DFMA: what does 'good' look like?

Digital/BIM

It is generally accepted that DFMA offers numerous benefits to the construction process. These include:

- Quality
- Cost/Value
- Time
- Productivity
- Health and Safety
- Process
- Logistics
- Sustainability

Literature and information on DFMA for construction is currently widely available and often understandably promotes a positive message. The website and organisation Buildoffsite.com has on its website on DFMA:

"Seeking to find the most efficient way of delivering a project inevitably reduces the resources required (whether this is measured in cost, time, carbon, waste or labour) while increasing positive aspects such as health and safety, quality, certainty. In other words, DFMA breaks the traditional relationship between cost, quality and time: a DFMA solution can be achieved to a higher quality at lower cost and in less time."

However, while there are many rational arguments for these benefits, there are few quantitative case studies where the benefits are clearly measurable and demonstrated across the board, and there are many practical instances of DFMA solutions achieving benefits in one area whilst not in others. For example, bathroom pods having programme advantages but ultimately at significantly higher overall costs, or suffering from quality issues.

It is important to note that introducing potentially beneficial new processes such as DFMA does not preclude the need for rigorous quality checking processes in place. In fact, one of its principles is quality checking at each key stage of manufacture and assembly. Digital technology can help to facilitate this, but it requires collaboration and cooperation from all stakeholders to be successful.

Early stage commitment to DFMA is best, so that concept designs take opportunities for DFMA into consideration and look at potential solutions to the project delivery holistically. This includes standardisation and division of parts, interfaces, practicality of construction solutions.

Digital solutions such as using BIM for early stage design can help to understand the physical limitations and challenges of the project volumetrically and spatially. They can also help in quickly reviewing design options and their impact on the areas of the brief.

Another DFMA company that specialises in SIPs, Innovaresystems.co.uk, states on their website:

"Greater benefits come from offsite construction when it is considered as *the* intended construction method from the outset, not just one of the options. Early collaboration with specialist design engineers then makes it possible to address issues of buildability, building performance and quality assurance far more effectively.

BIM is critical to all of this. It creates the environment in which collaboration happens and which drives quality improvements with benefits over the lifecycle of the building. The 3D model becomes more than a guide or representation of the intended structure it becomes the detailed blueprint from which panels and components are made."

Some of the key areas where DFMA offers benefits, with Digital/BIM enhancing them:

- Preconstruction stage better certainty can be achieved with BIM and more issues resolved
- Support management and delivery at construction stage
- Logistics
- Health and safety
- Time (4D)
- Cost/Quantities (5D)
- Facility management during building operations (6D)
- Energy performance/analysis
- Deconstruction of buildings after use

Challenges and solutions

A few developers have recognised the potential for DFMA to transform their business and pushed its use in their business, one of these being Berkeley Group, which has formed a modular focused company, Berkeley Modular, to deliver their volumetric modular projects. However it has not all been smooth sailing. They have recognised the difficulties of the still developing DFMA construction industry and the necessity for all parties involved in the construction process to be on board. They also partnered with a digital/data specialist, Cobuilder in recognition of the importance of having the digital processes to be in place for it to be a success. Peter Foster, CEO of CoBuilder commented:

"At present, the offsite industry creates data in a very ad hoc fashion, but when Berkeley has set up its data structure based on our solution, the entire supply chain will work to the same template and format, including the machines in the factory."

Thus, in order to succeed, there must be alignment across the supply chain in goals as well as digital processes. Currently, supply chain partners at different stages of the process tend to use different software to produce their output. Whilst this is far from ideal, it is very difficult commercially and practically to establish a wholesale common format for production across all the supply chain which have established software systems. Bearing this in mind it is essential for there to be processes in place to ensure the information/data produced can be shared and used in an effective way through other exchange formats such as IFC. This process must be carefully managed, with each stakeholder clearly understanding what they need to produce and how it fits within the overall delivery strategy.