

Monitoring Building Performance

Kate Moss is a model, who knows how to perform. The fashion industry understands this and recalls that back in 1990, supermodel Linda Evangelista uttered what has become the most famous quote in modelling history: "We don't wake up for less than \$10,000 a day" showing what a lean machine she and Kate could be. Her intelligence is that she knows how to work a runway, how to show a garment in its best light and to capture that moment for the *Haselblad*, clicking her every move. A model who cannot perform, is not a model for very long.

Performance is key to the construction sector too, where increasingly a building which cannot perform is not an asset but a drain on the economy, society and our precious planet; Earth. Rewarding better buildings, better constructions and better methods is not easily done and our current practices do not reflect this either. Finding new ways to encourage this and to demand it requires a new mindset and Building Information Modelling (BIM) offers a platform for this to happen. BIM is not a technique but rather an overarching support system providing a place or a stage on which all stakeholders can perform and excel in their roles, producing both new environments and retrofitting old ones.

Build 4.0, the Internet of Things and the Blockchain all offer new and exciting opportunities to progress a better, more sustainable world and to reward better performance, which patently did not exist before. The industrial model for procuring a project is still based on working with small margins, usually the lowest tender wins the contract. This sets the landscape for litigious conflicts, change orders and delays making the industry the worst performing sector in terms of productivity across all activities from automobiles to agriculture.

Similarly, there is little or no Evidence-Based Design (EBD) meaning designs are often architectural whims with no data to back them up. Brandenburg Airport in Berlin, started in 2008 and expected to open in 2012 at a cost of €1.2 billion, still has only hardhats on site. It has no completion date with many saying it would be easier to tear it down and start afresh. It is six times over budget, and has 66,500 building errors in need of fixing (Economist 2017).

At The Copenhagen School of Design & Technology (KEA) we use BIM-360 to provide a cloud-based solution. The students, working in groups of four use a whole semester to procure a project, collaborating through Problem-Based Learning (PBL), to provide the architectural deliverables, the structural and mechanical deliverables, the economy and contractual basis with specifications and tender packages. The 3D model is produced in Autodesk Revit and is overlaid with structural and MEP models. Next it is parsed into Sigma Estimates where the quantities are priced against a price book providing the 5D model (resources).

Next this model is exported to Microsoft Project where the 4D (time) can be modelled in a Gant chart. Here there is work back and forth in three interlinked models to fine tune the operation. Exporting the Revit model to NavisWorks allows the MS Project data to be applied, so that a time line can be animated and saved as a movie. Clash detection can also happen here. We are also assessing RIB's iTWO software which brings the 4D and 5D under one roof, which additionally can map the budgeted spend against actual workflows so that bottle-necks and liquidity can be controlled.



With regard to circular ecology; waste, CO2 and energy need to be evaluated. Making Life Cycle Analyses (LCA) and Life Cycle Costings (LLC) better inform design decisions and impact the above processes. Next is to find metrics that reward such practices. One is to make an embodied carbon price book using GtCO2e. Another is to transfer the 3D Model from objects to assets so that Facilities Management (FM) processes can be applied. Changes to the contractual model mean looking at Integrated Project Deliveries (IPD), where Integrated Concurrent Engineering (ICE) also comes to the fore using handheld devices.

Sidechains, a subset of the Blockchain means that if a tender package claims to deliver benefits, through the life cycle of the facility, which now can be sensed and monitored through its life, then it can be accountable. If savings occur, they can be rewarded by paying out a dividend from the accrued saving, each and every year in which it happens. Making an argument along these lines encourages better practices and, more importantly, rewards better procedures.

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BIMcert

News

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BIMcert - Developing BIM training and promoting energy efficiency for the European construction supply chain.

BIMcert driving energy efficiency in construction

It has become well documented that the building sector is the largest consumer of energy in Europe, accounting for nearly 40% of the total consumption of Europe's energy and CO² emissions. With global warming increasing the pressure to reduce energy use in buildings, and the global construction market forecast to grow by over 70% by 2025, the European Commission (EC) has defined clear targets to reduce energy consumption and CO₂ emissions.

In a bid to tackle the inefficiencies and emissions associated with the construction sector, BIMcert, a collaboration of seven European academic and training institutions, is leading the development of a new energy-focused BIM Skills training programme for the entire construction supply chain.

Avril Behan, Head of BIMM and Digital Construction at Ireland's Technological University Dublin, who are leading on Concepts and Methodologies in the Horizon 2020-funded BIMcert project, commented:

"BIM, or Building Information Modelling, is increasingly considered as a best practice model to address both energy and operational inefficiencies in construction. BIM can transform the construction sector, as it enables and supports the transition to more energy and cost-efficient practices. Building Information Modelling is essentially a digital representation of the building process, facilitating

the exchange of information in a digital format. This modelling has been proven to contribute significantly to energy reduction through, improved brief setting, more integrated and optimised design solutions, better specification and site delivery, and the more efficient operation of the building in use. Early projects utilising BIM have reported reductions in construction defects, material wastage and incorrect material or component installation."



From left: Avril Behan, Barry McAuley, Prof Gerald Farrell Director & Dean of College of Engineering and Built Environment, TU Dublin; and Paul McCormack, Belfast Met



The Belfast-led BIMcert project received €1.25 million from the EU Horizon 2020 Research and Innovation fund as part of a Europe-wide training agenda to develop BIM skills, and drive to make Near-Zero Energy Buildings a reality.

Barry McAuley from Technological University Dublin's School of Multidisciplinary Technologies, who are leading on the Concepts and Methodologies Work Package, added: "BIMcert plans to develop a framework of bite-sized

learning modules, which will enable individuals to upskill in BIM from any starting point, and will incorporate both online and person-led training. Our vision is to provide the entire construction supply chain, including 'blue-collar' workers, with access to BIM training, whilst promoting a new generation in BIM for energy efficiency."

Anne Artt

Technological University Dublin 'new' BIMcert partner

Ireland's first technological university has been formally established by law and is now the country's largest third-level institute. Technological University Dublin officially came into being on January 1st and has 28,000 students and more than 3,000 staff.

The main campus for the university formed from the merger of Dublin Institute of Technology, IT Tallaght and IT Blanchardstown will be in Grangegorman. However, it will continue to operate out of existing campuses at Tallaght and Blanchardstown. DIT are a partner on the BIMcert project.

Dr. Avril Behan, Assistant Head of the School of Multidisciplinary Technologies, reported that the DIT staff engagement in EU-funded projects such as BIMCert was critical to achieving the endorsement of an international expert panel and foundation as Ireland's first Technological University (TU Dublin).

Dr Behan, said: "The increased research and industry engagement remits of Technological University Dublin will enable continued and improved collaboration with European and worldwide partners to tackle societal challenges, such as climate change and the UN's Sustainable Development Goals."

Eugene McCusker

BIMcert platform becoming a reality

The BIMcert platform design is under development, and the first version of the platform front end has been already discussed at the Dublin meeting (23-24 October). Instituto Superior Técnico, from the University of Lisbon, leader of workpackage 3 has shared the vision for the gamified e-learning platform for BIM training and emphasised the role of BIMcert as the most relevant online BIM training platform. Many challenges are still ahead, but the BIMcert platform is becoming a reality:

See diagram opposite:

Fig. 1 - BIMcert frontend design first draft.



Feedback from BIMcert workshops

At the heart of the BIMCert project are the aims to upskill the workforce and develop new employees joining the industry. There has been feedback from some recent BIMcert workshops. The Macedonian workshop was held on October 10th. Among the key comments made were that the favoured training method indicated by attendees is blended learning. The introduction of BIM within Macedonian legislation is realistically within the next 3-5 years. The curriculum of all modules will be in English, because it is the most common language.

The Croatian workshop was on October 13th. Among the key comments were that there is a lack of use of BIM in energy efficiency, there is very little use of Revit in Croatia. Surveyors there do not understand a lot about BIM. The best method for assessing the BIM level needs in a company is bringing in an outside expert consultant. The Dublin workshop was held on October 23rd. Among the key comments were BIMcert needs to engage with actual workers, the next phase should involve tradespeople or at the very least, the contractors themselves. There is a need to monitor or at least record accounts of implementation of BIM in the Republic of Ireland and the EU. There exists a need to sell to contractors and monitor the implementation, not just the production rate of BIM design but the practice and follow through in the build.

The Lisbon workshop was held on November 6th. Among the key comments were contractors are doing BIM internally as no one is delivering training at present. The BIM implementation in Portugal is mostly individual, (Internal to organisation). There are a few collaborations between the different stakeholders, but there is a need to know how to work collaboratively.

A BIMCert workshop which was led by BIMcert partners Future Analytics and CITB NI was held at Belfast Met's Titanic Quarter campus on 13 November. A number of interested parties from the Northern Ireland construction scene took part including representatives of Farrans and Henry Brothers, two of the biggest construction enterprises in Northern Ireland.

The workshop encouraged interaction with the project team, Future Analytics are in charge of the trials, review and the testing process while CITB aim to ensure that developed materials meet the varying needs of the practitioners. Belfast Met Construction lecturer Andrew Hamilton whose work is focused on accreditation for the BIMcert project explained about the planned curriculum for BIMcert. The modules will include digital skills, BIM for contractors, advanced BIM and energy efficiency and BIM facilities management. Andrew pointed out the need to take the trades with us on the BIMcert journey, and there is a need to break the qualification into bite sized sections. It was suggested that the likes of an app could be used for this type of training. William Hynes from Future Analytics discussed the different types of learning that were available for BIMcert, the traditional classroom, the e learning

space, social learning, and self study offline/online. Barry Mc Auley from the BIMCert partner, Technological University Dublin commented people had different levels of knowledge, areas of need and user requirement. Meanwhile Gayle Beckett from CITB let the audience know that time and cost were the key barriers to training that they noticed from the recent CITB survey.

The BIMcert project aims to upskill the construction workforce and help develop new employees joining the industry. There is the strange conundrum that employees below 40 years old are IT literate but lack construction experience while employees over 40 have construction experience but lack the IT literacy required in the workplace to engage in BIM/digital construction.

The Farrans BIM Co Ordinator, Kyle Brennan mentioned its easier to initially offer face to face assistance to start the journey into BIM/digital construction before embracing the blended learning approach. Clients need to be educated on the benefits of BIM, and the benefits to contractors and their workforce.

Eugene McCusker

