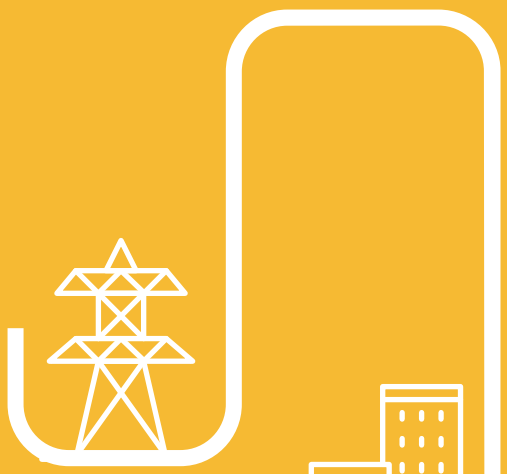
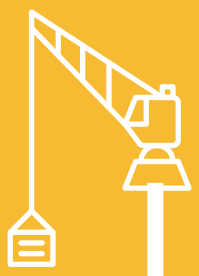
WORKFORCE AND EMPLOYMENT OUTLOOK



Subject to project funding decisions, the amount of work forecast for the next two years will hold employment around the levels that prevailed prior to the mining boom



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WORKFORCE AND EMPLOYMENT OUTLOOK

The pipeline of work forecast in this Report demands a strong labour response. The industry has embarked on an upswing in activity that is more modest in scale than the mining boom, but which is also more stable and sustainable for Queensland's workforce.

The Pipeline of projects captured in this Report represents a significant engine of job creation for Queensland's engineering construction workers.

Subject to project funding decisions, the amount of work forecast for the next two years will hold employment around the levels that prevailed prior to the mining boom.

The extent to which the increased activity in 2018/19 can be sustained will depend on how much of the unfunded portion of the Pipeline can be converted into live projects. Overall, it is probably reasonable to expect levels of employment on major projects in the range of circa 12,000 jobs.

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Occupational Profile

The engineering construction workforce is made up of more than 75 occupations. Yet 20 of these occupations account for almost 80% of the total workforce, while half of the entire workforce is concentrated in just 10 occupations. Concreters, labourers, construction managers and drivers of plant are the most populous engineering construction occupations.

Queensland Government Building and Construction Training Policy

The Queensland Government's Building and Construction Training Policy (Training Policy) requires contractors to employ apprentices and trainees and undertake other workforce training as a condition of being awarded work on eligible Queensland Government projects.

The Training Policy is one element in a longstanding partnership between the building and construction industry and the Queensland Government to develop the industry's skills base and future workforce capability. CSQ administers contractor compliance data on behalf of the Queensland Government through the Training Policy Administration System, which enables contractors to electronically report their compliance with the Training Policy.

It is estimated that approximately 94 projects captured in this Report are likely to be required to comply with the Training Policy. This is anticipated to generate around 17 million in training hours over the life of this pipeline of work. As a result, if all Queensland Government projects listed in this Pipeline are fully realised, around 10,000 new apprenticeship and traineeship places will be created from public investment in infrastructure.[1] In addition to these new jobs created, existing workers in the industry will be able to take advantage of skilling opportunities made available through this pipeline of work assisting them in gaining new skills and knowledge and to help support their career progression in the industry.

1 These figures have been calculated with the assistance of the Department of Employment, Small Business and Training and reflect the total project cost for all government-procured projects captured in this Report, both funded and unfunded. The realised figures will vary depending on the proportion of unfunded projects that do not proceed, any variations to the contract value from current estimates, and how the work is procured (the stages) which could affect eligibility and deemed hour calculations. The figures do not include private projects that are required to, or are choosing to comply with the Training Policy.

Figure 28

Major Project Jobs Outlook

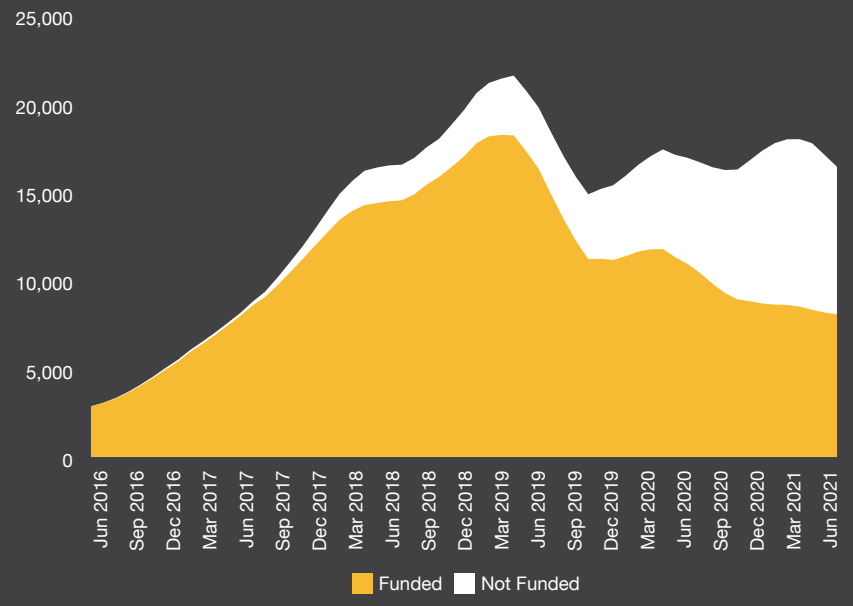
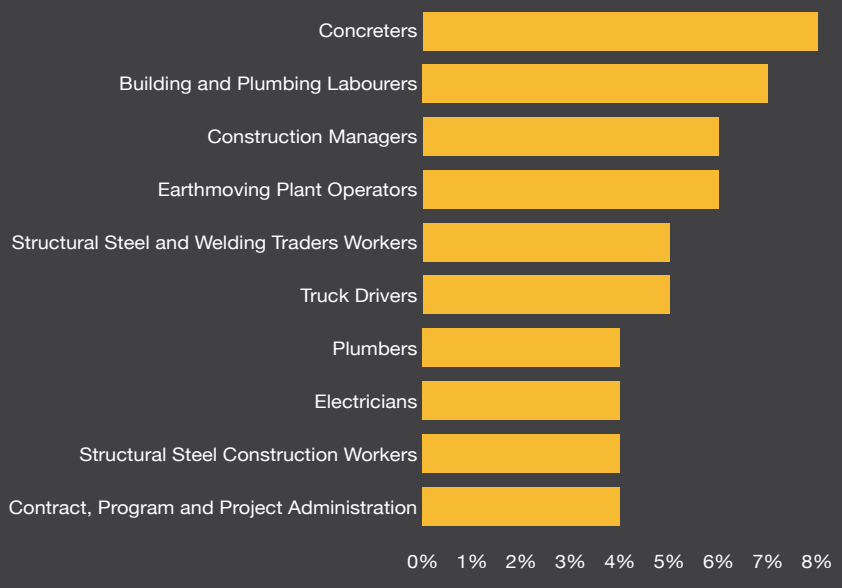


Figure 29

Major Projects Occupational Profile



The engineering construction workforce is made up of more than 75 occupations. Yet, 20 of these occupations account for almost 80% of the total workforce, while half of the workforce is concentrated in just 10 occupations

As has been advocated in previous years in this Report, the industry needs to take a longer-term approach to planning for the future workforce in a way that links infrastructure planning to business capacity building, workforce planning and skills development.

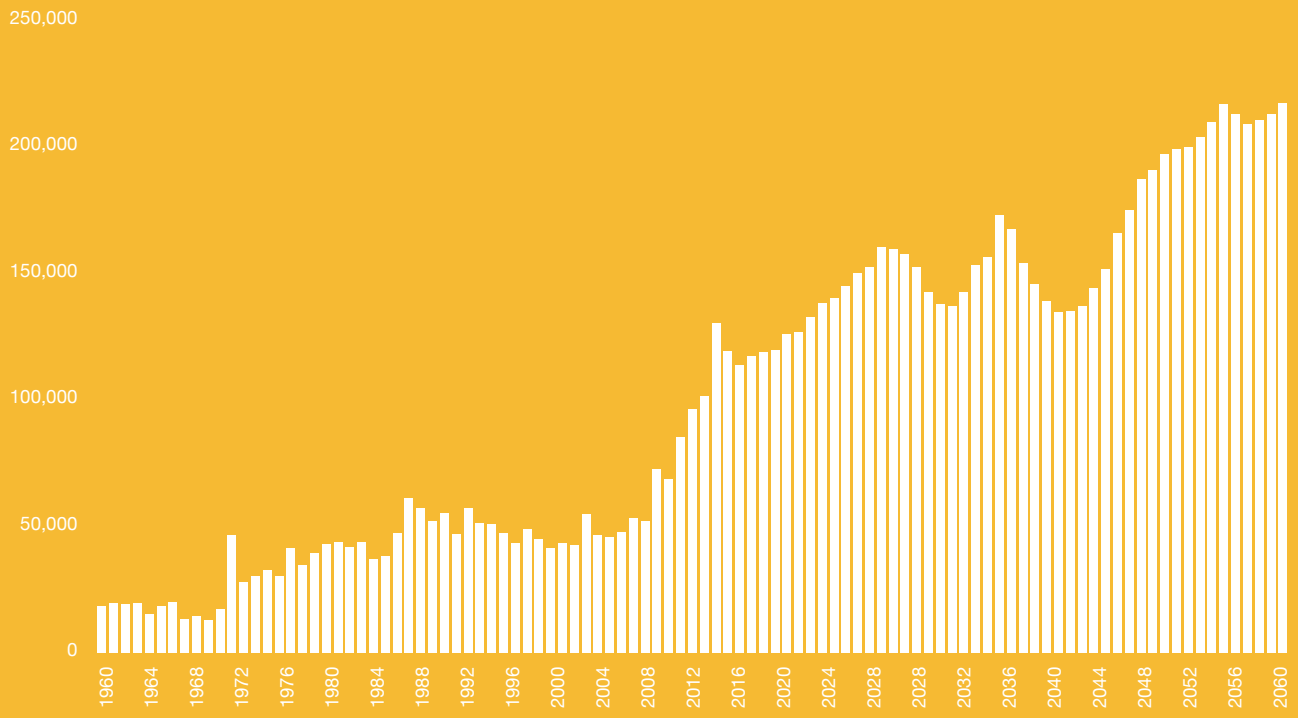
This is a challenge that will be compounded not only by digital disruption but by Queensland's and Australia's changing demographics.

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.

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.

Figure 30

Annual growth in over 65's, Australia



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

Whilst the construction industry would seem ripe for disruption there remains significant barriers for any new entrant into the market looking to provide alternative delivery solutions.

It is therefore more likely that disruption will take the form of new technologies being adopted by existing contractors either at the behest of major clients or in order to gain a competitive advantage. Some of these key technologies are detailed in the following pages.

Offsite Construction (Prefabrication)

Moving the construction process from the construction site to the factory is an accelerating trend that will catalyse 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' 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.[2]

Materials handling is also the activity that causes the most accidents and injuries on construction sites.[3]

Offsite fabrication promises to reduce this source of waste and risk, delivering significant productivity and workplace health and safety benefits. Workers will be able to keep working longer as their manual burden will be reduced. It is also likely that a shift to production in an offsite environment will encourage more women to enter the industry.

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 – such as standardisation, lean production, process optimisation, continuous improvement and total quality management.

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

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

It is worth noting that 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.

For this reason, the emerging players in offsite construction are not contractors but firms 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 contractor, 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.

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.[5]

A shift to offsite construction will have significant consequences as it implies a structural rebalancing away from construction toward manufacturing

4 www.technavio.com/report/global-construction-prefabricated-market

5 www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/1301.0Feature%20Article142001

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.

Digitisation and BIM

It has been estimated that 20-40% of construction costs are waste: wasteful spending, wasteful delays and wasteful communication.[6] Information breakdowns are often the root cause: information that's outdated, inaccurate, undocumented, or just uncommunicated.

Building Information Modelling (BIM) software systems provide a collaborative environment for information to be shared, coordinated and disseminated between the project participants, reducing the incidence of clashes between the different disciplines as design evolves and encouraging design innovation and value engineering. Whilst this results in significant cost / time savings during the construction of the project, even greater savings can be achieved over the life cycle of the asset if the use of BIM is maximised to include recording of project data such as equipment specifications and warranties. This allows an asset owner to readily call up details of a faulty piece of equipment such as maintenance history, supplier details and warranty information.

It is probably because the majority of savings are realised post construction, that BIM has been slow to be adopted by contractors and there needs to be increased incentivisation for its adoption or mandating of its use by owner organisations in order to realise the significant benefits that it can deliver.

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

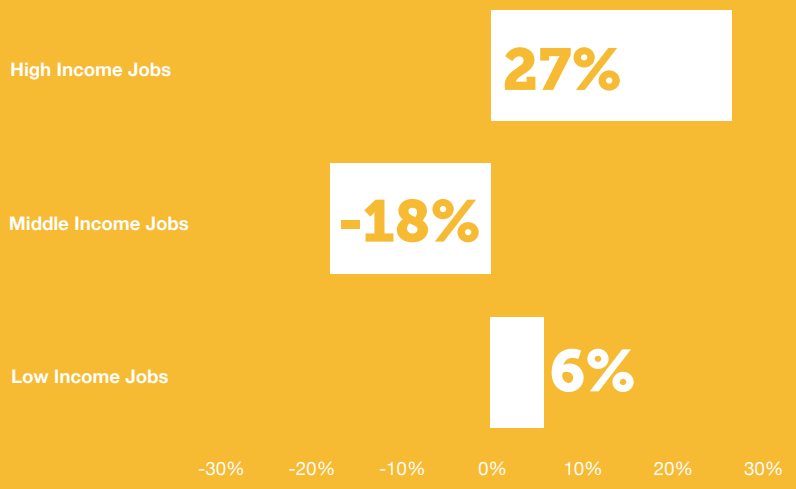
— **augmented realit**y, which will help construction workers complete tasks with greater precision and clarity by overlaying onto the physical world digital information about the task at hand, such as workflows, quality parameters, work instructions, etc.

— **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

6 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

Figure 31

Change in share of work, Europe, 1933–2006



Technological change is amplifying a trend towards a more polarised workforce. The Construction Industry has so far not been impacted by this change but as use of offsite fabrication and technology increases the construction industry will experience a similar decline in Middle Income jobs

— **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.

Lean Construction

Lean construction refers to tools and processes that have been developed, based in part on lean manufacturing techniques pioneered by Toyota after the Second World War, with the aim of reducing waste and improving productivity in the construction industry.

When fully implemented, lean construction tools and processes have been demonstrated to result in cost savings of up to 30% of budget and schedule savings of up to 20%.

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.'

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 of the skill spectrum, 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 manual jobs. The middle sector has seen a corresponding decline (Figure 31). All indications are that technological change is amplifying rather than attentuating 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. At the lower end of the skills spectrum, a small army of construction labourers will perform a range of unskilled installation and handling tasks both on- and off-site.

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.