Digital Engineering in Quality Assurance

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Abstract

The civil infrastructure sector has the challenge of maintaining and modernising the systems and assets on which we use to address increasing demands and improve customer experience. Digital Engineering in the infrastructure sector is seeing further surges in momentum at a time when industry and clients face pressure in decreasing capital budgets to build new assets while advances in technology proposes that we can do more with less.

The industry is grasping the Government mandate, and BIM is progressively reaching its maturity. Existing delivery models are being upgraded towards a transition to a fully integrated BIM process.

As the industry steadily progresses towards digitisation of services and products, the need for robust Quality Assurance is increasing as well. Recent reports have shown that production and consumption of data across all sectors including infrastructure is dramatically increasing and needs to be managed.

Clients, contractors and consultants need to rethink the ways which analogue/non-automated flows of data and products are being produced in project delivery across the industry. This report explores what Digital Engineering can do to improve Quality Assurance. Thus, benefits and challenges that may prevent adoption of this new approach are being reported. The report concludes with a summary of strategies for clients and the supply chain.

Introduction

CH2M supported by ICE and RICS hosted a workshop on Digital Engineering (DE) in Quality Assurance in September 2016. The event was set up following interest from clients in the rail sector and Tier 1 contractors to look at how each approaches DE to improve the Quality Assurance component of delivering projects.

Data production has vastly increased over the last years, and data has become more interconnected than ever before, but the interconnection has brought complexity and challenge. Findings from industry reports including the Digital Built Britain cover DE and the use of data in various sectors in achieving greater gains.

The purpose of this workshop was to outline key factors that may aid or damage the current strategies in place. This workshop captured the views of different parties who contributed in discussions on the past, present and future of DE in Quality Assurance. Key ideas and new strategies were shared and discussed at length which enabled collaboration and future discussion. A total of 14 senior managers from major consultancies, contractors and clients attended the event, with roles focused on the rail sector. This reports concludes with a summary of strategies for implementing Quality Assurance in a digital era.

The workshop was divided into four key topics of discussion:

a. Before getting deep into the topic participants were asked to define their understanding of DE in Quality Assurance so all can work on the same working definition. A round table format was formed so that ideas and discussions could be held between all members of the group. A facilitator took notes as the discussion progressed so that a singular definition could start to form. This task covered many different aspects (e.g. data handling, relationships, organisation etc.), which helped to establish an understanding within the group.

b. Participants were then asked to identify key benefits of DE in Quality Assurance they were aware of, write them on notes and affix/present them to a large board. The notes were then...
grouped according to their nature (emerging themes.) The group was encouraged to compare and debate on the findings.
c. Following the same process, participants were asked to identify key risks of DE in Quality Assurance they were aware of, write them on notes, affix/present them to the board and debate the points.
d. Finally, participants were asked to identify strategies for implementing DE in Quality Assurance that they would expect the client organisations or the supply chain to undertake. Once again, the participants wrote them on notes, affixed them to the board and debated the topic.

Figure 1.
Discussing Digital Engineering in Quality Assurance

Definition

As a first activity, participants discussed in a roundtable format the role of DE in Quality Assurance. The discussions build upon the working definition and covered various areas.

From a client point of view, the need for DE in Quality Assurance should break the barriers of existing siloed approaches and “can be assured that you get what you asked for” as opposed to existing solutions where the Client is not getting the right as-builds.
The people’s behaviour was highlighted as a key factor that should play some role, and others mentioned that DE can enable management of increasing interfaces in the infrastructure sector. Others highlighted that DE should give assurances that we are getting quality, flexibility, greater control on a project and in addition it is important that we are getting the right information at the right format and in the right time.

The Oxford dictionary defines Quality Assurance as the maintenance of desired level of quality in a service or product, especially by means of attention to every stage of the process of delivery or production. On the other hand, Digital Engineering is the process of manipulating data to aid the design process within an integrated database and parametric model throughout the project’s design-build-operate life cycle.

Considering the above, the group identified: Digital Engineering in Quality Assurance should ensure data and products are reliable, accurate and resilient, and ensure conformity of processes and behaviours based on standards.

Figure 2.
Benefits for Digital Engineering in Quality Assurance
Benefits

As displayed in Figure 2, the analysis showcased seven key benefits of DE in Quality Assurance. One of the key benefits of DE in Quality Assurance discussed was accessibility. A large majority of participants identified that an increase in the use of DE would bring about better accessibility to a wider range of data, transparency through accessibility of records, robust integrated solutions and more robust configuration control. DE should give control of access to sensitive information and should increase the speed and assimilation of verification of data in an accessible format.

Another key benefit that the group identified was collaboration. The participants summarised that DE in Quality Assurance could increase the ease of collaboration between employees, clients, stakeholders and their data and highlighted that DE increases the opportunity of collaboration and visualisation of the end products early in the process with a larger group of stakeholders.

A third benefit that was reported was confidence by means of early identification of errors. DE helps “towards certainty of outcome”, and gives confidence at project level of the digital information facilitating effective decision making based on that data.

Compliance was another benefit that emerged. The “reduction in the potential pollution in the data environment” was deemed an important element brought due to DE to ensure purity of data (risk of contamination). Making sure that a ‘component’ goes through a robust change process, DE should assist in ensuring ‘products’ of a project remain compliant.

With regards to accountability, DE can assist in early identification that end users expectations will not be met by the current specifications and establish a quality regime. The participants highlighted the need for a framework that broadcasts better ways of working and establishes accountabilities regarding the accuracy of data/information produced.

In similar lines to the above benefit, automation can be achieved, since there is potential for automate verification of information supplied against client requirements. The participants even shared some out of the box ideas and proposed linked to payment mechanism milestones, making certification simpler.

The final benefit recorded was accuracy. Digital Engineering in Quality Assurance should provide better outcomes, reduce re-work/re-design activities and provide greater definition of information / correct handout records.
Risks

Participants discussed current DE risks and six emergent themes have been identified and were grouped into three main categories: Capital, People and Delivery and Tools.

Politics & Costs was one of the highlighted risks. The group agreed that there are cost implications of investing in IT solutions due to capital demands; especially as the current approaches are enterprise focus, thus resulting in poor organisational infrastructure.

Contracts/Incentives and the lack of having them in the procurement was mentioned. The group suggested that there is room for improvement for the infrastructure industry to create motives and penalties via new commercial models built upon DE. Clients could rethink work processes to obtain benefits and justify investment.

The People factor was of critical concern to the participants. The group identified Skills crisis as an alarming trend the industry is facing and the need to have specialised training and education within companies. Equally, due to technology and automation the generational ability to use technology is making people obsolete who cannot keep up with new ways of working.

The other People risk was Cultural silos and the notion that people misunderstand DE’s importance and the immaturity of understanding what DE involves (not just a 3D model). The group suggested that people are somewhat resistant to change and that is reinforced through blame of systems.

Risks around Process were highlighted, and the potential lack of collaboration – disjointed design delivery was mentioned. The danger of overload was mentioned, and the risk that clients could end up with too much data and handover (pollution of data environment).
IT issues play definitely an important role, and a variety of concerns were raised involving data security risks (more information is available to more people than ever before). The speed of technological development was highlighted, on the basis that people can't keep up with the pace by which technology advances and barriers created by different companies / consultants / industries / clients using different platforms.

Project Focus Strategies

In this last activity the group identified a strategy for implementing DE in Quality Assurance on a typical project. The groups identified three key areas: Procurement, Delivery, and cross-functional Principles.

Procurement

In this area the group highlighted the importance of having accuracy of scope from the early stages of the project, and the need for a set of defined requirements. The Clients should clearly define the outcomes of the programme, and agree on purpose specifications with their supply chain. The group discussed the need for a data driven business case enhanced with DE.

As part of the procurement process, the participants highlighted that a common systems/platforms decisions should be made as early as possible, alongside with training requirements and definition of processes and procedures.

Delivery

In the Delivery area, the group identified that prior to feasibility stage, the project/programme teams make consideration of legacy data. As such, asset management unconventionally finds its way in the early stages and helps inform a data-driven decision making process through integration of data.

The delivery team responds to the data driven business case set up by the procurers and use visualisation for user/client buy-in. The engineering plans (i.e. EIR) sets out the requirements and includes the digital deliverables ie. asset data, project closeout data and communicates information processes to the whole team.

Moving to Design and Delivery stages, the project team looks at what changes have been made and inform/optimise the Business case.

Requirements are tested and quality audits are endorsed to ensure robust processes and procedures are in place from design to delivery.

At Handover, processes such as Soft Landings come in place to ensure distribution of lessons learnt are moved to other programmes of similar scale and a digital issue/retention of all files is build up.

Cross-Functional Principles

The group identified a number of cross-functional principles that need to be in place to ensure a robust Quality Assurance process is established. Data interoperability and the use of Open protocols was
highlighted as it will enable data to be moved across the development and delivery stages. Future-proofing of software platforms was another theme and this links back to the identified risk of companies using preferred software solutions resulting in IT issues. The group also identified the engagement with all stakeholders and users throughout data capture as another important principle, and this engagement could support improved review and design update.

Conclusion

This workshop helped to establish, as a primary goal, where we are as an industry when it comes to Digital Engineering in Quality Assurance and secondly, where we want to be in the next few years. Outlining the key benefits and risks helped to establish a good platform on which to build safeguards and strategies to minimise the risk and maximise the benefits.

The participants worked as a group to jointly define the role of Digital Engineering in Quality Assurance. This was then followed by identifying a series of key benefits and subsequent challenges/risks that Digital Engineering can bring to Quality Assurance.

The group ended the session developing a roadmap project-focused action plan that outlined the critical path for enabling use of Digital Engineering in Quality Assurance over the lifecycle of a project— inception to completion—including maintenance and operations.

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