage of affordable homes while house prices have hit record levels.

But quite apart from the political and planning ramifications of meeting the target, there are a number of logistical issues, too.

"There is just a lack of capacity in terms of people," says Mark Hayward, managing director of the National Association of Estate Agents. "When we were building 300,000 homes a year in the 1960s, all building firms had their own labour force. They don't have that now. Apprenticeship schemes are not producing enough people and the industry has not been training up enough people. During the recession, a lot of people left the industry to do other things and they are not coming back.

"The big developers reckon they can increase their capacity by 15 to 20 per cent maximum, which won't get us to the target. But anyway, the large plcs are pursuing profit not volume."

For the pace of home-building to increase, new entrants will need to come into the market, particularly smaller players, who have been leaving the sector in recent years.

Equally, we need to find places to put all these new homes. "That means we have to use as much brown-field land as possible and take a different view of green-field sites, while also revisiting some taboo areas such as certain flood plains," says Simon Price, director and resources leader at Ramboll, a sustainable engineering design firm.

In cities, one answer to the lack of space is to look up. The latest *London Tall Buildings Survey*, carried out by property consultancy GL Hearn and New London Architecture, shows that "263 tall buildings over 20 storeys were found to be proposed, approved or under construction within Greater London", an increase of 36 per cent from the 2014 survey. Of these, 70 towers are currently under construction, with 62 earmarked for residential purposes and set to provide almost 15,000 new homes for the capital.

> We need to look carefully at alternative methods of construction, as happens in Scandinavian countries, Germany and the United States

However, even when sites have been identified, challenges remain. "Large-scale residential developments will play a vital role in meeting London's housing supply demands, but their construction does present significant challenges from a design and environmental perspective," says Jerry Lehane, managing director at ChapmanBDSP.

"For super-dense residential developments in busy urban environments, one of the more fundamental engineering challenges is around energy supply. National Grid network reinforcements are expensive and have a long gestation period. Often the construction of the residential development in question can be completed faster than the network reinforcement.

"London has particular issues in this respect, where planning considerations and the sheer practical challenge of upgrading infrastructure in a densely populated environment can hinder swift delivery."

For new homes to be delivered rapidly, it may be that more radical thinking is required. "We need to look carefully at alternative methods of construction, as happens in Scandinavian countries, Germany and the United States," says Mr Hayward.

But the home-buying public in the UK has not embraced alternative building methods. "There is still a slight prejudice. People want something that they perceive as more substantial. But it still takes a long time to build a house. If we can get the public away from bricks and mortar to consider something slightly different, we will be able to give them something that is still very good, but a lot cheaper and a lot quicker," he adds.

Off-site construction can help to mitigate skills shortages and time constraints, says Mike Brogan, chief executive of Procure Plus, a North West-based social housing regeneration consortium. As well as regenerating properties, Procure Plus is currently finalising plans to open its own off-site manufacturing factory. "What we are looking to do is get to something that is more like the automotive industry," Mr Brogan says. "One of the benefits of off-site manufacturing is the process."

Given the pressure to deliver new homes quickly, off-site methods have obvious appeal in residential construction as they dramatically reduce build times, in some cases by as much as 14 weeks, says David Hopkins, executive director of Wood for Good, the timber industry's sustainability campaign.

One of the barriers to mass production of homes off-site is that every homeowner's requirements are different, but Procure Plus aims to get round this by using a process of "mass-customisation". "Customers still have a range of permutations, but they don't have unlimited choice," says Mr Brogan. Because there is an element of standardisation, the company is able to place large orders with manufacturers that result in cost-savings per property of 20 per cent. As a social enterprise, Procure Plus plans to pass these savings on to customers.

> What we are looking to do is get to something that is more like the automotive industry

Because off-site construction is more akin to a manufacturing process than building, it can be done by less skilled workers, helping to offset the loss of the industry's skills base, and at the same time it offers better quality and precision because the products are being built in a controlled environment.

Furthermore, it addresses one of the building industry's biggest environmental issues – the amount of waste it produces. When building homes on-site, developers tend to overorder materials to ensure that they do not run short. Currently, according to NetRegs, ten million tonnes of construction products are wasted every year, at a cost of £1.5 billion. Off-site, not only is far less waste produced, but what is produced can easily be recycled.

Off-site construction can also help developers to meet new sustainability goals. "There is a legal requirement to make sure that new homes reach sustainability targets – the code for new homes is being continually updated to wails of protest from house builders," says Suzanne Gill, a partner in the construction team at law firm Wedlake Bell.

Innovative use of materials can also help to make homes more sustainable. The Bristol-based company Modcell makes homes using straw packed in timber frames, for example. It has also adapted the off-site construction model to reduce transport costs by locating temporary "flying factories" in farms near its construction sites, from which it also sources the straw.

Timber is another sustainable option, says Mr Hopkins. Not only is it a very good insulator that helps to reduce the energy-in-use consumption of homes, but "the energy requirements to manufacture timber building products are so low that lifecycle assessment data shows there is more carbon absorbed and stored in the wood than is emitted though the rest of the supply chain," he says.

"This means timber products actually arrive on site with a carbon negative footprint and its inherent sustainability provides a cost-effective and natural way of incorporating this at source. Those that use it are effectively building with blocks of sequestered carbon rather than emitting it."

But ultimately the challenge is to build houses that people want to live in, says Ramboll's Mr Price. This doesn't just mean sustainable buildings, but also a different way of living, a move towards apartment living with more shared space such as communal gardens and roof gardens.

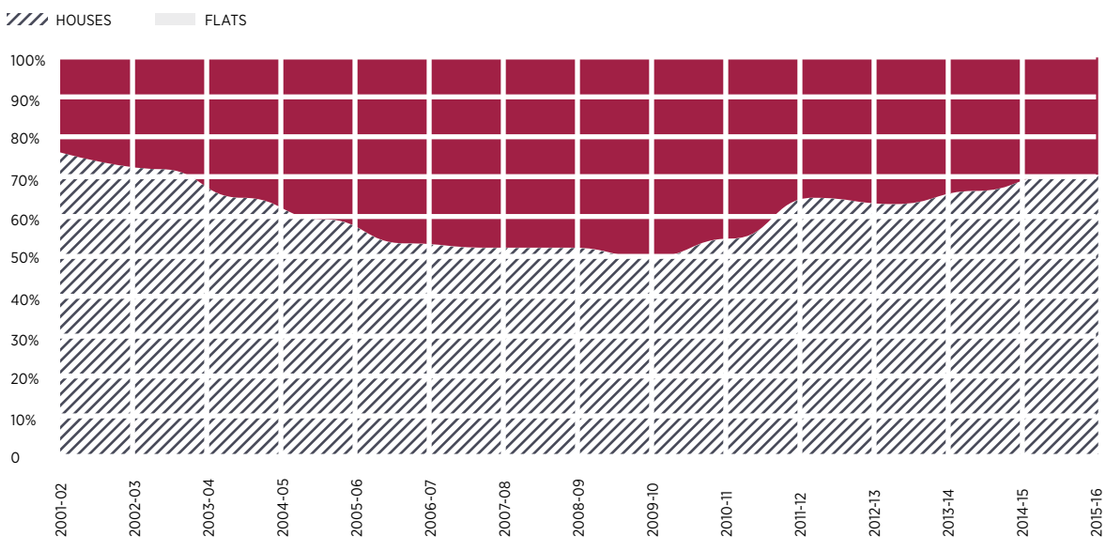
He concludes: "It also means more communal infrastructure such as district heating. Cost is a big issue for city-living and shared infrastructure can help with that. We also need a move towards more people renting like they do in other European cities. If people get more used to that it will help them move away from the fixation with owning a house and climbing up the property ladder."

WHAT MEASURES SHOULD POLICYMAKERS TAKE TO HELP BOOST HOUSING SUPPLY?

% of respondents

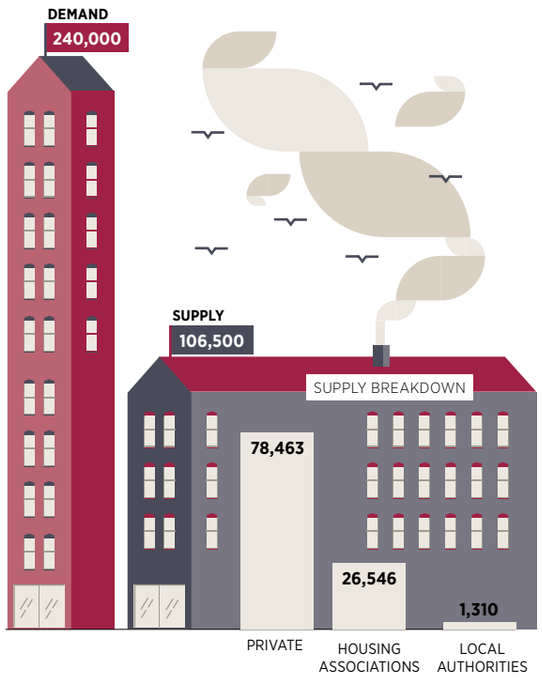
Source: Knight Frank Residential Research 2015

PROPORTION OF THE NEW-BUILD COMPLETIONS THAT ARE HOUSES AND FLATS



Source: House of Commons

2014 UK HOUSING SUPPLY AND DEMAND



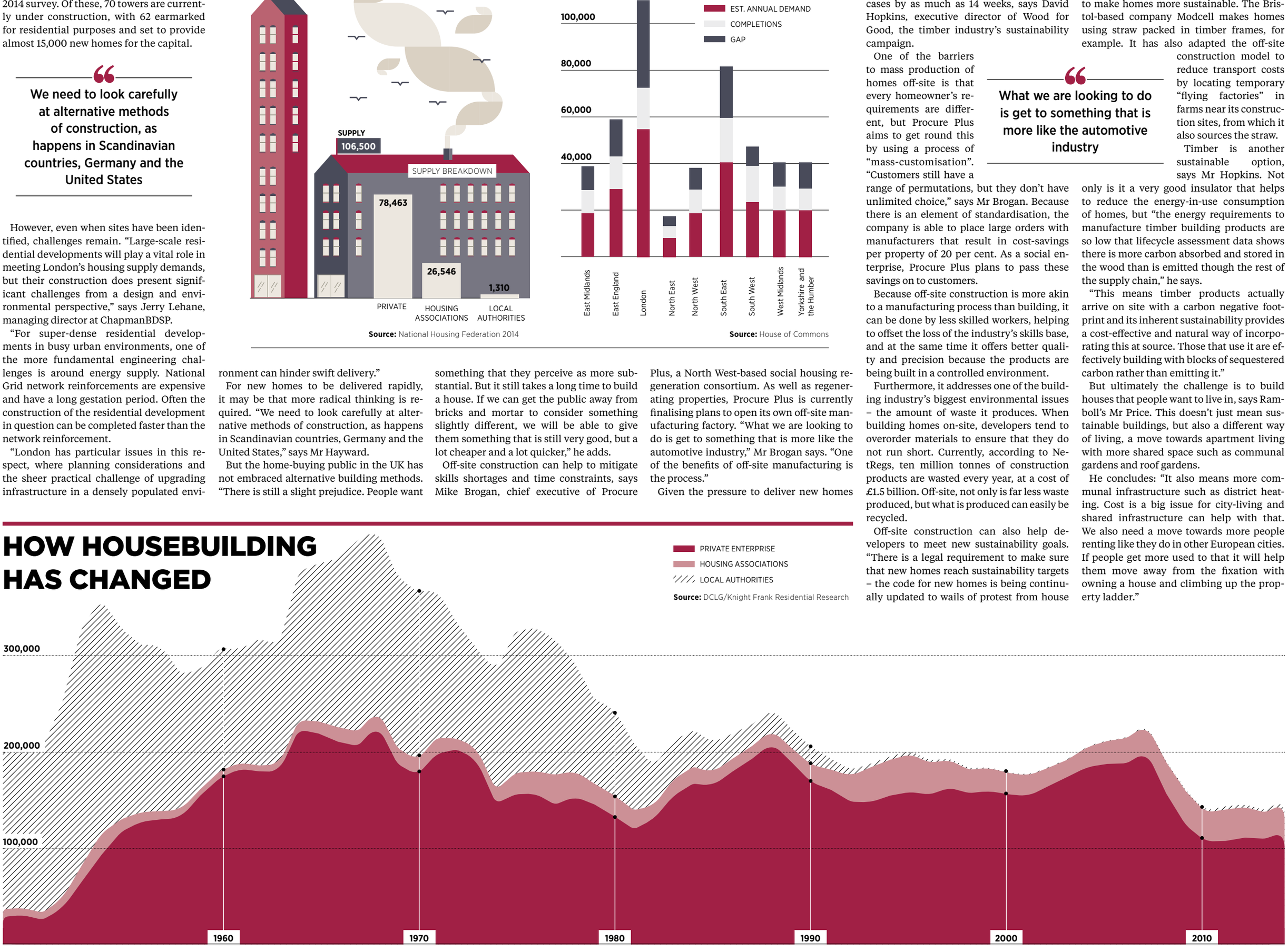
Source: National Housing Federation 2014

HOUSE DEMAND GAP BY REGION

2013-2014

Source: House of Commons

HOW HOUSEBUILDING HAS CHANGED



Source: DCLG/Knight Frank Residential Research

PRINTING A HOUSE

Getty Images

Building in cities, and the densely populated urban environment of London especially, is more challenging than ever before, with limited land available and often not a lot of room to work in.

One solution that may help to ease these constraints is 3D printing. While the process is most commonly used for small-scale components, ranging from car parts to hip joints, it is also possible to 3D print buildings.

Having in 2014 produced ten 3D-printed houses in a day, Chinese company WinSun earlier this year built a five-storey apartment building, with a mixture of industrial and construction waste, cement and a hardening agent, using 20ft-high and 132ft-long machinery that looks like a giant cake icer.

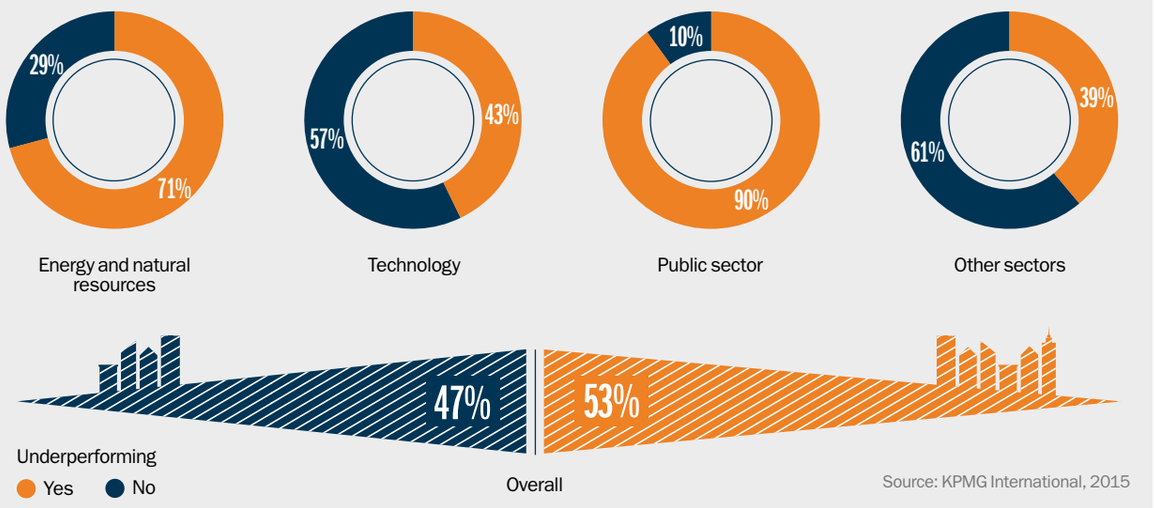
The company claims this reduces construction waste by 30 to 60 per cent, cuts the cost of labour by up to 80 per cent and the amount of time it takes to build a structure by 50 to 70 per cent, as well as reducing the requirement for virgin materials such as stone and brick.

Rob Francis, director of innovation and business improvement at Skanska, which is working with Loughborough University to develop 3D concrete printing, says: "3D concrete printing, when combined with a type of mobile prefabrication centre, has the potential to reduce the time needed to create complex elements of buildings from weeks to hours. We expect to achieve a level of quality and efficiency which has never been seen before in construction."

Meanwhile, in the Netherlands, DUS Architects has built a house using a biofuel-based plastic. In future, the firm says, architects could e-mail houses to building sites and buildings could become entirely recyclable at the end of their lives. In addition, DUS says: "Rather than using standardised elements, 3D-printed designs can each be modified and customised to fit the user's needs and taste. It will no longer be more expensive or more labour intensive to add details to, for example, your façade and it is easy to create unique objects."

Because the process goes straight from raw material to final product, there is no waste and transport costs are reduced because designs can be printed on site. "This also implies that when 3D printing is used widely, it will no longer be cheaper to have things produced in countries such as China or Bangladesh as opposed to the Netherlands. Everyone can just produce everything in their own local context," the company says.

COMMERCIAL FEATURE



DIGITISING THE FRONT OFFICE

If construction companies are to meet future challenges, they need to leverage innovation and IT in "front-office" project and supply chain operations, says ***Phil Brown, chief executive of Causeway Technologies***

Phil Brown
Chief executive

CAUSEWAY

It is not unusual for construction companies to make investments in information technology. Most of that investment, however, has been focused on enterprise resource planning (ERP) systems in the back office – apeing the strategy of large companies in other sectors.

The construction industry is not like other sectors though. The nature of the product is not uniform or predictable; construction projects are diverse, each carrying with them unique issues and challenges. In addition, around 90 per cent of a construction company's costs are in the provision of materials, sub-contractors, plant and labour needed to deliver these projects, where margins are thin, risks are high, and change is constant.

Yet the operational and commercial teams tasked with managing these projects are typically relying on a collection of siloed systems and spreadsheets in an effort to create a "single view" of the truth.

In the UK, attempts to make use of ERP systems to control project processes have on the whole been unsuccessful. This has inevitably led to duplicated effort, inefficiency, inaccuracy and a paucity of meaningful information at the sharp end, with genuine implications for overall efficiency and profitability.

> As data enters the Causeway system, it enables us to capture and compare real-time and historic benchmarking data across asset types. This is key as our clients seek to understand how their assets can be most efficient over a life cycle and is ultimately where we add value most

Furthermore, this is happening in an environment where the industry is under significant pressure to reduce construction and life-cycle asset management costs, while delivering better value for clients.

For example, the last government's construction strategy targeted a 15 to 20 per cent reduction in the cost of construction procurement within the public sector, to be delivered through streamlining processes. Looking further ahead, the 2013 government report, *Construction 2025, Industrial Strategy: government and industry in partnership*, included in its proposals:

- A 33 per cent reduction in the initial cost of construction and the whole life costs of built assets.
- A 50 per cent reduction in the overall time, from inception to completion, for new build and refurbished assets.

The drive to get better value extends to the UK's infrastructure too. The *Highways England Delivery Plan* is committed to making capital efficiency savings of £1.21 billion by 2020 (in nominal terms) while delivering an improved service.

In parallel, the government's Soft Landings programme is designed to eliminate, or at least minimise, the performance gap between design intentions and operational outcomes.

In an industry where low single digit margins are the norm, to paraphrase Einstein: "Doing the same thing over and over again, and expecting different results" just isn't going to cut it.

For many, building information modelling (BIM) is seen as the panacea, but BIM is still grounded in the design phase of the construction process, and has had minimal impact on managing construction delivery and asset maintenance. Indeed, many of the construction companies that have truly embraced BIM are still struggling with the age-old problem of understanding the true financial performance of their projects.

This brings us back to the need to digitise front-office processes. Unfortunately, the only way that the industry will be able to deliver game-changing efficiencies and savings, and take full advantage of the potential of BIM is if it can firstly integrate the dynamic and ever-changing relationship between time, budgets, cost and value.

Reporting in 2014 on the poor performance of a leading UK construction contractor, KPMG gave one reason as: "Accuracy of cost and programme forecasting – insufficient visibility, control and understanding on actual versus reported contract performance."

KPMG recommended that project managers should have greater financial and commercial accountability for project performance with an appropriate set of project key performance indicators.

So this raises a key question: will diverting IT dollars from monolithic back-office finance systems towards agile front-office operational systems offer greater scope for the process transformation and success the industry craves?

The answer must be a resounding yes. If project and commercial managers at the coalface are to be given greater responsibility (and risk), they also need the tools to do their job efficiently. They need systems that bring together all the business processes associated with cost-capture and management of project. They also need to be able to share that information with supply chain partners and, ultimately, clients' systems in integrated project teams.

increase in EM Highway Services' turnover since implementation of Causeway

increase in speed for Slattery to produce a measured bill of quantities using Causeway Cost & Programme Management

increase in overall tender win rates for Cheesmur since adopting Causeway Estimating

of service-level agreements (SLAs) achieved by University of Bradford with Causeway FM Facts

This approach played a key role in the successful delivery of London Heathrow Airport's Terminal 5, where BAA managed a single team of more than 50 contractors and mandated the systems they used, with Causeway solutions at the heart of them.

That was in 2008 so this isn't a new concept, but the sustained focus on back-office ERP has undoubtedly hindered its adoption.

In fact, as integrated project teams become the norm, there is a strong incentive for clients to take more responsibility for the systems being used. As KPMG notes in its *2015 Global Construction Project Owner's Survey*: "Project owners must invest in relationships with contractors to raise mutual trust and discuss problems or shortcomings. Rather than simply passing all or most of the risk to the contractor, it is preferable to create an integrated project team with common goals and rewards."

As with capital projects, contractors operating in asset maintenance need tools that will help them minimise costs and increase client satisfaction through better management of their precious resources. Causeway has observed that customers who integrate job processes with mobile technologies, GPS telematics and scheduling can increase the efficiency of mobile workforces by as much as 30 per cent.

So the good news is that things are starting to change, albeit rather slowly, and the technologies and know-how are now there to support digitisation of construction's "front office". The challenge is to make it happen quickly enough and that may well require a change of thinking at board level.

Discover four ways to digitise your front office now at go.causeway.com/future or contact phil.brown@causeway.com

Case study

Richer data for reporting and business intelligence

EM Highways provides highways maintenance services to a number of strategic clients. The company introduced Causeway as its core front-office business system in 2013 and has seen turnover increase by £210 million to £500 million. Finance director Joe Incutti recalls: "We looked at systems, such as Oracle and SAP, and realised quite early in the process that the Causeway solution, off the shelf, was going to be a very good fit. We decided we were going to implement the lot, not just take bits and try to integrate it with other bits of systems – we were going to use the whole thing from cradle to grave.

"Having that fully integrated suite of products gives us a much richer extraction of data from the system for reporting and business intelligence."

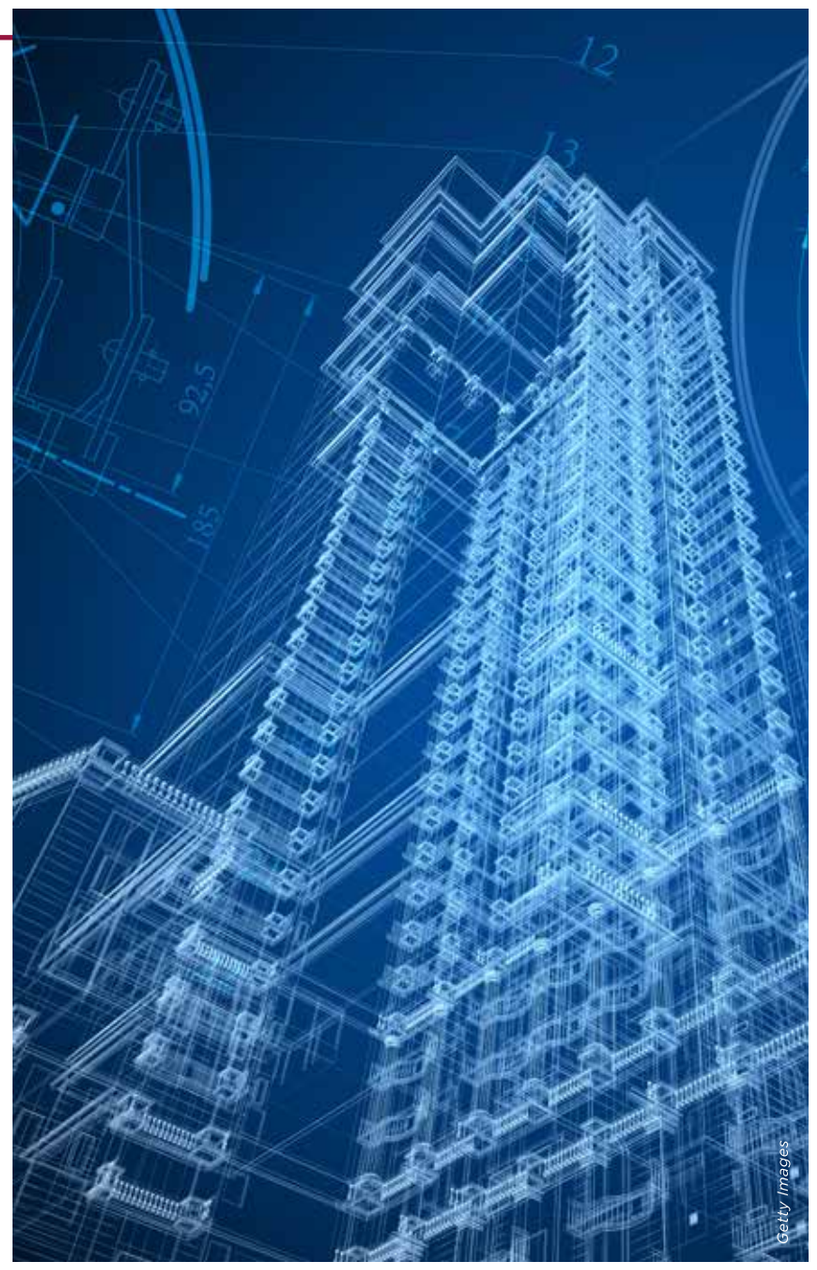
Since implementing Causeway, EM Highways has

- Doubled in size, scaling the Causeway solution in line with this dramatic growth.
- Automated numerous previously laborious, time-consuming front-office processes.
- Streamlined production of all key management reports.
- Come top in Highways Agency StART scores, with much credit given to the supply chain collaboration support provided by Causeway.
- Used the partnership with Causeway as an exemplar for BS 11000 accreditation.

Digital is a prize too great to miss

Adoption of government-backed digital technologies signals a new era for the construction industry which promises greater efficiencies and cost-savings

◆ **DIGITAL**
● **DAMIEN CARR**


Getty Images

Data-driven digital technologies have the potential to completely transform the sector, by helping to solve the efficiency issues that have plagued construction over the decades. But with the March 2016 deadline for level 2 of the government's building information modelling (BIM) requirements, how ready are architects, contractors and clients?

In the ideal BIM-enabled world, the architect, structural engineer and contractor work together from the earliest design stages to identify potential issues. This integrated project team work closely together sharing information electronically to build up precise 3D visual models containing geospatial information and data about different building elements to ensure there are no conflicts in the design, such as girders being in the wrong place.

> **It is the biggest opportunity to improve the way the construction industry operates so that we realise efficiencies the manufacturing and service sectors have made over the last ten years**

Armed with this detailed digitally held information, the contractor can construct the building more efficiently, without error, on time and on budget. Crucially, the BIM model and all its data is handed over to the client and used in the management of the building throughout its lifetime, helping to reduce operational costs.

Little wonder that Nick Tune, chief executive of BIM software provider coBuilder, believes BIM holds the key to transformative change. "It is the biggest opportunity to improve the way the construction industry operates so that we realise efficiencies the manufacturing and service sectors have made over the last ten years," he says.

Yet is the notoriously adversarial construction sector ready for better collaboration? David Philp, BIM director at AECOM and head of BIM at the UK BIM Task Group, which is leading the government's BIM drive, recognises the issue. "Construction 2.0 needs new behaviours, including the intelligent client, that will encourage collaborative forms of procurement and a supply chain which recognises that integrated concurrent working will drive better productivity, making them more competitive in the marketplace," he says.

Mr Philp remains positive that companies will take advantage of the new digital technologies and the increasing amounts of data to improve their bottom line. However, crucial to the success of digital collaboration will be the ease by which data is shared across different platforms and whether or not that is via open data formats.

Mr Tune, who is also director of buildingSMART UK, says that open BIM data will have to become the de facto engine of BIM, though he concedes that many businesses are still settling on proprietary data solutions such as Revit.

"But as they gain experience they will realise that the most efficient way to collaborate is to engage with open BIM standards, as it allows them better integration across the supply chain," he says. buildingSMART UK is part of buildingSMART International, which develops the open data format known as industry foundation class (IFC) that enables true interoperability between different software packages.

100

gigabytes of project data used in a large construction project in 2004

6,600

gigabytes of data – 66 times more (6.6 terabytes) – used in a similar sized project in 2014

Source: Newforma

The government recognises the importance of IFC even though for BIM Level 2 project teams will use COBie (construction operations building information exchange). Essentially a spreadsheet-based data exchange that teams share between their own individual 3D computer-aided design models, COBie is nevertheless an important first step in the sharing of information between teams.

Under the government's 2016 BIM Level 2 mandate, construction projects procured by central government departments and their agencies will need to be able to share data using COBie as a minimum. But the picture is mixed about how prepared the industry will be.

Take the broadly positive *2015 NBS National BIM Survey* of almost 900 building design professionals. Of the half of respondents who are using BIM, 60 per cent say they are ready for the BIM Level 2. Compare that to a survey of 84 small to medium contractors, carried out in November 2014 by the National Federation of Builders, which found that 68 per cent were still using paper drawings and just under a quarter had not even considered BIM.

"Here lies the biggest challenge," Mr Tune concedes. "Most companies in our industry embrace change and look to improve, but there are still a lot of businesses who are happy with the status quo. I recently met a few of these while delivering BIM training to SMEs [small and medium-sized enterprises]. These businesses will not be around in three to five years if they don't embrace improvement and innovation," he says.

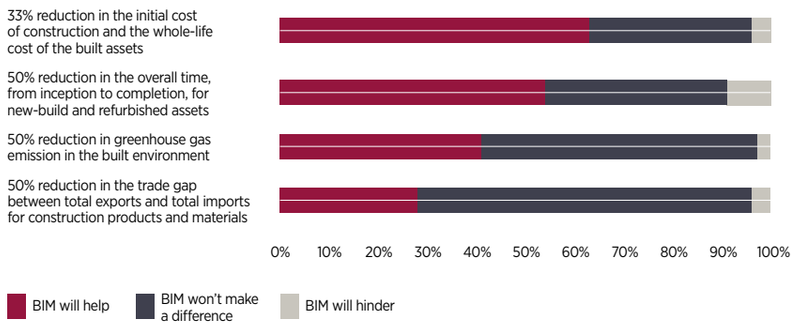
However, Allen Preger, co-founder and vice president of global product at project information management software developer Newforma, has seen increased interest in their products and "an exponential expansion in the amount of digital project data being used". To illustrate his point, he cites a comparative study of the data used in one their client's largest projects in 2004 against a similar project in 2014. The 2004 project contained 100 gigabytes of project data, including drawings, documents, image files and more than 100,000 e-mails; the 2014 project contained 6.6 terabytes (6,600 gigabytes) of data, comprising 288,000 project e-mails and more than 11,000 construction drawings, which adds up to 66 times more data.

All this data might suggest a need for new data science skills, though Mr Philp is against the creation of new layers of dedicated information managers. "Digital construction should be very much part of our everyday engineering, construction, architectural or surveying toolkit," he says. Indeed Mr Philp believes the sector must also rebrand itself as innovative and technologically advanced if it is to attract the "hyper-connected Generation Y".

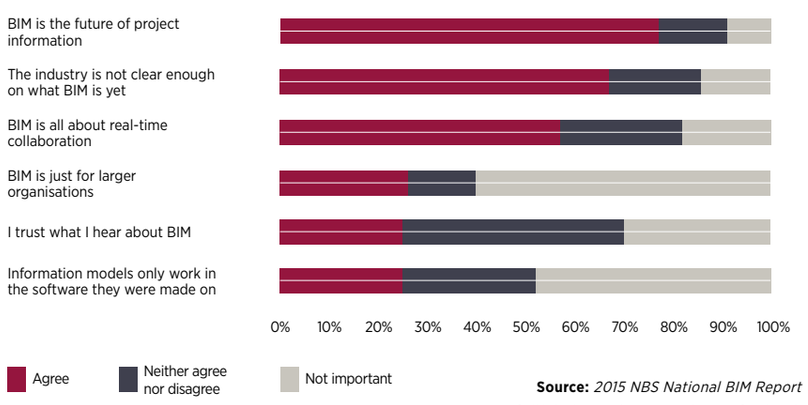
He is now working on Digital Built Britain, launched by the government this year to take forward BIM Level 3. This involves full collaboration between teams using a single shared BIM model. Level 3 also extends BIM into the lifetime operation of assets, which is where the majority of costs arise, with the harnessing of big data taking BIM into the realms of the smart city as building-level data can be scaled up to area and city level.

"Digital Built Britain is audacious in what it sets out to achieve," says Mr Philp, adding that although there is much to do, technically, commercially and culturally the prize of improved performance is too big to be missed. "Ultimately, I suspect the cultural mindset will be the biggest challenge," he concludes. "However, the switch to digital construction is not a question of 'if' but 'when'."

WHAT ROLE WILL BUILDING INFORMATION MODELLING (BIM) PLAY IN ACHIEVING THE UK'S CONSTRUCTION STRATEGY?



ATTITUDES TOWARDS BIM



Source: *2015 NBS National BIM Report* survey of UK design and construction professionals

Sustainable building is beautiful

Green buildings bring nature into urban spaces and have significant advantages in terms of energy-saving insulation, water management and combatting pollution

◆ GREEN DESIGN

● ELISABETH BRAW

Envy Rahm Emanuel. On top of his office in City Hall, the Mayor of Chicago can take a stroll among 20,000 plants from 150 different species. Should he feel particularly playful, he can even climb up into one of the roof's two trees.

Chicago City Hall's green roof delights many other Chicagoans too. And in the 13 years since it was completed, green roofs have become so common in cities around the world that citizens keen to visit one don't have to rely on distant relatives or lottery luck for access.

"There has been a big change over the past decade," says Dusty Gedge, president of the European Federation of Green Roof Associations. "Ten years ago, when I saw a crane, I'd hope that it was for a green roof. Now I know that it's for a green roof."

A big change indeed. According to a new report by market research firm Lux Research, in the past five years alone, the area covered by green roofs has grown from around 100 million square metres to some 150 million square metres, and by 2017 it's predicted to reach 200 million square meters. The big growth will come from Asia and the Americas, while the European market is expected to stagnate.

"What's driving the growth in green roofs is that they help storm water management because the plants, trees and soil on the roof help retain the water," explains Lux Research analyst Jerrold Wang. "They also act as insulation, lowering heating and cooling costs. In addition, people like them because they feel that green roofs can help cities manage pollution and they like to see the roofs look beautiful."

Green walls offer much the same attraction, but remain a much smaller market due to their technical challenges. A green wall is technically not part of the wall it covers, but an additional layer that is in most cases not attached to the wall itself. And, notes Mr Wang, while watering a green roof essentially just requires a watering can, watering a vertical garden involves expensive equipment. In total, building-integrated vegetation is now a $6-billion market, according to Lux Research's report.

Virtually every major city now features at least one green roof or rooftop garden. Developers of new mega-buildings, such as New York's Barclay Center, now add green roofs as a selling point. In Asia, the increasing popularity of green roofs is more to do with their air-cleansing attributes than with commercial positioning. According to a recent study, the severely polluted Chinese capital Beijing could save $4.7 billion by creating a comprehensive green roof programme.

No wonder, then, that Bangkok already has so many green roofs that a new one on top of the Siam Green Sky agricultural learning centre is just another addition to the mix, though at 2,000 square metres it's a very large one, and it's an innovative one as well, featuring a model farm where residents can learn traditional Thai farming techniques.

Green walls are, so to speak, also on the up. Thanks to Dutch architecture firm Venhoeven CS and countless plants and shrub, a run-down sports centre in Amsterdam has been transformed into what looks like a green fortress. In Sydney, the new One Central Park residential tower features an enormous vertical garden containing 25 species.

Combining the two green solutions, Italian architect Stefano Boeri's recently completed Bosco Verticale (vertical forest) skyscrapers in Milan feature trees and shrubs on every balcony. Greywater from sinks, showers and washing machines in the building is used to irrigate the mini-forests, while solar panels on the roof generate energy.

In Copenhagen, architecture firm Jaja has adopted a similar approach in designing that superbly boring urban fixture, a garage car park. Jaja's parking structure features staircases on outside walls, complemented by a multitude of planting boxes containing both trees and plants. The roof of the garage, to be completed later this year, will feature a playground.

In central London, the Rubens Hotel now features a 350 square-metre "living wall" consisting of 10,000 plants for the specific purpose of aiding wildlife. Buttercups, crocuses and strawberries have all been planted for the benefit of birds and butterflies.

> As the world continues to urbanise, future generations may encounter wildlife not on the ground, but on walls and roofs

So as the world continues to urbanise, future generations may, in fact, encounter wildlife not on the ground, but on walls and roofs. Though visitors to the Rubens Hotel and the Park'n'Play may not think of it that way, their lodging and parking thus provide an illustration of what the Harvard conservationist E.O. Wilson calls biophilic design. Human beings, he argues, have an innate affiliation with nature – biophilia.

"It's funny," says Edouard François, tongue in cheek. "Cities are changing their regulations in order to copy me." The French architect has reason to marvel at how city planners have discovered the virtues of green walls, which he has been designing in cities as diverse as Casablanca, New Delhi and Paris.

Hotels and office buildings are not the only ones suited to green walls, as Mr François has shown by, for example, creating a green cocoon around an enormous ventilation shaft in Paris's La Défence district. Yet the brains behind the M6B2 Tower of Biodiversity in Paris is not unreservedly enthusiastic about the green boom.

"Developers don't understand the nature of green walls," he argues. "They're doing them as make-belief; they simply want their walls painted green." Irena Bauman, an architect in Leeds and professor of sustainable urbanism at the University of Sheffield, agrees. "There's a lot of interest among a small group of architects who've developed a real understanding of the subject area and are breaking new ground," she says. "The great majority, however, don't have an interest in green architecture beyond what's required to achieve compliance with regulations."

Urban planners and legislators love architectural greenery for much the same reason: it offers practical benefits to their city and it looks pretty. "Cities know they have to adapt to climate change," says Mr Gedge. "It's a global phenomenon." Indeed, cities ranging from Berlin to Singapore now have a mix of regulations and financial incentives in place in order to green their roofs. Today more than 14 per cent of Germany's total roof area is green.

And which city dwellers would choose concrete homes and office buildings after they've entered ones surrounded by plants every day? The problem is, of course, that installing a whole horizontal or vertical garden costs far more than the plain concrete option.

"But the difference will in many cases be counterbalanced by reduced energy and storm water management costs, and by having a longer lifespan compared to regular roofs," says Esben Alslund-Lanthén, an analyst at the Copenhagen-based think-tank Sustainia.

A study from the National Resources Defense Council (NRDC) shows that temperatures on the surface of a conventional dark roof can increase the temperature in the air around it by 50C or more on a hot, sunny day. "By contrast, the temperature of a green roof may be cooler than the surrounding ambient air," notes Mr Alslund-Lanthén. According to research by the NRDC, green roofs can reduce the energy needed for building cooling on the floor below the roof by upwards by 50 per cent.

Mr François, adding that he selects projects with developers who do understand green walls, remains upbeat about green buildings. "This is evolution," he says. "Change happens slowly."

In coming years that change is predicted to include more and more solar panels on roofs. "They can be part of the green roof construction," says Mr Gedge. "We'll sing the song of sustainability at the next level."

For his part, Mr François doesn't care for the so-called biosolar approach. He's instead opted for creating access roads lined by solar panel and is raising the sustainability level in a different way altogether – through chickens. A building the Parisian architect is currently designing in Bordeaux features chickens in the courtyard. "It's green because it's life," he says. Green buildings indeed.

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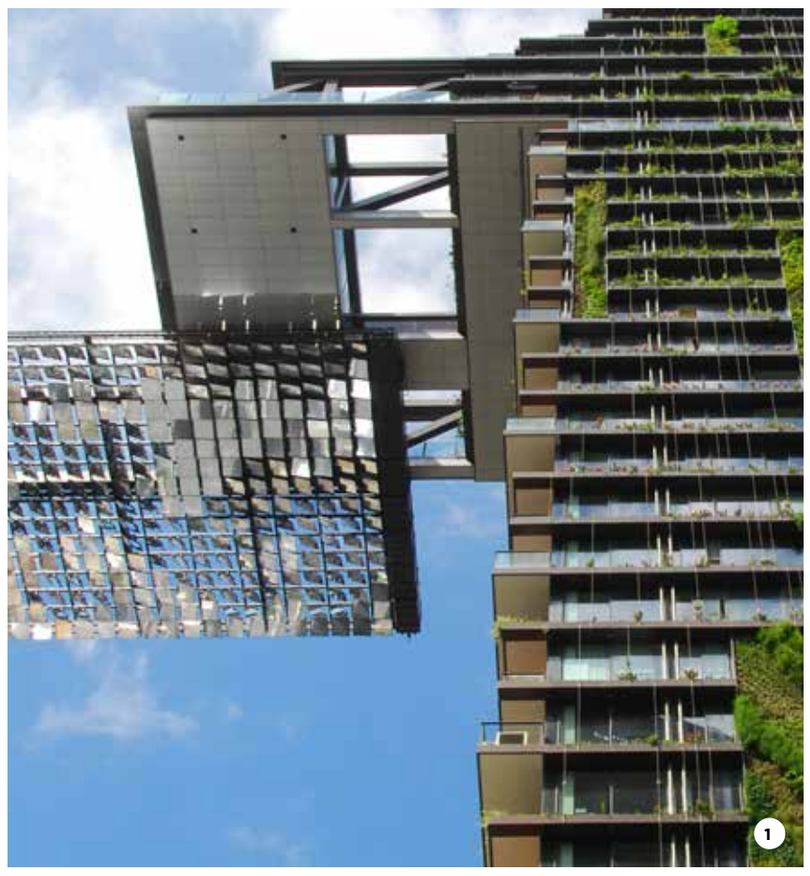

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1: One Central Park, Sydney (Photo: Rob Deutscher)
2: Bosco Verticale, Milan - Boeri Studio (Stefano Boeri, Gianandrea Barreca, Giovanni La Varra) (Photo: Paolo Rosselli)
3: City Hall Green Rooftop, Chicago
4: Tower Flower, Paris

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Collaboration means chains for the better

Improved management and performance of supply chains are central to the growth and prosperity of the UK construction sector in a period of expansion

◆ **SUPPLY CHAIN**

● **JIM McCLELLAND**

It's not all bikes and daisies. Chains come in many forms, with many applications. For business, the thinking that puts the "chain" in supply chain varies greatly depending on perspective. Associations range from positive to negative: from value and security, custody and command, to gangs and modern slavery.

For the construction industry, the one word that has not traditionally been mentioned in the same sentence as supply chains is "collaboration". However, change is in the air and currently on the lips of clients and contractors.

Behind this cultural shift towards more collaborative behaviours, sit a number of underlying factors, explains Carillion chief sustainability officer David Picton. "It is partly, as the economy starts to pick up, that workloads increase and capacity gets squeezed, partly a positive drive from clients and government, and partly a clear recognition of the benefits of sustainable, responsible business," he says.

There is, though, still a lot more talk than walk, according to Shaun McCarthy, chairman of the Supply Chain Sustainability School, with formal agreements proving part of the problem. He says: "If I had a magic wand I would tear up all the forms of contract we have in the industry now and start again. I would draft something similar to the Heathrow Terminal 5 agreement that allocates collective responsibility, risk and reward to all the businesses contributing to a project. This would require collaborative behaviours. What you contract for is what you get."

> **A commitment to ethical sourcing will surely strengthen tender bids – it will be a differentiator**

Mr McCarthy can, however, identify two potential agents for change. "Properly implemented and with training for all players, building information modelling could be a game-changer," he says. "I would hope this would lead to greater efficiency and enable collaboration between partners delivering a project around a common dataset.

"The other big change is building off-site. The move to creating most of a building or piece of infrastructure in a factory should make us radically rethink everything. Planning and integration of a closely aligned supply chain will be critical to success."

Interactive technology, data sharing, knowledge transfer and sector-wide training are all key components of a new integrated and industrialised business model for construction, as championed by the Supply Chain School. With more than 8,000 member companies, plus 19 of the top 20 contractors as partners, the school itself is evidence of a positive attitude and approach to collaborative working that simply did not exist in the sector ten or even five years ago.

Critical to this spirit of openness and sharing is transparency. Transparency and supply chain traceability go hand in hand and form foundations of corporate social responsibility (CSR) strategies, both within construction and among its clients.

Professor Jacqueline Glass, who leads on the Action Programme for Responsible Sourcing (APRES) at Loughborough University, sees ethical sourcing as an emerging trend, powered by accountability demands made on and by global construction companies. "We are a little way off ethical sourcing being business as usual, but there are signs," she says. "It is an appropriate risk management strategy for companies with complex, extended global supply chains. They see ethical sourcing as a talisman for the CSR agenda. It is definitely a hot topic."

In response, APRES is developing An Ethical and Social responsibility Portfolio for construction professionals (AESOP). This groundbreaking supply chain initiative will both publish an *Ethical Design Guide* and host a multi-stakeholder "hackathon" to co-create a *Manifesto for Ethical Sourcing in Construction*.

Professor Glass is realistic about the scale of the ethical challenge facing firms, whether world players or local traders. "While you could point the finger at major companies, simply on a volume basis, the unquestioning purchasing going on every day in builders' merchants is a hotspot. The lack of labelling and product information means tradespeople can't actually make an informed decision. Merchants and their suppliers need to step up their game," she says.

For Ian Nicholson, managing director of Responsible Solutions, lead authors for the *Ethical Design Guide,* it is a question of turning good intentions into better specification. "Ethical sourcing within construction has to date been led by major contractors seeking to protect their reputations. They currently do this with one arm tied behind their back because the topic has not yet made it into mainstream specification writing," he says.

This specification gap introduces a disconnect between the worlds of architecture and supply chain management, both of which he sees as still having a lot to learn. "Ethical sourcing has so far only really tackled products with short supply chains," he says. "The journey started with bulk products, such as stone and steel. I believe there are much greater risks in the more complex mechanical and electrical supply chains, and these have not yet been met head on."

In the wake of lessons learnt in the fashion industry from the tragic events of the Rana Plaza factory collapse, there are concerns within construction that it could take a comparable, high-profile and fatal breach in supply chain operations to shock the industry into action.

There are, however, many good lessons to be learnt as well from expertise in other sectors, explains Plan A project manager Lydia Hopton, who heads up ethical sourcing in property and store development at Marks and Spencer. She says: "There are sectors where ethical sourcing has been top of the agenda for decades, and we are working in collaboration with our colleagues in general merchandise and food to ensure we learn from their experiences."

Ms Hopton is also open about direct business benefits in prospect for supply chain contractors and suppliers. "It is clearly an opportunity and, as the industry develops in this field, it will become even more robust and attractive to new business and talent. A commitment to ethical sourcing will surely strengthen tender bids – it will be a differentiator," she says.

As can be inferred from key industry initiatives on sourcing and design – a manifesto and a guide – the construction supply chain is still very much at the start of its ethical journey. However, the direction of travel is plain for all to see. As Professor Glass is wont to say: "The only way is ethics!"

300k+
business in the UK construction industry
Source: Department for Business, Innovation & Skills

99.7%
of UK construction businesses are small and medium-sized enterprises
Source: Department for Business, Innovation & Skills

91%
of all UK-produced concrete was certified as responsibly sourced (to BES 6001) in 2013
Source: Mineral Products Association/Concrete Centre

Top innovations in construction

New materials and energy, design approaches, as well as advances in digital technology and big data, are creating a wave of innovation within the construction industry. Here are ten of the most exciting developments

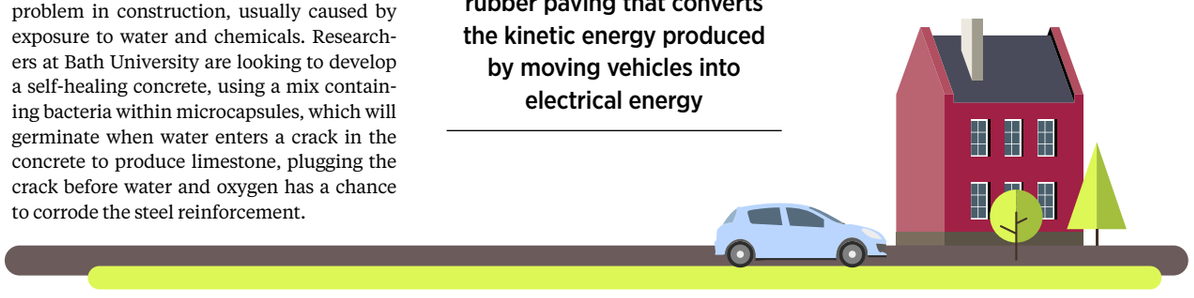
◆ INNOVATIONS

● FELICIA JACKSON

SELF-HEALING CONCRETE

Cement is one of the most widely used materials in construction, but also one of the largest contributors to harmful carbon emissions, said to be responsible for around 7 per cent of annual global emissions. Cracking is a major problem in construction, usually caused by exposure to water and chemicals. Researchers at Bath University are looking to develop a self-healing concrete, using a mix containing bacteria within microcapsules, which will germinate when water enters a crack in the concrete to produce limestone, plugging the crack before water and oxygen has a chance to corrode the steel reinforcement.

> Underground Power has developed a technology called Lybra, a tyre-like rubber paving that converts the kinetic energy produced by moving vehicles into electrical energy



THERMAL BRIDGING

Efficient insulation material is becoming increasingly important throughout the construction industry. Heat transmission through walls tends to be passed directly through the building envelope, be it masonry, block or stud frame, to the internal fascia such as drywall. This process is known as "thermal bridging". Aerogel, a technology developed by Nasa for cryogenic insulation, is considered one of the most effective thermal insulation materials and US spin-off Thermablok has adapted it using a proprietary aerogel in a fibreglass matrix. This can be used to insulate studs, which can reportedly increase overall wall R-value (an industry measure of thermal resistance) by more than 40 per cent.

PHOTOVOLTAIC GLAZING

Building integrated photovoltaic (BIPV) glazing can help buildings generate their own electricity, by turning the whole building envelope into a solar panel. Companies such as Polysolar provide transparent photovoltaic glass as a structural building material, forming windows, façades and roofs. Polysolar's technology is efficient at producing energy even on north-facing, vertical walls and its high performance at raised temperatures means it can be double glazed or insulated directly. As well as saving on energy bills and earning feed-in tariff revenues, its cost is only marginal over traditional glass, since construction and framework costs remain, while cladding and shading system costs are replaced.

KINETIC FOOTFALL

Kinetic energy is another technology under development. Pavegen provides a technology that enables flooring to harness the energy of footsteps. It can be used indoors or outdoors in high traffic areas, and generates electricity from pedestrian footfall using an electromagnetic induction process and flywheel energy storage. The technology is best suited to transport hubs where a large flow of people will pass over it. The largest deployment the company has done so far is in a football pitch in Rio de Janeiro to help power the floodlights around the pitch. It also currently has a temporary installation outside London's Canary Wharf station powering street lights.

KINETIC ROADS

Italian startup Underground Power is exploring the potential of kinetic energy in roadways. It has developed a technology called Lybra, a tyre-like rubber paving that converts the kinetic energy produced by moving vehicles into electrical energy. Developed in co-operation with the Polytechnic University of Milan, Lybra operates on the principle that a braking car dissipates kinetic energy. The cutting-edge technology is able to collect, convert this energy into electricity and pass it on to the electricity grid. In addition to improving road safety, the device upgrades and promotes sustainability of road traffic.

PREDICTIVE SOFTWARE

The structural integrity of any building is only as good as its individual parts. The way those parts fit together, along with the choice of materials and its specific site, all contribute to how the building will perform under normal, or extreme, conditions. Civil engineers need to integrate a vast number of pieces into building designs, while complying with increasingly demanding safety and government regulations. An example of this was work on the structural integrity of the arch rotation brackets at Wembley Stadium, undertaken by Bennett Associates, using ANSYS software, which simulated the stresses on the brackets that hold and move the distinctive arches above the stadium.

3D MODELLING

Planning innovation has been driven by the growth of smart cities. CyberCity3D (CC3D) is a geospatial-modelling innovator specialising in the production of smart 3D building models. It creates smart digital 3D buildings to help the architectural, engineering and construction sector visualise and communicate design and data with CC3D proprietary software. The models integrate with 3D geographic information system platforms, such as Autodesk and ESRI, and can stream 3D urban building data to Cesium's open architecture virtual 3D globe. It provides data for urban, energy, sustainability and design planning, and works in conjunction with many smart city SaaS platforms such as Cityzenith.

MODULAR CONSTRUCTION

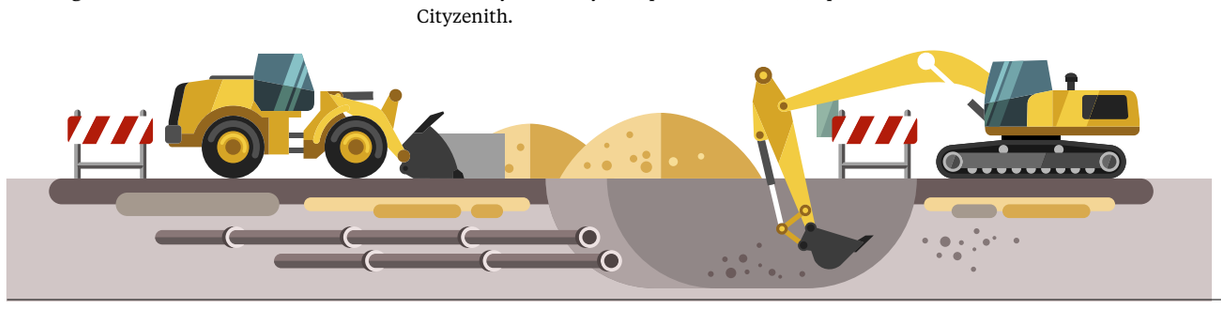
Modular construction is increasingly popular where a building is constructed off-site using the same materials and designed to the same standards as conventional on-site construction. It limits environmental disruption, delivering components as and when needed, and turning construction into a logistics exercise. It also has strong sustainability benefits, from fewer vehicle movements to less waste. With up to 70 per cent of a building produced as components, it allows a move towards "just in time" manufacturing and delivery. In use in the United States and UK, Chinese developer Broad Sustainable Building recently completed a 57-storey skyscraper in 19 working days using this method.

CLOUD COLLABORATION

basestone is a system allowing the remote sharing of data on a construction site in real time. It is predominantly a review tool for engineers and architects which digitises the drawing review process on construction projects, and allows for better collaboration. The cloud-based collaboration tool is focused on the installation of everything from steel beams to light fittings. The system is used to add "snags", issues that happen during construction, on to pdfs, then users can mark or add notes through basestone. Trials have revealed possible cost-savings of around 60 per cent compared with traditional paper-based review methods.

ASSET MAPPING

Asset mapping focuses on operational equipment, including heating and air conditioning, lighting and security systems, collecting data from serial numbers, firmware, engineering notes of when it was installed and by whom, and combines the data in one place. The system can show engineers in real time on a map where the equipment needs to be installed and, once the assets are connected to the real-time system using the internet of things, these can be monitored via the web, app, and other remote devices and systems. It helps customers build databases of asset performance, which can assist in proactive building maintenance, and also reduce building procurement and insurance costs.



CHANGING WORLD, CHANGING ROOMS

At the most basic level, all rooms are the same – structurally, they have a floor, walls and a ceiling. However, that is not how people perceive the spaces in which they live, work and play. To us, all rooms are different

British Gypsum SAINT-GOBAIN

Demands and designs vary enormously from one environment to another, changing not just between tastes and functions, but over time and with technology. From home to work, from the local supermarket to the local hospital, expectations are constantly moving forward and the construction sector is being asked to innovate and create multi-use spaces in response.

British Gypsum has more than 100 years' experience in plaster, plasterboard and ceiling solutions, helping create spaces that provide comfort, protect against fire and insulate against sound. More recently, innovations from British Gypsum mean that walls can be more interactive, customisable and even improve the air we breathe.

> Innovations from British Gypsum mean that walls can be more interactive, customisable and even improve the air we breathe

AESTHETICS PLUS PERFORMANCE

Examples of the trend for increasing the functionality of a space can already be found in the new "Rooms Made For You" range from British Gypsum: Thistle Magnetic Plaster transforms the entire wall into an interactive surface that attracts magnets; whereas Lifestyle Wall accommodates exceptionally high loads, such as flat-screen TVs, with standard screws, eliminating the need for specialist mechanical fixings. The range of Sound Solutions provide enhanced levels of sound insulation to protect against noise, enabling different members of the family to turn it up loud or enjoy a quiet night's sleep without any compromise. All of these products are highly versatile, plus they crucially combine aesthetics and performance.

"The win-win for homeowners and building designers alike is when they no longer have to choose design or performance. Enabling them to have both, together, drives the agenda for manufacturers," says Paul Howard, innovation manager at British Gypsum. "The focus is on making the internal walls and ceilings do more for the building user, increasing the functionality of the space. A good example is our ceilings offer, where we provide a high-quality design aesthetic and, at the same time, optimise the acoustic environment and enhance the indoor air quality."

HOW GOOD IS THE AIR INDOORS?

As we spend up to 90 per cent of our time indoors, we take it for granted that the air we breathe is clean and pollutant-free, as fresh as the air from the great outdoors. Yet impurities found in both our homes and workplaces can cause health problems and a reduction in our general wellbeing.

Allergies and asthma are on the rise, especially among children and young adults, with the US Environmental Protection Agency even going so far as to rank indoor air pollutants in the top five environmental risks to public health.

Pollutants, called volatile organic compounds (VOCs), get introduced indoors by people, pets and cleaning products, as well as finishes, fabrics, furnishings and floor coverings. With new buildings becoming more air-tight, these indoor pollutants become more of a problem in internal spaces.

People often complain about health problems after extended periods of time spent indoors and many of these symptoms can be attributed to VOCs, including formaldehyde. VOCs are easily evaporated at normal room temperature, releasing airborne toxins – "off-gassing" – which can give rise to headaches, lack of concentration and breathing problems.

HOW TO CAPTURE AND CONVERT FORMALDEHYDE

Helping tackle the problem of VOCs, ACTIVair from British Gypsum is a new technology added to a number of its products, including its Thistle PureFinish plaster which can easily be retrofitted. Specifically designed to transform emissions of formaldehyde, a common VOC, into non-harmful inert compounds, it eliminates the risk of re-emission. ACTIVair technology:

- Removes up to 70 per cent of formaldehyde concentrations in a controlled test environment
- Will produce cleaner, fresher air for at least 50 years
- Poses no risk of re-emission even if the product is damaged.

Improving the indoor environment is a major consideration, especially in your own home, and healthcare, education and workplace sectors, where good health, focus and concentration are key. Within a hospital environment, where young or vulnerable people spend long periods indoors, the removal of formaldehyde can help speed patient recovery.

Lifestyle Wall accomodates exceptionally high loads

Case Study

St Mary's Hospital

British Gypsum ceiling tiles and plasterboard products have been used to help create a healthy indoor environment for patients, visitors and employees at a new unit of St Mary's Hospital, Kettering. The Gyptone ceiling range with ACTIVair was installed in four key areas of the existing hospital as a retrofit test measure. With sufficient performance data successfully gathered, the system was then specified throughout the new build.
Tests showed an average reduction of 42 per cent in levels of formaldehyde, a common volatile organic compound or VOC linked to health issues in high concentrations. All results were well below the maximum recommended by the World Health Organization.

HOW SUSTAINABLE ARE THE PRODUCTS IN MY HOME?

Innovation is not limited to products, either. Developing relevant accompanying information, plus providing it in a user-friendly and readily accessible format can help save time and money.

Sometimes, the answers to complex concerns are actually quite simple. For example, the independently verified Environmental Product Declarations (EPD) do exactly what their name suggests, they tell you what you need to know about a product and the environment.

Sustainability leader at British Gypsum, Heidi Barnard, explains: "There are many claims made by product manufacturers regarding environmental performance, and it can be difficult for professional specifiers and architects, never mind DIY enthusiasts and homeowners, to see how sustainable a solution really is. The answer is EPD. Based on clearly defined rules, they give an indicator of performance that is reliable and transparent. In short, you know what you are getting."

Recognising the value of such convenience, credibility and clarity, British Gypsum now has a range of EPD covering much of its plasterboard and Thistle plaster products.

Customers across all markets are also now beginning to question not just what a product does, but where it came from, originally. Again, it is independently verified certification that provides assurance. Understanding the importance of such traceability, British Gypsum focused efforts to become the first manufacturer of interior lining systems to achieve a BES 6001 "excellent" rating for responsible sourcing.

CONTINUOUS IMPROVEMENT

For a manufacturer, as in life, the learning never stops; the aspiration need not diminish, as Heidi Barnard concludes: "While it is important for us to share successes, we must also strive for continuous improvement, understand current and future customer needs, learn from doing, and set ambitious objectives for the future."

www.british-gypsum.com

London is looking up to the sky

Most Londoners may not know it, but the capital is about to get a futuristic and controversial high-rise makeover

◆ **LONDON SKYLINE**

● **JOSH SIMS**


Getty Images

Look across the London skyline and landmark buildings speak globally of what it is to be in the capital – St Paul's, Tower Bridge, St Pancras Station and the Houses of Parliament – but also architecture of the modern era, Lloyd's of London, Tate Modern and The Gherkin perhaps. Their diversity reflects both the city's long history, but also its distinctively chaotic energy and charm.

Yet that skyline is set to change radically over coming years. Incredibly, some 250 or so tall buildings, of 20 storeys or more, are currently consented or proposed across London. It's a number changing almost daily, with some 113 approved for planning and 70 having started construction over the last year. Some 30 of the 250 will be more than 40 storeys high, 19 of them over 50. London, it seems, is set to take bold strides towards a more sci-fi aesthetic.

"All cities have to regenerate and refresh, and high-rise buildings are increasingly doing that for London," says Bill Price, director of building structures at WSP Group, engineers behind The Shard, perhaps the most internationally recognised of recent new buildings. "It's hard for engineers to drive all quality issues, but what's key about these new buildings is their quality. It is important they're good buildings and that attention is paid to the space and building on the ground around them, for example, to gardens and to civic amenities. But the evidence is these proposed buildings are being funded and are happening."

In the past ghettos of gated developments may have failed to deliver for local stakeholders, but there is new awareness and understanding of the issues among property and construction, says Paul Toyne, group head of sustainability at Balfour Beatty, winner of the £110-million contract for the 43-storey Providence Tower development.

"Of course, there are sensitivities around the impact of high-rise developments on the skyline, but if the decision is made to progress with a scheme, then the associated infrastructure surrounding it is vital; this includes transport links and other facilities such as retail. In that sense, the build can create investment opportunities to regenerate the area. Ultimately, for it to work, the whole community needs to benefit," says Dr Toyne.

Certainly the scope of the many proposals looks set to reimagine London's essential character, for good or ill. The Nine Elms area is currently a forest of super-cranes building, say critics, less than super towers, as is Canary Wharf, with other hotspots being the City, Southwark and generally along the south bank of the Thames. And, for the moment, Londoners appear broadly divided about the developments. According to a poll conducted last year by NLA, an independent forum on building in London, 40 per cent of respondents did not agree with the statement "there are too many tall buildings in London", while 34 per cent did.

What the same poll showed is that Londoners are impressed by towers; 46 per cent said tall buildings have made London look better, with 25 per cent disagreeing. Certainly some interested parties have argued that the rush to iconoclasm helps underpin the city's reputation, not only as the national capital, but as a global capital. Both in terms of image and office space, they say, this will help attract major international businesses too, although a majority of the proposed towers are residential and, it is suspected, like the Tower at One St George Wharf in Vauxhall, which is currently the UK's highest residential tower, will be at the luxury end of the market.

Others say, not without opposition, that with London's population growing at twice the rate of the rest of the country, increasing densities is the only way to conserve land area and so the pressure to build tall is hard to resist.

But, as might be expected, not everyone is pleased by this vision of a city given a *Blade Runner* makeover. Rather it is becoming a subject of great controversy. Campaign groups, such as Skyline, are finding growing support, backed by architect heavyweights the likes of David Chipperfield, David Adjaye and Eva Jiricna. "We're not anti-towers, so much as anti-bad towers in the wrong location," argues Barbara Weiss, one of Skyline's co-founders, along with her husband, a property developer who might well be expected to be on the other side of the debate.

> **These are towers that are likely to be there for centuries – you can say, in effect, they will be there forever**

"The question isn't just how they look, but how they look from miles away," says Ms Weiss. "The fact is there is very little master-planning going on, as there has been in New York, to give a feeling of continuity and consistency."

Ms Weiss is clearly not exaggerating when she says that the capital's proposed skyline "gets a lot of people very angry" and could prove to be a key issue in the election of London's next mayor.

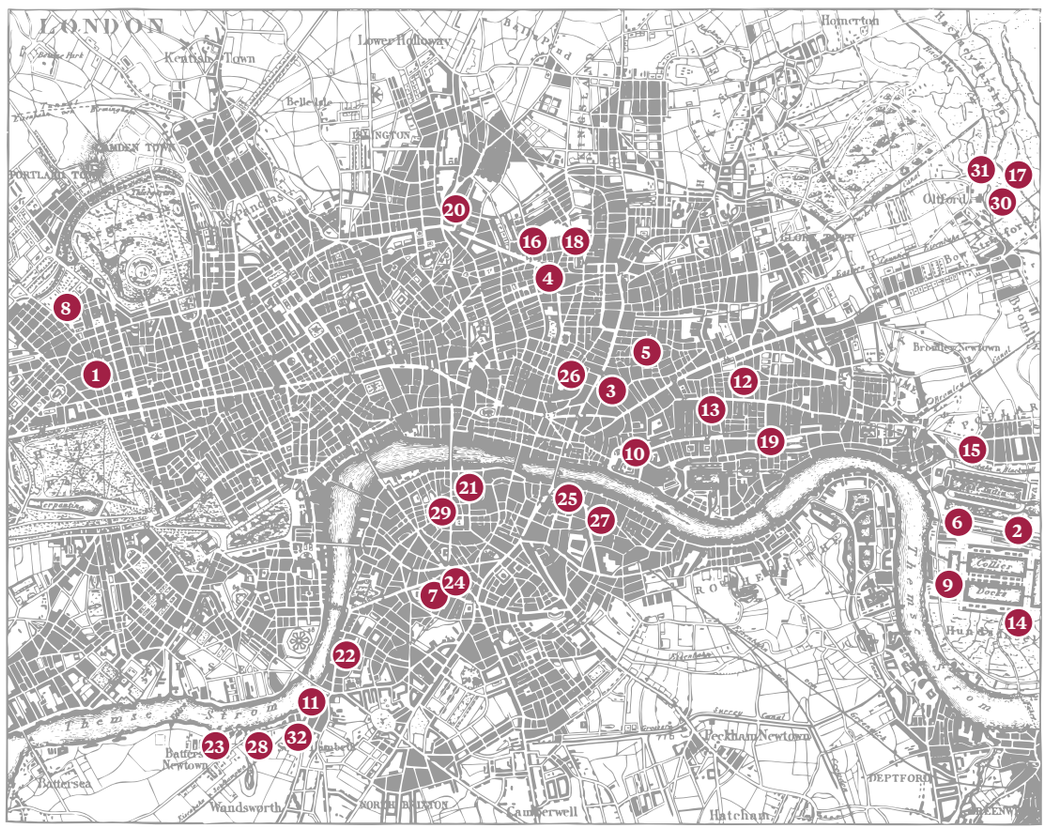
So could or should the construction industry be doing more to communicate the benefits and importance of high-rise development to the media, general public and planners? Dr Toyne thinks not. "It isn't the role of the industry to single out one particular element of our built environment. Instead, it is important that construction can demonstrate it's a modern industry with fit-for-purpose solutions that not only produce high-class quality infrastructure, but also do so in such a way that the local and national economy benefits as well," he says.

As WSP's Mr Price concludes, towers should not be constructed without long and serious consideration. "Since such tall buildings today are stronger than those built in the past, they are designed and made to last. These are towers that are likely to be there for centuries – you can say, in effect, they will be there forever."

That thought puts a new perspective on what is, both sides concede, an incredibly complex debate. Building never has been without controversy. But it looks like London's new construction scene is set to become more a battleground – just who does London's skyline belong to?

London's new skyscrapers

1 Merchant Square 1
1-18 Dollar Bay Court 2
100 Bishopgate 3
151 City Road 4
22 Bishopgate 5
30 Marsh Wall 6
360 London 7
399 Edgware Road 8
40 Marsh Wall 9
52 Lime Street 10
81 Black Prince Road 11
Aldgate Place 12
Altitude 13
Baltimore Tower 14
Blackwall Reach 15
Canaletto, 257 City Road 16
Capital Tower 17
Eagle House 18
Goodmans Fields 19
Lexicon 20
Manhattan Loft 21
Merano 22
Nine Elms 23
One The Elephant 24
One Tower Bridge 25
Principal Place 26
Providence Tower 27
Riverlight 28
South Bank Tower 29
Stratford Plaza 30
Stratosphere 31
The Atlas 32



Source: *The London Tall Buildings Survey 2015*, New London Architecture (NLA) and GL Hearn