

Construction
Predictions

2020



MAKING AN
IMPACT THAT
MATTERS
since 1845



The Age of With... AI in construction and infrastructure:

Creating value through data

Written by:
Laureano Álvarez
Deloitte Spain
jlalvarez@monitordeloitte.es

Galo De Reyna
Deloitte Spain
gdereyna@monitordeloitte.es



An industry in need of profitability and risk mitigation

Global demand for infrastructure is expected to continue growing over the next 30 years (only 25% of the infrastructure required for 2050 exists today). However, the Construction and Infrastructure (C&I) industry is facing major structural issues that have eroded margins (the EBIT-to-sales ratio stands at just 3% at European companies) and increased project risks.

C&I companies have made inroads into the digital world, but very few have been able to scale beyond certain pilot projects, facing three roadblocks: i) non-digitized processes jeopardize the ability to access consistent and ready-to-use data (paper-based documentation); ii) project execution is decentralized and deployment depends on the project managers; and iii) each project is perceived as unique.

Artificial Intelligence and Advanced Analytics at scale in C&I

The last five years have seen Artificial Intelligence (AI) and Advanced Analytics (AA) rapidly gain traction in the industry. Investment in data analytics has the potential to realize value throughout the project lifecycle: i) design, bidding and financing; ii) procurement and construction; iii) operations and asset management; and iv) business model reinvention/transformation.

Design, biding and financing

Historical construction issues typically stem from the design and bidding phase- inaccurate cost estimates, overly optimistic timelines and lack of risk and constructive alternatives analyses.

AI and AA can assist in the design review process (e.g. layout optimization), bidding process (e.g. predictive models of evolution of raw material prices) and post-mortem analysis (e.g. natural language processing to identify comparable work consignments) by analyzing vast amounts of internal unstructured data (such as bidding documents) and external data (such as commodity prices) to provide insights from previous projects. In doing so, C&I teams can generate more accurate estimates, reducing budgets and timeline deviations by an estimated 10-20% and engineering hours by 10-30%.

Procurement and construction

During the construction phase, the project manager must ensure the efficient use of resources (human and material),

anticipate potential risks (safety, quality, etc.) and adjust costs with subcontractors and suppliers, with the ultimate goal of minimizing costs while meeting timelines and quality and security requirements.

AI and AA provide real-time insights that help when negotiating with suppliers (e.g. image recognition algorithms to provide on-site measurements), organizing tasks (e.g. input optimization algorithms) and predicting risks (e.g. real-time models for unforeseeable events such as localized storms).

AI may be used during the construction phase for security purposes (e.g. predictive analytics based on real-time data generated by construction work wearables) and to help reduce and automate administrative processes (e.g. handwriting recognition algorithms and natural language processing to “read” work orders).

Potential savings from data analytics and related technologies may amount to as much as 10-15% of total construction costs.

Operations and asset management

AI and AA can be used in a number of ways in the operations and asset management phases – from analyzing worker productivity to building efficient predictive maintenance systems, enhancing asset revenue and forecasting customer demand. Each asset has its own set of AI and AA applications, through which toll road operators forecast demand and customer elasticity to improve pricing strategies, railroad operators use track measurements to deploy predictive maintenance strategies and airport operators forecast traffic based on macroeconomic and social global trends. Collectively, analytics-enabled initiatives may generate a 10-20% saving in operating costs during this phase and a three to seven percent increase in ROI due to the extended useful life of the assets.

Business model reinvention/transformation

All of the above allow for better decisions and/or improved performance, but how could C&I players extract value from their data through new business models? C&I companies heavily rely on subcontractors and, as the digitization of the sector continues to grow, so does the opportunity for a disruptor. In this context, C&I companies may aim to become a platform business to integrate different services from different suppliers and capture their operational data, and then provide services demonstrating how to become more efficient, pool resources across suppliers or improve the operation of the asset. All in all, data is not only a way to improve decision-making but a business itself.

Capturing the untapped value of Artificial Intelligence and Advanced Analytics in the C&I business

Moving from pilot projects to impact at scale requires C&I companies to reflect strategically on their business context and needs. We are in “the Age of With”: this is not about AI replacing humans at construction sites, but combining human work with the new possibilities offered by AI. In this context, we have identified five key success factors:

- **Develop a comprehensive data strategy:** C&I companies need to develop an overall data strategy - a strategy based on value generation for the company that helps support the choice of applications, infrastructure and tools.
- **Identify pockets of relevant data:** instead of endless IT deployments to create data lakes with all sorts of unstructured data, C&I should target relevant and actionable data to improve specific decisions and process performance.
- **Involve the organization through the bottom-up approach:** the selection and development of new technology should be driven not by top-level discussions, but by the real needs of the company's workforce, leveraging the expertise of its construction managers whose insights can help identify the key areas of opportunity.
- **Create a balanced and scalable portfolio:** companies should use a portfolio approach to their data analytics investments, rather than a project-by-project mindset. Pilots are fine, but only as a first step for deployment across company projects .
- **Ensure management buy-in and push initiatives top-down:** from the outset, organizations must develop a strong business case to help secure funding and organizational buy-in.

While investments in data analytics can generate value, success is not about simply acquiring and integrating new technology; it's about developing an organizational strategy and culture that integrate an insights-driven approach to key decisions, processes and business models in a way that enables the company to make investments at the right time and for the right reasons.



For further information, please visit www.deloitte.es

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee (“DTTL”), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as “Deloitte Global”) does not provide services to clients. Please see www.deloitte.com/about for a more detailed description of DTTL and its member firms.

Deloitte provides audit, consulting, financial advisory, risk management, tax, and related services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries and territories, Deloitte brings world-class capabilities and high-quality service to clients, delivering the insights they need to address their most complex business challenges. Deloitte's more than 312,000 professionals are committed to making an impact that matters.

This communication is for internal distribution and use only among personnel of Deloitte Touche Tohmatsu Limited, its member firms, and their related entities (collectively, the “Deloitte Network”). None of the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

© 2020. For information, contact Deloitte, S.L.

Governance and controls for large infrastructure projects

It is an exciting time for the infrastructure community. The Global Infrastructure Hub, a G20 initiative, calculates that the infrastructure spend across the 56 countries that it monitors will increase from USD 2.7 trillion today to USD 3.3 trillion in 10 years' time¹.

However, large projects often fail to achieve their stated objectives, especially their CAPEX budget. Project owners tend to use a disparate set of processes and tools to try to manage their projects in order to improve control and governance but often fall short as the solutions chosen lack integration or appropriate consideration to be able to add value to the project's particular circumstances.

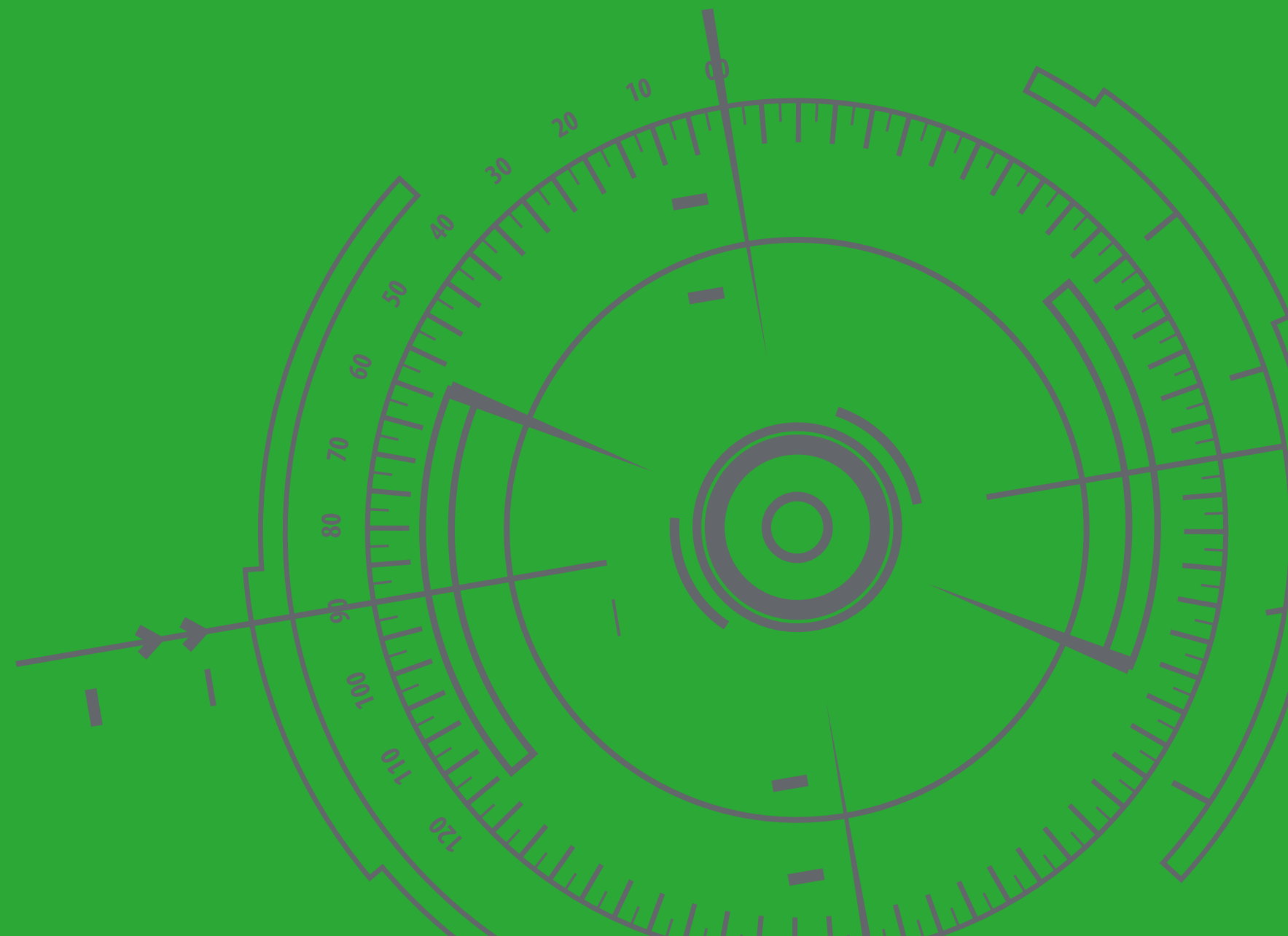
As projects start becoming data rich, their successful delivery becomes increasingly linked to the management of data, and traditional management methods and techniques are expected to change. Projects that are early adopters of integrated technology solutions will be able to make more robust decisions through the use of analytics and will be able to deliver significant benefits from automation, thereby leading to better project outcomes, as well as asset performance improvements.

Written by:

Nigel Shilton
Deloitte UK
nshilton@deloitte.co.uk

Alex Tsarouchis
Deloitte UK
atsarouchis@deloitte.co.uk

Nick Green
Deloitte UK
ngreen@deloitte.co.uk



Benefits of integrated systems

Integrated solutions for controlling and capturing key project data across various data sets (for example, cost, schedule, risk and change) are essential for creating a “live” single source of the “truth”. Such solutions are already being adopted on a number of large projects by a variety of organizations and, if implemented properly, can achieve a number of benefits, such as:

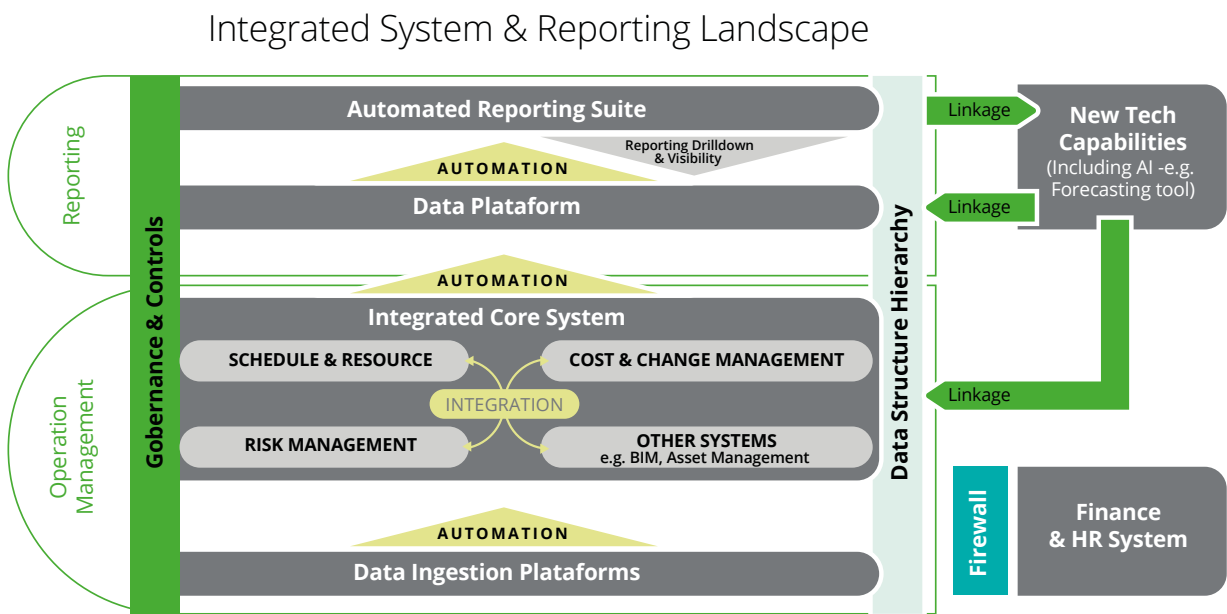
- Improved **governance** based on automated workflow systems;
- Reduced **data handling errors**;
- Overhead **efficiencies**;
- Improved **data analytics and insights** facilitating better decision-making;
- Enabling **artificial intelligence** and **machine learning**, by making use of structured data and data analytics;
- **Sharing data and information** between parties, increasing transparency and allowing an enterprise delivery approach to be created; and
- Improved asset performance based on **increased data availability**.

Requirements and challenges

In order for such technology solutions to be effectively enabled, a number of critical requirements need to be met:

- **Project Data structures:** It is necessary to develop robust data structures, data definitions and data assurance processes across the project and align the data to a detailed integrated breakdown structure (for example work, organization, asset). This will enable systems to interact with one another at the appropriate level and facilitate integrated reporting.
- **Increased IT capability:** There needs to be a shift towards increased use of system and data architects, who will integrate and manage systems as well manage the flow and storage of information in data warehouses and platforms.
- **Project or business maturity:** Appropriate consideration needs to be given to selecting the right tools to support the requirements of the project or business. A common mistake is to select an “off-the-shelf” product which lacks the maturity and flexibility to be successfully deployed to the task in hand.
- **Transition complexity:** Proper attention needs to be given to the integration, technical and human challenges posed by the transition to new systems and solutions. If this is not done in an appropriate manner, considering factors such as the technical solution, stakeholder engagement and training, it can create considerable disruption and significantly reduce the chances of a successful implementation.

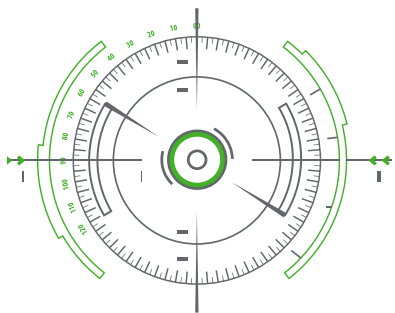
Figure 1: An example of an integrated system for controlling a project



Source: Deloitte

Conclusion

To be considered truly successful, large projects must demonstrate that they have successfully delivered against their critical success criteria and key performance indicators. Increasing use of technology is fundamental to achieving successful outcomes and it is something that will create a competitive advantage for early adopters. The question for all stakeholders is: Will you be a leader or can you afford to be a follower?



Deloitte LLP is a limited liability partnership registered in England and Wales with registered number OC303675 and its registered office at 1 New Street Square, London EC4A 3HQ, United Kingdom.

Deloitte LLP is the United Kingdom affiliate of Deloitte NWE LLP, a member firm of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee (“DTTL”). DTTL and each of its member firms are legally separate and independent entities. DTTL and Deloitte NWE LLP do not provide services to clients. Please see www.deloitte.com/about to learn more about our global network of member firms.

© 2020 Deloitte Development LLP. All rights reserved.

1. Global Infrastructure Outlook “Forecasting infrastructure investment needs and gaps”, <https://outlook.gihub.org/>, accessed April 24, 2020

Compliance, ethics and transparency

Compliance as a pillar of sustainability

The increasing importance that stakeholders (primarily investors) place on ethics and transparency matters has given rise to the need to have policies and procedures that ensure regulatory compliance.).

Written by:
Helena Redondo
Deloitte Spain

Jorge Reguero
Deloitte Spain
jreguero@deloitte.es

Silvia Zamorano
Deloitte Spain
szamoranobaca@deloitte.es



One of the most common causes of the increase in construction project execution costs is the failure to manage ethics and compliance. While it is true that such failures are not exclusive to the construction industry, it is one of the industries in which "non-compliance costs", measured in terms of penalties and indemnity payments, are highly significant.

Furthermore, nowadays investors do not just take the financial profitability of their investments into account when considering their investment parameters, but rather other variables have gained importance, including social, environmental and regulatory compliance variables. In this context, meeting certain compliance and transparency standards has become an obligatory requirement when it comes to winning major infrastructure projects and is one of the sustainability pillars of construction companies.

It is important to remember that, from the research or pre-design phase to start-up, many parties participate in a project and their conduct must be aligned in order to properly respond to the ethical dilemmas that may arise. Proper analysis and monitoring of the regulatory compliance of venturers, subcontractors and all those who participate in the supply chain are key to reducing reputational risks and inefficiencies, since a failure in one link in the supply chain will undoubtedly affect the entire project.

For these reasons, both public and private construction project developers increasingly require construction companies to have compliance risk management systems in place.

Also, Directive 2014/95/EU amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information, in order to improve undertakings' sustainability and increase transparency and investor trust, strengthened social and environmental reporting requirements for certain major undertakings, including the obligation to report on risks, policies and performance with regard to the fight against corruption and bribery.

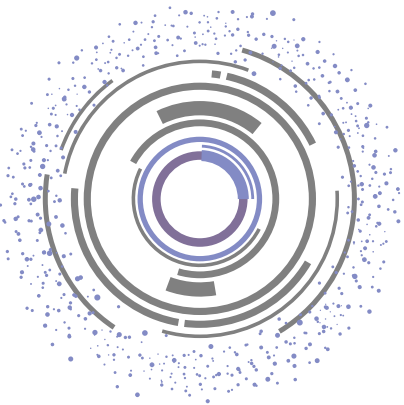
In response to these requirements, infrastructure companies are investing time and resources to address regulatory compliance, not only in a reactionary way in order to ensure compliance in the various regulatory areas, but also by integrating that compliance in the daily management of the organization to bolster a culture of compliance and mitigate reputational risks. Accordingly, a large proportion of infrastructure companies have opted to follow

the ISO 19600 international standard, which is an international benchmark guide for implementing a regulatory compliance management system, as well as ISO 37001, which provides a guide for establishing anti-bribery management systems. These systems also enable companies to respond to the demands of regulators, which constantly emphasize that having compliance policies, rules and procedures in place is not enough, but rather companies must ensure that the requirements are met, are incorporated in their daily management and that, therefore, the compliance measures are truly effective.

When implementing such systems, companies can take advantage of the various options offered by technology thanks to analytics, business intelligence and blockchain tools. These tools enable intelligent data analysis, providing indicators or alerts to monitor certain behaviors using the data provided by the transactional systems, or to provide digital security to certain transactions, thereby reducing human intervention.

Conclusion

However, management systems and the most advanced technologies are not enough to avoid behavioral risks and prevent regulatory non-compliance, as it is essential to have a strongly-rooted ethical culture that naturally enables us to live in accordance with robust values and instinctively rejects unwanted behavior.



For further information, please visit www.deloitte.es

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. Please see www.deloitte.com/about for a more detailed description of DTTL and its member firms.

Deloitte provides audit, consulting, financial advisory, risk management, tax, and related services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries and territories, Deloitte brings world-class capabilities and high-quality service to clients, delivering the insights they need to address their most complex business challenges. Deloitte's more than 312,000 professionals are committed to making an impact that matters.

This communication is for internal distribution and use only among personnel of Deloitte Touche Tohmatsu Limited, its member firms, and their related entities (collectively, the "Deloitte Network"). None of the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

© 2020. For information, contact Deloitte, S.L.

Predictions – Modern Methods of Construction

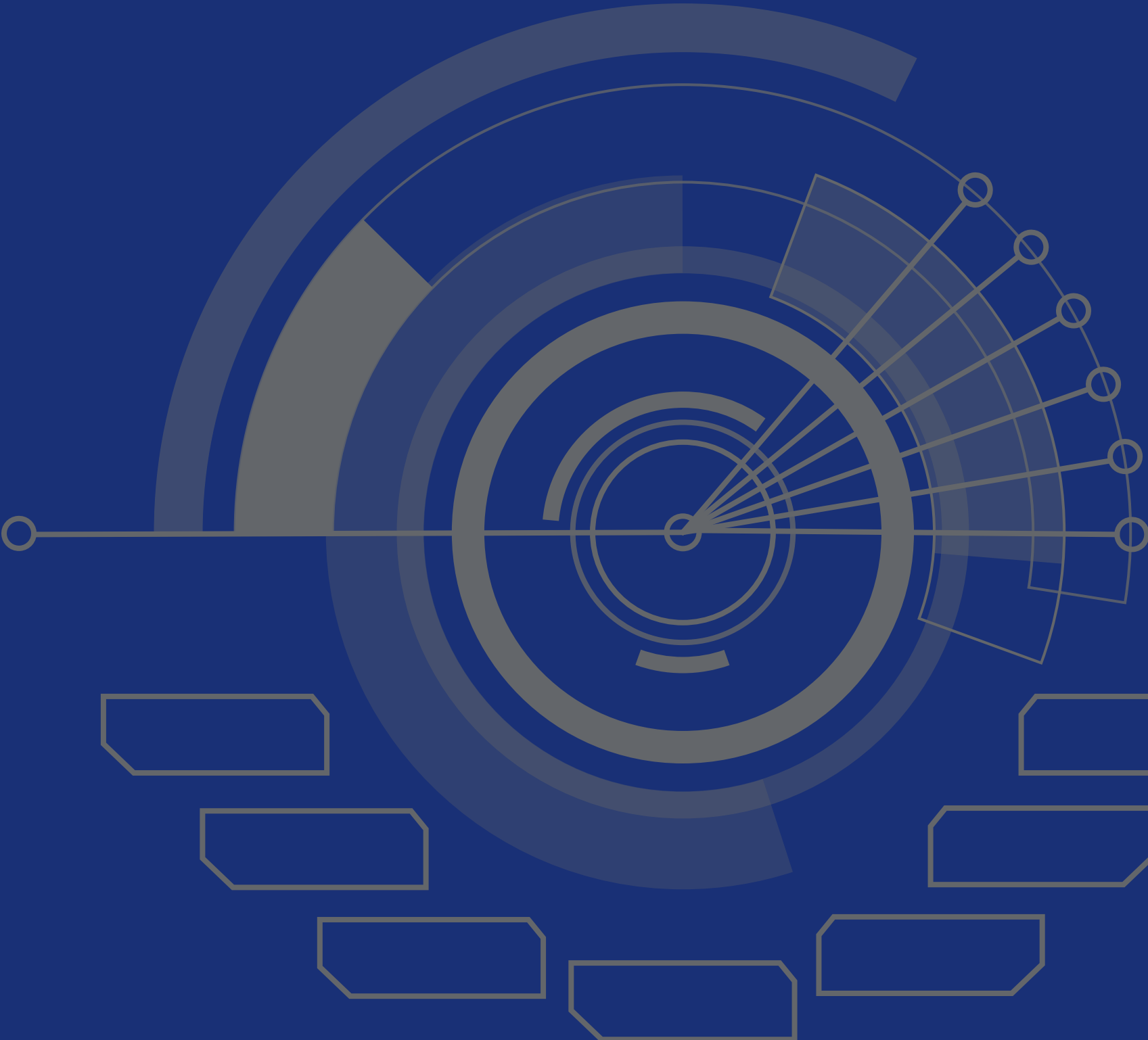
The world is on the brink of a technological transformation; one that will disrupt the way we all live our lives, the way we work, and the way we interact. The World Economic Forum has, for a few years now, described this upcoming event as the ‘Fourth Industrial Revolution’, and has characterized it as a ‘fusion of technologies that is blurring the lines between the physical, digital, and biological spheres’¹. Multiple industries are continuing to enter this exciting new era, transforming the way they work with the support of new digital technologies and automation, and innovative organizational structures.

1. Statement by Klaus Schwab World Economic Forum 2016, <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/> accessed 13 May 2020

Written by:
Nigel Shilton
Deloitte UK
nshilton@deloitte.co.uk

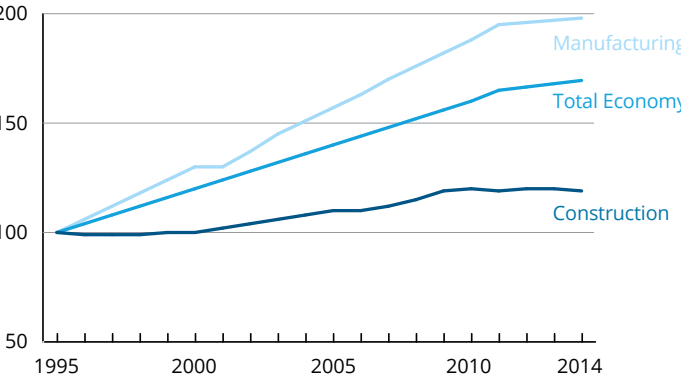
Scott Dudley
Deloitte UK
sdudley@deloitte.co.uk

Claire Handby
Deloitte UK
chandby@deloitte.co.uk



But the construction sector is lagging. Despite being one of the largest and most important industries (accounting for some 9% of the European Union’s overall economy according to the European Commission), construction has had a productivity problem for decades. Whilst other industries have progressed significantly in the last 25 years, construction remains a slow adopter of new technologies and innovation and therefore continues to be plagued with past failings. Low margins, high risk, skills gaps and inconsistent project delivery have a material impact on both the industry and its clients.

Figure: Global productivity, real gross value added, 1995 = 100 per hour worked²



Source: Deloitte

There have been substantial developments in some areas of construction including robotics and automation which are pushing the envelope as to what can be manufactured for building and infrastructure projects off-site. Building Information Modelling (BIM) is now in use across most major projects, and is even mandated on certain governmental projects. The capability exists to 3D print building modules and components, make extensive use of drones to complete site surveys and make greater use of the Internet of Things. If such technologies were more widely embraced the industry and its clients could potentially create more sustainable and efficient buildings. So, why is productivity in construction still lagging?

The continued alignment of new and recent technologies already within the industry will continue to trigger the disruptive modernization many continue to look and hope for. A more advanced position will be achieved through a holistic change of mindset within the industry that realizes that technology is a friend to be embraced rather than an enemy whose aim is the demise of tried and tested roles and norms. The industry’s past responses to the challenges that the construction industry faces (e.g., improved training, increased wages, creating and leveraging less adversarial contracting techniques) have not been universally effective in creating a catalyst for change. Past responses have generally failed to create a ‘tipping point’ to generate a notable uptick in productivity and we would therefore contend that only with the broader integration of people, processes, data and technology will the productivity of the industry be truly disrupted. Some of the key actions the industry might want to consider pursuing are listed below:

- Attract top talent - to do this, consider recruitment and training in line with other advanced manufacturing/heavy industries, such as the industrial and automotive manufacturing sectors. Focus efforts on re-branding to generate elements such as a more inclusive agenda, up-skilling with digital techniques and software platforms, new training and re-training to keep in-sync with the latest building technology methods;
- Construction organizations need a step change in their operating models, including their governance, processes and systems, so that they are more aligned with leading practices in manufacturing. Some of the reasons off-site manufacturing has not been able to fulfil its full promise is because it is too often used for single projects, or used to support or supplement other, more traditional, construction processes which makes it hard to justify the costly upfront investment needed to establish manufacturing facilities;
- Greater alignment of supply chains through the entire asset lifecycle will be needed in order to truly ‘system integrate’ the construction technology and innovation that is already available. For example, the use of BIM has been in place for more than a

decade but without buy-in and commitment from all key parties involved in delivering and operating the asset to be constructed, the true value of BIM, which applies throughout an asset’s entire lifecycle (not just the design), can never be fully realized;

- The industry culture must continue to build on the progress already made and strive towards even greater collaboration - To date, construction behaviors continue to struggle to get the balance right. Embracing more standardized processes (like those in manufacturing) and leveraging the latest available technologies (which can encourage contract compliance, and reduce potential claims through effective early warning systems and transparent ‘one version of the truth’ reporting) could help all parties work better together towards a common objective; and
- The industry must find a way of investing more heavily in integrated toolsets because single tools used by individual suppliers or clients can only add value to very specific elements in an asset’s lifecycle, whereas integrating technology across a project can align project resources, improve quality, and increase efficiencies. For example, BIM is a ‘gateway’ tool for other technologies, including robotics, drone construction monitoring, and 3D printing where each of these are strong value drivers for off-site fabrication, and could increasingly supplement the step change needed to improve productivity in the industry more generally.

Conclusion

The opportunities for ‘positive’ disruption in the industry continue to be large and exciting. The businesses that pioneer, embrace and develop these disruptive changes, and can take advantage of them, will have a significant competitive advantage over their peers. The key question remains – is your business doing enough to harness the opportunities of the Fourth Industrial Revolution?



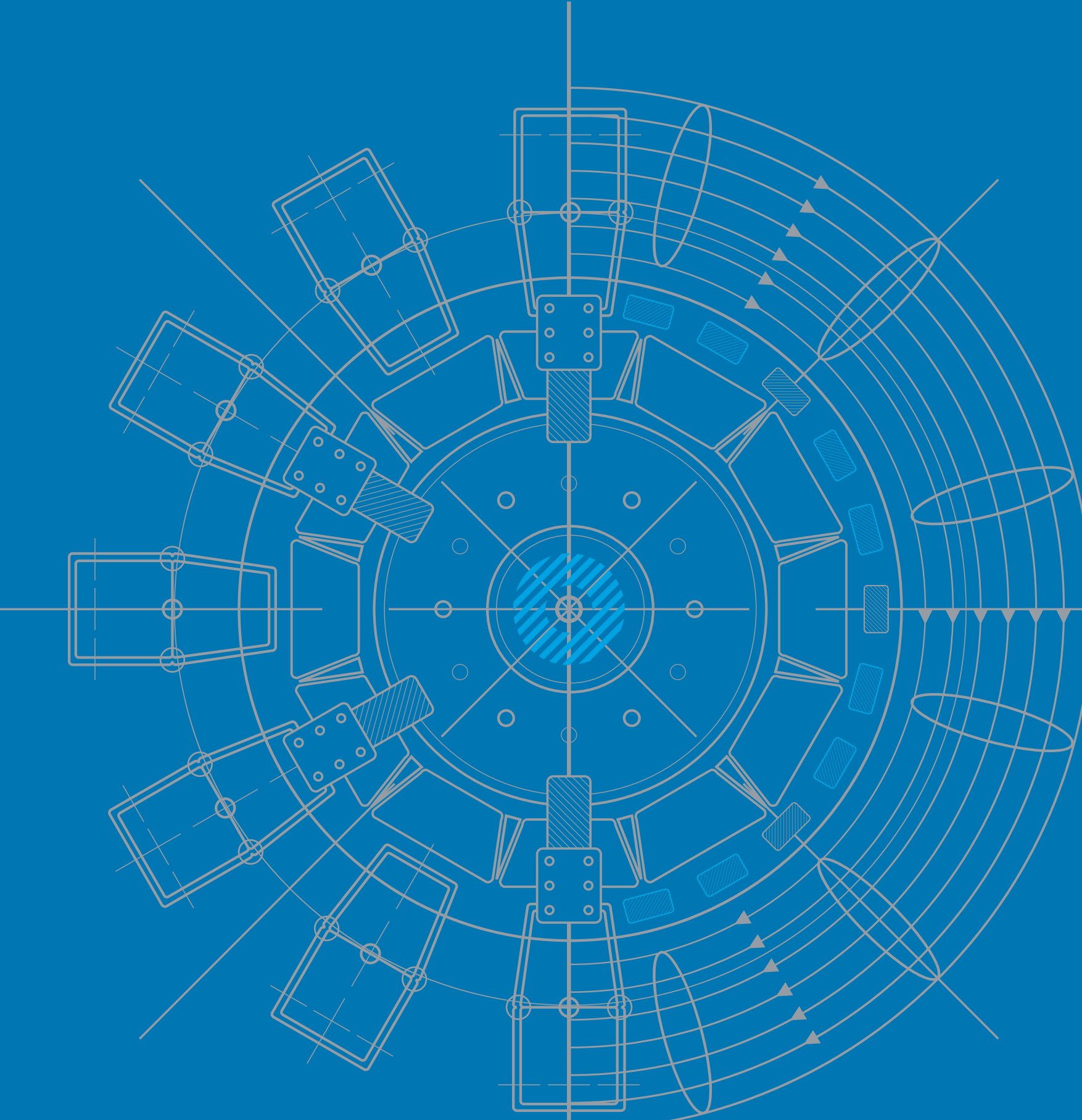
Deloitte LLP is a limited liability partnership registered in England and Wales with registered number OC303675 and its registered office at 1 New Street Square, London EC4A 3HQ, United Kingdom.

Deloitte LLP is the United Kingdom affiliate of Deloitte NWE LLP, a member firm of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee (“DTTL”). DTTL and each of its member firms are legally separate and independent entities. DTTL and Deloitte NWE LLP do not provide services to clients. Please see www.deloitte.com/ about to learn more about our global network of member firms.

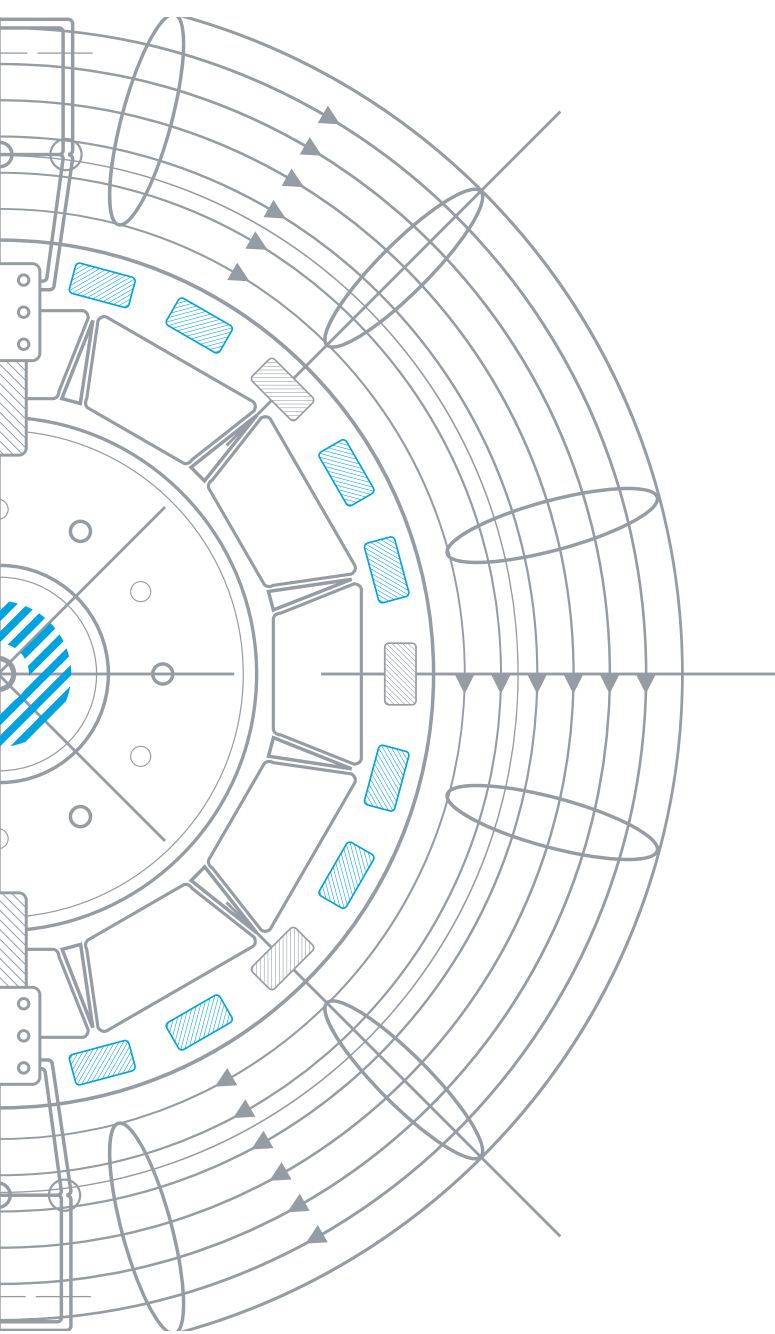
© 2020 Deloitte Development LLP. All rights reserved.

2. The Economist, The construction industry’s productivity problem, August 17, 2017, <https://www.economist.com/leaders/2017/08/17/the-construction-industrys-productivity-problem> accessed 28 April 2020

**Dawn of a new era:
Digital and advanced
technologies are
reshaping the E&C sector**



Written by:
Michelle Meisels
Deloitte US
mmeisels@deloitte.com



Technology is having an unprecedented impact on the E&C industry—from robots to connected job sites, the industry is seeing an incredible array of digital technologies that are transforming how E&C firms operate. These inherently disruptive digital and advanced technologies have the potential to provide greater efficiency, productivity, as well as safety breakthroughs the industry has sought for decades.

**From planning to design to construction
—digital is everywhere**

On the engineering side, digital capabilities surrounding predictive design, digital building twins, building information modeling (BIM), and the use of augmented and virtual reality (AR/VR) during the project planning stage can eliminate the cost and schedule overruns. For instance, BIM models allow stakeholders to see how a building is expected to look like after completion as well as the current stage of an under-construction structure.

On the construction side, connected job sites are using cloud-based technology to make information about almost every aspect of a project, available to all the relevant stakeholders located anywhere in the world. Digital technologies can also enhance ecosystem relationships, as E&C companies can easily collaborate on projects. These alliances can drive the future of connected construction, creating systems that link physical and digital assets beyond individual construction sites. Many contractors and builders are adopting these technologies to help them build more efficiently, but they are also driven by the need of the owner, who can more easily operate the facility with the use of tools like digital twins and other readily available data about the asset.

**Improving productivity and safety
– digital technologies – the key enabler**

E&C companies are gradually moving toward using automation and robotics for highly repetitive tasks as well as for site inspections. This could result in significantly improving productivity while creating a safer work environment and helping to address the industry's labor deficit. While mechanical arms are automating repetitive tasks such as brick-laying, drones are also set to become increasingly common in construction projects, primarily to perform inspections that would be otherwise dangerous for workers.

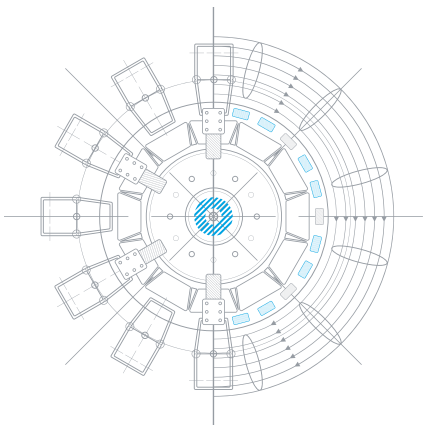
Beyond simple robotics and automation, the rise of artificial intelligence (AI) is also making its mark on the engineering and construction industry. For instance, AI and machine learning related software could help in optimizing supply chain logistics and reducing safety hazards.

**E&C companies are gradually moving toward using
automation and robotics**

Although there is tremendous interest and desire amongst E&C firms to transform their organizations via digital, the adoption rate is still low, and the industry continues to lag other industries. One of the main challenges for E&C companies is being able to demonstrate the ROI. These investments are significant and with constant pressure on margins, E&C companies are struggling to see how the benefits of digital can help improve the bottom line.

Building a digital-ready workforce to be future-ready

However, the growing popularity of digital capabilities requires new skills and could eventually change engineering and construction jobs—redefining the roles that humans perform on job sites. Hence, the E&C industry needs to be prepared to invest in upskilling the existing workforce to build a digital-ready workforce and effectively implement digital transformation within their organization. Moreover, developing a human and robot talent management strategy that accompanies the move toward digital is expected to be an essential ingredient for success for E&C companies.



About this publication This publication contains general information only and Deloitte is not, by means of this publication, rendering accounting, business, financial, investment, legal, tax, or other professional advice or services. This publication is not a substitute for such professional advice or services, nor should it be used as a basis for any decision or action that may affect your business. Before making any decision or taking any action that may affect your business, you should consult a qualified professional advisor. This publication is solely for educational purposes. This publication should not be deemed or construed to be for the purpose of soliciting business for any of the companies/organizations included in this publication, nor does Deloitte advocate or endorse the services or products provided by these companies/organizations. Deloitte shall not be responsible for any loss sustained by any person who relies on this publication.

About Deloitte Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. In the United States, Deloitte refers to one or more of the US member firms of DTTL, their related entities that operate using the "Deloitte" name in the United States and their respective affiliates. Certain services may not be available to attest clients under the rules and regulations of public accounting. Please see www.deloitte.com/about to learn more about our global network of member firms.

Copyright © 2020 Deloitte Development LLC. All rights reserved.

The impact of digital transformation on construction companies' diversified strategy

The construction industry globally operates in a highly competitive environment, with narrow EBITDA margins. Unexpected events, such as the current COVID-19 crisis, present additional challenges. Engineering and Construction (E&C) companies have been diversifying their business portfolios. The motivations behind this are common to all sectors and consist of growth, synergies, reduced risk and cash flow recurrence and stability.

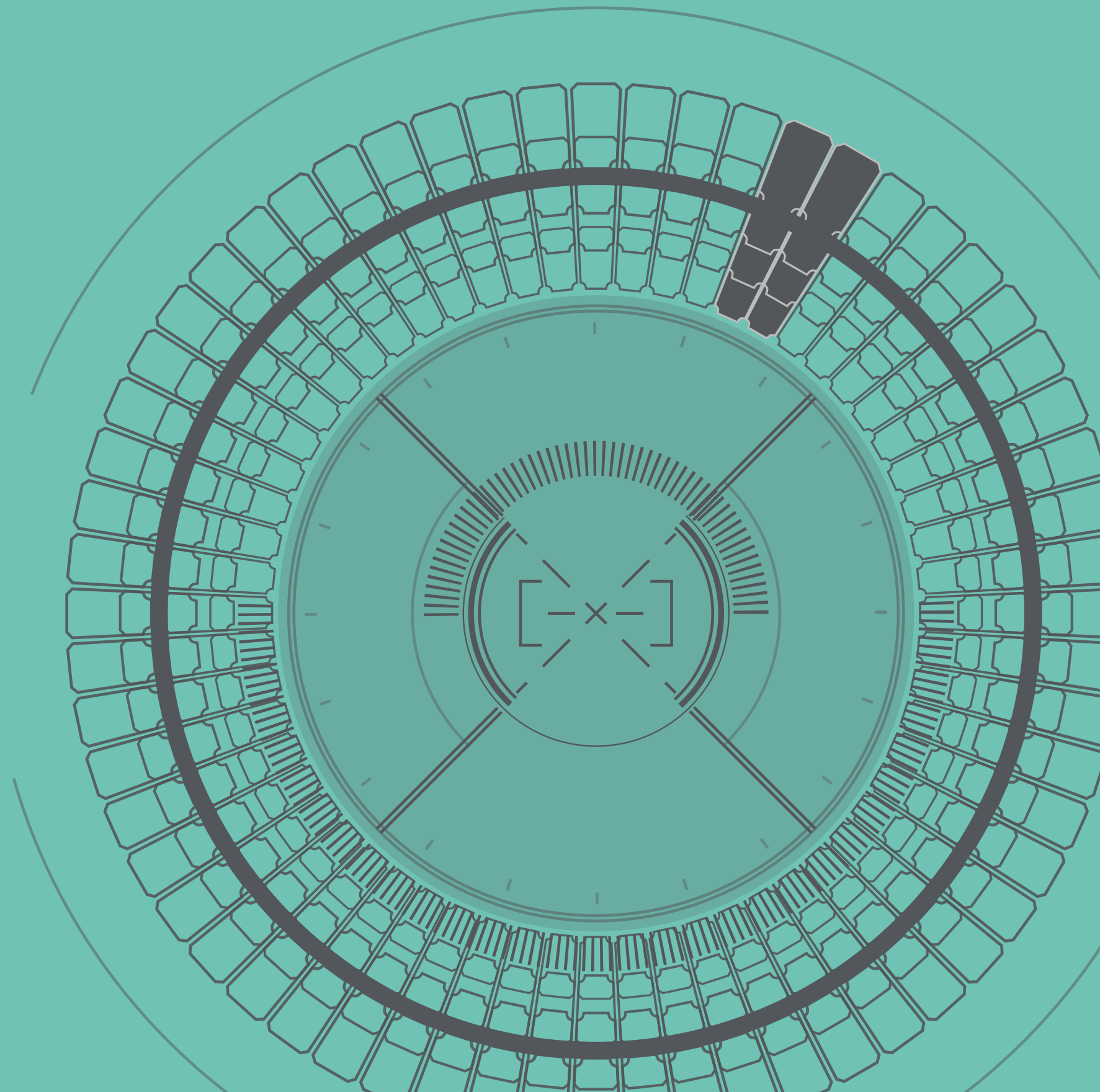
Digital transformation brings new challenges and new diversification opportunities. In this article we explore how E&C companies will ramp up growth now and into the future..

Written by:

João Paulo Domingos
Deloitte Portugal
jdomingos@deloitte.pt

Joaquim Duarte Oliveira
Deloitte Portugal
joaoliveira@deloitte.pt

Filipe Sousa Faria
Deloitte Portugal
fifaria@deloitte.pt



What motivates companies to diversify their business?

Companies continue to re-invent their business portfolio to leverage a set of specific drivers, involving construction and non-construction activities. These are: increased synergies, harnessed competitive advantage and knowledge, as well as higher profitability, shorter life cycles and more recurring revenue from non-construction activities. However, since these activities usually require higher investment levels than pure construction, diversification entails risks such as the burden of debt.

Two-way diversification strategy

Construction groups have been diversifying their business portfolio and, more recently, have done so mostly through M&A activity. They do this by providing non-construction services to construction customers and performing several activities included in the asset life cycle.

01. Providing non-construction services to clients

Firms are providing a full spectrum of solutions to extract value from technologies and the key business expectations of each client. The core goal is to shift from an exclusive focus on E&C to becoming a “full” business partner.

In recent decades, firms have been investing mainly in developing their offering of services in consulting, staffing solutions, procurement and supply chain, real estate and management (such as operations management, facilities management and IT). Certain players are also investing in less related areas, such as fashion and hospitality.

02. Performing activities included in the asset life cycle

Expanding the business portfolio also means offering an integrated set of solutions throughout the asset life cycle. To become end-to-end solution providers, companies have been investing heavily in concessions, water and waste management, energy systems and plants, maintenance and asset management solutions, remodeling and turnarounds.

The agenda for the future

Construction 4.0 will continue to transform the industry through digitization (through, for example, the automation of construction sites and artificial intelligence). Market disruption forces companies to be agile, i.e., to reassess their strategy and operations in a timely manner. Companies need to be flexible enough to adjust quickly to the market, lean enough to be competitive and innovative enough to deliver quality and new services. In less than ten years, we will have witnessed a massive industry and business reconfiguration.

In E&C, exploring new ways to grow will remain the building block for generating profits and building market share. Revenue and knowledge will be increased through dedicated innovation hubs, business incubators and accelerators and corporate venture initiatives. Competitive advantage and strategic market positioning will be achieved through partnerships with universities, start-ups and experts in niche technologies/knowledge areas, enabling firms to potentially become specialists. Participation in cross-market discussions and initiatives and a strengthened position in the value chain will be attainable by acquiring stakes through M&A activity. This is a path that results in improved financial performance and risk management and a growing market share, whether centered on the core business or not.

At the same time, E&C companies with different diversification levels, ranging from pure construction to diversified groups, are expected to hit the market differently, following their own particular strategies. For diversified companies, the future will bring additional trade-offs and challenges.

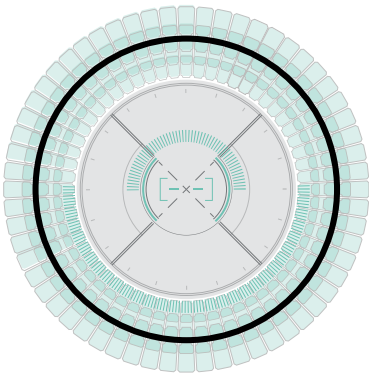
Construction groups with an extensive presence across segments will firstly have to evaluate which segments to serve, even before defining the assets/initiatives in which to invest. Intuitively, they will have to be selective and prioritize investments (to an even greater degree), choosing between building up core activity, integrating the value chain and embracing new businesses. Despite this, and following market trends, the construction segment will continue to have the biggest share of the pie, after divestments

of non-core businesses. Companies will rethink their participation in knowledge-intensive segments to free up investment capacity for capital-intensive segments (construction). Pure construction players will keep the focus on their single core business and invest in strategic assets, such as technology, to develop competitive cost advantage (efficiency).

Conclusion

E&C is an industry in evolution. In the coming years, companies must continue to invest in technology if they are to sustain their position. Innovation and growth will be centered on core business, despite the potential collateral contribution to diversification. Diversified E&C groups will come up with reinvented business portfolios and the growth and competitiveness of other activities, especially non-construction, are expected to fall.

There are two key takeaways: the need to explore new ways to grow as a key success factor and the importance of making strategic decisions tailored to the degree of diversification and profile of each company.



Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited (“DTTL”), its global network of member firms, and their related entities. DTTL (also referred to as “Deloitte Global”) and each of its member firms are legally separate and independent entities. DTTL does not provide services to clients. Please see www.deloitte.com/about to learn more.

Deloitte is a leading global provider of audit and assurance, consulting, financial advisory, risk advisory, tax and related services. Our network of member firms in more than 150 countries and territories serves four out of five Fortune Global 500® companies. Learn how Deloitte’s approximately 312,000 people make an impact that matters at www.deloitte.com.

This communication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms or their related entities (collectively, the “Deloitte network”) is, by means of this communication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

For more information, contact Deloitte Consultores, S.A.

© 2020 Deloitte

Engineering and construction multinational enterprises:

The future of taxation under the OECD's Pillars One and Two

The international tax landscape will change dramatically in the near future. The Organization for Economic Co-operation and Development (OECD) G20 Inclusive Framework (IF) on Base erosion and profit shifting (BEPS), formed by over 135 countries, is currently agreeing on how taxing rights on income generated from cross-border activities in the digital age should be allocated among jurisdictions¹. Measures to be agreed upon by the IF will represent a substantial renovation of key international tax rules, such as the physical nexus concept, which were designed more than a century ago. The new international tax rules will impact most economic sectors, including to a certain extent, engineering and construction multinational enterprises (E&C MNEs), affecting not only highly digitalized businesses.

1. OECD, "Statement by the OECD/G20 Inclusive Framework on BEPS on the Two-Pillar Approach to Address the Tax Challenges Arising from the Digitalisation of the Economy", January 29-30, 2020, <https://www.oecd.org/tax/beps/statement-by-the-oecd-g20-inclusive-framework-on-beps-january-2020.pdf>, accessed June 1, 2020.

Written by:

Jon Díaz de Durana

Deloitte Spain

jdiazdedurana@deloitte.es



New international tax rules under the OECD's Pillars One and Two

The IF grouped the proposals to address the allocation of taxing rights among jurisdictions into two pillars:

- **Pillar One** aims to reallocate taxing rights in favor of the “market country”, introducing new tax nexus and profit allocation rules under a three-tier mechanism:
 01. A “new taxing right” (Amount A) that allocates a share of the large (EUR€750 million consolidated revenue, approximately USD\$816 million) multinational enterprise's (MNE) residual profit to the “market country” using a formulaic approach. Amount A applies only to in-scope businesses that can participate in a sustained and significant manner in the economic life of a “market country” with or without local physical operations, namely automated digital services (i.e., online search engines, social media platforms, online marketplaces, etc.) and consumer-facing businesses (i.e., the sale of goods and services of a type commonly sold to final consumers).
 02. A fixed remuneration based on the Arm's Length Principle (ALP) for baseline distribution and marketing functions that take place in the market jurisdiction (Amount B).
 03. Additional profit calculated under the ALP where in-country functions exceed the baseline activity compensated under Amount B (Amount C).
- **Pillar Two** (also referred to as the GloBE proposal) intends to ensure a minimum level of global taxation. The GloBE proposal includes a set of intertwined income inclusion and tax on base-eroding payments rules. The income inclusion rule would act as a top-up tax to an agreed minimum rate calculated as a fixed percentage (pending agreement by the IF).

Impact of the new international tax rules on E&C MNEs

Based on the OECD's economic analysis and impact assessment, the combined effect of Pillars One and Two would lead to a significant increase in global taxation - around USD\$100 billion annually². However, the increase in taxation would not affect all industries equally. In particular, E&C MNEs operating under a traditional model should not be significantly affected by the upcoming new set of international tax rules for a number of reasons:

- Traditional E&C MNEs engaged in large infrastructure construction projects may not fall within the scope of Amount A of Pillar One, since they primarily operate under business to business (B2B) models (not consumer-facing) and do not provide automated digital services. Even if the E&C activities ultimately qualified for the application of Amount A, which is unlikely, the “new taxing right” applies only to the portion of profit exceeding a certain level of profitability (yet to be determined); E&C profit margins are not high (due to a highly competitive environment, etc.) and therefore, the redistribution of the residual profit to the market jurisdictions, if any, are not expected to be significant. In addition, E&C MNEs have a predominantly physical presence (i.e., construction projects) in the jurisdictions where they generate revenue and, accordingly, are already taxed in these jurisdictions under the existing international tax rules.
- E&C MNEs with headquarters, operating hubs and offshore construction yards located in low corporate tax rate jurisdictions may be affected by the income inclusion rules of the GloBE proposal. However, E&C MNEs are often headquartered and operate in regions with medium-to-high corporate tax rates, such as Latin America , Australia, the US and Canada and, therefore, the impact of this proposal in terms of the global minimum tax should be limited.

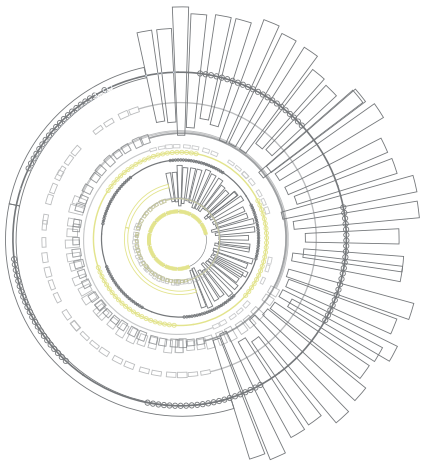
In any case, digitalization (i.e., 3D printing, advanced robotics, automation, artificial intelligence (AI) and analytics, cloud, Internet of Things (IoT), etc.) is reshaping traditional E&C businesses and the impact of these measures could increase with the introduction of new models; consequently, the changes in international tax rules must be closely monitored by E&C MNEs to accurately determine their future impact.

How to be prepared for the future of taxation

A case-by-case analysis is required. Anticipating the impact analysis and modelling the different scenarios before the new international tax rules enter into force is critical. Anticipation would allow an E&C MNE to implement measures to mitigate any potential negative impact (double taxation, for instance), in all possible situations (traditional vs. digitalized business models, potential future changes in operating structure, etc.). Adapting the systems to the new tax requirements is also key to correctly and efficiently managing and monitoring new tax filings worldwide.

Latest news

In spite of the coronavirus (COVID-19) emergency, the OECD has announced that teams in charge of Pillars One and Two are working virtually to meet the agreed deadlines, i.e., reaching a political decision on the key components of a multilateral consensus-based solution at the G20/OECD Inclusive Framework on BEPS plenary meeting scheduled for 1-2 July 2020 in Berlin, Germany.



For further information, please visit www.deloitte.es

Deloitte refers to Deloitte Touche Tohmatsu Limited ("DTTL") and its global network of member firms and their related entities, either to one or several of them. DTTL (also called "Deloitte Global") and each of its member firms are legally separate and independent entities. DTTL does not provide services to customers. For more information, see www.deloitte.com/about.

Deloitte provides audit, consulting, legal, financial advisory, risk management, tax, and related services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries and territories, Deloitte brings world-class capabilities and high-quality service to clients, delivering the insights they need to address their most complex business challenges. Deloitte's more than 312,000 professionals are committed to making an impact that matters.

This communication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively, the “Deloitte Network”) is, by means of this communication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

© 2020 Deloitte, S.L.

Designed and produced by the Marketing & Brand department, Madrid.

2. OECD, “Tax Challenges Arising From The Digitalisation Of The Economy, Update On The Economic Analysis & Impact Assessment”, February 13, 2020, <https://www.oecd.org/tax/beps/presentation-economic-analysis-impact-assessment-webcast-february-2020.pdf>, accessed June 1, 2020.

Digital Construction: incorporating digital technologies into the construction industry

The construction industry impacts all of our lives daily. Without it, there would be no roads, offices, hospitals, schools, and perhaps most importantly, homes. The industry represents the building blocks of our communities and, from a wider point of view, is a cornerstone of the economy.

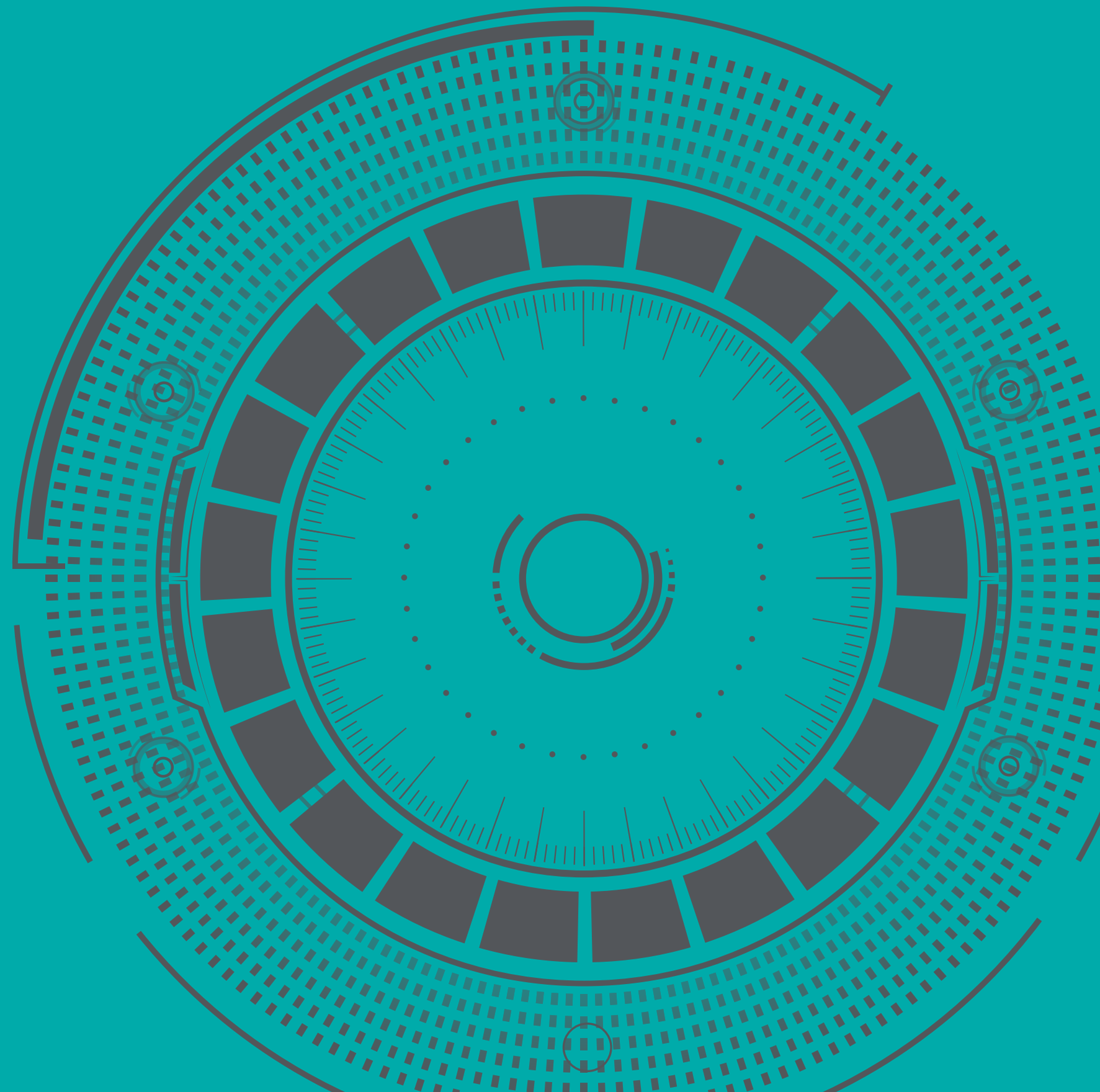
COVID-19 will without a doubt have a major impact on the construction industry. However, it can be observed that the challenges the industry faces are more fundamental and rooted in the lack of digitalization.

Written by:

Peter Sanders
Deloitte The Netherlands
PSanders@deloitte.nl

Jurriën Veldhuizen
Deloitte The Netherlands
JVeldhuizen@deloitte.nl

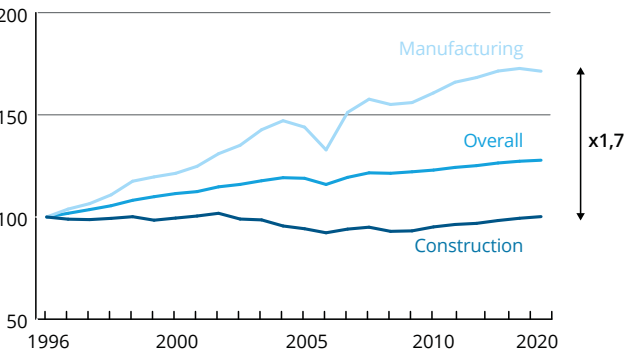
Rogier de Jong
Deloitte The Netherlands
rogdejong@deloitte.nl



Trends that shape the construction industry

In recent years, the construction industry has faced a number of challenges: Climate change, sustainability, talent shortage and financial pressure. The construction incumbents are still formulating a response to these trends, and productivity still lags far behind the norm.

Figure 1: Standardized labor productivity growth (28 EU countries) of various industries 1996-2019

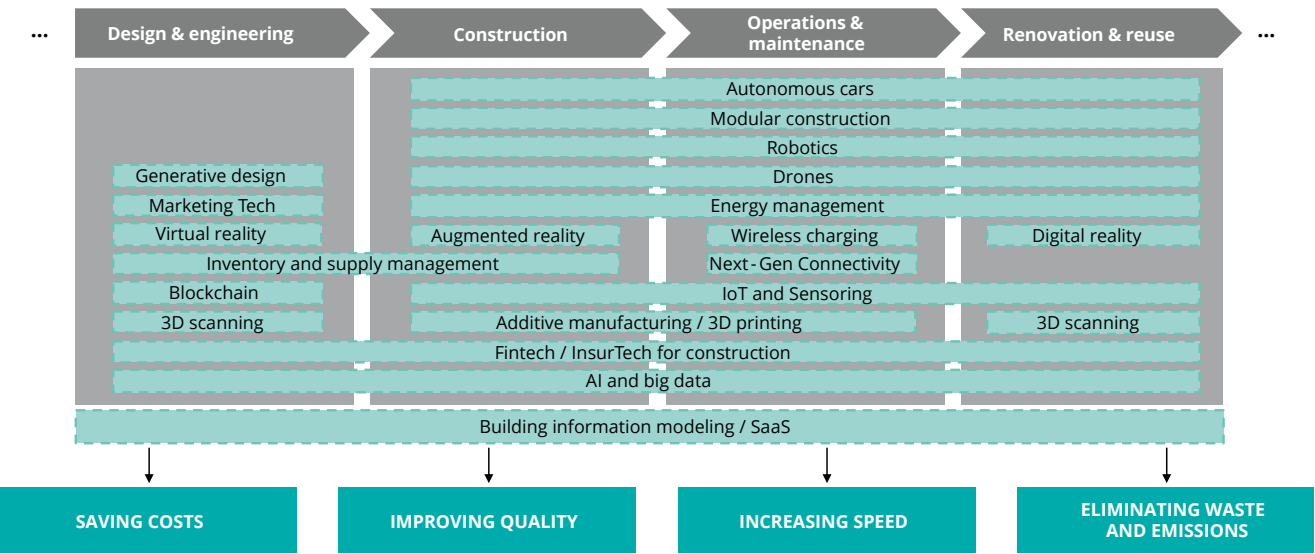


Digital technologies create opportunities

Digital construction could provide an answer to these challenges. Digital construction is defined as utilizing digital technologies to construct more efficiently with higher quality. However, when looking at Information Technology (IT) investments, the construction industry has historically underinvested in technology

— only 1.2 percent of its revenue is allocated to IT, compared to a 3.5 percent average across industries. We believe that digitalization presents a significant opportunity to not only deal with these challenges, but to use them to thrive.

Figure 2: Digital technologies through the construction lifecycle



1. Source: OECD, 2020; Monitor Deloitte analysis
2. Source: Monitor Deloitte analysis

Learning from new entrants

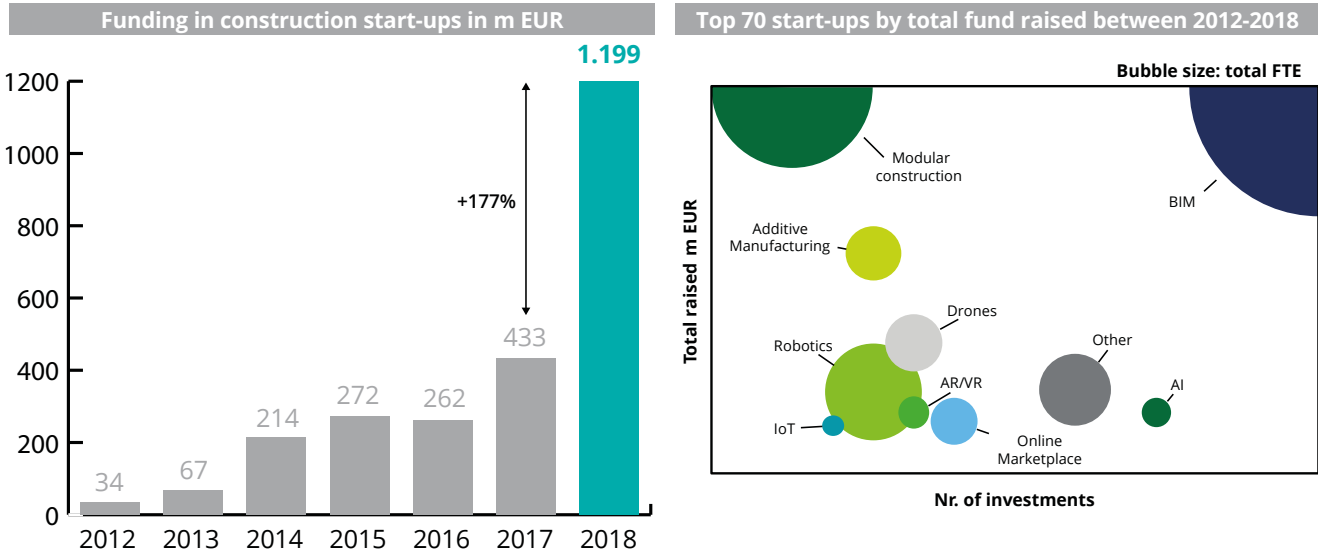
Digital construction is on the radar of ConTech start-ups and tech giants to gain a foothold in the industry by applying new disruptive technologies that could upend the playing field. And they aim to do it in different ways. ConTechs are presenting focused solutions around a single technology to solve a specific but industry-wide problem, such as using augmented reality to enhance the productivity and safety of workers.

In contrast, tech giants are focusing on solving the world's big problems, including urbanization and congestion, by rethinking the entire way of working and using a mix of technology solutions for one specific problem. They heavily invest to create industry-disrupting business models that stretch beyond 'simple' product development and sales. This is very different from most incumbents' strategies, which focus on cost saving and improved efficiency rather than value creation.

For construction incumbents wanting to seize the opportunity, there is much to learn from these new entrants' strategies. First, you need to be well-funded to change the value chain, as new entrants are either VC-backed start-ups or capital-rich tech giants. Simultaneously, be cautious in asset-centric thinking; disruptors bring "asset-light" strategies and think "digital first" in order to avoid only adding new tech to legacy products and processes. Another area of growth is identifying the critical data elements to own early on, which has proven vital to driving financial returns for most SaaS start-ups.

Finally, focus and speed matter. By focus, we mean concentrating efforts on as few technologies as possible, allowing you to continuously iterate and improve the proposition to facilitate a timely market launch ahead of the curve.

Figure 3: Capital investments in construction start-ups



3. Source: Pitchbook, 2019; Note: Buyout and M&A deals are not counted and technologies that are also applicable to other industries are not captured here (e.g. robotics for agriculture which also applicable for 3D scanning are not captured). Start-ups are categorized by their primary technology, i.e. AI here meaning start-ups using it as a core value proposition for their products.
4. Source: OECD, 2020; Monitor Deloitte analysis

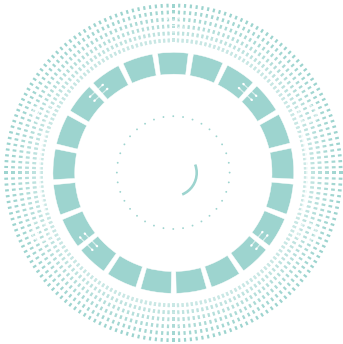
Conclusion: a call to action for construction incumbents

To successfully seize these learning opportunities, construction incumbents should consider establishing a digital foundry to accelerate their digital goals. They will need to think big, start small and act fast:

- Immerse yourself in technologies to explore the “art of the possible”.
- Build your ecosystem and evolve your supply chain into “value webs” through collaboration.
- Set up a “black ops” team to enable disruption on the edge of the established organization.
- Prioritize your two or three desired initiatives to start with.
- Prove it works (quickly) by using an agile, iterative approach.
- Champion your successes to gain traction and achieve enterprise-wide adoption.

We believe that by incorporating digital technologies into a more focused and value-creating mindset, construction incumbents can strengthen their position and respond to the disruption caused by the new players.

Figure 4: Establish a digital foundry



Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited (“DTTL”), its global network of member firms, and their related entities (collectively, the “Deloitte organization”). DTTL (also referred to as “Deloitte Global”) and each of its member firms and related entities are legally separate and independent entities, which cannot obligate or bind each other in respect of third parties. DTTL and each DTTL member firm and related entity is liable only for its own acts and omissions, and not those of each other. DTTL does not provide services to clients. Please see www.deloitte.com/about to learn more.

Deloitte is a leading global provider of audit and assurance, consulting, financial advisory, risk advisory, tax and related services. Our global network of member firms and related entities in more than 150 countries and territories (collectively, the “Deloitte organization”) serves four out of five Fortune Global 500® companies. Learn how Deloitte’s approximately 312,000 people make an impact that matters at www.deloitte.com.

Standardization and process automation: Key aspects for cost efficiency in construction

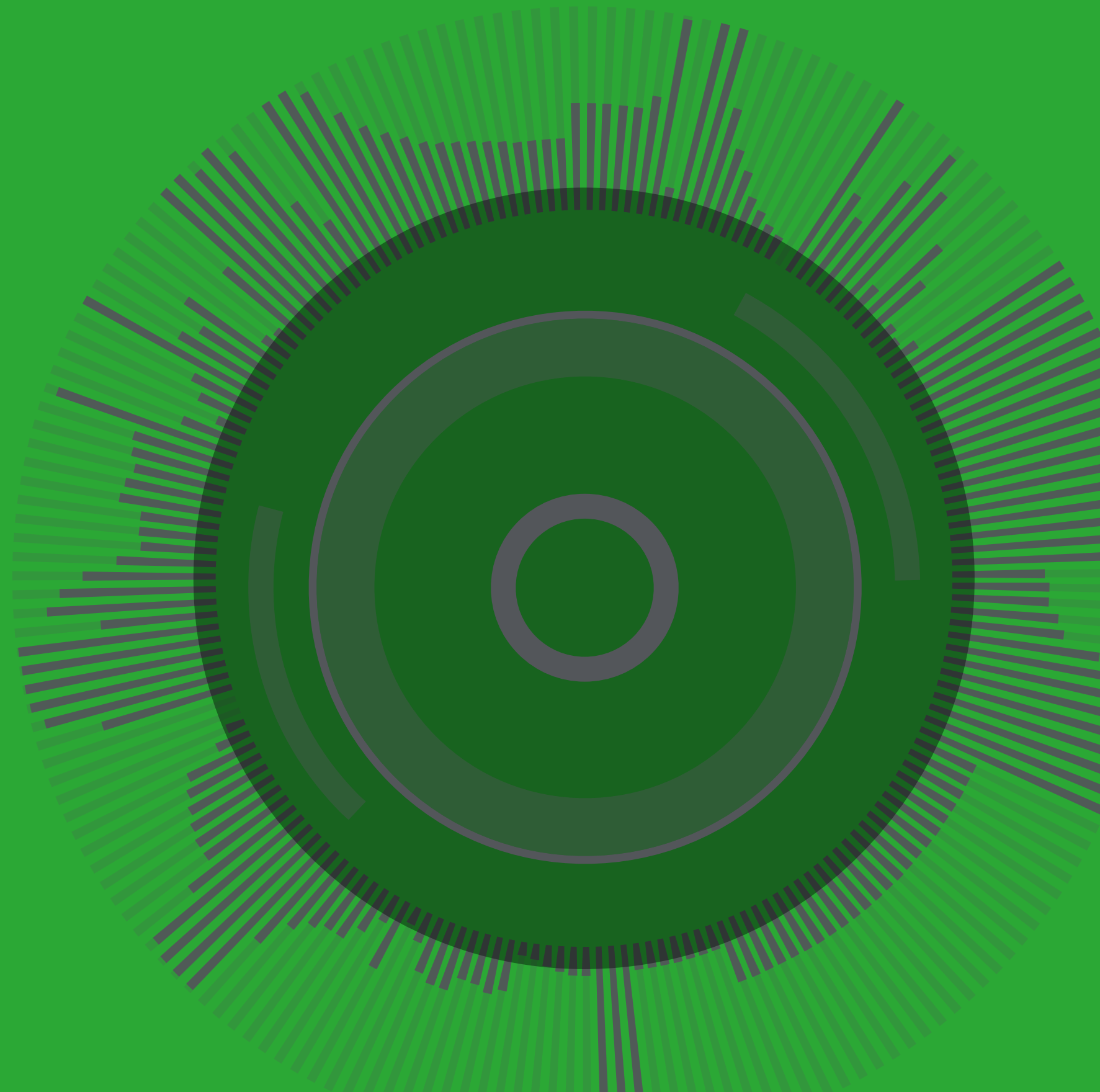
In recent years, the construction industry has embarked on a journey of slow transformation towards the digitization of its key processes, which the Covid-19 crisis is undoubtedly accelerating. The need to continue executing projects under conditions of social distancing and limited capacity necessarily constrains the work and productivity of workers at construction sites. Hence, the trend towards process automation and the use of remote and industrialized production solutions is increasing.

Written by:

Daniel Ramos Morales
Deloitte Spain
dramosmorales@deloitte.es

Luis Gonzalez Gugel
Deloitte Spain
lgonzalezgugel@s2g.deloitte.es

Alejandro López Navarrete
Deloitte Spain
alopeznavarrete@deloitte.es



A major obstacle for the industry to overcome has been the difficulty in standardizing designs and construction methods so that they can be adapted to the specific conditions of each project. Furthermore, not having a market standard at the technology platform and management systems level has been an additional impediment. However, the implementation of methodologies and tools such as Building Information Modeling (BIM), digital field surveys through Laser Imaging Detection and Ranging (LIDAR) and Georadar and a rapidly growing increase in connectivity are becoming increasingly important in ever more companies across the sector, with further developments and reusable standardizations available in the various projects.

In this regard, it has been found that the digital design of the entire project and the standardized assembly of its parts (which could be factory-built and assembled on-site) drastically reduce the number of changes and simplify the costs of production and assembly, increasing the quality of the final product and minimizing reprocessing. Design management and approval of engineering changes, contract management, communications and notifications are processes that can be quickly done digitally and partially remotely. In addition, through more industrialized production, part of the certification and quality control of work can be carried out before on-site assembly, and the safety of all operations can be improved, for example:

- Creating a virtual model (Digital Twin) in the early stages of design Front-End Engineering Design (FEED) or earlier: Cost accuracy in the conceptual stage can be up to +/- 50%, while in FEED (Ready for Tender) accuracy improves to +/-20% or +/-30%. The use of a virtual model could improve such accuracy even more significantly.
- Digital Asset Lifecycle Management: The inclusion of the Enterprise Asset Management (EAM) tool in the BIM model allows the Digital Twin to be created during design phase (accessible in the Cloud). This facilitates early detection of integration and interference problems and other risks. It also allows data integration with Project Control tools, Quantitative Risk, etc.
- Making better design decisions that limit the impact on Operations and Maintenance (O&M) costs: Digital control of the asset and all of its components allows O&M costs to be planned more accurately, thus anticipating and avoiding cost overruns at this stage.

Increased construction connectivity, sensor systems and Internet of Things (IoT) devices will significantly increase the quality and quantity of data as well as its traceability, allowing each work resource (personal, machinery) to be controlled and its productivity to be measured so that improvements can be made on ongoing basis. In turn, the use of these devices will enable event evidence to be generated that can impact planning, control actual physical progress and furnish a better legal foundation so as to reduce disputes between the parties during the project. The mitigation of contractual disputes is one of the most advanced aspects in the field of project management brought in by BIM methodology combining with IoT devices, since their use allows early warnings to be generated or future interferences and impacts on the work plan to be visualized. Therefore, the parties can adopt the appropriate measures before the impacts occur, thus reducing the final costs of the project.

Moreover, Geographic Information System (GIS) allow the available data of the physical elements of the project to be structured and tie them to their geographical location, thus reducing the need for comprehensive recognition campaigns, the uncertainties of the design phase, and, consequently, the costs of adapting future projects.

Therefore, the transformation of project management to an integrated BIM-GIS system, with the capability of integrating data from other systems currently used by the company (Customer Relationship Management, Enterprise Resource Planning, planning tools, etc.) offers significant improvements in the various phases of the life cycle of the assets and the organizations that manage them during those phases:

- In the design and construction phases, the associated costs are reduced (15-20% in design and about 10% during construction). The integration of unified information is materialized by reducing investment risk, attracting investment and operators, standardizing processes, and improving productivity and stability of time and costs. There are also other factors that contribute to cost reduction, such as the integration of models and suppliers, the digital implementation of each phase, the simulation of the construction process and virtual monitoring of design and construction.
- In the operation and maintenance phases, operating expense (OPEX) can be optimized at around 10-12% through procurement/supply chain monitoring, improved marketing and management solutions and increased competitiveness. Reducing personnel costs and optimizing processes also contribute to cost improvement.

This gradual standardization and digitization of processes in the project life cycle will give rise to key trends for the transformation of the industry, such as remote work. The possibility that qualified personnel can carry out their duties from any location with enough information about the status and progress of the project will allow productivity and efficiency to be increased without sacrificing control and quality. Even the use of industrialized processes and robots to perform the job will gradually reduce the need for people to perform high-risk work.

In summary, the standardization and automation of processes through digitization and the use of sensors will allow solutions to be resilient and flexible in times of crisis such as the current one, in which, due to the impact of Covid-19, we have validated hypotheses in a context of stress and confirmed the basic cornerstones of digitization in construction:

- Ability to create value in times of uncertainty: standardization and automation as an element of flexibility to create fast and efficient solutions.
- Maintenance of operations in stressful situations: ability to always operate (24/7) and adapt to changes in workload and relocation of the human factor.
- Ability to drive and incorporate elements of ecosystem innovation by building specific use cases. Applicability with a creative and critical spirit.
- Real-time data collection and analysis for decision-making with "legacy" connection capability.

Conclusion

Nevertheless, it is vital to consider the importance of advancing standardization, automation and digitization in the construction industry by identifying and acting on the challenges of adopting technologies and evolving the way we work. In this connection, it is the organizations themselves, with their difficulties in managing change and their governance, that can prevent changes in scale.



For further information, please visit www.deloitte.es

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. Please see www.deloitte.com/about for a more detailed description of DTTL and its member firms.

Deloitte provides audit, consulting, financial advisory, risk management, tax, and related services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries and territories, Deloitte brings world-class capabilities and high-quality service to clients, delivering the insights they need to address their most complex business challenges. Deloitte's more than 312,000 professionals are committed to making an impact that matters.

This communication is for internal distribution and use only among personnel of Deloitte Touche Tohmatsu Limited, its member firms, and their related entities (collectively, the "Deloitte Network"). None of the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

© 2020. For information, contact Deloitte, S.L.

Putting the construction sector at the core of the climate change debate

Climate change is having a significant impact on businesses, society, and individuals. It is increasingly understood that a shift towards a low-carbon economy is needed. The building and construction sector plays a central role in this shift. The sector's greenhouse gas (GHG) emissions account for approximately 40% of global GHG emissions (WBCSD 2018). The major contributors to these emissions are the materials used as well as the heating, cooling, and lighting of buildings and infrastructure.

Written by:

Michael Müller
Deloitte Germany
mmueller@deloitte.de

Thomas Krick
Deloitte Germany
tkrick@deloitte.de

Dr. Julian Blohmke
Deloitte Germany
jblohmke@deloitte.de



The beginning of the last decade was partly spent on a debate around stranded assets, i.e., the risk of devaluation of assets in the oil and gas industry due to regulations and market changes. It is now becoming increasingly clear that, because of their high direct and indirect carbon emissions, real estate assets and construction projects might not be stranded but require additional capital injections for refurbishment, and thus margins may need to be adjusted. This could lead to massive devaluations. As it is of basic importance to many industries, the highly carbon intensive construction sector is increasingly being pushed into the spotlight of the climate change debate.

Climate change and the construction sector

The building materials and construction sector is confronted with two major challenges, which expose sector stakeholders along the construction value chain to climate change risks in two ways. On the one hand, the sector contributes to climate change through greenhouse gas (GHG) emissions and is then exposed to carbon taxes in the production of building materials as well as from power and heat supply in the use phase of buildings. Moreover, the sector must address infrastructure and sector decarbonization goals (transition risks).

On the other hand, stakeholders are exposed to risks from the physical changes in the environment caused by climate change, like more extreme weather conditions on construction sites, water shortages, and other such deteriorating environmental conditions as temperature increase and flooding (physical risks).

The construction sector is a major contributor to climate change. An overhaul is needed to both minimize the sector’s impact on climate—as well as prepare for climate’s impact on them

Actions to combat climate change in the construction sector

There are several areas for climate action the construction sector should care about.

Reducing carbon emissions and transition risks

Companies are responsible for reducing their carbon emissions to achieve net-zero emissions by 2050, and, thus, the goal of the Paris Agreement to reduce global warming to below 2 degrees Celsius. Hence, their responsibility should be to drive decarbonization along the entire value chain. Most notably action should be taken to influence:

- The lowering carbon intensity of building materials in the upstream production process of materials
- The implementation of climate-smart, low, and clean energy consumption in the use phase of real estate and infrastructure
- The design of more recyclable materials and closed material flows in the refurbishment and demolition phases (circularity of building materials)

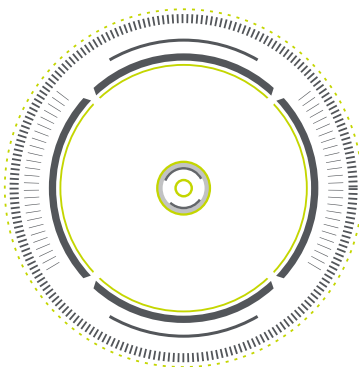
Building resilience against the environmental consequences of climate change

Physical risks like extreme weather events and floods may unfold in the mid-term future and require the forward-looking analysis of physical risks. Preparatory measures against the negative effects of these events during the use phase of buildings and infrastructure are required. The expansion of buildings and infrastructure will also influence the natural environment’s resilience to negative climate change impacts on the environment due to increases in precipitation and the ability to sequester carbon in the natural environment. This will include activities aimed at:

- Increasing the durability of materials against extreme weather conditions
- Overhauling heating/cooling and insulation concepts
- Revising water management towards more climate-smart water management systems during the construction and use phases of buildings
- Lowering the potential negative effects of the construction sector on the environment from soil sealing (change in water flows from heavy rain) or land use change (carbon sequestration)

Conclusion

The construction sector will be called upon to take action to manage climate change challenges actively and take responsibility for its direct or induced carbon emissions. It will also need to prepare for a changing environment and build resilience against the negative impacts of climate change.



This communication and any attachment to it is for internal distribution among personnel of Deloitte Touche Tohmatsu Limited (“DTTL”), its global network of member firms and their related entities (collectively, the “Deloitte organization”). It may contain confidential information and is intended solely for the use of the individual or entity to whom it is addressed. If you are not the intended recipient, please notify us immediately by replying to this email and then please delete this communication and all copies of it on your system. Please do not use this communication in any way.

None of DTTL, its member firms, related entities, employees or agents shall be responsible for any loss or damage whatsoever arising directly or indirectly in connection with any person relying on this communication. DTTL and each of its member firms, and their related entities, are legally separate and independent entities.

© 2020. For information, contact Deloitte Global.

Creating a better world: Circularity in Construction

All around the world, governments, companies, and NGOs have committed to minimizing raw material usage in the real estate and construction industry as the demand for such materials keeps rising. More than half of all greenhouse gas emissions relate to materials management activities¹. A shift towards circularity is pressing, but remains a challenge. Materials' passports can function as a crucial tool in accelerating this shift. By changing the perspective on materials and acknowledging their continuous economic value, the built environment becomes a material depot that can be re-utilized.

1. OECD, "Raw materials use to double by 2060 with severe environmental consequences", October, 2018, <https://www.oecd.org/environment/raw-materials-use-to-double-by-2060-with-severe-environmental-consequences.htm>, accessed April, 2020.

Written by:
Jurrien Veldhuizen
Deloitte The Netherlands
JVeldhuizen@deloitte.nl

Carlo Sturm
Deloitte The Netherlands
CSturm@deloitte.nl



The demand for raw materials continues to increase worldwide. Consumption of raw materials is set to nearly double by 2060¹. The construction industry is one of the largest producers of waste. Thus, a new perspective towards materials is needed. Reusing materials reduces the consumption of raw materials and depicts a first step from a linear to a circular economy. The transition to a circular economy is essential in achieving the objectives of the Paris Agreement. Many governments have therefore set themselves the goal of stimulating a transition to a fully circular economy. While the construction and real estate sector are mainly financially driven, moral and social arguments prevail in the discussion around circularity. Making the morally desirable financially attractive could speed up the transition.

Materials database: providing insight into reusable construction materials

Over the last decade there has been an increased focus on circularity in construction and real estate. Initiatives range from reusing materials and design for deconstruction to efforts to establish marketplaces for used building materials. However, in order to transition to a fully circular construction industry, reuse of materials from the built environment should increase. In order to do so, materials passports can be of use as they provide materials with a documented identity and value to enable them to remain visible in the economy. Knowledge of what is stored in the built environment stimulates reuse of products, prevents destruction of materials, and makes it easier to eliminate waste. Wide application of materials passports can steer the outlook towards valuing the existing built environment as a potential materials depot for future buildings.

A materials passport is designed as an online library of materials in the built environment, providing one central repository of all real estate data. This data includes all relevant information during the planning and execution phases of building administration and maintenance. The documentation and data can be useful for designing tenders, renovation, demolition, or new developments as well as for certification and sales/lease purposes. The idea is simple: based on global price benchmarks and corrected for demolition, transport, and reusage costs, the residual value of the materials is identified. One of the leading organizations in this approach is the Madaster Foundation, with its materials passport fast becoming the global standard.

From a financial value perspective, a materials passport takes away information asymmetry by providing a more accurate assessment of demolition costs or benefits. This impacts the cashflow of an organization and stimulates circularity by giving materials value and thus diminishing the amount of waste. When residual value becomes visible on the balance sheet, organizations and property owners will optimize design, maintenance, and demolition of property to increase residual value.

Digitalization in the construction industry: a chance for a free ride on current developments

Over the past decade, innovation and digitalization have finally taken flight in the construction industry. Mainly the larger construction companies are increasingly focusing on innovation and digitalization of their business models. In this area, building information modeling (BIM) serves as a main enabler. At an increasing pace, BIM models are used from the initiation phase to serve as a platform on which multiple stakeholders collaborate. Subsequently, the move towards digital twins allows failure costs to be reduced and more efficient work processes to be created. Digital twins are a real-time digital representation of a physical object that continuously delivers information on the assets' properties and statuses. These developments align well with the function of materials passports. IT platforms such as Madaster use BIM models to create materials passports of buildings. Once the passport is available, project developers can decide on more circular materials use in the design phase of the building, increasing circularity and, ideally, financial residual value—thus supporting the business case.

Call to action: stimulate a feasible circular business case

The circular business case has proven to be complex, as the financial perspective remains dominant in investment decisions in construction and real estate. There are still hurdles to be overcome in order to accomplish a shift towards a circular construction industry. Reused and refurbished materials are often the more expensive option. At the same time, valuing reused and refurbished materials has proven to be hard—not least because of the lack of (public) circular marketplaces. Therefore, the industry

as a whole must pick up the gauntlet to make circularity a viable business case. There is a need for front runners to create circular marketplaces and bring transparency to valuation in order to speed up the use of circular materials. In addition, we need governments to take a look at their tax regimes to see how they can stimulate the shift towards a circular construction industry by making the morally desirable more financially attractive.

Conclusion

Together with the Madaster Foundation and the Circular 8 (8 frontrunners in circularity: ASML, Bouwinvest, Erasmus MC, the Municipality of Rotterdam, Lefier, Rai Amsterdam, Shell, and Van Wijnen), Deloitte Netherlands has published research concerning the financial effects of applying residual value or future value of materials in property. Deloitte is continuously looking to facilitate the shift towards a circular construction and real estate industry by bringing down barriers in collaboration with partners in the ecosystem.



Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited (“DTTL”), its global network of member firms, and their related entities (collectively, the “Deloitte organization”). DTTL (also referred to as “Deloitte Global”) and each of its member firms and related entities are legally separate and independent entities, which cannot obligate or bind each other in respect of third parties. DTTL and each DTTL member firm and related entity is liable only for its own acts and omissions, and not those of each other. DTTL does not provide services to clients. Please see www.deloitte.com/about to learn more.

Deloitte is a leading global provider of audit and assurance, consulting, financial advisory, risk advisory, tax and related services. Our global network of member firms and related entities in more than 150 countries and territories (collectively, the “Deloitte organization”) serves four out of five Fortune Global 500® companies. Learn how Deloitte’s approximately 312,000 people make an impact that matters at www.deloitte.com.

© 2020 Deloitte

Internationalization of Chinese Construction Enterprises

Over recent years, Chinese companies have dominated all construction revenue rankings. If we look at the main listed construction companies, in 2019 China represented almost 44 percent of total sales recorded, with 12 groups included in the Top 100 ranking¹. Overall, Asia recorded 64 percent of the total sales obtained by the Top 100 listed construction groups in 2019 (Figure 1.1).

1. Deloitte, S.L., *Global Powers of Construction 2019*, July 2020, accessed 28 July 2020

Written by:
Yanfeng Xie
Deloitte China
edwardxie@deloitte.com.cn

Eric Shi
Deloitte China
erishi@deloitte.com.cn



Although Chinese construction groups have traditionally been focused mainly on their domestic markets, over recent years, internationalization has started for many Chinese construction enterprises. In 2019 the Chinese companies included in the Top 30 listed construction groups obtained almost USD\$45,560 million in revenue outside their domestic market, representing approximately seven percent of their aggregate income. International development is encouraged and supported by the Chinese government and is also aided by the intense competition within the domestic market.

In the context of weak global economic recovery, together with growing trade frictions among major international economies, investment protectionism and trade protectionism in 2019, the globalization challenges faced by Chinese construction enterprises have increased significantly. However, the joint construction of infrastructure under the Belt and Road Initiative has been documented in major publications issued by international organizations such as the United Nations, and by organizations which publish information on China-Latin America, China-Middle East and China-Africa relations. The Belt and Road Initiative Infrastructure Development Index continues to remain at a relatively high level, becoming an important driving force for

Chinese construction enterprises to develop overseas. The One Belt One Road countries have strengthened policy communication, improved the business environment, increased infrastructure spending and inspired cross-border investment and cooperation.

According to statistics from the Ministry of Commerce of the People's Republic of China, in 2019 the total amount of new contracts for China's overseas contracting projects was USD\$260.3 billion, a year-on-year increase of 7.6 percent, of which the giving rise to turnover of USD\$172.9 billion, a year-on-year increase of 2.3 percent. In 62 Belt and Road Initiative countries and regions, Chinese construction enterprises obtained approximately 60 percent of the newly concluded contracts -amounting to USD\$154.9 billion-, representing a year-on-year increase of 23.1 percent; turnover achieved was USD\$97.98 billion, accounting for approximately 56.7 percent, a year-on-year increase of 9.7 percent².

The types of overseas projects undertaken by Chinese construction enterprises mainly include water conservation, hydropower, ports, highways, railways and housing construction. In this context, some emerging economies and smaller developed economies are increasingly exposed to Chinese investment,

such as areas of Africa and Southeast Asia. In fact, China is now the largest foreign investor in Africa's telecommunications infrastructure. In terms of regional globalization, in addition to the aforementioned regions Chinese construction enterprises have also experienced rapid development in engineering contracting, PPPs and other investment-construction-operation integrated businesses in Russia and South America.

Overseas market expansion and global operations deployment have become a strategic choice for many Chinese construction enterprises. For example, China Railway Construction Corp. Ltd. (CRCC) has proposed an "Prioritizing overseas business " strategy, aiming to achieve 50 percent of its business from overseas in terms of both the amounts of its newly-concluded contracts and the profits it makes from them by 2030³;

China Communications Construction Group Ltd. (CCCC), as the Chinese construction enterprise with the largest overseas business scale, aims to establish a global industrial chain by 2035 with a transnational index exceeding 50 percent, successfully completing its transformation into a first-class global company⁴.

In 2019 the amount of CRCC's new contracts for its overseas business was USD\$38.6 billion, a year-on-year increase of 107 percent⁵, while CCCC's new contracts for overseas projects amounted to USD\$28.3 billion, a year-on-year increase of 24 percent⁶, both figures exceeding the growth rate of their amounts of new contracts as a whole.

Conclusion

In terms of future development trends, demand for transportation infrastructure will increase as a result of the acceleration of industrialization and urbanization in relevant countries. Infrastructure connectivity projects such as roads, railways, ports and airports will encourage stronger incentives for international infrastructure development. All these factors will bring new favorable conditions for the development of Chinese companies around the world.



About Deloitte

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited (“DTTL”), its global network of member firms, and their related entities (collectively, the “Deloitte organization”). DTTL (also referred to as “Deloitte Global”) and each of its member firms and related entities are legally separate and independent entities, which cannot obligate or bind each other in respect of third parties. DTTL and each DTTL member firm and related entity is liable only for its own acts and omissions, and not those of each other. DTTL does not provide services to clients. Please see www.deloitte.com/about to learn more.

Deloitte is a leading global provider of audit and assurance, consulting, financial advisory, risk advisory, tax and related services. Our global network of member firms and related entities in more than 150 countries and territories (collectively, the “Deloitte organization”) serves four out of five Fortune Global 500® companies. Learn how Deloitte's approximately 312,000 people make an impact that matters at www.deloitte.com.

Deloitte Asia Pacific Limited is a company limited by guarantee and a member firm of DTTL. Members of Deloitte Asia Pacific Limited and their related entities, each of which are separate and independent legal entities, provide services from more than 100 cities across the region, including Auckland, Bangkok, Beijing, Hanoi, Hong Kong, Jakarta, Kuala Lumpur, Manila, Melbourne, Osaka, Seoul, Shanghai, Singapore, Sydney, Taipei and Tokyo.

The Deloitte brand entered the China market in 1917 with the opening of an office in Shanghai. Today, Deloitte China delivers a comprehensive range of audit & assurance, consulting, financial advisory, risk advisory and tax services to local, multinational and growth enterprise clients in China. Deloitte China has also made—and continues to make—substantial contributions to the development of China's accounting standards, taxation system and professional expertise. Deloitte China is a locally incorporated professional services organization, owned by its partners in China. To learn more about how Deloitte makes an Impact that Matters in China, please connect with our social media platforms at www2.deloitte.com/cn/en/social-media.

This communication contains general information only, and none of Deloitte Touche Tohmatsu Limited (“DTTL”), its global network of member firms or their related entities (collectively, the “Deloitte organization”) is, by means of this communication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser.

No representations, warranties or undertakings (express or implied) are given as to the accuracy or completeness of the information in this communication, and none of DTTL, its member firms, related entities, employees or agents shall be liable or responsible for any loss or damage whatsoever arising directly or indirectly in connection with any person relying on this communication. DTTL and each of its member firms, and their related entities, are legally separate and independent entities.

© 2020. For information, contact Deloitte China.

Figure 1.1

Geographical area	Sales 2019 (M \$)	Percent of total
Asia	941,283	64%
Europe	350,094	24%
North America	139,976	10%
Australia	11,830	1%
Africa and Middle East	11,798	1%
Latin America	6,860	0%
Total	1,461,841	100%

2. Ministry of Commerce of the People's Republic of China , 2019 年我对 “一带一路” 沿线国家投资合作情况, Ministry of Commerce of the People's Republic of China official website, 22 Jan 2020, <http://www.mofcom.gov.cn/article/tongjiziliao/dgz/202001/20200102932445.shtml> , 2019 年我国对外承包工程业务简明统计, 22 Jan 2020, <http://www.mofcom.gov.cn/article/tongjiziliao/dgz/202001/20200102932442.shtml> , accessed 28 July 2020

3. Wang Hong Wei, 践行初心使命 担当发展重任在建设 “铁建一流” 企业中全面加快海外事业发展步伐, CRCC official website, 23 July 2019, http://www.cr14gi.com/art/2019/7/23/art_17790_2945214.html , accessed 28 July 2020

4. 公司概况, CCCC official website , http://www.ccccltd.cn/aboutus/gsgk_558/ , accessed 28 July 2020

5. 2019 Annual Report of CRCC, CRCC official website, 20 March 2020, <http://www.crcc.cn/col/col173/index.html> , accessed 28 July 2020

6. 2019 Annual Report of CCCC, CCCC official website, 4 April 2020, http://www.ccccltd.cn/tzzgx/dqbg_682/ , accessed 28 July 2020Wang Hong Wei, 践行初心使命 担当发展重任在建设 “铁建一流” 企业中全面加快海外事业发展步伐, CRCC official website, 23 July 2019, http://www.cr14gi.com/art/2019/7/23/art_17790_2945214.html , accessed 28 July 2020



For further information, please visit www.deloitte.es

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. Please see www.deloitte.com/about for a more detailed description of DTTL and its member firms.

Deloitte provides audit, consulting, financial advisory, risk management, tax, and related services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries and territories, Deloitte brings world-class capabilities and high-quality service to clients, delivering the insights they need to address their most complex business challenges. Deloitte's more than 310,000 professionals are committed to making an impact that matters.

This communication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively, the "Deloitte Network") is, by means of this communication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

© 2020. For information, contact Deloitte, S.L.

Designed and produced by Marketing & Brand department, Madrid.