The Business Post

Constructing a digital future

It may have been a slow process, but the construction industry is starting to properly embrace the digital innovations that we take for granted elsewhere, writes Quinton O'Reilly

By its nature, construction is a difficult thing to change radically. It's a large-scale process, requiring many different players and stakeholders just to build a small house, and it's a time-consuming process.

Yet digital innovations like analytics, big data, mobile connectivity and sensors are slowly starting to show their worth in the field.

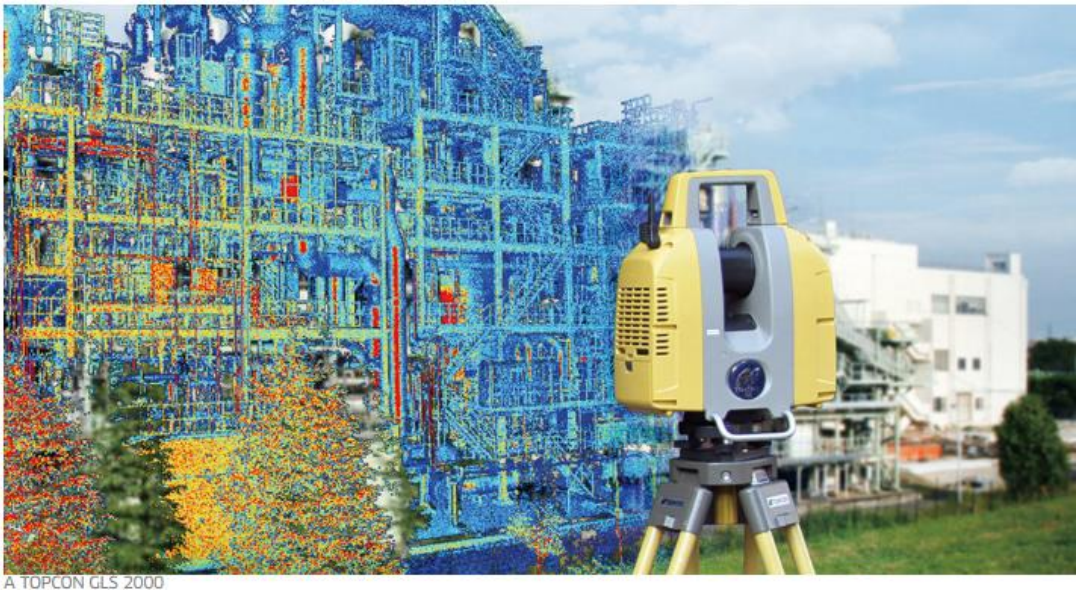
In most cases, technology would be seen as a way of aiding existing processes, but considering how much catching up the construction industry has to do with regards to digital, it's effectively a game-changer.

The big change is how digital is being embraced across the board instead of just specific areas, said Eamonn Doyle, chief technical officer at Esri Ireland.

One particular piece of technology that is making inroads is GIS (Geographic Information System), a way of capturing, storing, analysing and presenting all types of geographic data to help with planning.

"When you take all that information you get from drones or digital surveying and all the rest and put it all in one asset repository that you then need to manage, that's where we're seeing GIS come into the picture.

"We're working on the cross-rail project in London and they are archiving all the digital information from that project which, you can imagine, is massive. Using GIS as a system of record for accessing it and storing all of that information that they collect through all the various channels that they have."



A TOPCON GLS 2000

Another person who has seen the impacts that digital tools and services have on the industry is John Downey, director of sales EMEA at Topcon Positioning Group, where sensors, analytics and virtualisation have removed much of the pain associated with construction and planning.

One example is the ability to create a digital twin, which effectively allows you to see and make changes to a building before work commences.

"Before [projects] even go for tender you can see where all the mistakes are going to be," said Downey. "You can see where you're going to have problems and wastage because the guy who designed the pipework is not the same guy who designed the bridge and you might find that the pipe is going under the bridge.

"[Normally] you would find that when you get to site, but now you can see all of this, the software will work on a thing called clash detection where you're going to have a problem like wires and pipes touching each other."

Perhaps more importantly for those working in the industry is the savings made by avoiding such clashes. It's expensive to readjust a project when it's half-way done, but if the digital twin spots such clashes, it saves you from having to spend more money fixing it.

"The savings made are massive," he said. "The software will work out clash detection by value so they see how much it saves.

"We've done it now on a couple of projects with software where you can save up to a million in what would normally be reworked on site, where you have problems and you don't see them until you get on-site because the guy laying the pipes has a different set of drawings to the guy building the bridge."

Doyle mentions that since the construction lifecycle starts at the site selection and environmental planning area, tools like GIS become crucial to its success. Before you can set foot on the site, you need to be able to justify the reasons why you're building it.

"The construction lifecycle in our view starts way back in the site selection and environmental planning area, and that spacial planning so we're seeing GIS used a huge amount at that stage of construction projects," he said.

"We consider things like, if you want to build a Luas line, you look at the travelling population within certain distances of each of the stops, that sort of analysis before you ever turn a sod is really important."

Visualising project success

One area that visualisation can work to your advantage is contextualising the building for both stakeholders and the general public.

Doyle mentions that by using it in conjunction with other planning tools like CAD (Computer Aided Design), BIM (Building Information Modelling) and Revit – one of the best-known BIM software tools for designing virtualised versions of buildings – it opens up greater possibilities.

"People like to be able to see a visualisation of what a finished construction is going to look like," said Doyle. "The integration of CAD, BIM and GIS is very much in that space which I think is going to be an exciting area for us.

"[You can design building models from] Revit and drag and drop them directly into a 3D globe environment so people can see and understand what that building is going to look like. They can understand the shadow it's going to cause, where it's going to be visible from, and what's going to be visible from it.

"All of those things that people might have concerns about, if they think it's going to be overlooked or in the sunlight, you can deal with all of that very effectively within the GIS environment by integrating with your design environment like Revit."

Combining the likes of GIS, BIM and other data points can be crucial as it can help justify to stakeholders why you've chosen a site and the measures you're taking to ensure it goes off without a hitch.

"You can be more confident that you're building the right thing in the right place with

predictive analysis in the first place," he said.

"The whole area of site selection is a big area for us where they're faced with maybe you're trying to build something like a Tesco or Starbucks or something like that, you need to have done your site selection correctly in order to optimise the output of that construction effort. That's aside from using GIS in the actual construction process, that just the preplanning and the post-build analysis.

The other area Esri Ireland has been putting significant effort into is its relationship with Autodesk, the creator of Revit. One that has been ongoing for a year-and-a-half, it's allowed it to integrate its products closely so visualisation and planning are seamless.

This can be quite useful when dealing with public consultations, with Doyle saying that seeing it can really help with buy-in.

"We're integrating our two product lines really closely so that you can take information from BIM and bring it directly into a 3D GIS environment so you can start to visualise what your finished building is going to look like within the context of its location," he said.

"That's really important, especially for public engagement. If you're planning a big project and you want to get the public on your side, being able to show them what that building is going to look like in its environment and having analysis so you can say that's the right place, then you get buy-in from external stakeholders."

Much of the work is taking what already exists in the construction industry and updating it so they can complete more tasks passively. To give an example, Downey said that dozers can be fitted with sensors like accelerometers, GPS systems and other sensors so they can map out roads while they're performing their initial task.

It's the reason he says that Topcon is as much about selling sensors as it is tools and services for construction.

"The construction business is the world's largest manufacturing business, but it's the least automated and it has the lowest adoption of IT," he said. "It's no different to building cars or washing machines or anything, it's all down to automation and supply chains.

"What we're seeing in the future is the machines becoming more standard with this technology built in. We sell automated systems, but what we're now selling really is sensors. Sensors are feeding information back.

"A dozer is now a machine that actually maps where it's been, maps how much work it's done and it sends this information back out in a couple of seconds. Now you can see how productive you are and at the end of each day, am I on target or behind target, do I need more trucks tomorrow, you can see all of this live."

Keeping connected

The big development is that everything is now connected. Every machine you can think of is either fitted with sensors or has a SIM card inside so it can send data back to the cloud. In short, it can be used to capture multiple data points.

While the cost of materials or time isn't going to go down, the real savings come from speeding up processes, by either allowing for certain tasks to be carried out simultaneously, or by being able to adjust the process when unforeseen incidents arise.

It's the reason Downey places a great emphasis on connectivity, not just in terms of internet connections, but devices and services working in tandem. The individual saving might be small, but when combined, they can be significant.

"To give a prime example, let's say you're building a road and you have all the trucks delivering the asphalt," he said. "What we've done is connect the trucks to the paving machine to the rollers to the asphalt plant.

"[If] the trucks start to queue up, you slow down the production of asphalt. It does it automatically now and what that does is create less wastage because once asphalt is on the move, you can't put it back. Normally they might have to dump two or three loads because they turned up too quickly or there are too many there so they can't lay it quick enough. If you add that up over 20km or 30km, it's huge savings."

An Intel Falcon 8+ system drone

The other area it helps with is traceability. Similar to how Office 365 or Google Docs would keep track of changes and modifications of any document, the construction industry can do a similar thing with changes to virtual versions of any building or structure it's planning.

Since there are so many stakeholders involved in any one project – electricians, architects and plumbers to name a few – it's likely that each of them will have different views on how a project is going to unfold.

By knowing where each pipe, wire and structure is going to be, it not only makes the initial building process easier, but maintenance too.

"It's traceability, so you see that on the construction project. You know where everything is, you know this pipe is on the ground at this point here and it's placed at the correct level," he said. "If you have to go back and do maintenance work on it, you don't have to guess, you know exactly to the centimetre where it is and you know the whole project is built to the standard."

Such advances go beyond buildings and on to refurbishment and maintenance. Significant amounts go into maintaining existing infrastructure like motorways and bridges and with sensors now able to detect even the most minute of changes, it can help reduce both the time and cost of such projects.

"What's changing in the first world is it's not building new infrastructure, it's rebuilding the old infrastructure," Downey said. "We've seen the maintenance and refurbishment budgets are three or four times bigger than the new building.

"In Germany, the budget for rebuilding their roads is going to be €8 billion. The reason for that is their roads were built in the 30s, and they need to now basically maintain them and do them up because they're falling apart."

In some places like Sweden and Norway, Downey says, mapping such information is mandatory as that data can help government departments with planning and upkeep. Nobody wants a major infrastructure project to be rebuilt in a ten or 15-year period, so more intuitive methods are required.

"In the old days, they'd sample one part of the project, but with technology, everything is a sensor," he said. "Even the guy driving the roller, he's a sensor. When he's driving, he's measuring the stiffness of the road, feeding that data back to the cloud.

"Normally on a road project, they would sample [every couple of] metres, now with sensors and accelerometers built on to these rollers, GPS and temperature sensors on them, we can map the whole road centimetre by centimetre. It's like any other sensor in any other production line.

"It has to be there, it has to be on the job to finish it, so why not use it as a sensor to map the project and see if it's built correctly.

"It's gathering all of this data and finding out what's there. You can take 1.5 million points of data per second with high-density scanners, we can drive on a road at 70kmh and map the whole road."

The sheer number of data points available allows it to give projects a degree of efficiency that wasn't imaginable a few years ago. In the case of refurbishment, such efficiency is crucial for projects like motorways, as shutting one down for a day isn't possible.

If you did, businesses would experience millions in losses so working through the night and making every second count is important, especially if there's a penalty involved, as Downey mentions.

"We can tell you to the millimetre how much you need to take off and how much you need to put back, every single centimetre of the project," said Downey. "We're working now and we've shown this to Dublin Airport. They're very impressed because they're going to have to resurface Dublin Airport. They're doing some of it now, but there are more tenders to come.

"We just finished Bologna Airport. We basically had to go in every night, take material out and put it back, and have it open at a certain time every morning and we were fined for every 15 minutes we went over and the fines were massive."

Indoors only

While much of the construction process involves the area they're built in and the actual construction process, more attention is now being paid to the aftermath.

It's not enough to just build something and disappear, the need for active service and maintenance will still be required. With the data gathered from the building process, such services are easier to keep up.

We are also moving into [looking at] what you do in these campuses after you build them, the indoor space and how you can manage them," said Eamonn Doyle, chief technical officer at Esri Ireland.

"We're just about to launch a product called ArcGIS Indoors and it's aimed at campuses or buildings like hospitals, universities or airports where you have a lot of space to manage, you got to find your way around it, you got to report issues and those sort of things.

"We're stepping into that space of what you do with a large building after you build it."