DELIVERING CERTAINTY

Harnessing digital technologies
to engineer a sustainable future

AtkinsRéalis

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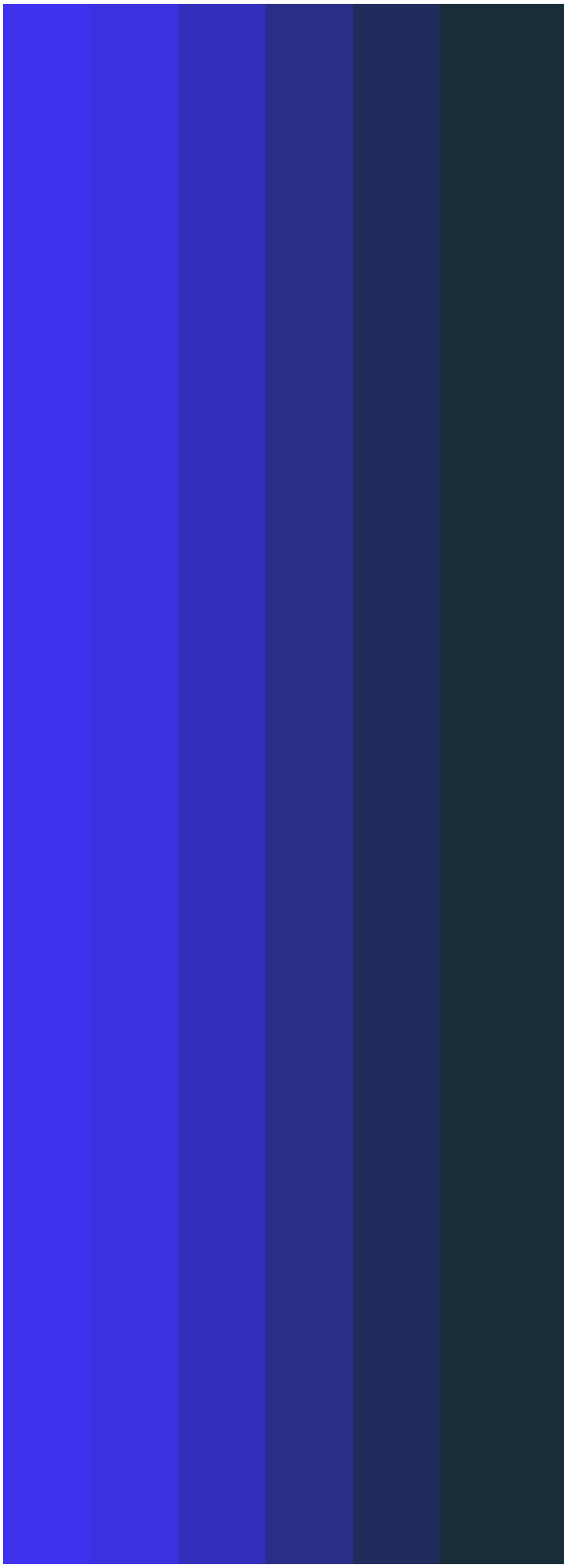

Welcome

The construction industry matters.

It contributes almost £90bn to the UK economy (6.7% of the total); its output comprises around 9% of UK GDP; and its 280,000 firms, including engineering consultancies, employ around 2.9 million people, which is over 10% of the UK workforce.

As such, the sector's productivity is vitally important, as is its role in helping the UK meet its 2050 net zero targets, particularly as the built environment accounts for 43% of emissions.

Over the last 10 years, firms have invested around £2bn in R&D as the industry looks to embrace digital technology to become more efficient, deliver projects with increased certainty, decarbonise infrastructure and accelerate the transition to net zero.

Data is now driving everything, from planning and design, through to construction, operation and maintenance, and decommissioning.

AtkinsRéalis is at the forefront of this transformation as we look to unlock the full potential of our engineering expertise by connecting people, data and technology to transform outcomes across the markets we operate in.

This publication provides a snapshot of the digitally-driven solutions we're offering clients, from data analytics that allow us to predict the previously unpredictable, to the use of aerial drones for virtual site inspection, and design solutions that can halve embodied carbon.

We also consider the potential of AI and the impact of emerging skills gaps, as well as what must be done by industry and academia to address these challenges.

But now is an exciting time for our sector, and I hope you enjoy this glimpse into what we're doing today, and what could be done tomorrow.

Engineering a better future

By Richard Robinson

BIM-fluence: what the BIM mandate reveals about Britain's journey to digital transformation

Richard Robinson

President, UK & Ireland

It's 2011. The UK government's BIM mandate has just landed, and the construction sector is scrambling to embrace the digital tools necessary to enable BIM and ensure ongoing compliance. Yet we all know what happened next. Rather than falling behind, companies quickly adopted new tools, and the UK emerged as a global leader in BIM.

More than twelve years on, as we approach a unified Information Management (IM) protocol, the lessons of the successful BIM rollout are especially relevant. The UK is no longer an undisputed leader; other countries learned from our approach, and several have now surpassed us. If we are to lead the way into AI, the next great wave of innovation, we must first mandate better practices around information itself, just as the BIM mandate paved the way for digital collaboration in the built environment.

Information, enhanced

Although we're migrating towards a more integrated understanding of information, where data is not just another asset but a core component, there's still a long way to go. Unfortunately, many projects are still beset by laborious, manual data retrieval systems, impeding collaboration and preventing seamless interoperability. With key information scattered across databases and filing cabinets far and wide, trawling this information is a time-consuming process, unduly delaying projects, obscuring the insights necessary for rapid, confident decision-making.

Planning is another difficulty. It's a big issue in the UK, where it has become a byword for labyrinthine laws and regulations, and which has proven difficult for policymakers to simplify.

Exacerbating the issue is a lack of capacity. We do not have enough staff to process backlogs, and while increasing funding will help in the short-term, it does little to address the long-term shortage. As distinct as these problems are, they both have a common cause: data. Our legacy methods for accumulating, processing, sharing, and storing it have embedded inefficiencies which sap productivity.

The future proof

Similarly, we need a digital register for our buildings, enabling all manner of efficiencies across the board, from retrofitting to decarbonisation. These aren't distant possibilities to be undertaken by the next generation: they're possible right now.

For example, the geospatial commission's National Underground Asset Register (NUAR), built by AtkinsRéalis, is a compilation of all below-ground utilities. Providing companies with access to a comprehensive database of underground assets eliminates unnecessary surveying, while improving safety and minimising disruption on projects. In turn, this accelerates the path to planning permission, saving billions. And yet a minimum viable product for NUAR – covering the whole of England and Wales – was developed in only two years.

The latest IM mandate review aims to integrate the BIM Mandate with the current IM Mandate, creating a holistic framework for the entirety of the built and managed environment. By replacing inscrutable incompatibility with common standards, and replacing ambiguity with clarity, it can expedite the adoption of innovative, cross-sector collaborative processes. In doing so, it can pave the way for AI adoption, which is hampered by 'walled gardens:' proprietary silos, limiting both the data set from which models can learn and the range of their potential applicability. Removing silos entrenched by idiosyncratic data standards increases our collective potential and decreases the risk of rework and obsolescence, ultimately benefiting everyone.

Lesson learned

The challenge is daunting. But the successes of the past should give us courage that two of the hardest problems - collaboration at scale, and boosting productivity - can be overcome.

In our fragmented sector, collaboration is hard. Yet despite this, we have already shown ourselves capable of widespread cross-sector cooperation. The Construction Playbook is a collaboration between government, delivery bodies, and industry to create an operating manual for best practice delivery of infrastructure projects. It's hard to implement, and is yet to achieve its potential, but it is still a huge achievement, and a world-first.

Productivity, meanwhile, has remained stubbornly low in spite of the widespread increase in digital proliferation. But look more closely, and there's a clear counter argument, demonstrating that our sector can change at speed: the pandemic. Throughout the lockdowns, construction kept going, translating legacy processes into digital equivalents in a matter of weeks. Rather than hobbling our industry, this rapid, cross-sector digital transformation yielded a tangible positive contribution - productivity in construction actually went up during the pandemic. It's a precedent that can give us confidence that the benefits of collectively embracing innovation outweigh the risks.

Still, it won't be easy. But if the UK can rise to this big challenge, the rewards are correspondingly large. We now have the opportunity to achieve a huge leap forwards in IM standards - just as we did with the 2011 BIM mandate. To shape the future, we must learn from the past.

How technology is revolutionising the way we deliver sustainability and resilience

Jonathan Holyoak

Policy and Net Zero Programme Director

Digital innovation is vital to the successful delivery of a sustainable future.

By 2050 the world's population is predicted to have expanded to nearly 10 billion people, all of whom will need homes, energy, transport and more. At the same time, the world's aging and carbon intensive infrastructure will need upgrading and replacing. And for the sake of our planet, and future generations, we need to reduce our carbon emissions to Net Zero.

The only way to meet this enormous challenge is to find new ways of doing things. To embrace sustainable energy sources, to reduce our carbon emissions, and to start designing with the entire ecosystem in mind. And this is impossible without the right data, the right technology, and the right expertise.

Data and decision making

If we want to reduce our environmental impact, the first step is to understand it.

Over the past few years, we have developed new solutions for collecting, analyzing, and visualizing data. For example, at AtkinsRéalis we have launched Carbon Insights, a platform which leverages years of project data to provide detailed insights into carbon management across the whole life of a project. Or for clients with large asset portfolios, there are specialized tools such as **Decarbonomics™, which help clients decarbonize their estates by giving them the information to make efficient and informed decisions.**

Tools like this are key to understanding both the scale of the challenge facing us and how effective our solutions are.

Proper connected data analytics tools are also vital for the process of reporting. They help clients and stakeholders easily meet their governance responsibilities and may be a major factor in the availability of future funding.

Clean energy and warm homes

We have seen incredible progress in clean energy technology over the past decade, from solar and wind to breakthroughs in nuclear fusion. And as these technologies advance, we've had to develop new digital technologies to support them.

For example, we have seen significant advancements in digital and data modelling to support developments in offshore wind. This innovation has helped make these wind farms more viable, helping solve challenges like reducing turbine downtime, and safely connecting them to shore.

We are also seeing real change in cooling and heating. As weather extremes become more common, good air conditioning and heating are increasingly important to human health and welfare. However, both these activities can have a massive environmental impact driving further climate change.

To combat this, some authorities are experimenting with removing boilers and air conditioners from homes, in favor of district-wide temperature control systems. These are much more efficient, using digital technology to manage the output and sustainably keep businesses and homes the right temperature.

Resilient cities

One of the greatest challenges with climate change, is understanding how it will affect towns, cities, transport, agriculture, energy, health...

Computer modelling, digital twins, and AI, all have the potential to help us simulate these changes and start finding solutions. For example, our City Simulator solution has been used to model epidemics, classify infrastructure at risk from extreme weather events, and predict flood damage.

These technologies have the potential to make a real impact because they can help us measure things that are left out of a traditional cost-benefit analysis – such as air quality, flood risk and heat islands.

Changing our world

There is a shortage of people with the right expertise to develop and implement these solutions. And Net Zero by 2050 is a deadline we cannot afford to miss.

That's why we need to start working together to ensure we have the right talent to solve these issues. This means upskilling our existing staff and encouraging interest in sustainable digital technology. But it also means working together with schools, universities, and government to raise awareness, support STEM learning, and encourage more young people to consider the impact they could make in this industry.

At the end of the day, we are all in this together.

Digital transformation: the game-changer for sustainability

Catherine McQuade

Assistant Mechanical Engineer

Sustainability is no longer a 'nice to have' but crucial if organisations are to meet the UK's net zero target by 2050. Catherine McQuade, Assistant Mechanical Engineer at AtkinsRéalis, outlines how digitalisation is supporting industrial sites to accelerate decarbonisation and meet their safety and sustainability goals.

Energy-intensive industrial sites are some of the most challenging to decarbonise, but the abatement of their carbon emissions is essential for achieving net zero.

We see three key types of carbon emissions that represent the majority of CO_2 produced throughout an industrial site's lifecycle: embodied, operational and people.

Embodied carbon is in the building materials we use, such as steel and concrete. Operational carbon is emitted during the working life of a facility due to heating, cooling and industrial operations. People carbon is the emissions associated with our own movements and activities, such as the carbon dioxide emitted from commuting to work or a site visit.

With an uphill climb ahead, we need to find new ways to speed up all forms of decarbonisation. We believe the answer lies with digital transformation.

Digitalisation accelerates decarbonisation

This is because digital solutions can assess and address each of the three types of carbon emission. For example, implementing intelligent building information models (BIM) throughout the lifecycle of a site - from the development of a new-build project to decommissioning - you can quickly calculate embodied carbon associated with concrete or steel structures across sites. Similarly, internet of things (IoT) sensors and data analytics can combine to highlight areas of large energy consumption – aka operational carbon.

While embodied and operational carbon represent a significant proportion of the overall carbon footprint, they're difficult to influence on a daily basis. But in recent years, and particularly since the pandemic, we've seen digital tools offer new ways of working that reduce the emissions associated with supporting operations and maintenance on industrial sites; the people carbon.

For instance, during the design and construction of a new site or in decommissioning projects, adoption of paperless technology makes it possible to view digital drawings on a mobile device.

This not only reduces printing, improves accurate data retention and increases the speed of decision making, but also enables remote expertise to be leveraged more efficiently and increases collaboration.

Laser scan point clouds, aerial drone imagery and 360° images and videos previously captured, also provide users with new ways of visiting sites virtually, either on their own or with their wider team, using virtual reality (VR) or augmented reality (AR) Livestreaming, on the other hand, allows one person to go to inspect and survey a site. Connected via a video call from anywhere in the world, they can then relay information to the rest of the team.

Using technology in this way offers both cost and carbon savings. As an example, recently, for a nuclear decommissioning client, we polled how long it takes engineers to drive to the site, and collated this information in a live dashboard. Based on the 23 livestreams they conducted across three buildings, we calculated savings of 490 hours in travel time, £24,500 in associated travel costs and 7224kg of of carbon[1].

1 Calculated using time taken to travel to and from sites and going through security, multiplied by average graduate engineer's salary and average CO_2 emissions per hour of driving.

Further, since April 2021, we have been analysing access to site survey data for all our nuclear and power clients, via our cloud-based survey platform, CIRRUSinsite. By measuring how many people 'virtually access sites' through the platform, we estimate that, in the last two years, clients have collectively saved over £1m in avoided travel costs and almost 300 tonnes of associated CO_2 emissions.

Using CIRRUSinsite to quantify how many times people access a site remotely and how long they spend there, it's also possible to calculate how many future site trips have been saved.

This approach has helped our clients slash carbon emissions and makes it easy to see why site walkdowns, installation, factory acceptance testing and support for operations and maintenance, are now regularly being done with only one individual or a small team on plant.

Knowledge retention and sharing

With an ageing workforce, it is also important to find ways to pass on the knowledge of experienced staff to new recruits and ensure decarbonisation isn't slowed down.

One way of doing this is through immersive training, making use of VR and AR, which can be stored in a central repository and accessed by all relevant staff. This enables the transfer of critical information while also reducing the time spent by experts on training new recruits.

The technology doesn't have to be complex or expensive – video walkthroughs by plant operations teams, for example, are simple to create but invaluable; saving someone from trawling through an old 30-page document. And with advances in transcription software, these can become searchable libraries providing valuable insights into a facility's history.

Benefits of digital transformation

It's clear the adoption of digital tools can have a real, measurable impact on carbon emissions and sustainability. But the benefits don't end there.

Digitalisation will not only support and speed up the journey to net zero, but also improve workplace safety and bring financial gains, helping organisations remain competitive and profitable during a challenging transition.

Why we can't afford to ignore AI

Darren Martin
Chief Digital Officer

Despite all the hype, our industry has been relatively slow in apprehending AI. Adoption remains low, use cases vague, and legacy methods stubbornly resilient. Yet AI has the potential to transform productivity - and if we are to meet the manifold challenges of the climate emergency, such a boost is indispensable. For our industry to harness this potential, we must begin working together more effectively to identify opportunities and minimise risks.

Imagine: it's 2010. The rollout of 4G, improving smartphones, and e-commerce is converging in Uber's ride-hailing gig-economy breakthrough. Except rather than Uber, the technology is instead in the hands of the construction industry - and, instead of Uber as we now know it, the industry builds a different app per location.

Internal digital teams argue amongst themselves about whose app is best and at a company level, with each prime contracting construction firm wrestling over which of the many apps should take primacy in each airport.

Customers have to download a different app in each airport. Tribal digital teams in each region compete on whose Uber app is best. The real scaling necessary to get taxi drivers to use the app and grow the concept in each country is completely missed. We are left with long queues, pricey cabs, and the quintessential struggle for exact change at the end of the journey. The opportunity is lost; moreover, developments emerging from the original breakthrough are also lost. Uber Eats is never realised, and we all go hungry on a Saturday night in. And perhaps even Netflix isn't there to entertain us.

It's a crude analogy, but blended with an important truth. The construction sector is fragmented. It's well known that this fragmentation obstructs productivity, hinders progress, and embeds unnecessary inefficiency. But the emergence of AI, and the cluster of machine learning technologies around it, is exposing our industry's lack of integration at a deeper level. Simply put, harnessing AI is much, much harder in a divided, fragmented, and siloed industry. It's riskier, it's more expensive, and the benefits are less certain.

If construction were a fringe industry, with only a trivial relationship to the global economy, this might be an acceptable quirk. But construction is vital to almost every major challenge of the 21st century, from meeting the needs of a growing population to decarbonisation and climate change resilience. In our industry, if we don't move fast, there are big consequences.

It isn't due to a lack of enthusiasm. In the past 18 months, AI has skyrocketed up the agenda. Many firms now have a compelling story to tell about how they're planning to deploy it in service of diverse use cases. Yet because every company is largely going it alone, the sheer volume of rework is sapping momentum and wasting precious capacity.

Moreover, if every company strives to design and deploy its own version of the next big thing, a crowded market lacking interoperability ends up suiting no-one - especially not our customers. Comparative advantage is lost, economies of scale recede, and valuable data remains locked inside walled gardens. And all the while, our whole sector loses a once-in-a-generation opportunity to leap forward, at a time when the world needs it most.

Robots and rigidity

Adjacent industries can show us how to implement innovation at pace. Earlier in my career, I was responsible for the deployment of robotic arms on a production line for a major manufacturer of cars and aeroplanes - applying a suite of cutting-edge tools to manufacturing of high tech consumer goods. In the motor industry, application of novel technologies was advanced, to the extent that it was part of the working culture. When I worked in the tech sector itself, the influence of cultural factors became even more obvious. In construction, a risk-averse mindset helps to uphold standards of care and responsibility. Unfortunately, it can also discourage breakthroughs. Whilst I never want to cross a chasm on a wobbly bridge, we all seem to use technology at pace to drive convenience and outcome, tolerating the odd glitch on the way.

Yet in the context of climate change, traditionalism may well be the higher risk option. Business as usual cannot deliver the efficient collaboration-at-speed necessary to win the race against a rapidly changing climate and the increased volatility associated with it. For once, brute force won't be enough to blunder our way through.

By 2030, it's estimated that around $130 trillion will be invested globally in improving capital infrastructure and moving towards renewables. That's a seriously hefty sum - but it doesn't absolve us from improving our processes. New schemes are conceptually challenging; permitting and consent is lengthy and labour-intensive; shifts in weather patterns, population, and regulations are challenging major projects to rethink their ways of working, from design to deployment and decommissioning.

Even a sum like $130 trillion fails to guarantee momentous progress towards the infrastructure and energy systems we urgently need in the very near future.

As well as efficiency, AI is indispensable for another reason. The staffing crisis in construction is getting worse. We are struggling to fill vacancies across a range of critical roles, and the problem tends to be more acute in burgeoning fields like data science. If we don't use AI to tackle human capital deficits, we may not have enough people to transform our industry. Overheating, resiliency, decarbonisation: the inefficiency of legacy methods, combined with a lack of human resources, is seriously undermining our capacity to protect our existing physical infrastructure from the ravages of rising seas and volatile climate.

Impossible to inevitable

The good news is that change is happening. From identifying how best to make assets more resilient to damage, to where best to allocate capital investment, AI is accelerating our learning and decision-making across a variety of complex areas. With so many variables, and so little time, we have no choice but to quickly and collectively learn how best to deploy machine learning and trust its outputs.

Our priority must be to focus on the most convincing use cases. Optimising and protecting critical national infrastructure amid increasing floods, droughts, and storms is as uncontroversial as they come.

For example, machine learning enabled the Federal Emergency Management Agency (FEMA) to rapidly assess over 146,000 structures, identifying over 30,000 for inspection - accelerating resilience interventions and saving FEMA millions in the first year alone.

Successful applications can then serve as proof of value for broader needs to scale across the industry at large. As well as mitigating catastrophic effects, the broad penetration of AI in construction will lay the foundations for the next generation of innovations.

To see what's possible, we should look beyond our own industry, and adopt best practices in sectors where AI adoption is rapid. Engineers love to create, but can't match the countless billions tech has already poured into generative AI, let alone its ongoing investments. And thankfully, we don't need to.

By working together, pooling our efforts, and making use of what's already available for us, we can avoid reinventing the wheel - or indeed the ride-hailing app - and focus on what we do best: building a better world.

Building resilient communities – using digital tools to put nature back in the picture

Zoe Metcalfe

Client Director - Local and Central Government UK

Nature is the world's ultimate multi-tasker.

Planting trees upstream not only reduces downstream flood risk – it improves air quality, reduces the impact of extreme weather events, locks up carbon, protects the soil and can even improve mental and physical health outcomes in nearby communities. The reverse is also true, and depleted or otherwise vulnerable natural environments can often amplify shocks and stresses, from increased flood risk to heat islands and loss of keystone species.

In this incredibly interconnected system, a single intervention can make a big difference. But how can we assess this if we are not appropriately measuring our impact on the natural world, and vice versa?

In a traditional cost benefit analysis, the benefits provided by nature are not normally valued. We take them for granted because they are provided for free. But if we don't measure this value, how can we make rational decisions? Or in the words of economist Joseph Stiglitz, "If you have the wrong metrics, you do the wrong things."

To address this disconnection, we must develop an ecosystem valuation approach that does not ignore the natural environment but instead helps us better plan, predict, and model our effect on the planet's diminishing reserves of natural capital in hand with human capital.

At AtkinsRéalis, we have been generating a solution that weaves together assessments of natural, human, and social capital with Geographic Information Systems (GIS) and Digital Twin technologies. This effectively creates dynamic 'digital story books' that can meaningfully visualise these complex data sets, and help planners, engineers and investors make decisions that will promote community and regional resilience.

These digital story books also enable us to take an asset-based community development methodology and approach, weaving in their needs and requirements as part of an evidence-based, co-development process. This empowers communities to share and build their social capital to be change-makers and be receptive to proposed interventions.

Capitalising on nature

Natural Capital Assessments assess natural capital stocks (habitats) and maps the benefit flows (or ecosystem services) from these stocks to humans. These assessments map both physical and monetary benefits, alongside articulating financial risk, allowing us to understand the impact of our natural stocks and to make more informed decisions.

We can use this insight to embed the real value of natural capital through biodiversity net gain (BNG), carbon codes and nutrient neutrality among others, to inform and support business cases, generate valuations for grant applications, statutory compliance and to develop the necessary depth of analysis for site interventions.

But how do we apply this information?

Advancements in Geographic Information Systems (GIS) and Digital Twin technologies have created a significant opportunity for the translation of remote sensing and other geospatial data sets into meaningful content. The resulting digital storybooks allow different stakeholders to assess potential interventions and explore ways to maximise the real value and long-term resilience of assets and communities.

Building climate resilience on the Evenlode

One place where this technique has already delivered results is along the River Evenlode in Oxfordshire, where we worked in partnership with the Environment Agency, Natural England, the Evenlode Catchment Partnership and the North East Cotswolds Farmer Cluster.

Here, we used remotely sensed data from satellites to identify the best places to reconnect the river with its floodplain, creating new habitats along the river whilst protecting both the railway and downstream communities at risk from flooding. This was presented in an interactive digital storybook for landowners and stakeholders to explore. Two pilot schemes have already been delivered on Pudlicote Farm and on the Blenheim Estate where historic drainage has been reversed to restore ancient channels that can hold water in the landscape and boost biodiversity.

Visualising the data in this way is vital to kick-start wider landscape transformation. It allows us to identify the best places to reconnect the river with the land around it to regenerate wetland and farmland, and provide new inspiring vistas along public footpaths. Even more importantly, it also allows us to bring local communities and landowners on the journey with us – working together with a collective of local farmers to develop the digital storybook and to analyse how this new use of their land would benefit them and their local community.

Reconnecting the River Thames with its floodplain

Similar work on the River Thames was also made possible by deployment of a digital twin of the river and floodplain. It could be used to model the hydrological effects and ecosystem service benefits of different ideas generated by project partners during a formal co-creation and collaboration process.

Biodiversity is essential for ecosystem health and resilience, providing direct benefits to humans through genetic diversity, pest control, pollination, and a variety of other ecosystem services.

However, river barriers on the Thames in this part of Oxfordshire (around an area known as Chimney Meadows owned and managed by the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust) were preventing the passage of fish upstream, reducing biodiversity and ecosystem resilience to climate change.

To repair this damage, and to re-enliven the surrounding meadows for both humans and nature, a 450m nature-based fish pass was built around one of the largest structures on the river. This not only opened up a 30km stretch of the Thames for fish spawning and migration for the first time in more than a century but reinvigorated the entire ecosystem, increasing health and wellbeing, providing new locations for recreation and learning, and improving the area's ability to store floodwaters and carbon.

Why education is key to tackling the cyber skills gap

Kate Blackie

Cyber Security Consultant

Computing science taught in schools today must be broadened, and must start being taught much sooner, if we have any chance of closing the cyber skills gap, says former teacher and AtkinsRéalis' cyber security consultant, Kate Blackie.

When I look at today's A-level computing science curriculum – from a position of having had 15 years' experience of teaching the subject – in my view it's putting off a swathe of young people who might be considering a future in a broader digital or cyber security career – and at some cost to UK plc.

Why? Because today's teaching of computer science places far too much emphasis on the technical aspects of the subject, at the expense of giving time and space to encourage students to develop other digital and cyber skills; skills we urgently need to meet the enormous challenges of the next century.

Are we missing a trick?

We're missing a trick. If a wider, more diverse group of young people can be convinced that a digital career is right for them, and cyber skills are incorporated into the curriculum from primary school age, just imagine the potential. We could be laying the foundations for a workforce that is supremely cyber-aware, and one that would benefit the whole of society.

In 2015 the Government removed GCSE and A-level Information and Communications Technology (ICT) qualifications in favour of more technical computer science qualifications. This was partially in response to pressure from the rapidly growing gaming industry. This had, and continues to have, serious implications on the diversity of students now pursuing IT qualifications.

With its focus on coding skills, computer science has also had a negative impact on the digital skills with which pupils graduate from school. This is backed by research based evidence. A computing education report in 2018 highlighted that the number of hours of computing or IT taught in secondary schools dropped by 35.8% during the transition from ICT to computer science. A 2023 article by Computer Weekly highlighted that 15% of girls chose to take A-level Computer Science. Compare this to 2016, where 42% of entries for ICT were from female candidates.

We need cyber savvy school-leavers

This doesn't bode well for a society that's becoming more and more reliant on digital technology and facing more cyber threats than ever before. We simply cannot allow our young people to leave education without good digital skills and being cyber savvy.

Despite the move to teaching computer science in schools, and a generally more digitally literate society, research from IPSOS in 2022 suggests that while 59% of the UK labour force is not reaching its full digital potential – some 82% of jobs require digital skills.

Research suggests that while 59% of the UK labour force is not reaching its full digital potential, 82% of jobs require digital skills.

Young people have grown up surrounded by technology. They have no fears about it and are often imaginative and innovative in using it. However, because young people are already proficient with digital tools, we have assumed that they're also aware of the risks associated with using new technologies.

Introducing computing concepts and principles to primary school pupils will undoubtedly encourage greater digital awareness. While the emphasis on the more scientific aspects of computer science has resulted in a fantastic pool of young people gaining excellent technical skills, it has also stopped young people from more diverse backgrounds entering the industry.

> **"Young people are gaining excellent technical skills – but the current approach has stopped many from more diverse backgrounds entering the industry."**

Engineering net zero on the Bridgwater Tidal Barrier

Balamani Bollapalli

Architect and BIM Analytics Carbon Lead

Using our custom BIM Analytics – Carbon tool to reduce the impact of carbon-critical design elements by 70% and halve the embodied carbon of the new Bridgwater Tidal Barrier.

Infrastructure accounts for over half of the UK's carbon emissions.

A great deal of this carbon is generated across the construction process and supply chain, with each ton of concrete, for example, producing about 73.1kg of CO_2. We measure this impact through embodied carbon, or the total greenhouse gas emissions associated with the extraction, manufacturing, transportation, and assembly of building materials, as well as the construction process itself.

Unfortunately, calculating the embodied carbon of a new piece of infrastructure is typically a complicated and time-consuming process. As a result, this is generally only done at the end of the design stage, once all the decisions have already been made. This limits the ability of the design team to make informed choices about their environmental impact, and often results in costly redesigns later in the process.

However, by combining carbon calculation tools with our tailored digital design workflows, the AtkinsRéalis team have designed a powerful solution...

A digital design solution for the Bridgwater Tidal Barrier

AtkinsRéalis was commissioned by the Environment Agency (EA) to undertake the detailed design for a tidal barrier to protect the town of Bridgwater from tidal surge flooding until 2125. This commission included not just the tidal barrier structure itself, but also the operational buildings and site, approximately 9 kilometers of raised downstream defenses, and modifications to 12 existing structures upstream of the barrier to improve fish and eel passage. The team were set a target of a 45% reduction in whole-life carbon from the baseline, in line with the EA's sustainability targets.

To ensure that we could meet this target, the team deployed our new BIM Analytics – Carbon package, a design workflow that AtkinsRéalis has been developing to measure the embodied carbon of the whole design in real-time, as it's designed. This allows our teams to understand the impact of their design choices as they make them and to iterate and experiment with lower-impact alternatives. At the EA's request, this tool was integrated with their existing carbon tool, ERiC, to ensure our results would comply with their accuracy and data standards.

The team used Building Information Modelling (BIM) software to create their first detailed design of the tidal barrier, before running our BIM Analytics – Carbon software.

This rapidly assessed the embodied carbon of the entire design, as well as each individual element, to provide a detailed carbon breakdown. The software then displayed this information visually through a custom PowerBI dashboard – breaking the detailed design down by construction materials and components and creating a 3D heatmap to reveal carbon-critical design elements.

From this, the team easily identified the proposed steel-cased reinforced concrete piles as contributing more than 25% of the design's total embodied carbon and began looking at ways to reduce the element's impact. By iterating with different materials and specifications (with the help of real-time feedback from the carbon analytics tool), the team were able to significantly reduce the element's carbon impact, reducing the number and length of piles, and switching to driven steel tubes. They then repeated this process with other carbon critical elements, reducing the thickness of the barrier's apron slab and developing a pre-cast solution for the construction of the three barrier towers.

In total, by leveraging the BIM Analytics – Carbon tool, the team were able to reduce embodied carbon of the barrier structure by 50% against the baseline, exceeding the EA's targets. These gains were made by focusing on reducing the impact of carbon critical elements, reducing their embodied carbon by an average of 70% and allowing us to tackle the project's carbon footprint in the most efficient, and most effective, way possible. And all during the initial detailed design process.

> **This tool has the potential to be a valuable addition to the Eric tool, allowing rapid and easy visualisation of carbon hotspots and significant carbon savings during the design process.**
>
> **Neil Guthrie, Environment Agency Carbon Manager**

The future of carbon reduction

AtkinsRéalis is committed to not just achieving Net Zero, but using our cross-sector expertise, passion, and global experience to create pioneering solutions that will help our clients rapidly decarbonize, for more sustainable economic growth. The BIM Analytics – Carbon tool forms a key part of this mission, allowing teams to easily assess and reduce their environmental impact, and we are now working with the EA to deploy this technology more widely.

Following our success decarbonizing the tidal barrier itself, AtkinsRéalis have now received funding to deploy the carbon analytics tool across the entire Bridgwater Tidal Barrier Scheme, including the extensive downstream defenses and fish and eel passage improvement works.

Detailed design is forecast to be by the end of 2023 with construction forecast completed in 2028/9. We are also working closely with the EA to further integrate their carbon measurement procedures with our tools, so that our carbon analytics can be deployed on even more projects across the UK, helping us deliver more innovative low-carbon solutions.

The completed Bridgwater Tidal Barrier will protect over 13,000 homes and 1,500 businesses from flooding caused by climate change related coastal changes and rising water levels. This protection will last for at least a hundred years.

On time and on budget: how data analytics and AI will shape the next decade of program and project management

Paul Lakin

Vice President of Special Projects

The challenges in program management are well-documented.

From HS2 in the UK to Hanford's nuclear remediation in the US, the news is full of big projects which are delayed and over-budget. In fact, as many as 80% of large infrastructure projects worldwide are estimated to overrun.

But as we look to the future there is a massive opportunity for change.

Improvements in data management technology and AI breakthroughs offer an opportunity to overcome many of our industry's traditional challenges, getting programs running quicker, and helping us accurately identify and manage cost, schedule and quality risks earlier.


Select Data Date to visualise in the graphs below:
Impact versus Likelihood
1.0
0.6
0.4
0.2
Likelihood

We are also experiencing a big rise in demand for program management services, with megaprojects in the Middle East and huge public works programs in the US and Europe. Approximately $130 trillion is predicted to be invested into decarbonization and infrastructure renewal projects alone by the end of 2027.

So how can we capture this value?

Data

Everyone wants us to do things faster, more efficiently, and more predictably. And the key to this is data.

Barring extraordinary extenuating circumstances (such as global pandemics) most project overruns are caused by a lack of good quality data. This can either take the form of not enough information at the start of the project, preventing accurate planning and costing, or not enough information during construction, so that teams struggle to identify and respond to challenges and risk in a timely manner.

Data analytics and visualization tools have improved in leaps and bounds over the last few years, significantly improving our ability to manage and plan. But without comprehensive and up-to-date underlying data we still are not realizing their full potential.

Take schedule analytics. To assess an ongoing project against its schedule, you would usually export the data from Primavera P6 or Microsoft Project, run a DCMA quality check, and then use a tool such as PowerBI to interpret and display it. The challenge is that this process can take a long time to do manually, meaning that by the time data has been properly assessed it is out of date.

By improving our data models and connecting the backend of these project management systems, we can automate this process so that it takes just five minutes. This has the potential to significantly improve the speed at which program management can identify and solve problems, making it easier to keep programs on schedule and control costs.

Our data solution – the Advanced Analytics Control Center – has also revealed significant benefits in ease of reporting, allowing clients and stakeholders to easily view authoritative, up-to-date information on program progress.

Technology

If we can get this underlying data infrastructure in place, it will help us to realize the value of solutions like Machine Leaning (ML) and Artificial Intelligence (AI).

ML and AI is predicted to revolutionise our industry. Tech consultancy Gartner predicts 80% of project management tasks will be completed by AI in 2030, with data collection and analysis making up a big part of this. AI also has the potential to help us set up and launch projects faster, dramatically improve our prediction capabilities, and allow us to simulate project performance under a wide range of scenarios.

AI is only just starting to be adopted across the program and project management industry, and its value can be extremely limited where there isn't the data infrastructure in place to support it. Yet we've already seen value in our own business using machine learning algorithms to improve our Advanced Analytics solution's prediction capabilities, and I'd expect to see more widespread adoption in the future.

People

If we want to realize this potential, we need a real mindset change in the way we approach program and project management.

We are a traditional industry, and it can sometimes be challenging to persuade people to adopt new techniques – particularly when risk is involved. However, with such significant benefits on offer, change is inevitable. As the advantages of this digitally enabled approach become more obvious, more practitioners will begin to embrace the opportunities it can provide, but there is also plenty that individual organizations can do to encourage adoption (more on this in our next newsletter).

We also need to start attracting more talent into program management. Successfully adopting these technologies requires both a willingness to learn and people with expertise in data management and AI. That means working with governments and institutions to attract more graduates and encourage STEM learning, but also working together to upskill and empower our own people. This can be challenging but will really benefit the industry as a whole.

At its core, program management is quite simple, it's just got a lot of moving parts. And by sorting out our data infrastructure and embracing the value that technology can provide, we are within reach of a future where the majority of projects can be delivered on time and on budget.

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