Best practice collaboration

EXECUTIVE SUMMARY

The UK architecture, engineering and construction (AEC) industry was once almost synonymous with inefficiency and conflict, and was regarded as low-tech. Over the past two decades, great strides have been made in revolutionising project delivery processes, and in using technology to enable effective collaboration. Web-based platforms provide a powerful means to centralise information for use throughout project delivery, from the earliest conceptual stages where the project brief needs to be developed, through detailed design and construction, to hand-over of a fully-documented new asset to the owner-operator.

In the second decade of the twenty-first century it is increasingly difficult to imagine working in the architecture, engineering and construction (AEC) industry without the internet. Today, almost every organisation has its own website, email has become almost ubiquitous for day-to-day written communication, social media is passing from 'fad' to normal, and many of us can and do routinely access the internet wirelessly 24/7 via smartphones and tablets.

Twenty-five years ago, it was very different. CAD (computer-aided design) had yet to replace manual drafting, word-processing was gradually making typewriters obsolete, the fax and (later) email were accelerating correspondence, some once-laborious design, visualisation and analysis tasks were being automated, and we had bulky mobile telephones as well as desktop devices. However, the initial industry tendency was almost always to turn the end product back into paper; information exchanges on the vast majority of AEC projects was still achieved through traditional means: face-to-face meetings, telephone voice calls, and overwhelmingly paper-based communications.

Project delivery was also a largely sequential – and often inefficient – procurement process. For example, a client might seek professional help on preparing some initial plans to meet a perceived need. A design team would then spend time developing the conceptual proposals to an advanced level of detail before seeking a constructor (and its supply chain of subcontractors and suppliers) and, after a tendering process, making a start on site. The main contractor and supply chain would then construct the project and upon practical completion hand it over to the client handover who then assumed responsibility for the asset's operation and maintenance. Despite 'lean thinking' impacts in other industry sectors, construction project teams seldom shared information with their supply chains; from the outset, specialist suppliers, contractors and sub-contractors were, thus, often unable to contribute to design development, buildability, or future asset operation and maintenance of the client's asset.

The transience of many project team relationships was also a factor in the industry's inefficiency. For example:

- teams were usually assembled only for the duration of an individual project
- only a small portion of the total team might ever meet or be co-located on site
- technology constraints limited the ability to share information freely (even if teams overcame adversarial, mutually suspicious contractual mindsets)

- project perspectives were coloured by the type and volume of information shared between individual team members
- and at the end of the project, teams were disbanded, often dispersing the collectively acquired knowledge.

The AEC industry has always been highly information-dependent, and sharing accurate, timely information is critical for all participants. Yet, in the late 20th century, many projects were delivered late, over-budget or falling short of client expectations. Expensive and time-consuming litigation often resulted as customers, contractors, consultants and supply chains – and their lawyers – sought to apportion blame for wasted time, cost overruns and/or construction defects: issues that could almost always be traced back to poor co-ordination caused by late, inaccurate, inadequate or inconsistent information.

Moreover, most of the industry's IT applications did little to improve matters, being developed as stand-alone tools (eg: CAD was separate to scheduling, which was separate to cost control, etc) with little integration between them. With most team members widely dispersed and mobile, what was needed was some means to communicate, centralise and share that information more quickly and efficiently.

PARTNERING, INTEGRATION AND COLLABORATION

Fortunately, during the 1990s, the UK construction industry began to grapple with the problems. A key step was the 1994 publication of Sir Michael Latham's report *Constructing the Team*[1] which made 53 recommendations to change industry practices, to increase efficiency and to reform the bureaucratic and adversarial nature of most construction projects.

Within a notoriously conservative industry, some contractors and consultants embraced Latham's key 'partnering' concept, recognising the value of establishing long-term relationships with customers and other members of the supply chain. Instead of working on single projects, some clients (eg: BAA, Sainsbury's) began building more long-lasting, strategic relationships on the grounds that they were also capturing information, experience and best practice by working repeatedly with a small number of framework suppliers. They realised that knowledge created during project delivery was a valuable 'whole life' asset that could be used to enable better planning, continuous performance improvement and risk reduction across their current and future property portfolios – an ambition that is today, of course, reflected in clients' push to adopt building information modelling (BIM).

In 1998, a construction task force, chaired by Sir John Egan, produced a report Rethinking Construction which endorsed the progressive Latham thinking and underlined the importance, among other things, of integrated processes and teams. Existing bodies incorporated the Egan agenda into their activities, and worked with newly formed industry change organisations,[2] developing new forms of contract, testing new procurement processes (for example, early engagement with the supply chain to enable more concurrent working, whole-life PFI and PPP arrangements, 'prime contracting' on the 'Building Down Barriers' projects, etc), and setting performance targets that emphasised 'information technology and standardised document handling' as an increasingly vital area.

1 Latham simply marked the latest in a long series of industry reports (eg: the Simon Report in 1944 and Banwell 20 years later).

2 Existing organisations such as the Construction Industry Board, Construction Best Practice Programme and the Design Build Foundation were augmented by, among others, the Movement for Innovation, the Confederation of Construction Clients, the Housing Forum, the Local Government Task Force and the Government Construction Clients Panel. Many of these now groups were later merged into what is now Constructing Excellence.

In 2002, the Strategic Forum for Construction, also chaired by Egan, produced Accelerating Change, echoing the calls for greater integration of teams and of IT, and identifying 'IT and the internet' as one of several cross-cutting issues that could act as enablers or barriers to change:

> IT and E-business, as enablers, have already radically transformed many operations in the construction sector and there is still a vast potential for more. IT can deliver significant benefits for designers, constructors and building operators. ...
>
> The widespread adoption of e-business and virtual prototyping[3] requires the construction industry to transform its traditional methods of working and its business relationships. Key barriers to this transformation include organisational and cultural inertia, scale, awareness of the potential and knowledge of the benefits, skills, perceptions of cost and risk, legal issues and standards.

THE RISE OF ONLINE COLLABORATION

So, by 2003, the future direction of the UK construction industry was being tied to the adoption and implementation of more collaborative and integrated methods of working, underpinned by new collaborative forms of contract (eg: PPC2000, the NEC, the JCT Collaborative Contract, etc). And the key role of IT was also being repeatedly stressed by industry change initiatives, particularly as progressive clients were already harvesting the benefits of new web-based technologies.

The development in the late 1990s/early 2000s of new internet-based collaboration platforms – so-called 'project extranets' – had already heralded a new era. Unlike previous technologies such as FTP, groupware or LAN/WAN-based electronic document management systems, these did not tie end-users to particular networks, and did not compromise corporate network security by allowing outsiders to penetrate firewalls, etc.

Moreover, being mainly provided by independent software providers such as 4Projects, they freed clients or project team members from committing IT resources to a system's acquisition, implementation and support. The systems also did not require any major investment by other end-users in new hardware or software to access the system (an important factor, perhaps, when partnering with smaller suppliers and other project participants). Information could be made available from a project-specific website hosted at the vendor's facility, and remained private, securely managed and only accessible by authorised team members.

Broadly, all such systems can be accessed through a computer equipped with a standard computer browser and a working internet connection. The same basic functions are common to all. Authorised users, no matter where they are located, can get immediate access 24/7 to a single, secure, central repository of project data that grows as information about the project or programme (a building, a road, a bridge, a water treatment plant, etc) is developed by the team. Feasibility studies, budgets, sketches, CAD drawings, approvals, schedules, minutes, photographs, specifications, standards, procedures, digital models, etc, can all be viewed; team members can add comments, issue notices, instructions and requests for information (RFIs), and publish drawings and documents, singly or in batches. Everyone works on the most up-to-date, accurate and relevant information – "a single version of the truth" – backed by all the archive material, with all versions and interactions tracked and documented in a secure audit trail.

3 This reference to 'virtual prototyping' was also significant, coming some eight years before the UK Government explicitly endorsed building information modelling as the route forward for public sector projects (in 2011).

Ultimately, these web-based applications offered a way to improve the management of key project information; project times, costs and risks (as well as post-project claims and litigation) could be reduced; and efficiency, communication and quality improved. And as adoption grew, vendors such as 4Projects were able to provide more functionality to support different stages of the procurement process, from pre-construction, through construction to post-completion

PRE-CONSTRUCTION

A construction collaboration platform can help the client's team share key information at the initial conceptual and planning stages when the project brief may still be in development, and when there may be different options to satisfy the client's need (for example, refurbish or extend an existing facility rather than build a new one). The brief can be reviewed by end-users, including those – such as facilities managers – who will ultimately be responsible for operation and maintenance, and their post-construction information requirements can begin to be incorporated.

Feasibility studies, site surveys, ground investigations, utilities information, site access routes and other information can be collated to support the initial project team's deliberations, and early design concepts can be developed to form part of the tender information issued to prospective contractors. And once contractors and their supply chains are appointed, they can advise on potential buildability and logistics issues before construction starts, and develop detailed plans to mobilise on site.

In the meantime, engagement with planning and building control agencies can be simplified by giving them controlled access to the information they need to grant the necessary permissions. And local consultations might also be supported by communications (website, newsletters, etc) based on information on the platform.

CONSTRUCTION PHASE

Once construction starts, the collaboration platform will handle the constant exchange of information between all project team members, supporting common processes such as RFIs, change orders, instructions and notices. With information stored in one place, finding the latest versions of drawings and other documents is simplified; search and reporting tools allow any authorised user to view the current status of any aspect of the project.

If users haven't logged into the system recently, email alerts highlight matters that needs their attention, while the system's audit trail constantly records who does what and when. Site photographs (including webcam outputs) can be captured in the system to help non-site-based team members monitor progress or resolve particular issues.

Contract change management workflows can be tracked to give project managers and the client more accurate forecasts of schedules and budgets, adjusting for weather events and other unpredictable factors.

Drawings, documents and workflow information on the collaboration platform can also be accessed via mobile devices when the user is out on-site. Structured data can also be captured in the field – for example, during inspections for health and safety, construction quality control, or commissioning – with information about, say, a construction defect automatically routed back to the relevant work package contractor for resolution.

As-built information, inspection reports and compliance certificates can be progressively assimilated into a structured Health and Safety File to meet CDM requirements for post-completion operation and maintenance purposes.

POST-COMPLETION

From the project's inception, information about the asset can become an indivisible part of what is ultimately handed over to the owner-operator. While some of the detailed exchanges of information during design and construction may have little value for future operation and maintenance, the client will at least have a complete archive of the project, including an audit trail of all communications to review should there be any claims or disputes relating to the final outturn (project team members can also receive an archive recording their involvements with the scheme).

More importantly, the owner will have a detailed electronic record, including graphical and written information, about what has been handed over. Some of this data can be re-used for facilities management purposes, with the as-built information capable of being updated when any repairs, maintenance, refurbishment or extension works are undertaken. Such information might also be augmented by data (historic and real-time) from operational systems, providing a 'dashboard' view of the facility at work. Such feedback, combined with the brief that emerged, may be useful if the client then wants to deliver an even better project in the future.

A COLLABORATIVE CAVEAT

The achievement of these benefits throughout a project, however, remains dependent on adopting an open and collaborative approach:

- collaboration requires a combination of people, processes and technology/information;
- successful collaboration is 80% people and processes and 20% technology or information.[4]

In other words, successful collaboration is much more dependent on the culture of the team than it is on the technology it employs. Collaboration in the built environment is also different from collaboration in other fields:

- It involves individuals representing different professions with different goals, objectives, even beliefs. Architects, engineers, clients, property managers, and others who comprise a design team rarely share a common educational foundation, and often differ on what is important and what is not.
- In turn, those involved with regulatory work, with construction activities, with supplying materials and products used in the project, and with long-term responsibility for the asset's operation or maintenance will have different perspectives and motivations to those in the design team.
- A construction project involves temporary groupings of independent organisations who join forces to accomplish a specific, relatively short-term project. While they work together to achieve the common goals of the project, each organisation also has its own, long-term goals, which may conflict with the project goals.
- Collaboration in construction also tends to stretch out over a long time, often beyond the involvement of the initial participants, though their decisions and actions may still affect the project. Equally, some team

6 The exact numbers vary – some say it is more like 90:10, for instance – but the culture, people and process issues are always most critical.

members may only have a transient input during a project, but their involvement and the legacy of their actions can still leave a lasting impact.

So what is purported to be collaboration may not be collaboration at all, particularly if a project team is unable or is not prepared to collaborate. Team members may look to configure or customise their applications to mimic traditional project information controls and so electronically restrict access by some team members to certain types of information. Such teams might achieve one-off savings on tangible costs such as postage and printing, and but will miss out on the significant efficiency (time, cost and quality) improvements arising from adopting more integrated and genuinely collaborative approaches.