

SMART VISIONS

The digital transformation of the government sector in the Middle East

FEBRUARY 2022





Government-mandated policies that establish common standards and processes, facilitate better results from public and private spending on large capital projects

FOREWORD

DIGITAL OPPORTUNITY

Building information modelling is transforming project delivery

he adoption of digital technology to develop smarter cities and more competitive economies is a key outcome of the national visions outlined by most countries in the Middle East.

In a poll of 50 GCC construction professionals conducted by MEED in 2021, survey respondents reported that the UAE is leading the way in the region's construction industry technology transformation. Other countries in the region are not far behind and their national agendas are set to be major drivers of digitalisation in the region.

While there is widespread acceptance of the value of digital technology across the construction industry, its deployment has been uneven. This is where the systematic roll out of digital technologies can act as a catalyst for fulfilling the digitalisation agendas in the industry.

Building information modelling (BIM) has led this transformation as stakeholders divert their focus towards the utilisation of resources to improve productivity, profitability and project quality. BIM is an aggregation of technologies and processes that can help in increasing delivery and operational efficiency, reducing cost and time of delivery, improving collaboration across the supply chain and thereby, enhancing the quality of outcome.

For this reason, it has been used in several private and public projects, such as Expo 2020, Neom future-city, Dubai Museum of the Future, and the Red Sea Project, but not necessarily due to an existing mandate.

A national mandate defines a tangible, long-term target for the country and steers public policy and institutions to work it. Government-mandated policies that establish common standards and processes, facilitate better results from public and private spending on large capital projects.

Governments around the world have recognised the urgency of developing smart initiatives that can boost economic growth, but their role does not end here. It extends to providing guidance and direction in defining a clear roadmap that can lead to planned outcomes.

One major step in this direction is the creation of a national guide by the UAE Ministry of Energy and Infrastructure. The National Guide for Smart Construction calls for the adoption of innovative technologies in construction projects and aims to provide support for investment decisions to achieve measurable business objectives.

DIGITAL STRATEGY

BIM and digital twins to drive rapid digitalisation

echnology plays a significant role in increasing collaboration and creating transparency within the industry. Over the past three years, the region's construction industry has opened up to the potential of digital technology to improve the way projects are planned and delivered, and data is increasingly being used to inform future developments.

The region is rapidly embracing these advances and driving digitalisation in response to the push from clients and governments.

Building information modelling (BIM) has grown tremendously in the infrastructure industry.

The three-dimensional (3D) digital representation of a project, that BIM creates, enables real-time access and feedback by multiple stakeholders. This technology has gained acceptance due to its potential to render savings in project delivery time, materials and costs.

The modelling and visualisation connections from BIM demonstrate why the team designed what they did and how they will execute it. Essentially, BIM helps in turning concepts into reality.

But the digitalisation journey does not end with project delivery. Data collected from the integrated workflows and information sharing on BIM models can be layered with real-time operational data to create a 'digital twin'.

"BIM and the digital twin are generally confused as being the same. However, they are different concepts that operate on varied work models," says Anas Bataw, director, Centre of Excellence in Smart Construction (CESC), Herriot Watt University, Dubai.

ENABLING REAL-TIME DATA

Digital twins work in real-time and are the most significant part of a building's technology stack – as they provide a comprehensive picture of the built environment. In comparison, although a key data collector for digital twins, BIM cannot resolve the operational questions facility managers may have about optimising operations.

"A digital twin is more focused upon assets performance than a traditional BIM model. It provides current information on a building's performance, its subsystems and how it is being affected by occupant behaviour.

"Digital twins can fill data gaps and make predictions on unanticipated scenarios while continuously optimising the operational performance," Bataw explains.

WORKING SMARTER



Naseebah Al Marzooqi Ministry of Energy & Infrastructure (MOEI), UAE



HE Dawood Al-Hajri Dubai Municipality, UAE



The supply chain models in the sector need to become a lot more adaptive and resilient. We are now in the early stages of a positive recovery from the setback brought on by the pandemic. Lessons learned need to be analysed and action must be taken to improve the acquisition and movement of material and the management of labour. It is time for companies within the construction sector to adopt collaborative approaches to ensure continued success. *Engr Al Marzoogi is the director of studies, research & development, MOEI, UAE*

Positive outlook for smart construction technology

Dubai is seeking to promote the widespread use of digital systems and modern technologies such as BIM in the local industry in line with rising global trends. Digital transformation has been proven to bring multiple benefits across the life cycle of structures by reducing costs, shortening implementation time, increasing the efficiency of construction, and operating processes, enabling multiple smart services and increasing opportunities for using 3D design technology. *Engr Al-Hajri is the director-general, Dubai Municipality, UAE*



David Glennon The Red Sea Development Company (TRSDC)

A compelling reason for change

The appetite for digital techniques in the delivery of gigaprojects is high. BIM has been very successfully embedded at TRSDC. We have seen a shift to a 'model first' working practice which has allowed us to automate a number of tasks, driving efficiency and data to improve decision making. We are increasingly seeing this approach being adopted on other projects. The time, cost, quality and sustainability improvements offered through digital ways of working at scale becomes a very compelling reason for change. David Glennon is the senior digital delivery director, TRSDC

LEADING BY EXAMPLE

BIM processes for infrastructure projects in the UAE

he building and construction sector is important from an economic, social and environmental perspective. In fact, very few industries compare with the construction industry when it comes to solving challenging problems.

The construction industry is defined by its ability to deliver complex, bespoke structures, in unique locations, against impossibly tight time and cost deadlines.

Over the last few years, the construction industry in the GCC has undergone a paradigm shift as it doubled down on its efforts to reduce operational expenditures and optimise workflows by adopting new technology and practices.

With strong backing from their governments, Middle Eastern countries are among early adopters of cutting edge technologies.

The region is home to several iconic projects where design and construction professionals have used emerging technology to meet complex project demands.

Government-led mandates and regulations play a critical role in addressing the challenges of adopting new practices and in supporting the sector's ability to deliver. This is evident from the actions of several public entities in the region that have issued BIM mandates for infrastructure projects as digital construction gains wider adoption.

ENFORCING MANDATES

BIM was first introduced as a requirement in Dubai in 2013 by the Dubai Municipality, thus becoming the first public authority in the Middle East to mandate the implementation of building information modelling (BIM) across all construction projects in the emirate.

The initial mandate, which provided for the application of BIM for the architectural and MEP work, was updated in 2015 to specify the use of BIM in relation to the architectural and mechanical works.

In early 2020, Ajman Municipality announced its plans to make BIM software mandatory for projects across the emirate of Ajman.

With this move, Ajman Municipality became the second public entity in the Middle East to mandate the use of BIM for projects, after Dubai.

The Abu Dhabi Municipality (ADM) has also issued BIM guidelines for all infrastructure projects as laid out in a document titled 'Code of Practice'.

BIM MANDATES



Dubai's building information modelling (BIM) roadmap for building construction. Source: Government of Dubai

These are big steps in the right direction and if others are to follow suit, project delivery will be revolutionised.

A CODE OF PRACTICE

Abu Dhabi Municipality's BIM mandate, which form part of the prerequisites for design or construction permits for infrastructure projects submissions and confirm the requirements for the asbuilt submission for handover to asset management. It further states that the municipal infrastructure and asset sector BIM guidelines are to be considered when developing a project's employer's information requirements (EIR) as a reference for any BIM deliverable.

The mandate notes that EIR should align with the BIM specification, and in the document hierarchy, BIM specification will supersede the EIR. The purpose of using BIM processes for infrastructure projects is to accomplish strategic objectives, goals and uses.

For each project, a BIM model of all assets including existing site conditions, buildings, and infrastructure has to be developed. This model is created using topographic survey, 3D laser scanning, reality capture, aerial mapping, and other surveying techniques. BIM tools have to be used to evaluate existing properties and to determine the most optimal design for a future project.

The document also specifies that roads, bridges, airfields, tunnels, transportation, and underground utilities must be developed as separate models. These models should be coordinated with the most up-to-date existing site survey data and underground utilities to have all the existing condition information in a single 3D model. *Source: www.dmt.gov.ae/en/adm/media-centre/e-library*

IMPROVING DELIVERY

BIM-GIS integration can help build a more resilient infrastructure



IM is a tool that owners can use long after a project is completed. Advanced BIM modelling has progressed beyond static 3D building renderings to include elements of construction scheduling, cost, operations, and sustainability.

These added dimensions use the 3D model as the base, relying on its accuracy and completeness to provide digital information such as predictive analytics and simulations for all project phases. BIM is also demonstrating its value in the operations stage of the project lifecycle. This is important across projects such as airports, roads or highways and water systems.

Embedded intelligence combined with performance analytics is only possible with a BIM workflow, and owners and operators are using BIM to better understand impacts to performance and operations.

To improve urban planning and management, project owners need a deeper understanding of BIM design

IMPLEMENTATION

processes and GIS technologies, and how to integrate them to find new approaches to planning, design, and asset management.

Insights into the geographic information and infrastructure design data of an asset's environment can help solve macro-economic challenges and build a more sustainable and resilient infrastructure.

SPATIAL DATA INTEGRATION

The disconnect between BIM and GIS teams can lead to inefficiencies, critical data loss and increased risk.

In this new approach, GIS informs BIM and BIM in turn fuels GIS.

It is important to bring different types of information together, including geospatial data, to create an information model that forms the basis for planning, analysis and simulation, sustainability and visualisation.



By providing a real-world context of an asset's existing environment



With accurate models to improve the overall operations and maintenance of assets

BENEFITS OF GIS-BIM INTEGRATION

Transforming the



project lifecycle

Building site context



with the environment

Sensing site

change



Designing and visualising the real world in 3D



Optimising infrastructure operation intelligence



Open and extensible systems

The integration of GIS data with BIM optimises the performance of assets within systems, which feeds back into the planning of new and more sustainable projects. It can result in workflows that move data seamlessly from one system to another.

Such a streamlined flow of information between operational and construction life cycle data will allow project owners to plan, fund and maintain community infrastructure assets more accurately.



ITALY Genoa Project

Redeveloping

Genoa city by

creating a digital model at the

ground level and by mapping the underground services

BRAZIL

Sewage Network Replacing a 100-year-old sewage network in Rio de Janeiro using BIM



INNOVATIVE INFRASTRUCTURE

Global examples of BIM adoption in government-led infrastructure projects



FRANCE

City of Strasbourg

- Leveraged 3D modeling for the redevelopment of 33 municipalities
- Automation scripts for 3D model generation reduced process time by 75 per cent
- Created a detailed 'existing conditions database' by converting 2D data into 3D visualised data that facilitated comprehensive analysis



ONORWAY

Norwegian Railway

- Enabled new workflows with BIM-GIS integration to deliver complex projects more quickly, with better communication, and with reduced risk
- Saved 20 per cent time with connected BIM process in the planning and approval phases of the project
- Communicated design intent and issues with over 120 stakeholders to drive design approvals
- Fast-tracked the highspeed rail extension project by utilising GIS





SAUDI ARABIA

Riyadh Metro

- Used building information modelling processes and a common BIM software platform for project design and delivery
- 3D modelling was done for the coordination of the piping running through tunnels between stations and the underground metro tunnels
- Intelligent design models helped in saving the time, expense, and potential errors associated with manual data re-entry



QUAE

Expo 2020 Dubai

- The BIM strategy for Expo 2020 focuses on the delivery of intelligent 3D models throughout the project life cycle
- Used BIM data to perform computational fluid dynamics, simulations, and solar and energy modeling analysis
- Integrated BIM models with cloud-connected software to analyse pedestrian behaviour, crowd flows, bottleneck identification, and scenario testing



Nagpur Metro Rail

- A platform with BIM management along with an integration software was best suited for the project's requirement
- Achieved 5D BIM integration and provided integrated view of project by linking 3D model, schedule, cost
- Created single platform for 3D model, scheduling (4D) and cost (5D) with timely rectification of flaws in construction sequencing through simulation



Punggol Digital District

- The Punggol Digital District is Singapore's first district to adopt an open digital infrastructure
- BIM visualised against surrounding geospatial data helped gauge the design impact on the existing environment and landscape
- Aerial scans were geo-referenced on a GIS platform to ensure that the construction was aligned with the planned design
- BIM data was integrated on a GIS platform to track assets inside

SMART DECISIONS

The industry must collaborate to help reduce risks and costs



echnology is constantly evolving to accommodate the specific demands of the evolving business landscape. The adoption of technology during the design and construction stages has revolutionised project delivery in this sector.

Such advances have improved connectivity between man and machine through automation and the use of smart machinery to boost efficiency, productivity and sustainability.

"Some of the technologies impacting the construction industry include big data, artificial intelligence and machine learning, the internet of things, robotics and drones, BIM, augmented and virtual reality, cloud, and blockchain," says Naseebah Al Marzooqi, director at Ministry of Energy & Infrastructure (MOEI), UAE. "However, the most significant trends in the construction industry that will continue to impact the industry are the emerging levels of BIM."

DIGITAL SUCCESS

MOEI has launched the National Guide on Smart Construction to help industry stakeholders to visualise new opportunities and identify applications that can be explored.

The Ministry has implemented BIM in its projects and received the ISO 19650 for BIM Level 2 compliance. "We have already seen the benefits of BIM in clearing up design conflicts



with real-time visibility of changes and updates. Now we shall progressively upgrade as BIM is advancing with the overlaying of costs and time in 5D BIM and with 6D BIM to resolve energy issues in the early stages of project development," she adds.

Efficient, safe, smart and sustainable outcomes in construction projects are possible. For example, we see the development of the digital twin, and its associated big data sources as crucial to the long-term development of the construction sector, Al Marzooqi notes.

Technology is allowing designers to better design with the end result in mind. Design for manufacturing and assembly (DfMA) enables construction teams to move work off-site, which reduces time, errors and cost.

"We see the advances in off-site pre-construction with DfMA technologies, a design approach that helps in reducing time-to-market and total production costs," says Al Marzooqi.

Technologies such as robotics and 3D printing are emerging out of the research and development phases to become market-ready, and will have a very positive impact on project delivery timing.

Al Marzooqi highlights that since the construction industry in the UAE is undergoing a transformation, a culture of collaboration and information sharing will be the key to success.

"We have access to organisations such as the Centre of Excellence in Smart Construction and numerous universities and academic minds in the UAE. The industry should leverage these institutions to channel collaborative ideas and industry benefiting solutions," she adds.

Al Marzooqi admits to a level of financial risk with any new technology. She insists that the industry needs to move collectively rather than as individual companies, which will help lower risks and implementation costs.

"As new technologies emerge and are found to be viable and effective on the global stage, this guide will be updated to provide the UAE construction sector with a place to find out where and how they can improve or solve new challenges," explains MOEI director AI Marzoogi.



Naseebah Al Marzooqi, director at Ministry of Energy & Infrastructure, UAE

SMART CONSTRUCTION IN THE UAE

UAE National Guide by the Ministry of Energy and Infrastructure in the UAE

- 1. Smart buildings to employ modern and innovative technologies, and smart industries in describing the materials, specifications and design guides for construction
- 2. Includes benchmarking for qualifying contractors' capabilities
- 3. Calls for more cooperation between architects, designers and contractors to improve the overall results of the construction project
- 4. Focuses on reducing cost, time and unskilled labour to complete projects on time

LEADING THE CHARGE

igital processes can help during every phase of the project lifecycle. Through digitalisation and data management, industry stakeholders can gain visibility into design and construction processes, support investment decisions through insight into asset performance, meet sustainability and resiliency goals, and reduce operations and maintenance costs to stay within constrained budgets.

To facilitate the digital transformation, companies must change the way their

business operates. The Middle East region is already spearheading innovative initiatives and delivering world class projects.

Whilst there have been success cases of mandating BIM in infrastructure projects, true change and adoption can only be realised when governments in the region offer clear mandates for such projects. These mandates can then form a foundation for city-wide data collection and help realise smart cities of the future.

GOVERNMENT ACTION

- Mandate use of digital data tools such as BIM to create common data platforms and share information with various parties, across phases. Establish a national programme of training workshops.
- Establish an industry initiative to capture real time project data to provide an understanding of the contributing factors to overruns.
- Build a national construction industry project archive that acts as a 'memory bank' of project details, behaviours and lessons learnt.
- Regulatory requirement of early contractor involvement on public projects.
- Establish an industry body with projects sponsors, government entities, contractors, consultants, subcontractors and suppliers to help promote collaborative practices, transparency and innovation in construction.
- Introduce a system of accreditation for contractors and suppliers.
- Introduce regulations with transparency of financial information and costs.
- Introduce BIM compliance requirements in new contracts to enable seamless information sharing.
- Encourage alternative designs and innovation by contractors

ABOUT AUTODESK

From the greenest buildings to the cleanest cars, the smartest factories to the biggest stories, amazing things are created every day with Autodesk. Over four decades we've worked together with our customers to transform how things are made.

Today our solutions span countless industries, empowering innovators everywhere to combine technologies in new ways, unleash talent, and unlock insights to make the new possible.

Visit www.autodesk.ae to learn more

ABOUT MEED

MEED has been integral to delivering business information, news, intelligence and analysis on the Middle East economies and activities for over 60 years. Attracting a key senior management audience through its content and activities, MEED is a media brand, publication and data business that covers a spectrum of services which inform, engage, connect and ultimately support our subscribers and partners in their business development and strategic growth.

Recently acquired by GlobalData Plc, MEED is now part of one of the largest data and insights solution providers in the world with the capacity to build global communities for our clients.

Our purpose is to support the region's companies to make better and more timely decisions through our innovative data solutions and grow through our comprehensive and world-class marketing solutions.

To find out more email: info@meed.com

