Insight

making the **difference**

How well do you know your asset?

By George Mokhtar, Turner & Townsend

When planning and designing a new asset, how confident are you that it will still be useable in 20 or even 50 years' time? Having a steady flow of consistent, rich and accurate data can help you deal with uncertainty and understand your customers better.

Today, 54 percent of the world's population lives in urban areas, and this is predicted to jump to 66 percent by 2050. Cities will become more densely populated and technology will radically change the way we live and work. The need to create an adaptable asset becomes even more pressing when you factor in the likelihood of extreme weather events and rising temperatures.

Designing a structure that is highly adaptable is one way of hedging against the vast unknown. This option may suit some assets, but it may not be necessary for all scenarios.

Start with data

An alternative and potentially less costly approach is to focus on gathering relevant data and engaging with stakeholders as early as possible. The guiding principle is to track every element, every hidden corner of your asset and how the occupants behave within it. Detailed, consistent data leads to greater knowledge, the bedrock on which confident decisions can be made in later decades. Much of this knowledge can be embedded in one shared digital model, created and developed by the builders and designers of the asset, and then handed over to the client once the project is completed. At its simplest, building information modelling (BIM) creates a defined 3D digital design that exactly mirrors the physical asset. More sophisticated models also contain hosted and relational information on every object within the structure. They are an archive for everything from materials to appliance installation instructions and maintenance logs.

The most obvious benefit of digital models is that they aid efficient operation through the life cycle of an asset: employees are able to locate hidden pipes and power networks, know whether ceiling fans are under warranty and even understand how to dismantle sections at the decommissioning stage. A well-populated model can also be a powerful tool for forecasting operational costs:

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predicting spending peaks and troughs in planned maintenance and replacement schedules. Knowing every element of your building or asset, and how it was constructed, could shave months off remediation work or retrofitting in future years. Imagine that an adhesive commonly used in building materials is suddenly discovered to be dangerous to human health. A model could not only identify the location of every element containing the toxic matter, it would also show how it was installed and which materials surround it.

Contrast that with the complex, expensive and time-consuming surveys that must be carried out when searching for asbestos in older buildings today.

The people factor

As the above example illustrates, BIM offers some tangible benefits for managing assets in the short and medium term. But when combined with other technologies, it can unleash a world of far more exciting possibilities, shifting our mind sets from subjective to objective decision-making. Social data, gathered from sensors or mobile phone apps, can radically shift the perceptions of how people interact with assets. For example, a university recently decided to build an extension to better cater for its growing student population. This was based on the assumption that the seminar rooms were constantly full, according to the institution's timetabling system.

To test this, carbon dioxide sensors were installed in every room. It quickly became apparent that many of the venues were booked but regularly left empty. As a result, the university was able to review its booking system and avoid a costly building project. Thanks to advances in technology and cloud computing, the cost of embedding sensors such as these into building and asset management systems is much lower than it was ten years ago.

Owners have the opportunity to measure everything from temperature and humidity, to motion and flow of people. Sensors will become an increasingly powerful means for tracking how an asset is being used in real time: identifying common areas of wear and tear; supporting planned and even predictive maintenance, providing true insight into capital investment planning, optimisation and portfolio management.

Sensors built into supervisory control and data acquisition (SCADA) systems can monitor and control everything from power stations to pumping stations in water treatment plants. They can be installed into major infrastructure assets such as tunnels to monitor ground settlement. But they are also increasingly helping asset managers to manage the expectations of the general public: a simple example is the digitised information that tells passengers when the next train or bus will arrive.

Allowing people to interact with assets, both passively and actively, is a key driver in improving outcomes and optimising future developments.

Right first time

When considering how to future-proof an asset, it is critical to ensure that all parties are comfortable with the design in the early stages. All too often, occupants don't get to see a facility early enough – the project can be too far advanced or even completed. As the MacLeamy curve demonstrates, the later changes are made to a project, the higher the subsequent cost in time and money.

The challenge is how to help staff, customers and end users visualise how they will interact with the asset before it exists. Hotel and retail chains often construct physical models to test the design, finishes or layout of a room. As well as substantially adding to costs, this can significantly extend the project timeline. We can rationalise this process now.

Although physical mock-ups are unlikely to be replaced entirely, BIM provides interesting alternatives: a data-rich 3D model can be used within an immersive or augmented-reality scenario. Stakeholders can experience virtual representations of interiors wearing glasses, or enter augmented-reality 'caves'.

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As well as facilitating feedback during early design stages, these tools are useful for staff training and helping occupants familiarise themselves with the new facilities before they open. BIM will play an increasingly important

role for smooth handovers, sometimes referred to as 'soft landings'.

BIM can also safeguard a facility against possible health and safety breaches. For example, digital modelling on a recent hospital project predicted that the airflows would be ineffective within the new operating theatres. There was a risk that air could stagnate around open wounds, leaving patients vulnerable to infection. Altering the position of air vents during the design stage avoided costly delays in the construction and fit-out phases.

Conceiving a building that can successfully adapt for future needs remains a significant challenge, but BIM can help to speed up decisions: certain elements of the digital design could be fixed within the digital model, leaving interchangeable sections that could be moved around and tested against different scenarios.

This could also be carried out when anticipating future expansion strategies or kept as a record to inform a future design team, acting as an executive or pre-emptive design exemplar.

Going one step further, some forward-looking firms are now creating physical structures that can be almost as easily remodelled – or 'hacked' – as the virtual ones: the principle is to build modules that can be dismantled and moved about within the outer shell of the building.

Thus, room sizes can change and new spaces emerge with the minimum of cost or effort. The building becomes a dynamic organism, creating an adaptive environment for an evolving community.

When planning for the long term, all we can be certain of is that the future is unpredictable. The problems that preoccupy us now may be irrelevant in a decade. New obstacles will emerge.

Consistent, rich and accurate data is our greatest weapon for dealing with uncertainty. You may not be able to see everything that is on the horizon, but knowing and understanding your asset, and closely tracking how occupants are using it, is essential preparation for the unseen challenges and opportunities ahead.

Asset Management

The past and present

Subjective decision-making: Clients rely on anecdote, user feedback and fragmentary data evidence from disparate and unconnected building management systems.

Testing physical models: Clients create physical mock-ups of modules or interiors of rooms, testing them for strength, finish and constructability. Stakeholders experience the models and give their feedback. This lengthy and time-consuming process can add months to a construction schedule.

Planned/reactive maintenance: Schedules prompt the replacement of worn-out appliances. The system relies on efficient reporting of problems by the building management system, staff and occupants. Planned regimes are based on static cycles but the system does not automatically learn or evolve.

Historical analysis of data: Clients learn about facilities through a reporting structure and examine past patterns using data from different sources. Future building decisions are based on a reaction to what are often subjective reports, supplemented with commissioned feasibility studies and experience.

Reliance on human memory: Clients lack full records of construction history, and are unaware of alterations, materials used and the evolving design and installation of building services. Too much reliance is placed on staff memory; new building work can take place only after extensive condition and material surveys.

Fixed buildings: Structures are inflexible and difficult to adapt without significant investment.

Inaccessible data: Data is held in an outmoded format is lost to future generations.

The Future

Objective decision-making: Clients rely on rich, integrated data. Building management systems are linked with other forms of data capture to create a more accurate, holistic picture.

Testing virtual models: Stakeholders and future occupants experience a virtual 3D model of the new asset, using augmented-reality tools and immersive technology, such as 3D caves. Early feedback during design stage avoids costly changes later in the construction process.

Predictive maintenance: BIM provides unified, reliable data, allowing staff to forecast lifespan and replacement programmes of materials even before commissioning. Social data and sensors track the building, identifying areas receiving most use, and predict more accurate patterns in life cycle duration.

Real time or 'as needed' data: Client tracks the asset using an information model underpinned with BIM that is linked to sensors and social data. Emphasis shifts to spotting and predicting trends to provide a proactive quantitative basis for informed decision-making.

Central source of information: All vital information, potentially down to the adhesives used in building materials, is contained within a virtual digital building model that exactly mirrors the physical structure. The 3D model is a central source of information on which all future building decisions are based.

Flexible buildings: Buildings have modules that can be moved around in a matter of days, creating dynamic flexible spaces that can adapt to the evolving needs of the occupants.

Accessible data: Data is held in a standardised format, future-proofed against changing technology.

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How social data can transform assets

Exciting developments in cloud computing are making it increasingly easy to link building control systems with data from sensors or electronic devices such as mobile phones. This creates new opportunities for asset owners to engage with customers or occupants, understanding their motivations and behaviour patterns. It can also help to build brand loyalty.

For example, luxury retail and hotel chains record the habits and likes of a frequent user on a central database. From then on, whichever hotel the guest checks in to, from Boston to

Beijing, the building control system will automatically adjust the room to suit their preferences. On opening a door, their favourite radio station could be playing, and the lights will be dimmed to the right level.

Linking social data with the building's supervisory control and data acquisition (SCADA) systems creates a tailored 'home from home' environment for each guest. Imagine the possibilities that this could create for daily life across a city.

For leisure, retail and residential complexes, the asset owner could get closer to residents and visitors by encouraging them to download an app.

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The app creates a unique user profile. On a simple functionality basis, occupants could use apps to control the appliances within their homes (often referred to as the 'internet of things'), report problems and gain access to restricted areas.

An app that tracks movement could also provide valuable feedback to the building's designers. It could identify, for example, that no one in a certain block goes out onto their balconies, or that some corridors are not being used.

Ultimately, social data will play a vital role in creating smart cities, but this will be realised only when data is truly standardised across municipalities and regions. This is underpinned by intelligence and information model management systems.

It all starts with BIM.

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Turner & Townsend has significant experience of successfully support clients throughout the procurement lifecycle. We have experience in all construction sectors including infrastructure, property and natural resources.

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