Unlock the Benefits of Going Digital in Construction

It’s time for construction to take the 21st century Turing test – can machines help us think better?

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Advancing Infrastructure
This June marks 65 years since Professor Alan Turing, the renowned cryptanalyst that broke Nazi code, died. It is now seven decades since the pioneer of modern computing and artificial intelligence wrote, “I propose to consider the question, ‘Can machines think?’”

Turing’s question has now been proven beyond doubt in many fields. In chess, the IBM supercomputer Deep Blue beat former chess Grandmaster Garry Kasparov in 1997. In science, the HiSeq X can map tens of thousands of human genomes in a year – a task that initially took an army of scientists from 20 universities across the world more than 13 years to complete.

Many people in the construction and infrastructure industry need to ask this question: “Do you believe that machines can help you to think better? Do you believe that information and data can help you to work smarter?”

As Michael Douglas’ character Gordon Gekko in the 1987 film “Wall Street” said, “The most valuable commodity I know of is information.” These words have never been more relevant.

The importance of information has seen an explosion in the creation of data. In the first 19 years of the 21st century, we have produced more data than in the previous 5,000 years of humankind.

The most important value that we personally derive from information is insight. This insight helps us make better decisions for ourselves, our business, and the wider world. Indeed, the British Government’s policy paper on data highlighted that more effective sharing of data within and between organisations can unlock GBP 149 billion of operational efficiencies and GBP 66 billion of new business and innovation opportunities in the UK alone.

Going digital can unlock these insights and make data the new currency. One only needs to look at the USD 110 billion of sales that Google made in 2017 or the USD 55 billion in revenue Facebook recorded in 2018 to know that it is true.
Why do we need to redefine working practices?

Looking at the results of Bentley’s global survey into organizational working practices, it seems that many people in our industry do not believe that technology can help them think better.

Our survey of more than 720 business professionals—across Europe, North America, Latin America, the Middle East, Africa, Australasia, India, China, and South East Asia—has shown that almost of half of business (44.3%) have limited or no insight into company or project performance. These professionals are either not collecting data or are collecting it manually instead of digitally.

It has never been more important for businesses and all project delivery partners to know what is happening on their projects. With 21st century construction projects becoming more complex, project partners are putting more money at stake while working to achieve tighter margins. Indeed, the results of our survey come just months after one of the British government’s largest contractor Interserve went into administration following spiralling project costs. A year earlier, the global contractor Carillion collapsed after losing GBP 470 million (USD 614 million) on contracts in the Middle East and Canada, and GBP 375 million (USD 490 million) on problem contracts in the UK.

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Making errors in project delivery can kill off a business. Our survey shows that many businesses in our industry across the world still do not have genuine oversight and understanding of their performance on projects or overall business performance. This situation needs to change, for their sake and for the industry’s sake.
Now is time for us to work together to win the battle for the industry-wide adoption of digital construction

While our survey has highlighted that many businesses are still not working digitally, what is heartening is that almost half of those business with little or no insight (45.2% of the number of total respondents) understand the importance of collecting project data. They are just failing to make the most of it by not digitizing it.

These businesses really value the importance of data, as they are investing the time to collect, collate, and report the information. However, they are taking longer by not going digital. This delay costs society. With USD 5.25 trillion a year at stake, taxpayers could be on the hook for USD 740 billion.

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Collaboration is another case in point. 43.5% of respondents to our survey say that they have no capability for digital collaboration, or their information is paper-based and siloed. These companies are not enjoying the full benefit of collecting this data, as they are not able to analyze and share it easily with their own organization or their project partners. They cannot properly collaborate and communicate with project partners because they are unable to effectively share their valuable information. This system significantly impairs the productivity of a project and the project partners.

The global construction consultancy Mace estimates that in ten years’ time, the world will be spending USD 5.25 trillion on infrastructure a year. However, their analysis showed that around 80% of large projects experience cost or program overruns. Unless we can improve how we deliver infrastructure projects, Mace has calculated that taxpayers around the world could be left picking up the tab for an unexpected USD 740 billion worldwide. For taxpayers in individual countries, it translates into a cost of USD 229 billion to the United States, INR 9.1 trillion to India, AUD 59 billion to Australia, and GBP 19 billion to the UK.

This needs to change for society’s sake.

The four Ps to unlock the benefits of digital construction

Our industry is constantly moving forward. There are many challenges that our industry has overcome to get to where it is today from the creation of tools, industrial revolutions, and the improvement of health and safety standards. Now is time for us to work together to win the battle for the industry-wide adoption of digital construction.

To help, we have created the four Ps that outline the journey construction and infrastructure businesses need when going digital.
Prepare for it

This is the single largest battle we face as an industry.

The over-riding barrier holding us back from implementing digital construction is not the technology and whether it’s up to the task; it’s the mindset and psychology of us working in the industry.

As Nietzsche said, “The worst enemy you can meet will always be yourself.” The industry needs to challenge itself; and each one of us working in the industry must individually challenge ourselves and ask if our outlook and preconceptions are holding back ourselves, our businesses, and our industry.

We must defeat our own tactical objections by submitting ourselves to the answer of the strategic question – do I believe that machines can help us think better?

Once we have defeated our own objections and prepared ourselves for change, we need to prepare our businesses for going digital by defeating the objections of our colleagues and the leaders of our industry.

It is crucial to get the buy-in of the entire senior leadership team to successfully instigate change.

However, the tactical objections over monetary cost, time, effort, human resources, and education can all be overcome if we are prudent and prepare our businesses for change in an orderly fashion.
Every business, and every business’s encounter with digital construction is slightly different. As humans, we are fundamentally different people with different experiences, backgrounds, and perceptions.

To make going digital a success, we must first pilot it among a small portion of the company on a single project and take the time for team members to get used to, understand, and become familiar with the technology.

Long-lasting, sustainable change happens slowly. Winning over a small portion of the company to new ways of working is the most effective method of enabling that change to distill throughout the organization.
To win over advocates, we must demonstrate the benefit of going digital and probe change. We need to measure and quantify success to prove that going digital has saved the time of team members, made their jobs simpler, and made them more productive.

We need to monitor and evaluate the performance of the project at frequent stages to capture progress and refine and improve our working practices. Hold open forum meetings and get people thinking collectively about the changes they are implementing. It is important for empowering team members to think and analyze how they work and to discuss whether there are any ways that they can do it better.

Showcased at Bentley’s *Year in Infrastructure 2018* Conference, Infraero – Empresa Brasileira de Infraestrutura Aeroportuária, an airport operator in Brazil, recently needed a better way to organize its data for the fourth largest airport in southern Brazil. Located near the city of Londrina, the airport occupies 727,000 square meters, and the terminal covers an additional 5,280 square meters. For this estimated BRL 330,000 (USD 85,000) project, Infraero wanted to create a digital twin that would act as a reality mesh and a central repository for all airport data, including infrastructure, buildings, building systems, facilities, and maps and management data. With the digital twin completed in 2018, Infraero saw maintenance cost savings and improved airport operation at SBLO. The project team expects to save over BRL 559,000 (USD 150,000) per year with its digital twin. The organization also expects to see an increase in commercial profitability and the availability of critical equipment. The first digital twin in Brazil, it will be used in Infraero’s future building and infrastructure projects.
Process it
*We need to capture, understand results, and repeat.*

To create and maximize impact across the whole organization, we need to be able to process it. We need to capture changes, understand how we achieved results, and repeat them.

Adopting and embedding digital ways of working need buy-in at all levels of a business. Organizations should develop board steering groups so that the top of the business can see and understand the benefits of going digital.

Businesses should also nominate digital champions for each department and each project to ensure that processes become embedded and the results of going digital are communicated to all team members.

Reviewing and improving existing organizational processes are important parts of going digital because otherwise, organizations are replicating the same problems.
Businesses that embrace and master the four Ps are setting themselves up to be at the forefront of construction over this century. As an industry, it is important for us to remember that a construction project is only as strong as the weakest link in the chain. Project partners who are not working digitally do not have the level of productivity, communication, and assurance necessary for 21st century project delivery.

The innovation is here to transform the way that we are working. We need to challenge ourselves, our businesses, and our project partners to spread the benefits of going digital and stop the deployment of 18th century (and sometimes earlier) working practices on 21st century projects. Our motivation for going digital is our businesses, our clients, and our society.

“You are never really playing an opponent. You are playing yourself, your own highest standards, and when you reach your limits, that is real joy.”

— Former American Davis Cup captain and French Open, Australian Open, and Wimbledon champion Arthur Ashe

Let’s take on the task of going digital. There is too much at stake for us all not to.
**Going Digital Survey Results**

**QUESTION:** What is your organization’s capability to manage and share project information?

- **24%** We currently have no capability for digital collaboration.
- **23%** We have moderate capabilities with project information shared through an electronic file portal.
- **20%** We have limited capability, because project information is generally paper-based and data is siloed.
- **17%** We have a good capability by sharing and exchanging data through a common data environment.
- **17%** We have excellent capability for sharing project information in a connected data environment.
- **8%** We provide best practice through a connected data environment for all the design, construction, and engineering work.

**QUESTION:** What is your capability for information mobility?

- **24%** We have moderate capabilities for information mobility through some established model classification. Our mobile field workflows are only partly digitally connected.
- **24%** Our organization has limited capabilities due to predominately paper-based workflows and inconsistent identification for digital models.
- **18%** We have a good capability for information mobility as audit and quality checks follow a documented standard. Our mobile devices are workflow integrated.
- **16%** We currently have no capability for information mobility.
- **16%** We have excellent capabilities with inherent characteristics of the model to support the identification and classification of assets for collation and information handover. Our mobile workflows have real-time data connectivity.
- **6%** We have a best practice capabilities as operational characteristics are retained, managed and version control through formalized change management work processes. Mobile workflows are integrated in real-time.
**What digital workflow design and construction capabilities do you have?**

- **22%** We have Moderate capabilities for digital workflows as we use model-based design, review, and mark-up for new projects.
- **21%** Our organization has limited capabilities as much of our modeling is in 2D and paper-based workflows.
- **18%** We currently have no capability for digital workflows.
- **16%** We had good capabilities as digital workflows deliver model-based design, review, and acceptance as standard across our projects.
- **15%** We have excellent capabilities as digital workflows deliver mainly 3D designs for multi-disciplines for the entire ecosystem and advanced visualization and offsite fabrication.
- **8%** We have a best practice as the digital model is the primary deliverable back to the client. We benchmark techniques, capabilities and integration between models and workflows as continuously review and optimize with notification capabilities.

**Does your firm have the capability for insight into projects and organizational performance?**

- **23%** We have limited insight into projects and performance as information necessary to support project performance, program progress and cost reporting is manually collated, managed, and reported.
- **22%** We have moderate insight into projects and performance as much of the work we do is manual. We have managed to digitize and develop some automated processes.
- **21%** We currently have no capabilities for project insight or performance benchmarks.
- **17%** We have good insight into projects and performance with projects KPI, progress, and cost reporting.
- **12%** We have excellent insights into project and performance within integrated project information management environment that publishes performance dashboards. We have automated notification alerts for project participants into project progresses.
- **5%** We have to best practice for insights into projects and performance with integrated dashboards, insights, and historic goal that we had information that spends our project portfolio, to direct improvement initiatives.
About Bentley Systems

Bentley Systems is the leading global provider of software solutions to engineers, architects, geospatial professionals, constructors, and owner-operators for the design, construction, and operations of infrastructure. Bentley employs more than 3,500 colleagues, generates annual revenues of $700 million in 170 countries, and has invested more than $1 billion in research, development, and acquisitions since 2012. From inception in 1984, the company has remained majority-owned by its five founding Bentley brothers. Bentley shares transact by invitation on the NASDAQ Private Market.

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