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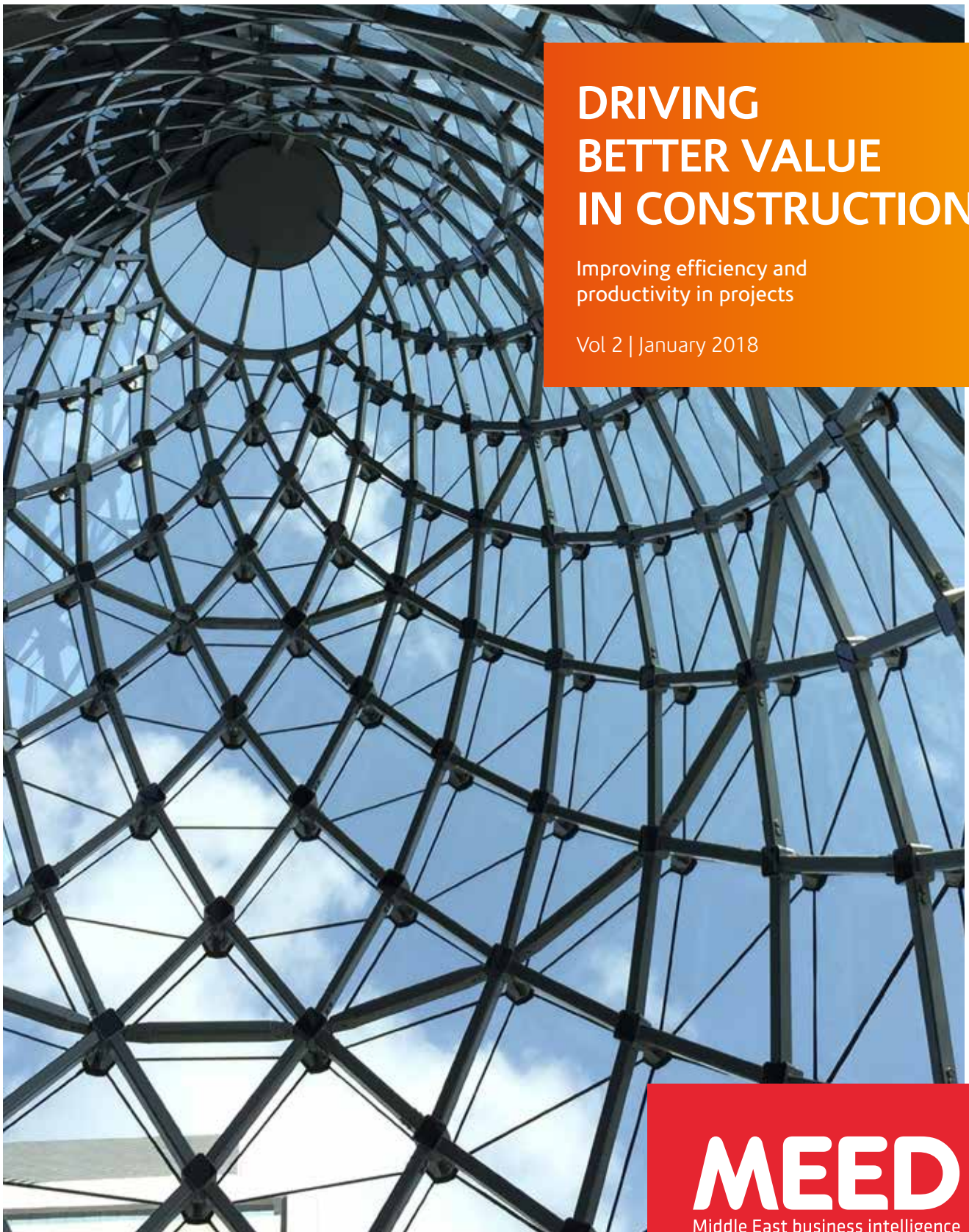

DRIVING BETTER VALUE IN CONSTRUCTION

Improving efficiency and productivity in projects

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DRIVING BETTER VALUE

Today's innovations will be tomorrow's construction norms

Investment today in world-class infrastructure and services is essential to the long-term, future success of the region. Not only do today's projects drive growth and create jobs, but they also lay the foundations for life and work that will drive prosperity.

That is why it is vital that the region's construction industry leads the world in terms of quality, safety and productivity. With more than $820bn-worth of major projects planned in the UAE alone, a lot will be gained, or lost, by the way today's projects are delivered. This makes the construction industry strategically vital to the future of the UAE.

In addition, governments are increasing their focus on the value and scrutiny of public sector spending. In order to balance their budgets, finance ministries are demanding that every dirham, riyal or dinar spent adds value to the economy. And nowhere is this more apparent than in the region's projects sector, where vast sums have been wasted by projects that have run late and cost more than they were ever expected to cost.

And yet, despite this strategically central role, surprisingly little has been done to try and improve an construction industry that often appears stuck in a self-destructive culture of cut-throat bidding, late payments, and adversarial contracting.

The culture, which starts with the industry clients, of getting projects built as quickly and cheaply as possible with no thought to the long-term sustainability of the project parties, undermines the sustainability of construction and projects in the UAE. It is therefore damaging to the long-term prospects of the country.

But there is an opportunity to change. The digital and technological disruption that is transforming every aspect of our lives, provides an opportunity to get rid of these damaging construction practices and to reform the way projects are delivered.

This report features the outcomes and findings of a wide-ranging consultation with construction industry stakeholders in the UAE, who have shared their insights on how things can and are being changed for the better.

Supported by the UAE's ambitious Vision 2021 strategy and its drive to innovate, project teams across the country are taking their first steps towards the digitalisation of construction planning and delivery. The adoption of virtual project 'twins' in the cloud are forcing project teams to share information and collaborate. They are connecting every aspect of a project through its full life cycle, from concept design through to end-use. Meanwhile, technologies such as virtual reality, drones, 3D printing and generative design are all providing opportunities to rethink construction.

Utilising these new technologies requires a greater focus on quality from project clients, who must recognise that investment is needed to bring best practice into UAE projects. While it may require higher levels of up-front capital investment, evidence shows that increasing capital expenditure to improve quality can massively reduce operation and maintenance costs throughout the life cycle of a project, and increase revenues generated from infrastructure.

We are just at the start of the process, and it requires a much greater push from all parts of the industry, but particularly from project owners and construction clients, for today's innovations to become tomorrow's norms.

EXECUTIVE SUMMARY

- Digital transformation drives closer collaboration between project parties enabling better planned and designed projects that can be built more efficiently with greater transparency
- Achieving this requires project owners to instigate a change in approach, deepening their relationships with the supply chain and engaging with their project teams more frequently to gain the benefits of their experience and drive productivity
- There is substantial scope for greater use of offsite manufacturing, prefabrication, modularisation and onsite assembly in the UAE to reduce construction time
- Conservative approaches to construction methods by authorities and regulators in the UAE hinder the adoption of prefabricated components such as large precast structural elements
- Use of drones for surveying work is reducing planning costs and more opportunities exist to exploit the technology for site monitoring and inspection, reducing labour costs
- Additive manufacturing and 3D printing can create efficiencies on site, replacing expensive formwork with 3D printed moulds that also enable prefabrication. Printing fit-out components and spare parts also offers cost efficiencies. Large-scale production of buildings using 3D printing is a long-term objective.
- Low-cost, lump-sum contracting with inappropriate risk allocation and slow payments is deterring cash-strapped contractors from collaborating with project owners and the downward pressure on prices prevents innovation from flourishing in the supply chain
- Design & build forms of contract can be more widely used to fast track construction projects and successful examples are emerging in the UAE
- Better contract administration on both sides and more timely decision making from project owners would reduce claims and improve efficiency on projects

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STATE OF THE MARKET

Significant steps are being taken to improve project delivery in the UAE but others must follow

The UAE has embarked on an ambitious journey to establish a diversified, knowledge-driven economy that will deliver sustainable growth for future generations without relying on oil exports. Central to achieving this vision is the need to install world-class infrastructure and facilities that will ensure that the UAE economy functions efficiently and is competitive.

At the end of 2017, the UAE had a pipeline of about $820bn of projects planned across all sectors. It is expected to award about $40bn of project contracts every year from 2018-21. But with increased pressure on liquidity as a result of lower oil prices and reduced government spending, investment in capital projects will be curtailed by cost overruns and delays.

As the region adjusts to lower levels of oil export revenues than in the past, government ministries and other project sponsors must rethink the way their projects are delivered to minimise wastage. And to achieve this, it is vital that they take steps to ensure that the region's projects market is being driven by an efficient and productive construction industry.

Improving productivity in the UAE construction market is a challenging proposition given that low margins and slow payment terms dominate projects and create a necessity for contractors to carry out work at rock bottom prices. If there is an area where contractors can save money, the chances are it has already been found.

Continuing to do things in the same way will not deliver the transformation the construction industry needs and bold steps are required to break with some of the bad practices that have become entrenched in the industry.

Digital transformation

The good news is that some elements of the required transformation are already underway.

The industry is witnessing the first stages of a digital transformation that is delivering step changes in productivity, and which promises to create opportunities for efficiency throughout the project chain, from concept design through to asset management information that can be employed on the next project.

From the outset, virtual reality and digital models can enable clients to better understand, and define, how they want their projects to look, feel, and function. Designers are using algorithms to simplify the engineering process and are developing cloud-based generative designs to develop more options in less time, ensuring clients receive the optimal solutions, which in turn can drive better contracts in the UAE.

Adoption of building information modelling (BIM) by clients means that virtual versions – 'virtual twins' - of projects can be built before the physical asset emerges, allowing contractors to detect clashes, obtain more crucial information more quickly, and better align their work with the design.

Meanwhile, offsite prefabrication is growing and modularisation through design for manufacture and assembly is taking off as the undeniable time and cost savings are recognised in projects around the region.

Management of projects through online, increasingly cloud-based, collaborative platforms is promising to increase transparency, accountability and reduce delays. What is more, data is being retained and reused enabling live benchmarking and giving clients virtual models of their assets that can revolutionise asset management.

For the UAE to harness the benefits promised by the digital revolution, significant challenges must be overcome. The country's top-level commitment to innovation is supporting significant investments in technologies such as 3D printing and drones, and gives the UAE construction industry an ideal platform from which it can seize the opportunity to improve.

But the industry cannot deliver the required transformation on its own. It is vital that it is supported by government agencies, whose approval and permitting processes frequently do not match the national vision and slow the adoption of innovative practices.

Supply chain reform

Additionally, construction industry supply chain relationships require an equally comprehensive overhaul if the full benefits of the transformation are to be realised.

Improved engagement and communication with the supply chain is vital if the construction project circle is to be closed and project owners are to benefit from the experience of the contractors and suppliers. Meanwhile project sponsors must reduce their focus on driving prices down to the cheapest option and forcing contractors to take disproportionate risk as this leaves no room for investment

in innovation.

These opportunities for improvement are being taken by some of the UAE's more enlightened construction clients, including many of those working on the delivery of Expo 2020, who are raising the quality requirements and using global best practice in procurement.

But, as with the new approach to data sharing that is enabling digital transformation, new approaches to supply chain management need to be cascaded through the industry before the country's projects market can make the most of the opportunities currently being trail blazed by the industry's pioneers.

UAE CONSTRUCTION INDUSTRY

UAE construction has many opportunities to improve project delivery

STRENGTHS

- Mature supply chains with strong local capacity and capability
- Multi-disciplinary contractors applying learnings from other markets such as oil and gas
- High level commitment to new technologies and digitalisation
- New contract arrangements being successfully implemented and delivered
- Mature clients forming long term relationships with trusted contractors who are involved in projects at an early stage
- Leading clients mandating digital modelling and information sharing between project parties

WEAKNESSES

- Lack of trust between project owners and contractors
- The "construct only" contract market places disproportionate focus on price over quality in construction projects
- Too many contract clauses and specifications cut and pasted
- Client requirements or engineering design not clear or changed post award
- Contractors bid too low to deliver work on budget seeking to claim for variations
- Inappropriate risk allocation, bonds too high and client payments too slow

OPPORTUNITIES

- Collaborative project models using BIM are leading to time and cost savings on projects
- Government support for smarter technology driving innovation at strategic level
- Potential for Dubai to become a leading global centre for 3D printing
- Wider use of prefabrication and design for manufacture and assembly (DfMA) could accelerate construction
- Pursuing quality ahead of lower capital costs can lead to greater long-term benefits and savings through more efficient maintenance and operations.

THREATS

- Unwillingness from clients to accept that contractors must generate profits if they are to invest in new technologies and deliver the aspirations of government
- Lack of empowerment of client's engineers to manage issues on projects as they arise
- Disengagement of client which maintains control of project but tries to pass on all risk
- Inadequate contract administration leads to more claims of poor quality
- Conservative regulatory approach to new technologies and construction methods

TRANSFORMING DELIVERY

Digitalisation of construction projects will improve productivity through the project cycle

It is day one of a typical construction project in the UAE. The main contractor has won the work on its low price and the tender documents are shared as documents and drawings. The project manager arrives at his desk to find 17 requests for information (RFIs) relating to the engineering of the project. Each request has the potential to become a claim, or to lead to a contract variation, and hundreds more RFIs are likely to follow as the project evolves. The project manager must get answers from the designer or client as quickly as possible or the project risks falling behind schedule before it has even started.

The scene is one that is common on Day One of projects around the world and illustrates how the seeds of many of the problems facing the construction industry are embedded from the very outset of a project.

But it does not have to be this way. Across the UAE, leading construction clients are seeking to remove many of these issues by introducing new, digital processes as a requirement of their schemes.

Dubai's Roads & Transport Authority (RTA) for example is the first non-UK body to receive British Standards certification for BIM level 2 meaning that all parties on its projects use 3D digital modelling.

Airport project

While Abu Dhabi Airports Company (ADAC) is currently using what is thought to be the world's largest BIM model on its $2.9bn Midfield Terminal complex, the model is being used to its fullest capabilities by design and build joint venture of Athens-based CCC, Turkey's TAV and the UAE's Arabtec. It includes not just 3D construction information but moves into 4D incorporating time. What is more the project uses Bentley's cloud based ProjectWise management software to create a collaborative management and information platform. Other cloud-based project management solutions include Oracle's Contract Management Cloud Solution, Aconnex, Procore, Artemis and CMiC.

For projects using BIM and collaborative management platforms, the contractors seeking additional information can first turn to the shared information held in the digital environment. If the data is not there, the RFI can be raised digitally through the shared, cloud-based project information platform and elevated to the party required to answer the question. On ADAC's Midfield Terminal, this process alone reduced the time taken to respond to RFIs from 28 days to between 2 and 7 days.

Other benefits of using BIM include prevention of clashes between the façade and other disciplines saving over $1m, and huge time and cost savings in reduced manpower for drawing development and quantity surveying.

Tipping point

Key to the success of 3D models and cloud-based project management and control systems is the quality of information input into the system and that it is shared among the key parties, which requires collaboration.

Using BIM requires architects and designers to have a better understanding of how designs will be built and details of the objects that are specified in the model.

For contractors, this should create a more detailed 3D blueprint of the required work reducing the potential for variations and clashes of services on site. But achieving this increased transparency means earlier supplier involvement and a fundamental change in the historically top down, silo-based structure of construction projects. Project owners in the UAE must lead on this if they are to reap the benefits of new technology.

Looking ahead these 3D models are becoming 4D by bringing time enabling the sequencing of construction activities, forecasting schedules and logistics studies, and even 5D by bringing in cost. Contractors are now looking at using the models to drive construction and installation work packages, all linked to the same information.

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For project owners such as ADAC, the next major efficiency gain lies in taking this information and using it to enable better understanding of the asset once in operation. Software such as Bentley's AssetWise can be used to migrate information from the 3D model creating a virtual representation of the physical asset, known as a digital twin, which ultimately supports digital management of assets that communicate through the Internet of Things.

Many of the concepts of digital asset management have become established in the process and manufacturing sectors, but only once the construction of a facility has been completed and handed over. By bringing the construction process in to the digital process, clients will benefit from genuine whole-life synergies on a project.

DIGITAL DISRUPTION

Generative design, drones and virtual reality are the next generation of disruptive technologies

While the UAE already is able to showcase some of the world's leading digital projects such as Dubai's Museum of the Future, Abu Dhabi's Louvre Museum, and of course ADAC's Midfield Terminal complex, the reality is that the country is still only at the beginning of the adoption curve. And there are plenty of examples of how digital adoption can be done better.

Different designers for example have developed different BIM models for the same projects and not been required to share them, limiting the potential benefit. This is changing however as clients have made the models part of the deliverables for a project and information sharing becomes more sophisticated and consistent.

Collaborative modelling

Collaborative models using BIM are relatively new to construction but software modelling in design is not. Architects and engineers for decades have used programmes to design infrastructure and these too are becoming more sophisticated. Taking this further, consultants are investing in centralised digital design warehouses that can use algorithms to automate design sequences.

For the UAE, where most consultancy agreements are cost reimbursable based on day rates, this is an exciting development in terms of reducing costs. Another advantage is that this automation enables the creation of more design options in less time, ensuring that project owners get the optimal solution.

Generative design

Taking this to the next level is the concept of generative design, where parameters are inserted into an algorithm-driven programme that uses cloud computing to envisage all possible permutations of a design solution and learns from each iteration.

The UK's Mott MacDonald for example has done this to design structural elements and Autodesk used it to create its own offices in Canada.

In the future, artificial intelligence could be used to define design parameters further automating the process.

Virtual reality

For architects, virtual reality is the next disruptive technology. This, they say, could help construction be more efficient by ensuring that clients fully understand what their building, facility or project will look and feel like once constructed.

In the same way that 3D models allowed better visualisation, virtual reality models viewed through optical headsets are enabling owners to experience their buildings before construction.

Walking through virtual structures will allow changes in design to be made before construction begins, a step that could reduce claims or variations during execution.

Drones

Another technology that is boosting productivity in the early stages of projects is the use of drones to carry out surveying work.

Local UAE drone company Falcon Eye Drones says demand for the technology has boomed over the past two years with it alone reporting 600 per cent growth over the past 12 months.

Land surveying of construction sites where drones collect millions of geo-referenced aerial images to create 3D maps, can be undertaken in days rather than traditional land surveys that took weeks.

As the technology takes off, the licensing and registration process is too. All pilots and drones must be registered under a commercial company with the UAE General Civil Aviation Authority (GCAA) and the Dubai Civil Aviation Authority if operating in Dubai. They must then apply for a permit to the GCAA, DCAA and Ministry of Defence each time they fly a mission, which could be a day of surveying or months of monitoring. The maximum permit life is six months.

Some contractors say that the complex permitting process is deterring them from using the technology, which has wider applications than surveying. Monitoring and inspection can also be carried out cost effectively using drones and in the US insurance firms are one of the biggest users of drone monitoring and inspection services.

NEW DIMENSION

New construction methods from modularisation to 3D printing offer time and cost savings

UAE Vice-President and Prime Minister and Ruler of Dubai Sheikh Mohammed bin Rashid al-Maktoum in 2016 announced ambitious plans for Dubai to become a global hub for 3D printing and additive manufacturing, decreeing that 25 per cent of buildings in the emirate would be 3D printed by 2030, starting from 2 per cent in 2019.

Since this April 2016 announcement, action has been swift. One month later, Dubai Future Foundation delivered the 3D printed Office of the Future, manufactured in China then imported and assembled in Dubai. In July 2017, Dubai Electricity & Water Authority (Dewa) took the plan one step further by locally printing a new laboratory, which itself will be used for studying 3D printing and the use of drones.

These developments have acted as catalysts for investment in 3D printing, drawing start-ups and global pioneers to Dubai. Those developing the technology report that lessons from these early adopter projects are invaluable.

Fit-out

But mass printing of commercial-scale buildings remains a long way off as innovators grapple with fundamental challenges, such as the performance of concrete, which must be altered to ensure more viscosity so that it can hold its shape while printing, as well as the finer aggregate used in the mix. Similarly, the requirement to print metal and concrete together to provide the tensile reinforcement that concrete buildings need is also extremely technically challenging.

As a result, the real and more immediate gains for the construction industry are not perhaps where everyone expects them to be.

Forward-thinking contractors are exploring the use of the technology to create complex moulds that can be used in prefabrication of structural elements such as curved walls which would create major savings in replacing traditional formwork.

The development of interior fit-out components is another area of focus along with using 3D printing for the creation of spare parts and tools to support construction sites, solving the problem of having to wait for days or weeks for components to arrive.

Factory focus

More extensive use of design for manufacture and assembly (DfMA), prefabrication and modular construction could also improve performance. Leading-edge clients are realising major time savings on site thanks to innovations from its supply chain.

One contractor in Dubai maximised prefabrication on the 304-room hotel with 40 per cent of mechanical, electrical and plumbing (MEP) units fabricated offsite and over 300 prefabricated bathroom pods factory built and lifted in, shaving months off the construction schedule and contributing to the sustainability requirements of the project.

Precast concrete manufacturers report full order books as contractors accelerate progress using offsite fabrication of walls and other components, but find that continuous downward pressure on price is seeing clients seeking precast products at in-situ prices.

However, a hurdle that will have to be overcome if new methods and technologies are to grow is wider acceptance of different approaches from regulatory bodies who take a traditional and conservative approach to licensing and approvals.

MODEL CONTRACTS

Reducing disputes and using alternatives to lump-sum contracts could drive efficiency

The FIDIC Red Book is by far the most common set of contract documents used in the UAE construction market, and not always the latest 1999 version. The 1987 version remains in common use. These come with pages of amendments containing clauses cut and pasted from other project contracts where risks are allocated to suit the employer. This creates a bespoke version of an old agreement with clauses that are not always enforceable due to inconsistency.

Law firms are rarely used in the process of creating these new contracts instead they are brought in to deal with disputes, which in some cases might be avoided had a better arrangement been created in the beginning. For all parties, the cost of advice in planning stages is a small fraction of that required to deal with a two-year dispute.

Disputes arise for many reasons but lawyers note that projects continually make the same mistakes. Project parties do not always adequately understand the contracts that they have agreed to, and both sides fail to administer them properly.

To reduce the number of disputes and save the money and time required to deal with them, these areas should be addressed and there needs to be more recognition from project owners that claims are a natural part of a project and that dealing with variations quickly reduces delays, which can have a domino effect becoming a dispute if ignored. Client's engineers should also be empowered to make decisions on variations.

Despite the use of dated contract forms, parties from across the spectrum say that this is not the problem that holds back productivity and efficiency; it is the relationships between project owners, consultants and contractors which, remain confrontational and price driven.

From the outset, the odds are stacked against contractors who must pay enormous project bonds of up to 20 per cent, clamour for every dirham earned, and then wait months for payment. In this environment, there is little incentive to produce high-quality, innovative, efficient work.

Alternative approach

But as other industries have demonstrated, there are other ways to save time and money. For mature clients with clear sets of requirements, the use of design and build is shaving months from contract schedules as it gives the contractor design risk and responsibility along with the freedom to build the project in the most efficient way.

The contract forms that enable this are well understood with the FIDIC Yellow Book common and the FIDIC Silver Book, usually used for EPC in the energy sector gaining popularity.

One leading contractor employed on a design & build contract to deliver a major stadium project in Abu Dhabi says that the contract arrangement motivated the contractor to make extensive proposals for value engineering that were accepted by the client and kept the project on its fast track.

Value engineering itself, where contractors review the scheme seeking lower cost methods or materials that maintain functionality, is a useful step that projects could benefit from, but often clients seek to employ this on traditional contracts with no sharing of the benefits gained. The risk apportionment on design and build however means contractors have an incentive to value engineer.

In Dubai, a large-scale hotel project being delivered by a main contractor on a design & build contract was recently delivered 12 months faster than would have been achieved using a traditional approach. DfMA was also used here with over 5,000 items built in a factory and assembled on site.

Bringing in contractors during the design phase to give their input into buildability is another trend that is expected to improve the efficiency of construction projects.

Partly driven by the need to have better information in design models, and partly by enlightened clients who are seeking to create better project requirements, these pre-construction service agreements (PCSAs) are deriving benefits for project owners.

RELATIONSHIP BUILDING

Improving supply chain relationships could improve collaboration and boost productivity

When it comes to supply chain management, Dubai's Expo 2020 project team has been paying attention to global best practice.

Not only has it engaged leading contractors in PCSA agreements to strengthen its requirements for major contracts, but it has been extensively engaging with the supply chain ensuring that its needs are well understood and its partners are aligned with the ultimate vision.

This is a crucial step for the UAE, where supply chains themselves are already highly integrated. Contractors are often part of multi-disciplinary holding groups that are adept at delivering multiple aspects of projects simultaneously, at low cost, and can give the buildability advice that consultants and designers often lack.

But to gain their insight clients must engage more actively with the industry. Parties across the sector lament a lack of pre-project working groups, supplier conferences and general engagement. The average supplier works with many clients but the top down nature of the industry means that they are often not given the opportunity to share the lessons learned.

The Chartered Institute of Procurement & Supply (CIPS) is going through the process of awarding corporate certification for Expo 2020 which would confirm its procurement and supply chain processes were in line with global best practice and align it with other leading clients in the region such as Emirates Nuclear Energy Corporation (ENEC).

CIPS points out that successful supplier relationships can generate massive savings. Apple for example maintains a relatively lean 3.5 per cent research and development budget, which is around 10 per cent lower than its competitors because it works with strategic suppliers on long-term contracts who create products Apple then buys.

Developing more long-term frameworks with suppliers could benefit project owners with large programmes of work in the UAE.

Payment challenge

One of the most important steps for clients in the region who want more productive project teams is to pay their supply chains on time.

As one tier one contractor says "everyone wants to work for the client who pays." Payment terms in construction are out of sync with other industries, which typically use 30-day payment terms and it comes as no surprise that rates of innovation are considerably higher in other sectors.

Contractors and suppliers in construction can wait 120 days for payment, and combined with the large retentions sought, cash flow is a serious issue throughout the project supply chain.

Even in the current competitive market suppliers are examining their relationships with contractors above them in the chain, reducing their payment terms, some as low as 7 days, and rejecting the back-to-back clauses that feature in many contracts in the UAE.

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Established in 1957, MEED has been delivering business information news, intelligence and analysis on the Middle East economies and activities ever since.

MEED is a senior management media brand that encompasses a subscription website and magazine, C-level executive conferences hosted by MEED Events, awards programmes and the high-value projects tracking database MEED Projects.

ABOUT MASHREQ

Established in 1967, Mashreq is the oldest bank in the UAE, with award-winning financial solutions and services. Throughout its 50 years' history, Mashreq has differentiated itself through innovative financial solutions, making it possible for its customers to achieve their aspirations.

Today, Mashreq has a significant presence in 11 countries outside the UAE, with 21 overseas branches and offices across Europe, the US, Asia and Africa.

Mashreq launched its new Vision and Mission recently, outlining its commitment towards its clients, colleagues and the community. In line with its vision to be the region's most progressive bank, Mashreq leverages its leadership position in the banking industry to enable innovative possibilities and solutions for its customers across corporate, retail, international, treasury and Islamic banking.

Mashreq is proud to be the first financial institution in the UAE to be awarded the Gallup Great Workplace Award for four consecutive years from 2014-17. Mashreq also continues to invest in recruiting, training and developing future generations of UAE national bankers.

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