SMARTER CONSTRUCTION:

HOW WILL DATA ANALYTICS SHAPE THE NEXT TEN YEARS IN THE INDUSTRY?

A report by CACI's Business Intelligence Division

CACI

EXECUTIVE SUMMARY

The construction sector is one of the most important drivers of the UK economy, but also a sector that has been playing catch-up with other industries in adopting digital technology and data analytics.

With construction companies facing many unique challenges this year and next – including uncertainty around Brexit and the implementation of Building Information Modelling (BIM) levels – it has become more pressing than ever that the companies upgrade their digital and data capabilities. Luckily, it seems that the sector is doing just that and is currently undergoing it's very own ''digital revolution''.

What this revolution entails is the adoption of data analytics to inform decision-making and financial planning; new technologies such as drones, apps and the internet of things to aid data collection; collaborative design tools; and a whole host of other digitally-driven changes.

This report takes the digital revolution as its starting point and builds on industry research into what the construction sector itself considers its main challenges to advise on how the challenges can and will be met using the new digital and data technology available to companies. A key recommendation is for the industry to invest in data analytics capabilities as a fundament for adopting other technologies while reducing costs and improving quality.

In terms of the industry's main challenges, the sector continues to see cost management, productivity and efficiency as a key hurdle – and as between 50 and 80 per cent of problems on construction sites are attributed to missing and delayed information,[1] data analytics is well poised to help on this front. Research by Northumbria University even found that construction businesses with fully integrated digital strategies are 26 per cent more likely to outperform their competitors,[2] so there is tangible value in sight for companies looking to implement digital strategies and wider data analytics programmes.

Meanwhile, from the side of the government, the goal by 2025 is a 50 per cent reduction in greenhouse gas emissions in the built environment. The private construction sector is expected to help with this change, and benefit from it too: the global green industry is expected to continue to grow over the next few years. Yet meeting all of these challenges in the new marketplace requires the ability to stay agile and continually change while adopting new technologies and ways of working.

BIM levels, data analytics tools or drones, however, are not goals in and of themselves, but rather means to an end of increased profits and efficiency. It is important not to lose this perspective when discussing these topics as it can sometimes seem that people get lost in a maze of technology, buzzwords and convolution. For any new technology, success is judged by whether it improves performance, which at the end of the day means the bottom line.

Mark Perkins,
Consultant,
CACI

[1] ''Assessing the influence of automated data analytics on cost and schedule performance'', Amin Abbaszadegan and David Graub
[2] Digitising Construction

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INTRODUCTION

Construction, being one of the most important UK industries, is this year standing in the middle of its very own digital revolution – both in terms of BIM level 2 implementation and because of wider technological changes.

Many other sectors have already been completely transformed by new digital and data tools; it's enough to look to travel or financial services. For construction, however, there is still a digital gap to be filled with many in the industry believing that the sector still has a long way to go. Many companies need to catch up and make the necessary changes to reach their targets and to reap the benefits of broad-scale data analytics.

Yet for the people working in construction, and indeed other sectors, the digital revolution can sometimes appear distant and less than relevant to their working days. This is a challenge that the industry needs to take seriously, to make sure new technologies or data analytics tools are not seen as "merely an IT project".

In fact, digitisation is but a stepping stone for optimising production by cutting time and cost, and improving quality, while moving away from working in silos. The end goal is to bring different teams and disciplines together from the very beginning of a construction project all the way through to the end. And it is only when digital tools are properly implemented in all parts of an organisation that everyone working on a construction site or other project really experiences the huge advantages that the technology brings with it.

Construction faces many challenges over the next ten years, but thanks to existing and emerging technologies the UK industry as a whole will be better equipped to deal with them than ever before.

> *The UK has a world-class science and research base that supports the development of innovative solutions in a number of priority areas for construction. These solutions need to be exploited across the industry in order to achieve the strategy's ambition.*

Government, Construction Strategy 2025

INDUSTRY SNAPSHOT: THE NEXT 10 YEARS – WHAT'S IN STORE?

To paint a full picture of what the UK construction sector as a whole is currently most concerned about, CACI conducted industry research into which topics are most discussed by the sector. The findings revealed a forward-looking industry concerned with how best to meet new demands from government, alongside pressures to innovate from competitors, customers and other sectors. At the same time, businesses are all too aware of the need to remain profitable and increase the all-round efficiency of construction operations around the triangle of time, cost and quality.

Of course, the UK's decision to leave the EU dominates many discussions at the moment and political uncertainty is never optimal for businesses. In the initial aftermath of the referendum many were worried about a broader economic recession; in the slightly longer term, worries about subcontractor relationships and staff recruitment are manifest. Yet what the Brexit debate highlights is a construction industry that is working harder than ever to achieve its profits and growth goals. While politicians continue to spar over the future of European relations, the industry is focusing on what it does best: efficient and well-managed projects and operations.
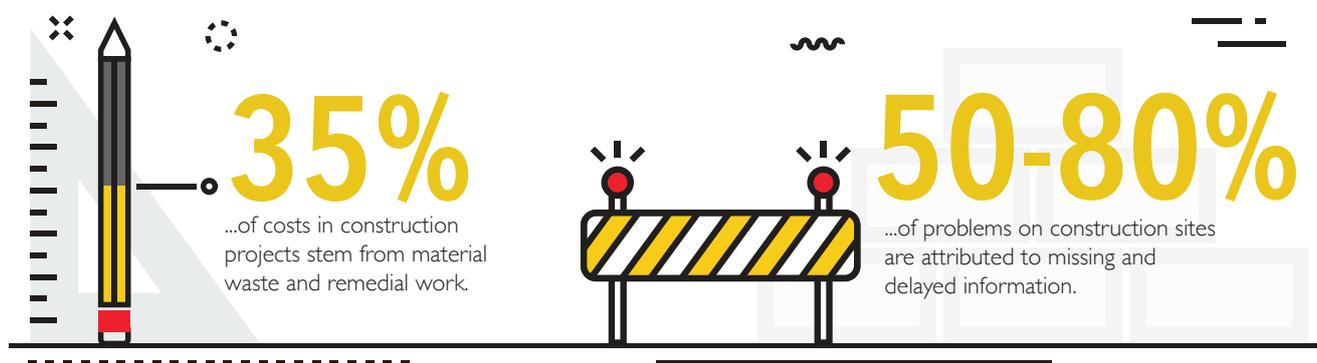
The government's Digital Built Britain report set out a road map to the final BIM level 3 and is a cornerstone for long-term strategic planning across the industry. Moving on to BIM level 3 within the next decade requires further development of technologies and commercial models, as well as bridging concerns about data privacy. But it also promises enormous benefits from fully transparent data sharing capabilities across the supply chain.

Beyond Brexit and BIM implementation, concerns about industry-wide issues such as operational efficiency, cost and resource management, waste reduction and sustainable practices are also pervasive across the sector – as are discussions on the uses of new technology, big data and data analytics, all of which are discussed in the following chapters of this report.

> *"Over the next decade technology will combine with the internet of things, advanced data analytics and the digital economy to enable us to plan new infrastructure more effectively, build it at lower cost and operate and maintain it more efficiently."*
>
> Digital Built Britain, 2015

EFFICIENCY, RESOURCES AND COST MANAGEMENT:
TAKING CONTROL OF PRODUCTIVITY

35%
...of costs in construction projects stem from material waste and remedial work.

50-80%
...of problems on construction sites are attributed to missing and delayed information.

Over a third of costs (35 per cent) in construction projects stem from material waste and remedial work[5], and greater complexity will only make bringing down this figure more difficult. That is part of the reason why CACI's industry research found that for resource efficiency project managers and finance directors are continually looking for ways to streamline processes and move away from working in silos. By working towards an even more coherent view on resources, costs and change management, they hope to stay on top of the ever-changing landscape of business risks.

For those looking into the future, meanwhile, the technologies of drones, wearables and the internet of things are all popular discussion topics for improving efficiency. While at this moment in time, data analytics and big data are seen as perhaps the key solutions.

Indeed, data analytics and big data are already staples in many UK industries, from health and social care to finance and advertising. In the construction sector, however, the efficient use of data analytics is still lagging a bit behind other industries. Yet the potential is most definitely there and the government expects the overall analytics market to continue to grow.

Construction projects already produce and are driven by masses of data that could be used in better ways for increasing efficiency, cutting time, reducing costs and improving a company's overall performance. And through the internet of things, the number of connected objects with the ability to generate and transfer meaningful data – be it construction equipment, buildings themselves, or anything else – is estimated to grow to a staggering 44 billion by 2020.[6]

But even today the immediate potential for improvement is one of the great untapped resources in construction, and the latent possibilities will only increase with time as BIM levels are implemented and new technologies adopted across the board. Between 50 and 80 per cent of problems on construction sites are attributed to missing and delayed information,[7] and as such companies that take care to upgrade their data analytics capabilities alongside their other digital transformations will be much better equipped than others to really reap the benefits of the coming years' digital and smart construction.

These benefits are particularly centred around cutting time and costs, while improving quality, which are obviously enduring concerns across the sector. Keeping costs down is a particular priority for any construction project, and is also one of the areas where data analytics can improve performance the most.
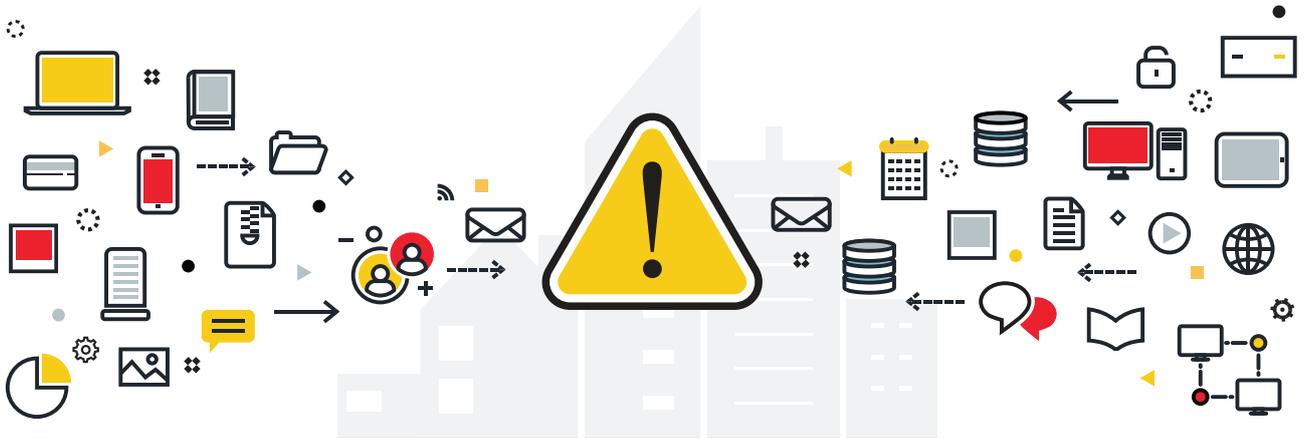
[5]Autodesk

[6]Digital Built Britain

[7]"Assessing the influence of automated data analytics on cost and schedule performance", Amin Abbaszadegan and David Graub

The challenge for many companies when it comes to data analytics is not that they don't have enough data to make the analyses useful – it's that they have too much data. With buzzwords such as big data being thrown around more often, it's not always clear how to make sense of the large masses of data that companies sometimes sit on, often without realising. But this is where proper data analytics capabilities become so essential by cutting through the noise and turning large and seemingly unconnected masses of data into useful insights that can inform real-life, real-time decision making.

A key priority will be having enough data analytics capabilities to facilitate data-driven planning and decision making, as well as being able to store and manage large masses of data. This includes advanced software programmes to perform analysis, for example SAP BI Suite, and also a team with the ability to make sense of the results. Only by bringing data from different sources into one, with a single analytics platform will companies be able to organise and make sense of all the input.

The ways in which data analytics can help companies take control over time, costs, productivity levels and resource use are manifold, but the common denominator is that it will make companies more resistant to variables outside of their control. By being able to run advanced simulations of everything from cash flow and staff reductions to external factors such as the weather, companies will eliminate the element of surprise in many circumstances.

An excellent example of bringing together complex processes in one singular view is how technology from JCB and Wipro has used the internet of things to connect 10,000 pieces of construction equipment, including loaders and excavators, into one. This has allowed for remote monitoring of all ongoing processes at once, helping to streamline operational availability and optimise the resource efficiency of projects. It also helps prevent misuse and theft of assets.
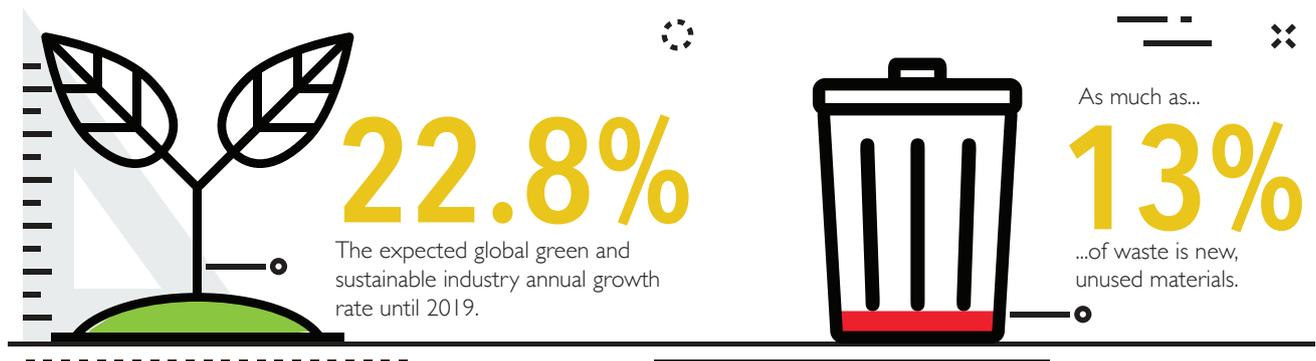
> *"UK construction is well placed to benefit from the opportunities presented by the global shift to a low carbon economy and green construction."*
>
> Government report: UK Construction – an economic analysis of the sector[8]

SUSTAINABILITY: REGULATIONS AND MARKET FORCES

22.8%
The expected global green and sustainable industry annual growth rate until 2019.

As much as...
13%
...of waste is new, unused materials.

Increased efficiency and better use of resources, however, not only drive improved profits, but also bring a whole host of other beneficial effects. With waste-reduction and sustainable operations being two of the major challenges for the industry, accompanied by an increasing number of government regulations in these areas, streamlining project administration and grounding decisions more firmly in evidence-based data projections will make forward-looking construction management a lot easier.

The government has set the goal that by 2025 the industry achieves a 50 per cent reduction in greenhouse gas emissions in the built environment. Simultaneously, the global green and sustainable industry is expected to grow at an annual rate of 22.8 per cent until 2019.[9] Moreover, as reducing waste also means reducing costs, achieving these goals will create a virtuous cycle with profits and regulatory compliance.

From the client perspective, the demand for low-carbon, or green buildings will only increase in the years to come. London continues to be amongst the best in the world at integrating green structures to its skyline.[10] This trend is not likely to slow down at any point soon and green buildings are also an integral part of the government's smart cities strategy[11] – another exciting development on the sustainability and technology front.

A building like the Lancaster Institute for the Contemporary Arts is a great example of the positive results data-led sustainability can produce. The building made use of prefab construction and includes roof-mounted solar panels and rainwater harvesting, both with live digital information displays in the reception area. The construction design even allows for three-quarters of thermal heat to be recovered by the building.[12]

The ways in which data analytics will help the industry reach its sustainability goals are similar to the ways it will improve operational efficiency. By bringing together many different aspects of a project at the early stages, and readily sharing data throughout, environmental concerns from one team can be built into engineering designs from another team from the very beginning.

How important this is becomes clear when looking at waste statistics. Figures from the Building Research Establishment (BRE) show that as much as 13 per cent of waste is new, unused materials.[13] This is a very strong indication that waste can be dramatically reduced by better resource management. Over-ordering to avoid running out of material may be convenient for individual teams on a construction project, but it is definitely not an advantage for the project as a whole. And for a director of finance, knowing that more than a tenth[14] of the resource budget could potentially go straight into the bin should for many be a clear sign that more data-led planning is a necessity.

[8]Government report: UK Construction – an economic analysis of the sector

[9]Construction 2025

[10]Solidiance, The top 10 global cities for green buildings

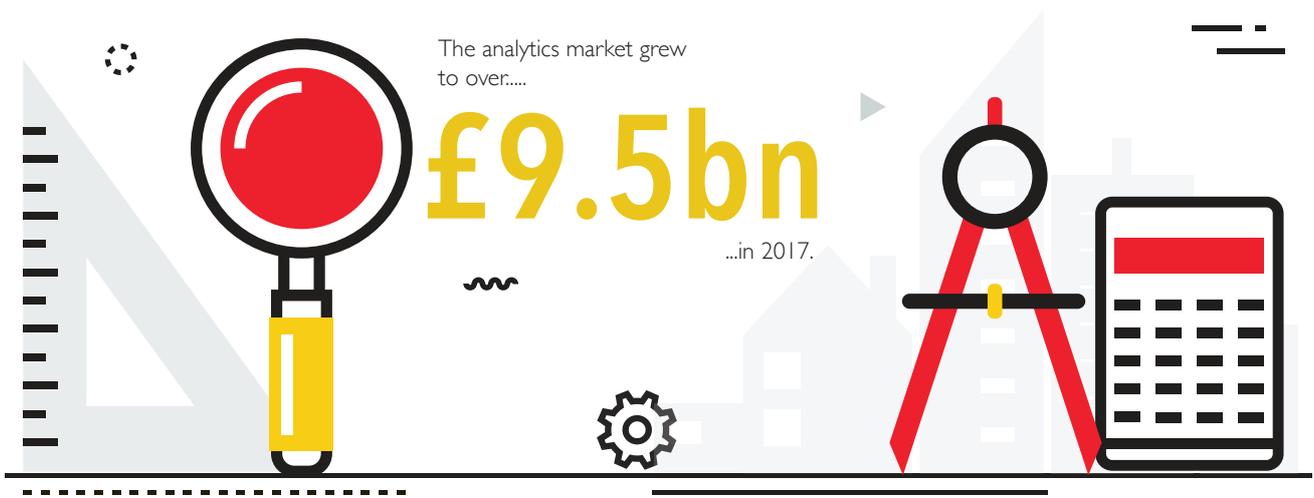[11]The Smart City Market: Opportunities for the UK

[12]Unstoppable! The rise and rise of Britain's green buildings

[13/14]BRE, Sustainable Construction

COLLABORATION: DIGITISATION AND REMOVING SILOS

The analytics market grew to over.....

£9.5bn

...in 2017.

Underlining all of the ongoing changes and challenges in the construction sector is the goal to move away from working in silos and increase collaboration between different teams and companies. The government's entire BIM strategy, for instance, is based on the basic principle that "significant improvement in cost, value and carbon performance can be achieved through the use of open sharable asset information".[16]

Research by Northumbria University even found that construction businesses with fully integrated digital strategies are 26 per cent more likely to outperform their competitors.[17] The strategic perspective on new technologies is, in fact, essential for ensuring that a company fully benefits from digitisation. Before implementing a technology, a company has to be clear about who in the organisation needs to benefit and how the new tech will work with the existing systems.

A key to succeeding with such an integration strategy is through scalable procurement. This will work best if a company brings together all the different parties on a project – such as architects, engineers, PMs, finance and subcontractors – at the early stages to give them full visibility of the project. When everyone is aware of both the overarching project targets and the risks and impact of possible changes on timelines or budgets, procurement can be a more collaborative and agile process, easily adapted to changes in data input.

[15]Forbes, How Big Data And Analytics Are Transforming The Construction Industry

[16]BIM Task Group

[17]Digitising Construction

"Establishing collaborative practices is of particular importance on building design and construction projects, as they are likely to involve bringing together a large number of diverse disciplines, many of whom will not have worked together before. They are also likely to involve the co-ordination and integration of a great deal of complex information, procedures and systems."

Institution of Civil Engineers[18]

Looking beyond the coming five to ten years, predicting how the industry will shape up is more of a guessing game. With the implementation of collaborative working methods and widespread data analytics, many new doors will open. And the new technological breakthroughs beyond these doors will perhaps lead to completely different working practices from those today.

The main thing individual companies can do to prepare for this future is to load up on data and technology capabilities so that they are as equipped as possible to deal with continued and accelerated change. By using tools such as SAP Predictive Analytics, companies can increase their resilience to change and prepare for a whole range of eventualities. The rate of change will only increase in coming years and so making a move sooner rather than later is not just advisable, it's a necessity.

"There is no excuse for not collaborating in construction projects – the incentives have been there all along, both carrots and sticks, and now many of the requisite tools are there or on their way."

John Gelder, former head of content development and sustainability at NBS/ RIBA Enterprises[19]

[18]Collaborative Practices for Building Design and Construction
[19]Removing Barriers to Collaboration in the Built Environment

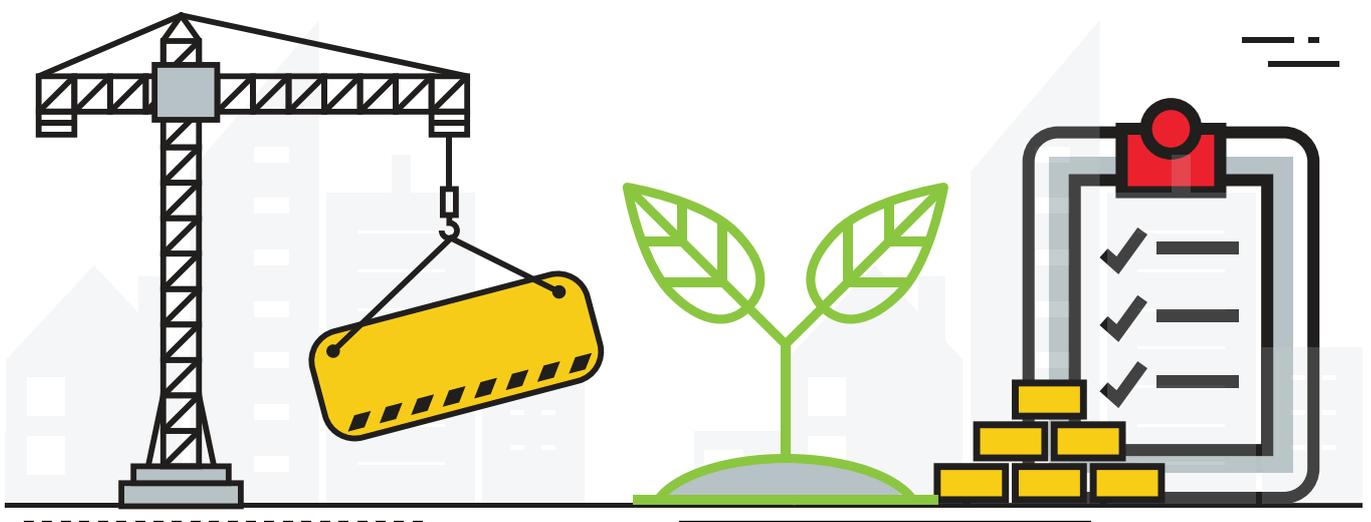# CONCLUSION: GETTING AHEAD OF THE GAME

Digitisation is proving to be one of the greatest competitive advantages for the UK industry as a whole, and for individual companies. Essentially, British companies are also increasingly opening their eyes to the fact that BIM – which gets a lot of the focus – is only one part of a broader digital revolution across the industry.

For this industry-wide digitisation, the first thing individual companies will need is an overarching strategy, as well as a clear road map of how to get where they want and a plan to invest in the right technology, now and over the next five to ten years. With so many new developments continually progressing, a clear plan is an absolute necessity.

Knowing where to begin when facing new technologies, regulations and demands, however, is not always an easy task – especially when running a company that must remain profitable quarter on quarter. But perhaps the one key component to unlocking possibilities in all of the different areas is to begin by investing in strong data analytics. This should be the centre piece around which the entire digitisation strategy is based in order to achieve reductions in time and cost, and continued improvements in quality.

The reason for this is that with one technological development comes opportunities in other fields, and the key to unlock all of these connected possibilities is always through the use of data. That is why a strong foundation of data analytics is the starting point for any other technological investment plan. As when building a house, thorough groundwork and a strong foundation will ensure the building stands the test of time.

In volatile times, such as the post-Brexit UK market, businesses need certainty where they can find it. And the first step to such certainty is a data-driven strategy for continued growth. By strategically investing in data capabilities, companies will be able to reap benefits far beyond what they may have originally envisioned.

CACI