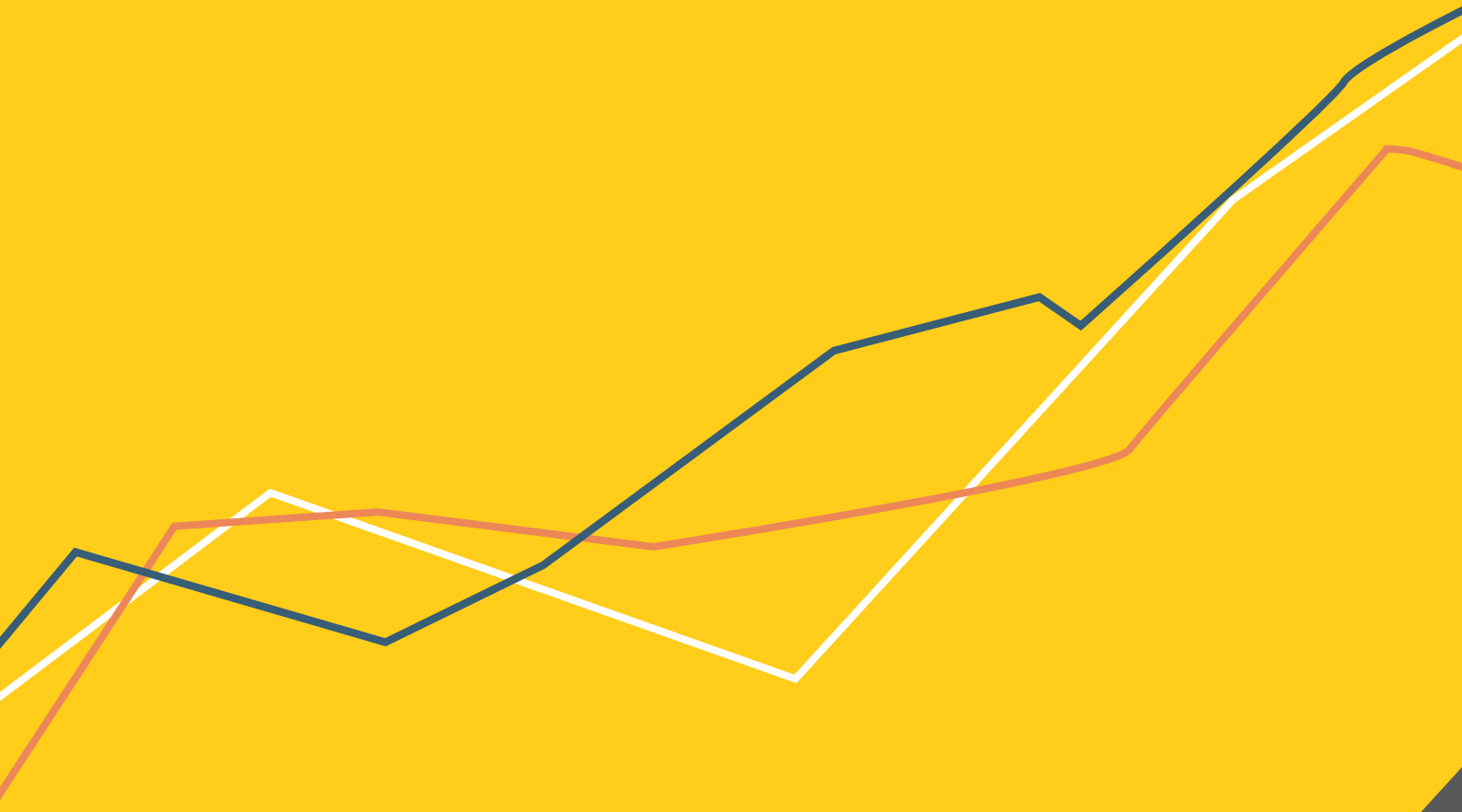
CSQ



Industry Outlook 2018-19

LOOKING TO THE HORIZON AND BEYOND

Contents

Introduction

Construction Skills Queensland (CSQ) is an independent industry-funded body supporting employers, workers, apprentices, trainees and career seekers in the building and construction industry. CSQ invests funds collected by the Building and Construction Industry Training Levy into services and programs that directly support the growth and development of skills in Queensland's construction industry.

This investment is always driven by a clear assessment of the state of Queensland's construction industry and its workforce. Each year, a detailed assessment of the landscape underpins CSQ's investment strategy for the year ahead, which is outlined in its *Annual Training Plan (ATP)*. In this report, we present CSQ's view of the industry and workforce for 2018-19.

The *Industry Outlook* is CSQ's assessment of the predictions for key construction sectors, the state of the construction workforce, as well as the pipeline of apprentices and trainees who represent the future of our industry. The *Industry Outlook* underpins CSQ's *Annual Training Plan 2018-19* and should be read as a companion to this key corporate document.

CEO foreword

In this year's *Industry Outlook* we look to the future through both short-and long-term lenses.

It seems that almost daily a new report is released describing transformations that will shake our economy to its core. These changes promise to disrupt not just how we order food and move from Point A to Point B, but threaten to re-write the very DNA of pillar industries such as construction.

Yet we also know that over the next five years we will build things largely in the same way we did in the last five years. So the show must go on. For this reason, the first half of this *Outlook* is devoted to the business-as-usual indicators that will drive our lives in the near-term: construction activity forecasts, labour market indicators and apprenticeship numbers.

The data suggests that while Brisbane apartment builders will be competing for a much thinner pipeline of work over the coming years, builders of lower density product, those outside the south-east corner, and those in the engineering sector will maintain healthy, even growing, books of work.

The workforce will stabilise over the next few years around a strong supply of construction tradespeople, although the labour market in regional Queensland will be tighter than in the south-east. The apprenticeship system continues to deliver an ample supply of new tradespeople to meet the future needs of Queensland's construction industry.

As we move beyond this short-term horizon, things become much more uncertain. It would be negligent to ignore the structural shifts underway in the economy and blindly project the past into the more distant future.

So for the second half of this report we explain how the growth in demand for construction services is outpacing the growth in its capacity to meet that demand. This will force the industry to innovate – not because it wants to, but because it is the only way to deliver on the built environment needs of the future.

Productivity-enhancing changes that increase output per worker and enable older workers to stay on the tools will lead the way. The technology-catalysing environment of offsite construction will be key, acting as an accelerator for automation and digital technologies.

The impacts on the workforce could be significant. The 'construction' and 'manufacturing' industries will bleed into each other, challenging their existing definitions. The skills-base of the workforce could polarise, with highly-skilled technicians, engineers and designers at one end, and lower-skilled labourers at the other, while the venerable mid-tier construction trades are left only with repair and maintenance functions.

Brett Schimming
Chief Executive Officer

Productivity-enhancing changes that increase output per worker and enable older workers to stay on the tools will lead the way

Short term outlook

In 2003, Queensland's construction industry was doing around $15 billion of work annually. Over the following decade the amount of work done ballooned to almost $63 billion per annum. More than a third of that work evaporated over the subsequent three years, with just $41 billion done in 2017.

This rollercoaster ride was, of course, entirely the doing of Australia's once-in-a-generation mine building effort and its subsequent unwinding. The adjustment is now complete. Over the next three years engineering construction will grow at a more normal, sustainable rate of about 5% per annum.

This next phase of growth for heavy construction will be driven mainly by government spending on public infrastructure. The latest National Accounts reveal that governments increased their spending on fixed capital in Queensland last year for the first time since 2010. This is a turning point – the future is in roads, rail, bridges, tunnels and ports.

Much has been made of the surge in residential construction that gripped South-East Queensland (SEQ) as mining investment collapsed. In truth, this 'apartment boom' proved to be more of a cotton bud than a pillow under the weight of the mining bust. While the residential growth rate was impressive—75% over three years—it did little to offset the mining cliff towering over it **(Figure 1).**

That said, we have certainly built a lot of homes in the last few years. Since 2014, around 38,000 dwellings a year have been added to the stock of buildings in Queensland, compared to 25,000 per annum in the years prior to 2014.

This naturally begs the question of oversupply. The average Queensland home accommodates around 2.5 people. Yet lately we have been building one new dwelling for every 1.5 new residents. This certainly suggests that more dwellings have been built than is needed to keep up with population growth **(Figure 2).**

But there are two quite important caveats to this story.

Fig.1 – Queensland construction activity

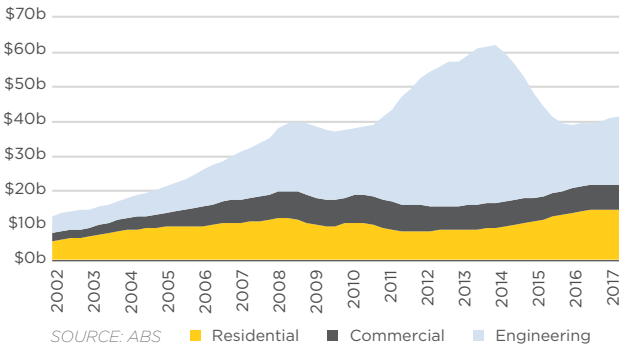
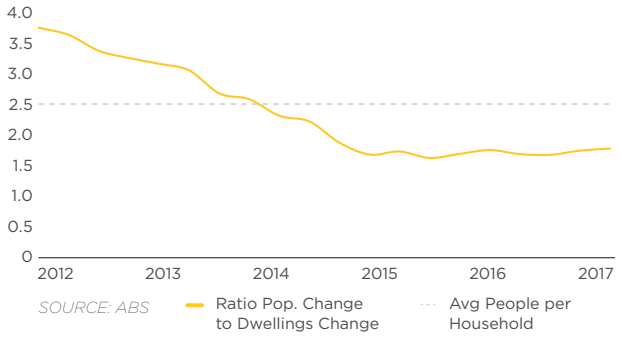


Fig.2 – Queensland dwelling supply and demand



The first is that we were significantly under-building in Queensland in the run-up to 2014, with population growth running a full two percentage points ahead of dwelling growth. So some amount of over-building has been necessary to soak-up this excess demand.

Secondly, there is a strong argument that what has been built since 2014 is a poor match for what people actually want to live in. The boom was mainly driven by apartments, many of which are small investor-grade units around inner Brisbane. In contrast, the growth in detached houses has been slow and steady. While we have certainly over-built inner-city apartments, other types of homes arguably remain underdone **(Figure 3).**

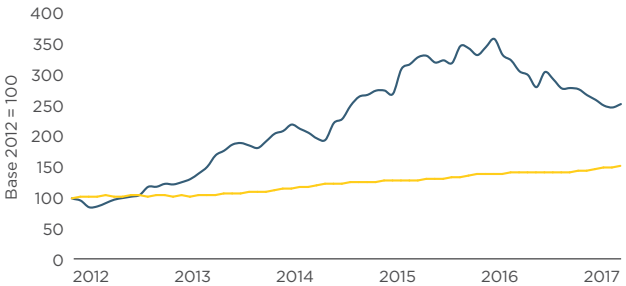
The upshot here is that the next few years will see Brisbane apartment builders competing for a much thinner pipeline of work, while builders of lower density product, and those outside the south-east corner, will maintain healthy, even growing, portfolios.

Yet the residential story is really a subplot; engineering will be the main act over the next few years. The residential sector will contribute only $500 million to a $4 billion expansion in overall activity across 2018.

A strong pipeline of government projects will single-handedly generate high single-digit growth rates over the next couple of years, making construction a $50 billion industry by 2019 **(Figure 4).**

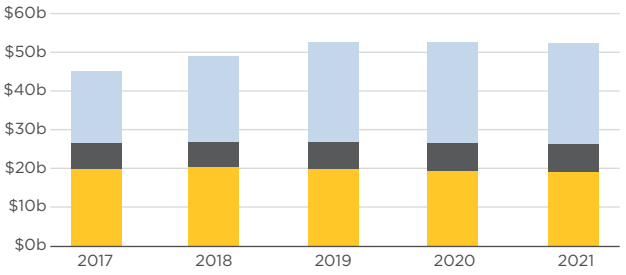
There is also some geographic nuance to this picture. While the last few years have been all about SEQ building with little activity in the regions, the next few years will see a turning of the tide. Residential activity in SEQ will contract at the same time as regional Queensland enters a period of growth for the first time since 2014 **(Figure 5).**

Fig.3 – Queensland dwelling growth



SOURCE: ABS Houses Other Residential

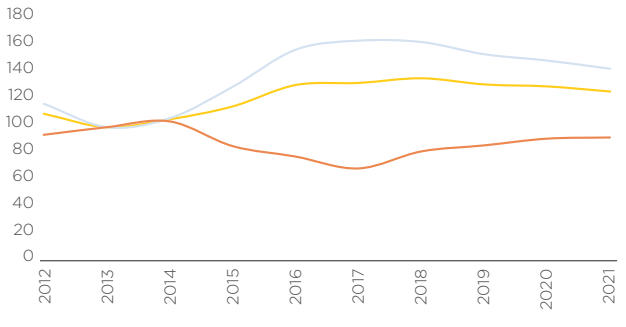
Fig.4 – Queensland construction outlook



SOURCE: NIEIR Residential Commerical Engineering

YoY	2017	2018	2019	2020	2021
Change	-$0.08b	$4.02b	$3.40b	-$0.16b	-$0.34b

Fig.5 – Construction activity growth forecast



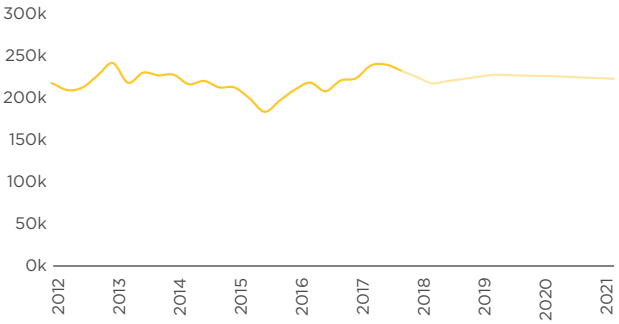
SOURCE: NIEIR QLD SEQ Regional QLD

The labour market response to this environment will be largely neutral. The construction workforce peaked at around 240,000 in 2013. From there it slid to around 190,000 in 2015. The labour force then swung upward, driven by apartment building, peaking again at 240,000 last year. We expect this rollercoaster ride is now over, with employment set to stabilise just below 230,000 over the coming few years **(Figure 6).**

Of the roughly 230,000 construction workers in Queensland, around three-quarters work in the south-east corner and two-thirds are tradespeople. Over the next five years we expect the state to carry a strong supply of construction tradespeople, although the labour market in regional Queensland is likely to be tighter than in the south-east corner **(Figure 7).**

The recent intake levels and completion rates for construction apprentices in Queensland is delivering an ample supply of new tradespeople to meet the needs of the industry into the future. Our latest estimates are that around 68% of the 2016 cohort of construction apprentices will complete their apprenticeship, which is just above the long-run average. Since 2013, completion rates have averaged a healthy 65%, which has delivered a strong and steady stream of new tradespeople into the industry. Indeed, apprentices who complete in the coming years are likely to find themselves in a fairly competitive labour market, while employers will have the luxury of selecting from a reasonably deep pool of talent **(Figure 8).**

Fig.6 – Queensland construction employment forecast

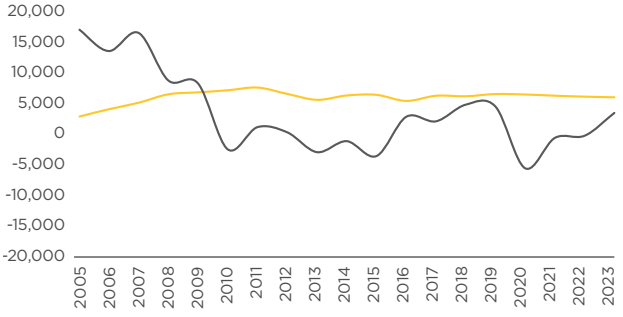


SOURCE: ABS, NIEIR

Fig.7 – Construction trades labour balance

SOURCE: NIEIR QLD SEQ Regional QLD

Fig.8 – Construction apprentice pipeline



SOURCE: NIEIR, CSQ Completing Apprentices New Workers Needed

Over the next five years we expect the state to carry a strong supply of construction tradespeople

Over the horizon

Australia generally, and the construction industry particularly, is being disrupted. Not just digitally, but demographically.

Australia's population continues to grow relentlessly – we will be two-thirds larger by 2050. This in turn demands year-on-year increases in construction activity. Yet it is not the growing population, per se, that is so disruptive. It is the ageing profile of that population **(Figure 9).**

Australia's ageing population means that workers won't just be older; they will be fewer. While the population expands, the proportion of the population available to work is shrinking. Currently there are 4.4 Australians of working-age for every person over 65. By 2040, that ratio will be two-to-one.

There are two paths to meeting expanding demand with an ageing and shrinking workforce. The first is to keep people working longer. The second is to produce more per worker.

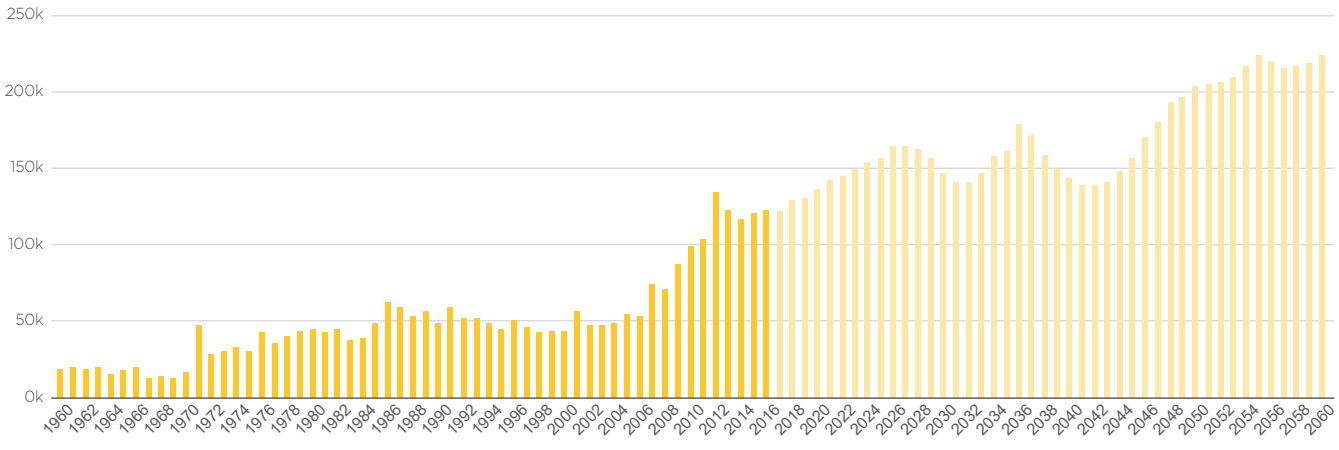
In short, the construction industry is facing a future where it will need to get more work done with fewer, less physically-capable workers.

These demographic drivers are converging with several other macro forces that are squeezing the capacity of the construction industry. These include climate change, which is making the construction site less productive and more hazardous, urban densification, which is making construction more complicated and logistically difficult, and globalisation, which is seeing lower-cost and innovative suppliers threaten certain sectors of the domestic industry.

All the while, technological progress continues to accelerate.

Fig.9 – This chart will change every industry

Annual Growth in over 65s, Australia



SOURCE: ABS

Technological change

While history teaches us that new technology alone is not enough to disrupt the construction industry, technologies that respond to these macro drivers with compelling solutions are likely to make good headway. Though it is worth remembering that the construction industry has, until now, proven very resistant to disruption.

There is good reason to believe that this time is different. These macro trends are boxing the industry into a corner from which the only escape is innovation – a position in which construction has not found itself since the Middle Ages. And there are a range of technologies ready to take up this invitation to disruption.

We therefore expect the adoption of construction innovations to accelerate over the coming two decades, moving from the fringe into the mainstream. But not just any good idea will gain traction.

The construction innovations that will win in the coming decades will be those that fulfil four fundamental requirements:

1. Make construction work less manually burdensome, allowing older workers and women to continue working in, or enter, the industry.
2. Increase the productivity of the construction process, delivering more output with the same amount or fewer worker-hours.
3. Address the industry's unique culture, which is polarised between a highly-educated professional class and a low-to-mid skilled class of tradespeople and labourers.
4. Respond to the fragmentation of the industry (99% of construction businesses are small businesses), dealing with the realities of thin profit margins and low capacity to invest.

Scanning the landscape of construction technologies, three stand out as candidates for rapid adoption over the coming decades: offsite construction, automation and robotics, and digitisation (including Building Information Modelling (BIM)). These are the essential technologies we believe every construction stakeholder must consider. While each stakeholder's strategic response to them will vary, these three innovations will have the most significant impact across the Australian construction industry.

These macro trends are boxing the industry into a corner from which the only escape is innovation

Offsite construction

Moving the construction process from the construction site to the factory is an accelerating trend.

We see this shift as the industry's 'gateway disruption.' The key advantage of offsite construction is that it catalyses other technologies. Robotics and 3D printing, for example, are very difficult to implement in the ever-changing and uncertain conditions of a construction site, but become far more feasible in a controlled environment. Similarly, a world of digitisation and the 'internet of things' (see below) is far easier to achieve offsite.

Another advantage of offsite construction is that it dramatically reduces materials handling. Materials handling represents the single biggest opportunity for productivity gains in the construction process – studies have found that more than a third of construction workers' time is spent idle or non-productive while waiting for materials and tools[1]. Materials handling is also the activity that causes the most accidents and injuries on construction sites[2].

Offsite fabrication promises to reduce this source of waste and risk, delivering significant productivity and Work Health and Safety (WHS) benefits. It also means that older workers are able to keep working longer by reducing the manual burden. It is also likely that a shift to an offsite environment will result in an industry less hostile to women, diversifying its talent pool and promoting innovation in a virtuous circle.

The move to offsite construction also involves a productive cultural shift. The manufacturing ethic that takes over once inside a factory means that all of the discipline and rigour of operations management can be applied – standardisation, lean production, process optimisation, continuous improvement, total quality management, and so on. It is also worth noting that global competitive forces are brewing in this space. The Asia Pacific Region, led by China, India and Indonesia, now dominate prefabrication globally, accounting for more than 67% of global revenue.

The main barrier to offsite construction is the limited ability of construction companies to raise the capital needed to bring a solution to market. There are only a handful of players in a financial position for such an undertaking. There is also significant regulatory and industrial uncertainty in this space, with the prevailing industry structures entrenched in traditional on-site methods. This is a very large ship to turnaround.

For this reason, the 'green shoots' of offsite construction are, as a rule, not coming from builders but from other parts of the supply chain. The leaders in this space are the likes of CSR (a building products company), Stoddarts (a steel fabrication business) and Hyne Timber (a timber mill). A notable exception to this rule is the large multinational builder, LendLease, who has made a significant investment in a prefabrication plant in Western Sydney. There are also a range of smaller players in the prefabricated 'modular' and 'kit home' market, such as Happy Haus and ArchiBlox, but this remains a largely cottage industry. Mainstream adoption will be led by the big players.

[1] Jenkins, J, and Orth, D. (2004) 'Mechanical and General Construction Productivity Results,' Cost Engineering, 46(3): 33-36

[2] Perttula, P. et al (2003) 'Accidents in materials handling at construction sites,' Construction Management and Economics, 21(7): 729-36

Materials handling represents the single biggest opportunity for productivity gains in the construction process

Automation

Industries such as agriculture and manufacturing realised significant productivity improvements over the last century through automation. In the 1920s, the agricultural industry employed almost one third of the entire labour force. Today, widespread adoption of labour-saving technologies means the industry accounts for less than 3% of the workforce, even while the volume of output is far greater. This industrial revolution glanced off the construction industry without so much as a flesh wound – construction employs roughly the same proportion of the workforce today as it did a century ago[4].

There are some prominent signals that the construction industry will not be able to avoid the next industrial revolution. Many technologies are starting to appear and enter into common use that promise to deliver labour productivity gains on a scale similar to that seen in other industries:

- Civil construction operations are increasingly combining the power of satellite positioning with 3D modelling to direct earthmoving tasks. Where civil contractors once relied on a labour-intensive process of placing and replacing survey stakes to guide cut/fill operations, technology is now available that allows machine operators to work from digital site plans in a manner not unlike in-car navigation. These sophisticated machines are transforming a once highly specialised task into one that requires no more than a few hours' training to perform proficiently. The Japanese company, Komatsu, is taking the next logical step, pairing fully autonomous, driverless plant with surveying and inspection drones to measure, doze and grade a site without any human intervention.

- Concrete and masonry work is traditionally the most labour intensive and back-breaking of all construction tasks. This domain has already seen some labour-saving technologies enter the mainstream, such as concrete pumps, finishing machines and precast concrete panels. More ambitious and experimental, but well-funded, robotic solutions such as the Semi Automated Mason (SAM) and Hadrian X provide accurate and efficient placement of masonry units. These solutions are claimed to at least triple the productivity of the typical bricklayer, while significantly reducing the manual burden on the worker.

- Prefabricated components are increasingly used throughout the commercial and engineering sectors, including structural steel elements, roofing systems, bathroom pods, wall and floor cassettes, and other structural and finish materials. This componentry is produced in factory conditions with equipment employing varying degrees of automation, including 3D printing. These methods are delivering productivity benefits combined with installation processes that do not expose workers to adverse ergonomic impacts.

- Site inspectors and surveyors are increasingly making use of high resolution drone technology to undertake site surveys and building inspections. Drone technology enables rapid mapping of sites for engineering design with unparalleled accuracy. Building inspectors are now able to inspect areas of buildings that were previously inaccessible or only at great expense.

These innovations have, to date, been used primarily by large contractors completing large engineering and industrial projects. The coming decades are likely to see these technologies penetrate the bulk of smaller contractors as the costs to access automated equipment falls, and as the supply chain continues to re-tool around these capabilities.

[4] http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/1301.0Feature%20Article142001

BIM is the leading innovation in this space, promising to iron-out the information breakdowns that add-up to the industry's habitual cost overruns

Digitisation and BIM

It has been estimated that 20-40% of construction costs are waste: wasteful spending, wasteful delays and wasteful communication[5]. Information breakdowns are often the root cause: information that's outdated, inaccurate, undocumented, or just uncommunicated. It has become a cliché that survival in the slim-margin world of construction demands that contractors get control of this waste.

The problem is not that builders are generally incompetent. The problem is that the construction environment is always changing. Builders cannot optimise their operations in the same way production managers can optimise their factories. In construction, the 'factory' changes every day, the 'product' is never the same, and neither is the workforce.

Herein lies the promise of digitisation. BIM is the leading innovation in this space, promising to iron-out the information breakdowns that add-up to the industry's habitual cost overruns. The potential benefits to the bottom line have been shown to be significant[6]. And it is relatively cheap to acquire and implement because it is software not hardware.

BIM should be the low hanging fruit of technological change in construction. Yet it has been spectacular only in its failure to achieve its potential.

Things are made especially difficult for BIM by the structure of the construction industry. 99% of the industry is comprised of thousands of small, independent businesses that come together in different groups for different projects, then disband again. These groups work according to a largely unwritten manual. BIM has rewritten large swathes of that manual, and demands that its learning be synchronized across the entire industry simultaneously. This has proven to be an insurmountable barrier to innovation in an industry that places little value on ongoing learning or digital literacy.

We therefore see little prospect of BIM's success beyond the narrow realm of 3D modelling unless and until we see significant vertical consolidation in the industry — that is, the amalgamation of the industry into larger entities to outweigh the mass of subcontractors — or, in a more likely scenario, a shift to offsite construction catalyses BIM's widespread adoption.

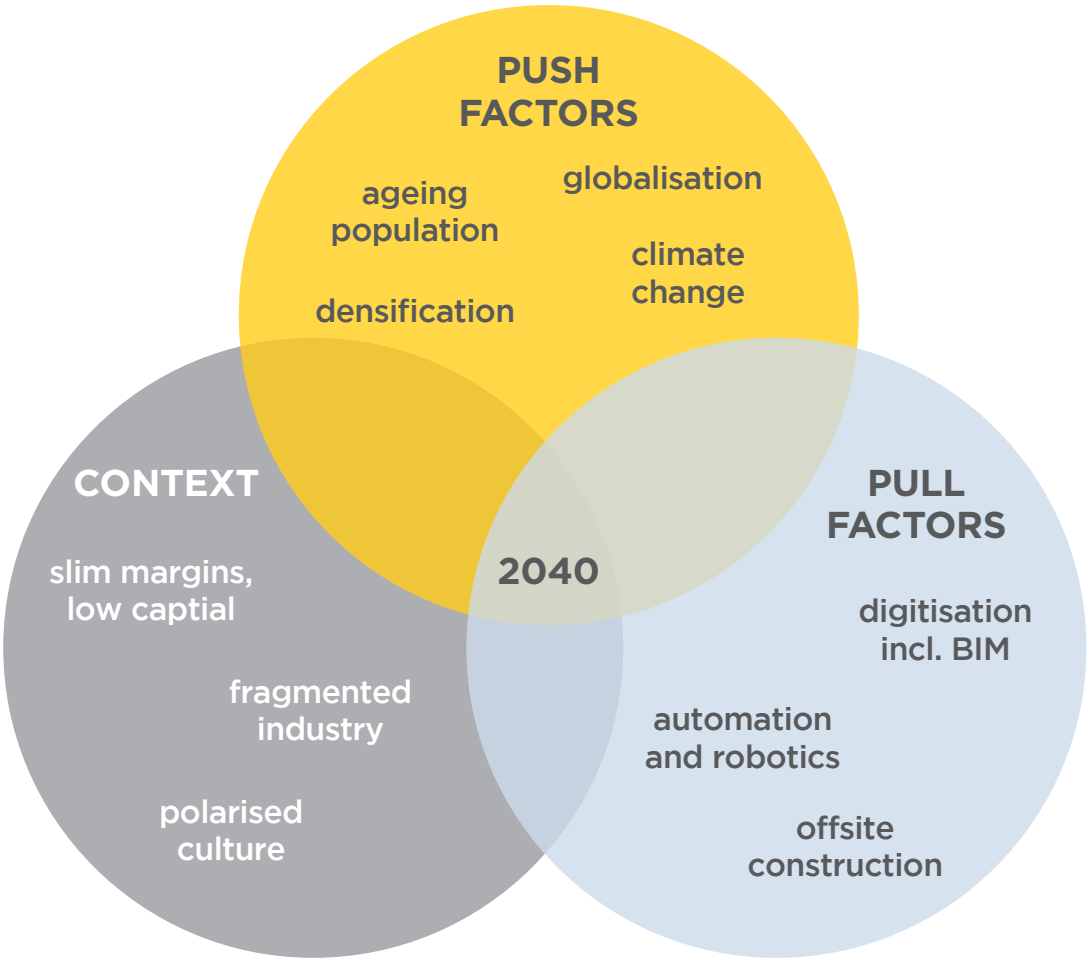
[5] Flyvbjerg, B., Holm, M. S., and Buhl, S. (2003) 'How common and how large are cost overruns in transport infrastructure projects?' Transport Review, 23(1): 71–88

[6] Bryde, D. Broquetas, M. and Volm, J. (2013) 'The Project benefits of Building Information Modelling (BIM)' International Journal of Project Management, 31(7): 971-980

Digitisation, of course, goes beyond just BIM. Under the right conditions, a raft of related technologies can improve the productivity of construction, including:

- augmented reality, which will help construction workers complete tasks with greater precision and clarity by overlaying onto the physical world digital information about the task at hand, such as workflows, quality parameters, work instructions, etc.
- the internet of things, where all elements of the construction process — people, plant and material — are embedded with sensors and networked, producing oceans of data that can be leveraged to improve the efficiency of construction processes
- artificial intelligence, which digests the data produced by the internet of things to quickly and accurately make decisions about things like the most optimal flow of trades and material throughout a site.

These digital technologies, while technically feasible, are unlikely to make significant headway in isolation. Much of the promise of digital technology in construction relies on it being integrated with digital plans and schedules. Their potential can therefore only be realised in an environment of mature and widespread BIM adoption.



Workforce implications

The disruptive trends we have identified imply significant change for the workforce. A shift to offsite construction, in particular, will have significant consequences as it implies a structural rebalancing away from construction toward manufacturing. This means that employment in the 'construction' industry will fall, offset by increasing employment in 'manufacturing.'

This is an issue we at CSQ are already bumping up against, with questions often being raised about workers' eligibility for subsidised training. An increasing proportion of workers operate in the construction supply chain but are not considered construction workers. For example, a steel fabricator who supplies a construction project may or may not be considered a 'construction worker' depending on how and where the work is performed. Where in the supply chain that line is drawn is by no means clear-cut. These are questions that will only become more frequent and pertinent as we move into an increasingly 'offsite' paradigm, and construction bleeds into manufacturing.

These disruptions are also likely to deliver a more polarised workforce. This will bring the construction industry into line with patterns playing-out across other countries and industries. At one end, there has been an increase in the proportion of highly-educated, well-paid knowledge professionals, while at the other, there has been growth in low-skilled menial jobs. In the middle, growth has been severely negative, meaning this category has been robbed of its market share by both higher and lower skilled jobs **(Figure 10)**. All indications are that technological change is amplifying rather than attenuating this trend across advanced economies.

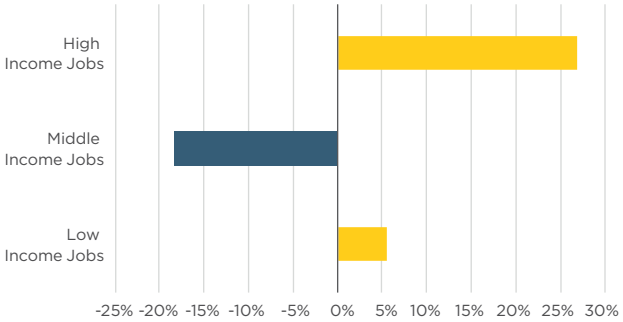
The construction industry is one of the few industries maintaining a high proportion of mid-skilled trade workers, with two-thirds of its workforce falling into the middle income 'trade worker' category.

As offsite fabrication and automation takes hold, we will see a bifurcation of construction jobs along similar lines to that seen in agriculture and manufacturing. A cohort of highly skilled technical, design and engineering professionals will form the engine room of the construction workforce — although they may not be administratively recognised as 'construction' workers — responsible for coordinating, maintaining and directing the deployment and operation of intelligent construction machinery. At the lower end of the skills spectrum, a small army of low-skilled workers will perform a range of installation and handling tasks both on- and off-site.

All this has ramifications for the current apprenticeship model and industrial and licensing systems. Currently, building regulators and industrial instruments make it very clear what is required to work in the industry, and these requirements reflect a traditional industry structure of licensed trades working on-site. As companies depart from the traditional model, they will place increasing pressure on regulators to adjust flexibly to meet new ways of delivering construction outcomes.

At the same time, as we move toward a more flexible and polarised workforce, individual workers will exercise a stronger voice in determining what collection of skills they wish to cultivate to achieve their career goals. Regulators will set the boundaries, but individuals will demand far more scope to craft unique skilling and career pathways.

Fig.10 – Growth of share in jobs, 1993-2006



SOURCE: Goos, M. et al (2009) 'Job Polarization in Europe'

As offsite fabrication and automation takes hold, we will see a bifurcation of construction jobs

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