

Digitalisation, Disruption and the Energy Renovation Sector

Robots and the construction industry may not go together like a horse and carriage in parlour talk but, as digitalisation gathers pace, they look set to define Europe's building sites in the next century.

Experts predict that a **transformation of the construction sector may be well underway by 2030**, and politicians are sitting up to take note. “We are very close to a big acceleration and disruption,” says the Italian MEP Brando Benifei. **“The disruption will come quickly and it will be quite impactful on our whole society.”**

A recent [McKinsey report](#) concurred. “The construction industry is ripe for disruption,” it said, adding that today's building projects typically take 20% longer to finish than scheduled – and cost up to 80% more than promised.

The global construction sector may be worth [\\$10 trillion a year](#) but its productivity has barely changed since 1945, according to McKinsey - compared to a 1,500% growth in manufacturing, retail and agriculture. Automation may be about to change that, faster than anyone thinks.

“Digital solutions have great potential to **increase productivity, reduce construction costs, alleviate burdensome and physical tasks, improve the data collection and analysis of energy efficiency performances and lower life-cycle costs of buildings**”, explains Eugenio Quintieri from the European Builders Confederation (EBC). “Thus, they display an important element to reduce energy consumption of buildings, diminish their environmental impact, and **reach women and young people, nowadays underrepresented in the sector**”

The robots are coming

At the moment robots and cobots - collaborative robots that work with human colleagues – need operators and only have limited learning capacity. But their functionality is advancing rapidly. A \$2m prototype 'Hadrian X' bricklaying robot now being assembled – and [due to go into commercial production next year](#) – can reportedly lay up to 1,000 bricks an hour. It would take two human bricklayers one day to lay 1,000 bricks, by comparison – and some robots may be [three times faster than the Hadrian](#).

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These one-armed robots would also work 24 hour-shifts with no breaks and need minimal human interaction. They can lay a residential house from the ground up within two days, regardless of weather, with an error margin of just millimetres, [reports](#) say.

While these may be the bricklayers of the future, the problem with today's manually programmed robots is that “the layout of a site changes every day,” according to Sue Arundale, director of technical affairs at the European Construction Industry Federation (FIEC). “Obstructions that weren't there the day before may have appeared. Obstructions that were there may have moved. [But] **artificial Intelligence could change all that and we are on the brink of it.**”

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The timeline for widespread deployment of autonomous or semi-autonomous robots that can communicate with (and learn from) each other is “just over the horizon,” Arundale says. As it approaches though, **changes in sectoral production and labour processes are already becoming evident. Most broadly, the focus of production is moving from installation to assembly and labour is mutating from the physical to the technical.**

Faces of digitalisation today: 3D printing

Outdoor robots are just one face of 'digitalisation' – a catch all term which covers phenomena from the **increased use of prefabricated materials, often involving 3D printing, to virtual reality modelling and other automotive processes.**

3D printing (also known as additive manufacturing) may offer the greater disruptive potential here, and its deployment appears close. **The technology has developed from being a small components builder, to a creator of entire exterior structures.** It is astoundingly fast, versatile and could be a crucial technology for dealing with future natural disasters. Some teething issues still have to be addressed though, including its exterior finish – which can be primitive – and interior features such as insulation, which are not yet applicable.

But the technology involved is snowballing to the extent that Dubai has set a target for 3D printing [a quarter of all its new buildings by 2030](#). The crane-like robotic 3D printer involved is mostly expected to create low-rise buildings there but skyscrapers are also being tested.

One Chinese company, Winsun, has already built [ten 3D printed concrete houses in just one day](#). Photos of the 3D printer have been banned although it is reported to be 150 metres long, 10 metres wide and 6.6m high. It has reportedly slashed costs and construction times by at least one half, reduced labour needs by up to 80% and cut the need for new construction materials by 30-60%. Winsun claims that it could even 3D print President Trump's promised Mexican wall.

Professor Sigrid Brell-Cokcan of Aachen University, says that the regulation, certification and standardisation of safe materials for 3D printed prefab-buildings could be controversial in Europe.

“China is further ahead very often because they [proceed] without regulations,” she said. “This will be a hurdle for 3D printing here: How can you assure quality for real time 3D printing on a building site? Who qualifies that the material has met the standards?”

At present, most European regulation takes place on the shop floor, rather than the building site but, with Europe's Top 10 cement producers already researching 3D printing – and companies from outside the construction sector getting involved – technological change may force the regulatory pace.

“I think we will see breakthroughs in the next five to ten years,” said Brell-Cokcan, who is also the founder and president of the [Association for Robots in Architecture](#). “By 2030, it will definitely be looking like a very different industry from today.”

Industrialising the renovation process – Assembling the lego

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This not only reduces the cost of the renovation process, but also gives better working conditions as the production process is mostly undertaken indoors rather than standing on a cold rainy construction site – something which appeals to the younger generation. Indeed, on-site work for the Energiesprong project takes only a week, mostly adjusting the prefabricated modules onto the exterior of the terraced houses, and then upgrading and synchronizing the internal building systems.

BPIE and i24c highlight that such an [industrialisation of the renovation process](#) is only made possible thanks to **economies of scale**. It is applicable when a segment of the building stock is identified as having ‘similar’ characteristics - such as a row of terraced houses – so that **the prefabricated components can be produced at scale indoors beforehand.**

But the benefit for the inhabitants is significant as it **dramatically reduces the ‘hassle factor’ for inhabitants, who do not need to relocate during a long period while the works are taking place.**

Drones and BIM

One technological innovation already evident on many building sites is the use of drones. Just as robotic technology developed for hazardous nuclear plants may soon be deployed on building sites, **drones are increasingly making dangerous construction scenarios safer.** They may be used to survey tall buildings or ascertain the scaffolding needs of a job.

Sometimes they are used in renovations for surveying buildings before panels are designed. At other times, they can be used for quality assurance and safety inspections, but the light aircraft are limited in how much weight they can lift, and they can be noisy.

More mundane perhaps, Building Information Modelling (BIM) stands out as the most ubiquitous digitalisation technology of today by far. BIM allows three dimensional site modelling which can be changed in real time – as a building site changes – and accessed by multiple actors using Virtual Reality sensors.

The machines give architects and engineers more data and better telemetry and allow improvements to be factored into areas ranging from site equipment to support contractors. That leads to **smoother, faster and more accurate construction**. Concerns have been raised that the technology is currently too “product driven” - oriented towards selling the wares of supplier companies – and not focused enough on the building process itself. But its potential for a new generation of architects is unquestionable.

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Arundale said: “With BIM you can put on a VR visor and it is like walking around your house, saying 'I don't like this door here. I want it there'. You can streamline design processes, improve delivery times, collaborate with others and be creative. It's almost like a video game, and that makes it more attractive as a career for young people who before might not have considered construction”.

The face of construction workers tomorrow?

Working in the building industry has long been characterised as a physically exhausting and rather low paid activity that lacked innovative drivers, according to the European Builders Confederation (EBC), the organisation representing construction SMEs and craftsmen in Europe.

“**We have a skills shortage, an ageing workforce and the fundamental problem that young people do not consider the sector attractive enough**,” said Eugenio Quintieri, the confederation's Secretary General. “Construction is no longer a dusty sector where people just get their hands dirty. Digitalisation and the accompanying demand for higher-skilled workers will help to reach woman and young people, nowadays underrepresented in the sector.”

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A future digitalized energy renovation sector which requires less muscle and more technical skills also opens the door to more female workers, currently at a low of 10% in the construction sector. **The improved working conditions operating indoors rather than battling the weather outdoors on a construction site could also help bridge the widening gap to the younger generation.**

One [recent survey](#) of 3500 construction CEOs in the UK described labour shortages as the industry's second biggest challenge, with 700,000 employees expected to retire within a decade.

Brell-Cokcan said **the sector's problem was that it was “not very sexy” and “not very sophisticated” for the iPhone generation.** But enabling people to control state of the art robots would create a much more positive impression of the work, she added.

“Younger people are growing up as 'digital natives' and expect to be able to interact with their environment at home and at work using mobile phones, tablets, even their watches,” explained Anda Ghiran, a sustainable energy policy manager at Johnson Controls (JCI).

JCI has made its building managements systems compatible with popular digital services, enabling smart phone access to its HVAC equipment and a new room thermostat controlled by a voice-activated cloud-based app, she said.

EBC believes that these sort of technological upgrades – **supporting physical labour with digital solutions** – will increase the sector's recruitment appeal to younger people and also, crucially, to women.

“Our fear is that we have large numbers of people in the construction industry now who will retire at some point in the near future and, at the other end of scale, there is not a large number of people coming into industry to replace them,” Arundale said.

Ensuring no-one gets left behind

While digitalisation stands ready to tempt waves of new graduates into the construction industry it poses questions about what will happen to the older workers who remain. At least they may find the health and safety of their workplaces transformed. Construction has been a notoriously dangerous vocation, [accounting for over a fifth of all workplace fatalities](#) in the US in 2016 – or 991 people. The leading causes of deaths were falls, followed by being struck by an object, and electrocutions.

Some forecasts predict that the US market for robotic exoskeletons - which construction workers may wear to offset bone-crunching heavy lifting work - [will reach \\$1.9bn in 2025](#). Switching from manual labour to app-based working more generally may not only save the need for dangerous working, but delay retirement ages, anecdotal evidence suggests. Either way, reskilling is rising up the political agenda.

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“I think we can demand - and will need to pay - some societal costs in terms of the people who will lose their jobs and need to be reskilled,” Benifei said. “We are very keen on the need for new training and preparing the [existing] workforce for these kind of jobs.”

Changing business models will also need to be addressed, given that **92% of the companies working in today's construction sector are small and medium-sized enterprises (SMEs)**. Most of these are subcontractors which provide, among other things, data for BIM inputs and other software.

These SMEs can only be given the chance to compete if they are **equipped with upgraded IT infrastructure capable of storing the vast amounts of data that will flow from the BIMs, drones, prefabricated modules, 3D printing and robots of tomorrow's construction sector.** Arundale emphasizes that state-of-the-art IT infrastructure is critical for a collaboration across the value chain.

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“Digitalisation is an enabler and not a goal in itself. Digital solutions make sense when they are affordable, easy to access and constitute a real added value to our construction SMEs and craftsmen. Only an **inclusive digital transformation will ensure the strengthening of the sector as a whole**”, emphasises Quintieri.

Supporting SMEs in the post-2020 MFF

“We need to involve construction micro, small and medium-sized companies, as well as craftsmen, with specific training, with funding support, and the right regulatory framework,” Quintieri said. “Transformation has to be gradual.”

Here, backing from lawmakers will be important. Having assumed a greater say in the governance of President Juncker's European Fund for Strategic Investments, **“the European Parliament will be united in pushing for more support for SMEs and investing in the workforce,”** Benifei says. “On the one hand, we need for sure income support measures for workers that will need to change their job but also **we need to do more [for] training and to make this inclusive.**”

The [New Skills Agenda for Europe](#) also concentrates funds which can be used for reskilling workers whose jobs have been made obsolete by new technologies. EU Member States must request use of the funds themselves but Parliament has tried to incentivise its use by creating easier ways to access the funds.

“We've also been pushing for structural funds, especially the European Social Fund to be used more specifically for digital literacy and [retraining for] new jobs,” said Benifei.

In many ways, we are still only at the beginning of understanding how far-reaching the various ripples from digitalization will be for the energy renovation sector. But with change comes opportunity, and **the potential to transform the industry for the better is huge.** The rate and the depth of energy renovations across the EU must be boosted to cut CO2 emissions, lower energy bills, create local jobs and improve living conditions for millions of EU citizens suffering in damp cold homes.

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Renovate Europe is a political communications campaign with the ambition to reduce the energy demand of the building stock in the EU by 80% by 2050 compared to 2005 levels through legislation and ambitious renovation programmes. This will bring the energy performance of the entire building stock in the EU to a Nearly Zero Energy (NZEB) performance level.

Renovate Europe brings together 38 partners from across the building value chain (trade associations, companies, trade unions, city networks and 15 National Partners):

