FM 2.0

Re-imagining Facility Management
for the Digital Age

ARUP

About Arup
Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. We offer a broad range of professional services that combine to make a real difference to our clients and the communities in which we work.

We are truly global. From 80 offices in 35 countries our 14,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourage collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients.

The people at Arup are driven to find a better way and to deliver better solutions for our clients.

We shape a better world.

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Foreword

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Demands on property are rapidly changing – new patterns around how we work, live and play demand greater flexibility and a more personalised experience. Individuals are also becoming more aware of their own health and well-being, which is driving more interest in the quality of internal environments. Alongside this there is a steadily increasing industry focus on the environmental impact of buildings in operation. Taken together, these factors are leading to a significant increase in pressure not just to design and construct our buildings differently, but to operate and maintain them differently too.

FM 2.0 is our vision for the digital future of facility management. It is all about improving the performance of our buildings, so that we improve the end user experience whilst reducing environmental impact. Our vision applies intelligent automation to the process of managing buildings, optimising performance and taking on many of the menial tasks that dominate facility management today. As a result, systems operate more efficiently, contractors can work more effectively, and facility managers are able to become more proactive, putting them in control and releasing time for future long-term planning. As a result, users' experience of buildings becomes more satisfying. They are able to interact with buildings more directly, taking control of their experience, and giving and receiving feedback. Whilst our vision is enabled by technology, it is driven by an understanding of the people who will live, work or play in the space.

We would like to express our thanks to all those industry practitioners who have collaborated with us on the process leading up to this publication. Their input has ensured that our vision is grounded in an understanding of the current facility management market. As is evidenced through the case studies, many of those collaborators are already leading the way towards an exciting digital future for facility management.

Our approach to digital transformation

The move from conventional ‘analogue’ facility management to a digital approach implies a significant transformation. This transformation encompasses people, the processes that govern their day-to-day activities, and of course technology. Before embarking on a journey such as this, a clear view of the destination and what you are intending to achieve are essential together with the purpose of the journey.

Making the business case for change

It’s no secret that many buildings don’t perform to their potential, and digital transformation certainly has the potential to address this. Building a business case for digital transformation needs to focus on an organisation’s facility management objectives, whether that’s improving user satisfaction, reducing complaints, resilience of systems, comfort, air quality or energy performance. Alongside the hard commercial benefits, it’s important to recognise the softer benefits, such as improvements to health and well-being, recruitment and retention of staff.

Clear business case

Changing people

The hardest part of a digital transformation is changing the ways people work. FM 2.0 implies roles for facility managers and contractors that are significantly different from the ways in which they work now. They will be managing and using different types of systems, interacting with their buildings in different ways, and working in more flexible ways. This change needs to start in procurement, locking in positive incentives to engage in data and drive performance improvement.

Transformed skills and behaviours

As new forms of contract come into place, a managed programme for skills development & behavioural change throughout the supply chain will be critical for ensuring that your business goals are met.

Changing technology

All technology can do is enable change. The change ultimately is delivered by people and, to be effective, digital transformation needs to focus on the user experience. A clear understanding of all users and their needs is required. Using this understanding to inform the design of the various use cases is essential if the application of digital tools is to be successful.

Technology to deliver user experience

Digital transformation relies heavily on data, and another key component of success is an active process to manage data quality. Poor quality data will very quickly undermine a transformation process and cause people to lose faith in the systems.

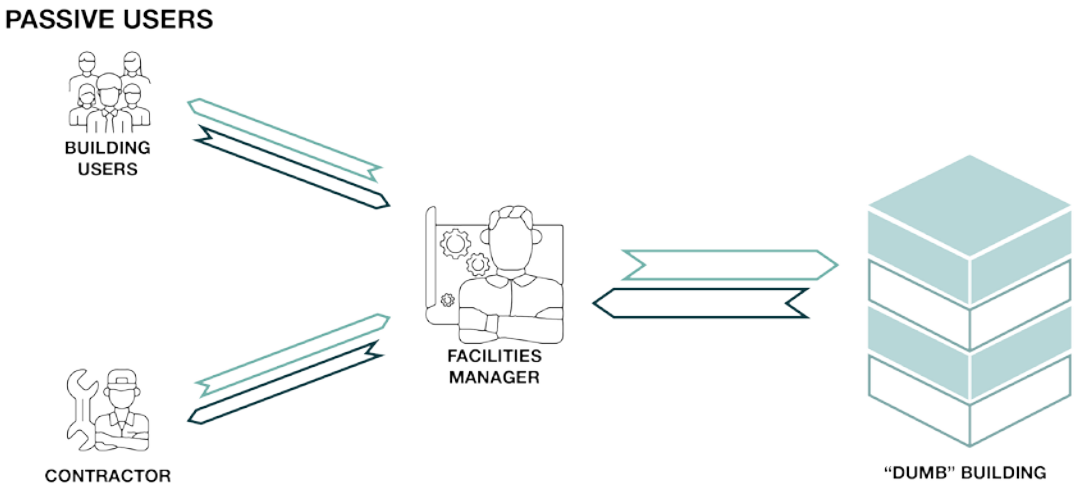
Facility management today: FM 1.0

Management of today's buildings is a relatively labour-intensive process. Opportunities for interaction with building systems are limited, and most communication flows via the facility manager, often causing communication bottlenecks. These can negatively impact the service provided to users, as well as building performance outcomes.

Facility managers are the centre of day-to-day communications, and can easily become frustrated and overwhelmed with mundane short-term tasks. This constrains facility managers to be reactive to the building's and tenants' short-term needs.

For users, the opportunity to personalise their experience within a building is usually limited. The only access to services is often via a helpdesk and users typically have relatively little control over their environment.

Maintenance activities are undertaken on the basis of fixed planned maintenance schedules, with little feedback from the building's systems, and as a result the use of labour, and the performance of the building are rarely optimised.



Facility management vision: FM 2.0

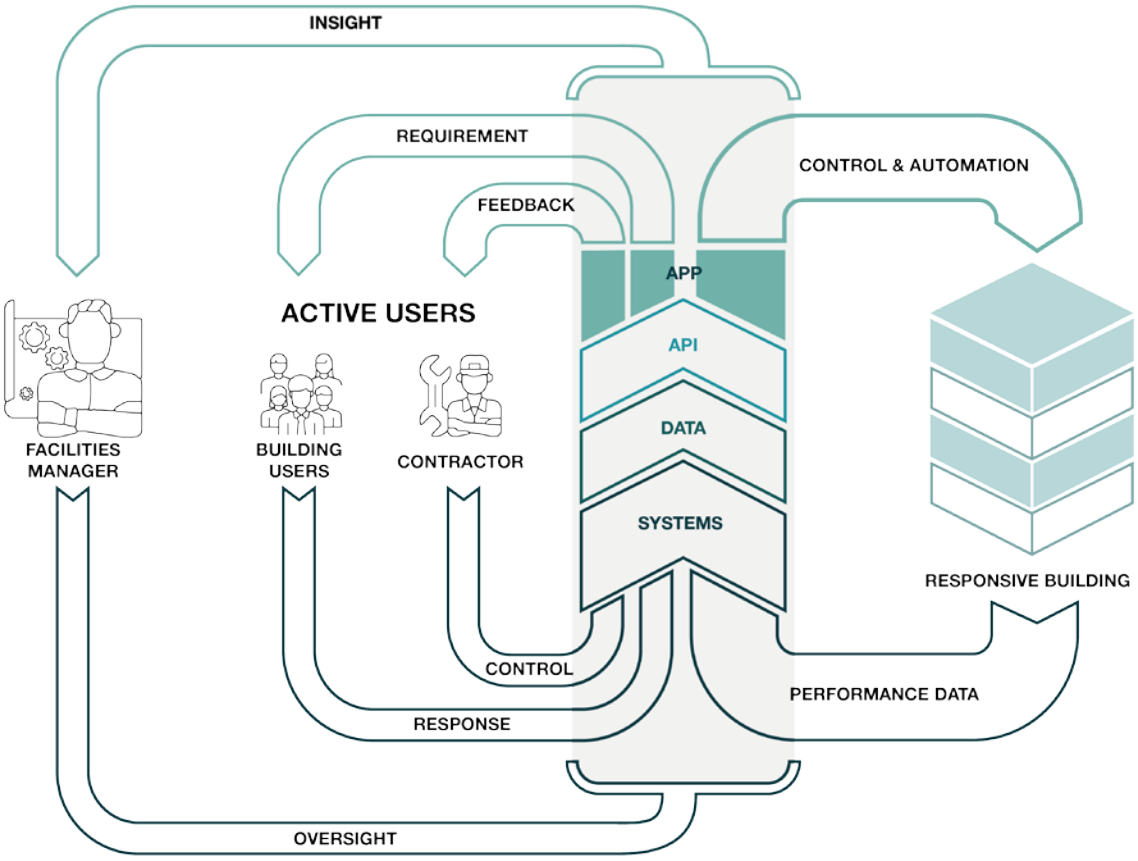
FM 2.0 is our vision for the future of facility management. It applies intelligent automation to take the pressure off the people, opening new avenues for creativity and customer-focus in the industry.

FM 2.0 puts an intelligent building at the heart of day-to-day processes and communications. Automating data flow and analysis means that menial requests or decision-making can be managed by an intelligent building platform, with oversight provided by a facility manager to ensure decisions are aligned with the long-term plan for the building.

In this future vision, users are able to interact with their building directly, taking control of their experience, accessing services, providing and receiving feedback at the touch of a smart device.

Contractors work in response to data on building performance, so they are able to focus on problem areas and contribute to a process of continuous improvement.

In FM 2.0, all aspects of a building's operation are optimised, whether that's utilisation of space, allocation of labour for cleaning or maintenance, or control of systems and equipment. The result of this optimisation is better building performance that is more cost-effective.



FM 2.0: user experience

New, more agile and flexible ways of working and living, driven by the broader digital revolution, are driving a change in the nature of the demand for spaces. From co-working at WeWork to co-living at The Collective, buildings are increasingly expected to provide a seamless user experience, demanding a new kind of facility management.

In FM 2.0, users interact with their building in the same way we interact with our smart devices. Users have all they need at their fingertips, whether it's access to resources, or the ability to take control of their environment. Management of the building is transformed through automation, and so the roles of those who manage and maintain the building are transformed too. Their roles become less dominated by repetitive menial tasks, and are more skilled, more effective in terms of outcomes and so ultimately more satisfying for the facility managers themselves.

FACILITY MANAGER VISION

“

I want to feel informed and in control to deliver better services to my customers.”

BUILDING USER VISION

“

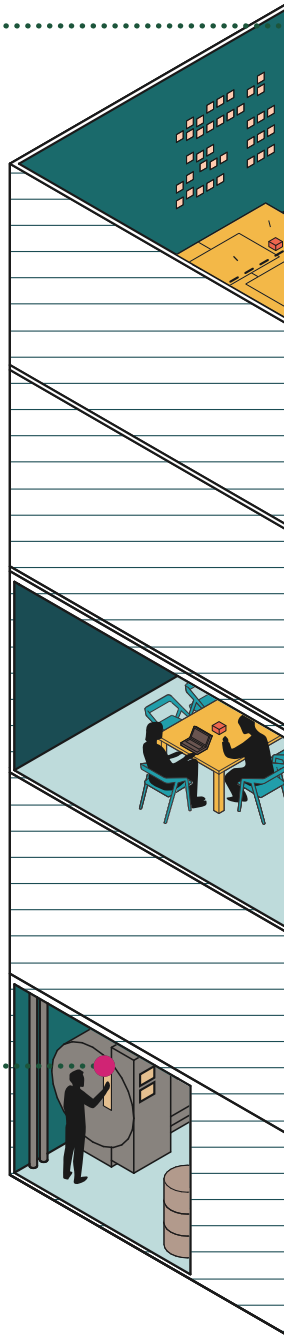
When I enter the building, it disappears into the background, seamlessly supporting my needs and wellbeing.”

BUILDING CONTRACTOR VISION

“

I want to develop and use my skills in delivering challenging and rewarding work.”

Users are part of a virtual community in their building, able to access a range of products, services and events.



Maintenance tasks are created automatically based on demand or statutory requirements.

Users are able to adapt and personalise their spaces and experience in a variety of ways.

Users can access building information and services from their personal devices.

Day-to-day FM operations & scheduling are automated. Facility managers have an overview through a dedicated portal.

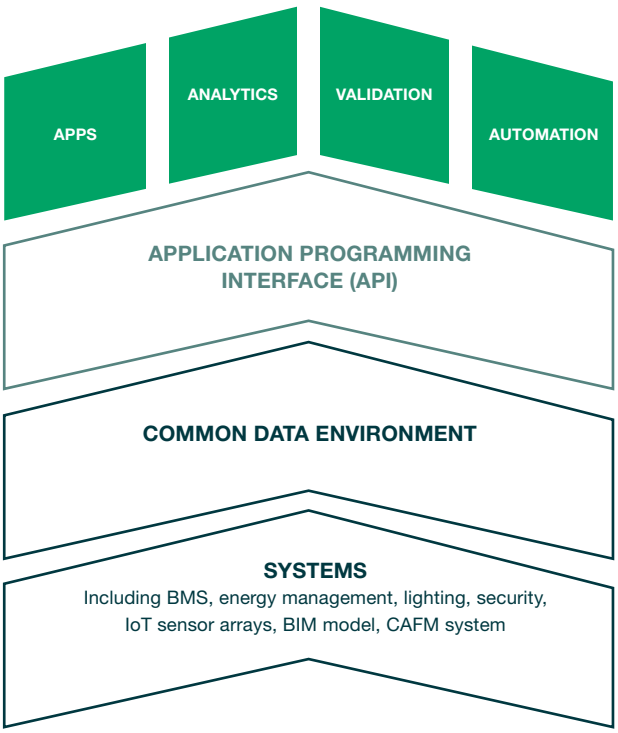
Building systems provide users with personalised way-finding through their personal devices.

FM 2.0: technology

The user experience vision is underpinned by a technology vision built around a common data environment. Whilst this environment may be made up of a range of data systems, application of a common data structure or schema allows data to flow seamlessly between systems, and combine in a range of user interfaces via APIs and user Apps.

Trust in data is a major barrier to many facility managers acting on the information available to them. The introduction of a 'validation layer' addresses this by enabling self-checking of data quality. Integrating the BIM model within the common data environment requires geospatial tagging to be applied throughout, but dramatically enhances analytics capabilities, and enables users to engage with the data through more intuitive user interfaces.

Critical to the technology vision is the ability for users to interface directly with the building, through AI-driven interfaces. This improves the experience for users by providing direct control over their environment and access to services. The facility manager's interface provides an overview of performance and highlights key issues requiring attention.



AUTOMATED USER INTERFACES

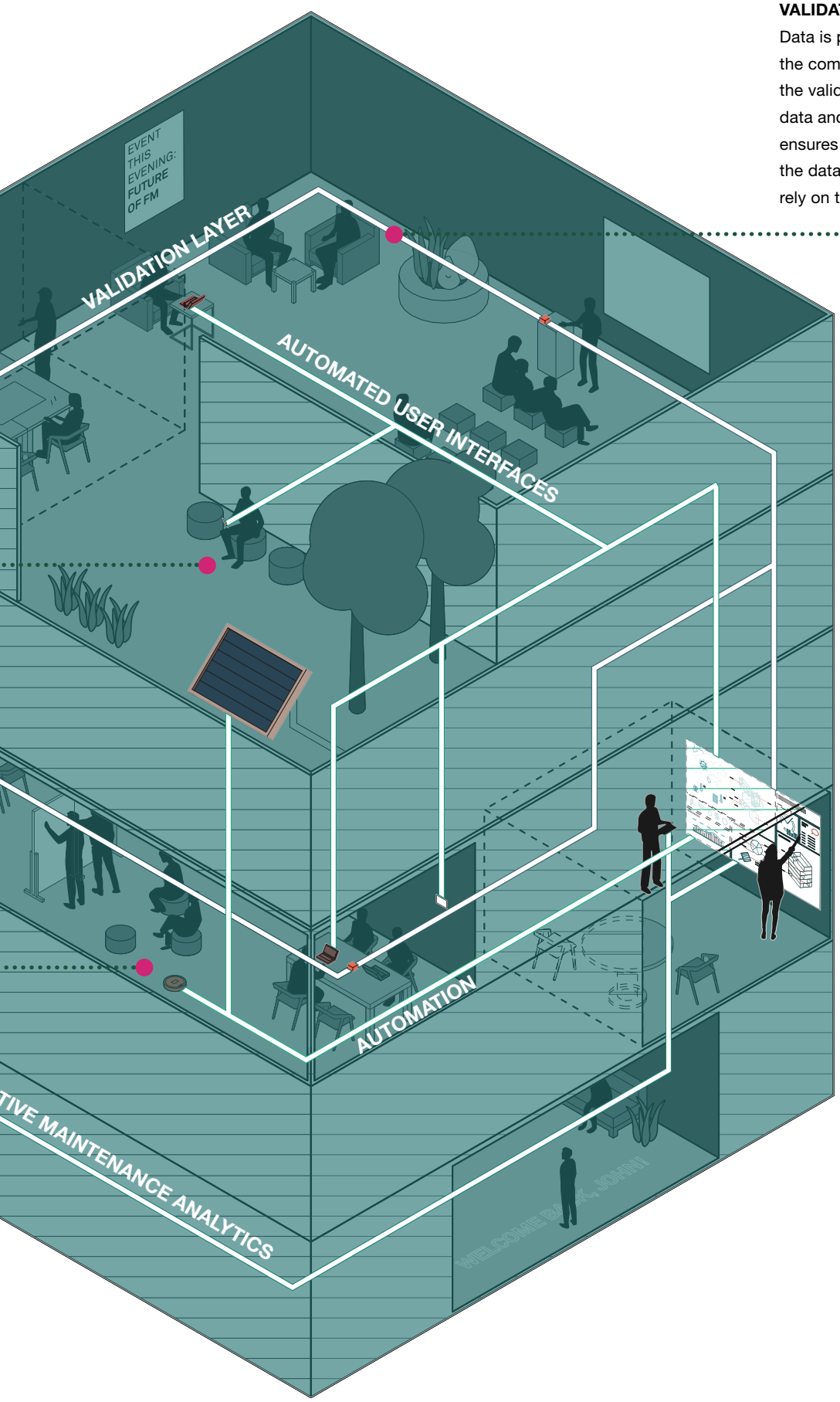
All users are able to interact directly with the building systems. This includes facility managers and contractors, as well as occupiers. Interfaces are tailored to the needs of the user, providing information and taking feedback from users in a structured way.

AUTOMATION

The performance of the building systems are continually optimised on the basis of a range of parameters, including feedback from users. Autonomous devices perform menial tasks with little or no user input.

ACTIVE MAINTENANCE ANALYTICS

Active, or condition-based maintenance tasks are allocated flexibly in response to demand data, so making the best use of human resources. This is underpinned by advanced analytics which uses a broad range of data to identify specific 'actionable insights'.



VALIDATION LAYER

Data is pulled from individual systems into the common data environment. Analysis in the validation layer ensures good quality data and flags anomalies for action. This ensures that users can have confidence in the data, and the automation systems that rely on them.

A day in the life of a building today

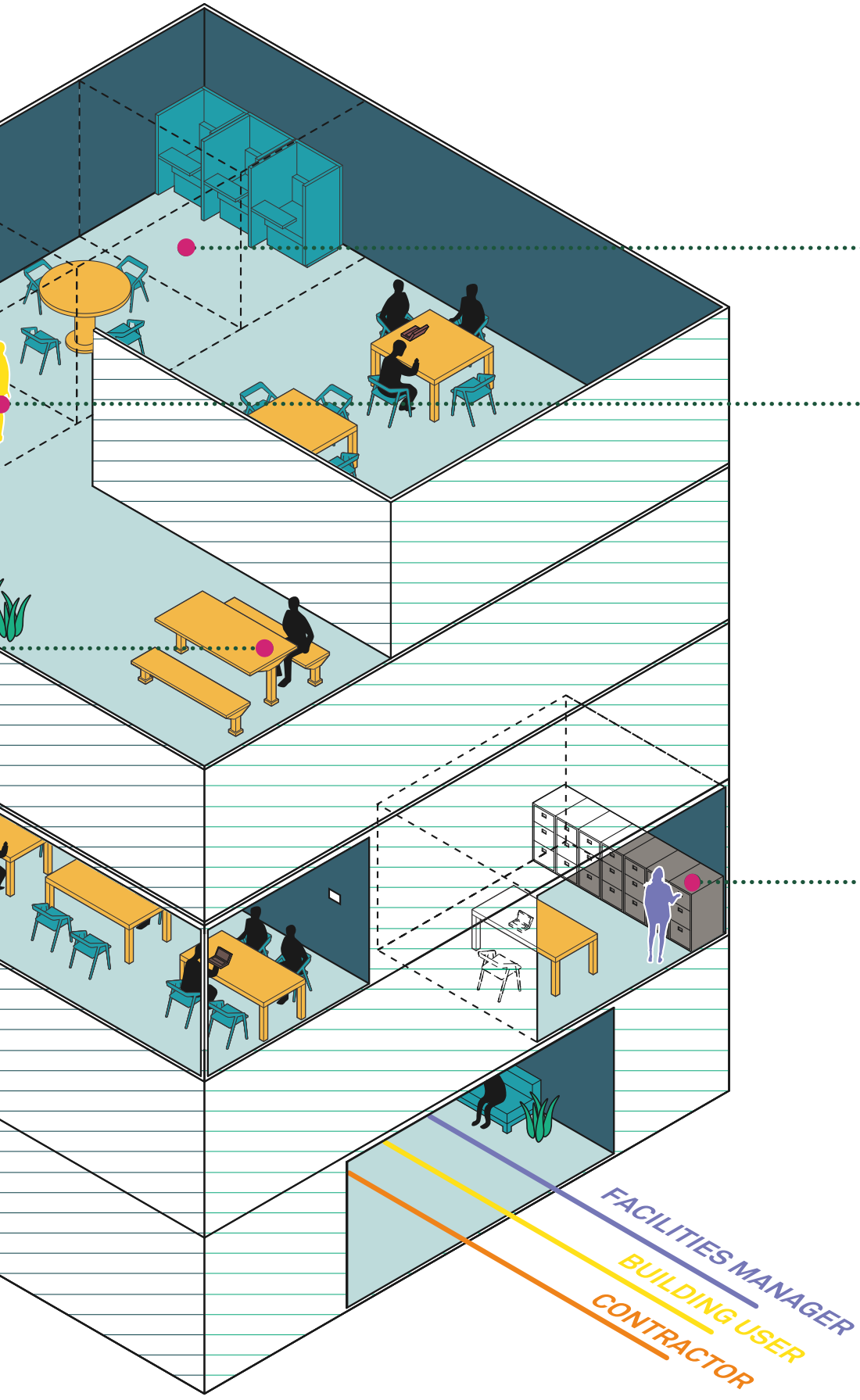
The development of FM 2.0 was informed by a detailed understanding of the challenges in the facility management industry today. This illustration maps out a building as it is typically experienced today, and on pages 14-15 we explore the same issues from the perspective of a facility manager.

The facility manager's day is often dominated by the short-term needs of the building and its tenants. While the facility manager is investigating energy issues, the user is distracted by temperature problems and untidy meeting rooms, and a contractor is brought in for scheduled maintenance.

A user logs a complaint that their space is too warm. The facility manager checks the BMS and responds that the system temperature is within parameters. The user is still not satisfied and raises another request.

Last month the facility manager changed the boiler time controls for an office party and forgot to revert the settings. Now the heating system is on between 9pm and 2am every night, wasting a considerable amount of energy.

The boiler contractor completes scheduled maintenance of the boilers. The maintenance schedule doesn't include a review of BMS data, so the Contractor misses that the boilers are running over night.



Only 40% of the meeting rooms were used today, while 85% of them were booked out.

Users have little faith that facilities managers will reply to their requests in time so often take matters into their own hands, in this case, tidying a meeting room that has been left untidy.

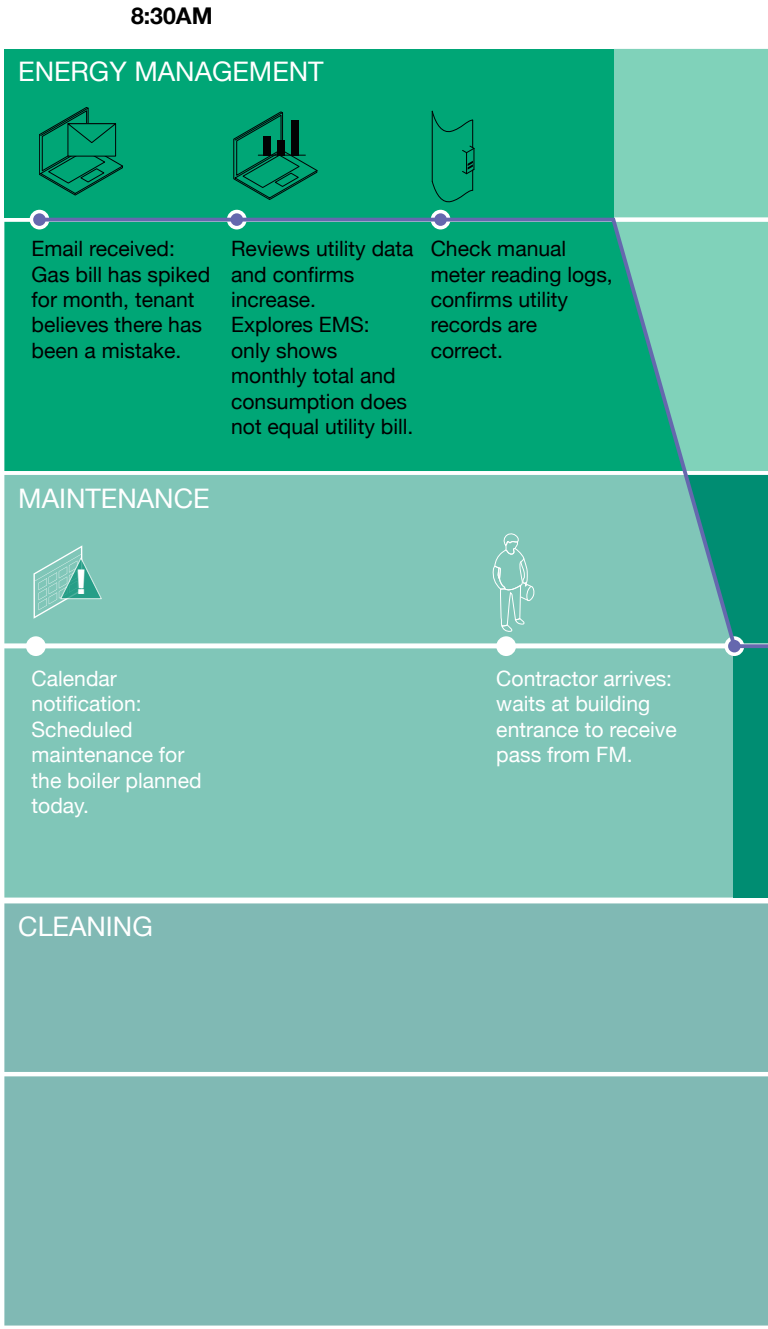
The facility manager is often pulling information from various disparate systems, and has little trust in the data available.

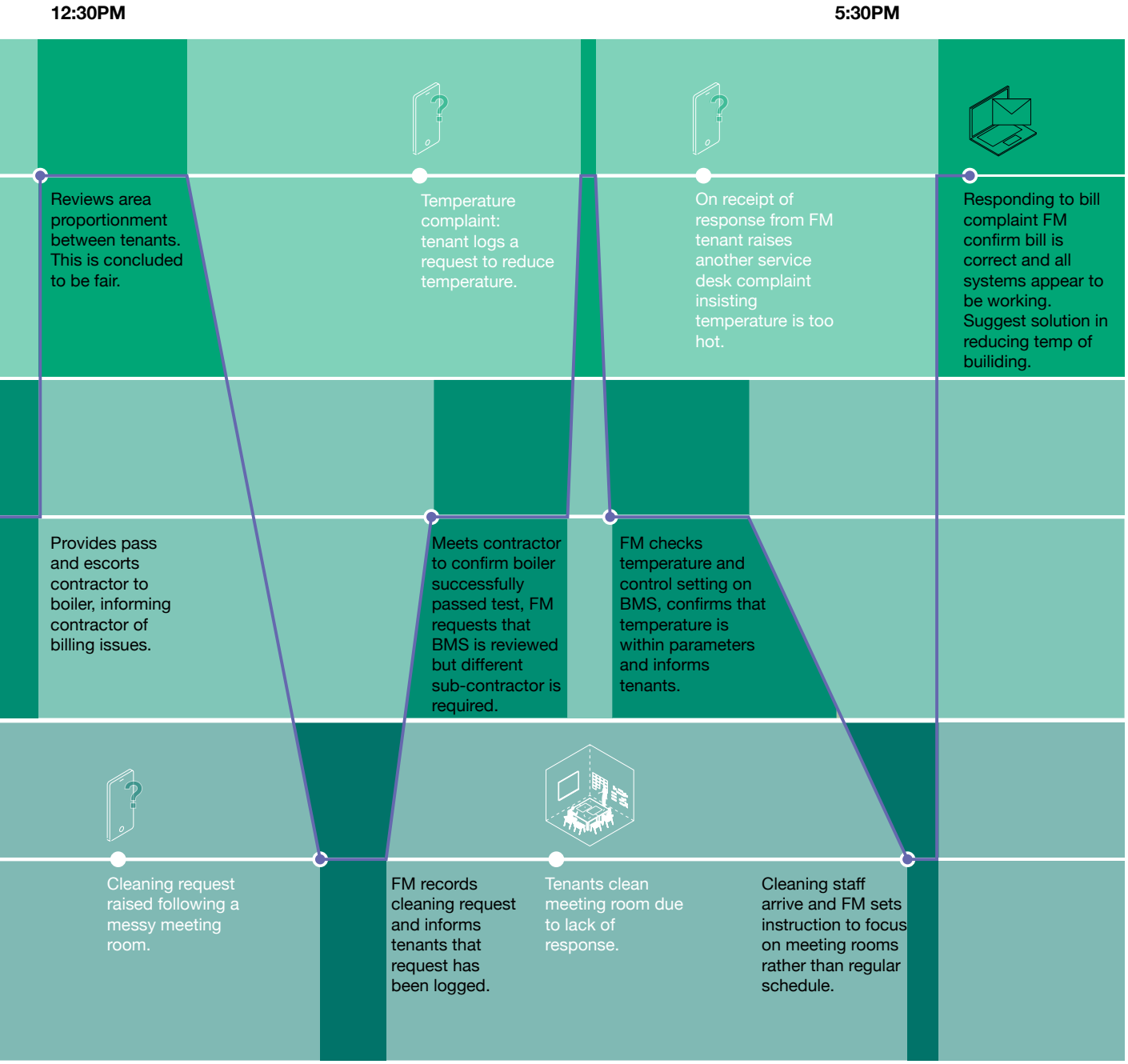
A day in the life of a facility manager today

In the previous section we explored some of the challenges faced in the operation of typical buildings. Here we look at how these issues impact the role of the facility manager.

This user journey follows the story of a facility manager switching between four core areas of focus across one day — energy management, maintenance, cleaning and tenant communication. These areas are illustrative of a typical day, and are the synthesis of the research carried out with our industry partners. Although this does not cover all tasks a facility manager carries out in a day, it is illustrative of the typical challenges faced in day-to-day activities.

On this day, the facility manager is troubleshooting a tenant's energy bill that is unusually high. During the course of the day, the facility manager fails to notice that the building settings had been changed and the heating was coming on overnight.

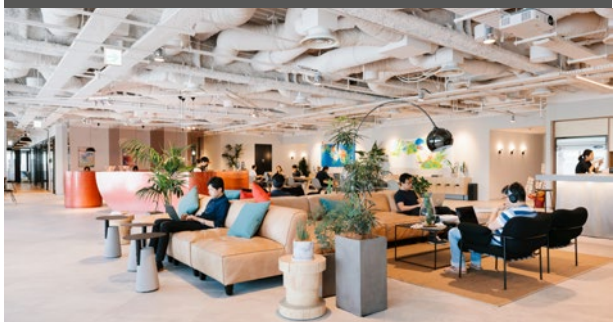



12:30PM
5:30PM
Reviews area proportionment between tenants. This is concluded to be fair.
Temperature complaint: tenant logs a request to reduce temperature.
On receipt of response from FM tenant raises another service desk complaint insisting temperature is too hot.
Responding to bill complaint FM confirm bill is correct and all systems appear to be working. Suggest solution in reducing temp of builiding.
Provides pass and escorts contractor to boiler, informing contractor of billing issues.
Meets contractor to confirm boiler successfully passed test, FM requests that BMS is reviewed but different sub-contractor is required.
FM checks temperature and control setting on BMS, confirms that temperature is within parameters and informs tenants.
Cleaning request raised following a messy meeting room.
FM records cleaning request and informs tenants that request has been logged.
Tenants clean meeting room due to lack of response.
Cleaning staff arrive and FM sets instruction to focus on meeting rooms rather than regular schedule.

The case for change

The facility management market conventionally has been highly cost driven. The benchmark for service charge in grade A offices has remained around £10/sqft in London, whilst buildings have become more complex and challenging to manage effectively. Pressure on the status quo is gradually increasing from a number of different directions.

Space disruptor: WeWork



WeWork was founded in 2010. Entering what was then a relatively small serviced office market, WeWork now has 605 serviced offices in 101 countries.

> “We are helping to create a world where people work to make a life, not just a living. There has been a macro shift towards a new way of work — one focused on a movement towards meaning. WeWork is accelerating this movement.”

New ways of working

New more agile ways of working, driven by the broader digital revolution, as well as a desire from tenant organisations to make more effective use of space, is driving a change in the nature of the demand for commercial space in general, and office space in particular. The trend towards hot-desking, and the exponential increase in co-working are examples of this, and illustrate the rapid pace of change.

Demand for building performance

The ‘performance gap’ between buildings’ theoretical and actual performance has been well documented, and is evidence that the performance of commercial buildings has for a long time been under-valued in the market. There is evidence that this is starting to change. The Better Buildings Partnership’s Design for Performance project is leading the way and others including BREEAM and the BCO are acknowledging the importance of achieving performance in practice. This is starting to translate into more pressure on facility managers to improve the performance of the buildings they manage.

Digital buildings

The BIM revolution has to date been focused primarily on transforming building design and construction. The new trend towards ‘digital buildings’ is much more about how buildings work in operation, with common data environments designed to provide a more seamless user experience. As more clients invest in the development of digital buildings, the facility management industry will come under increasing pressure to change and develop service delivery models that maximise the potential of these buildings.

FM 2.0 aims to show how facility management can meet these challenges head on, through strategic adoption or integration of new technologies and ways of working.

Evidence of benefits

Demand for operational energy efficiency in the Australian market is stronger than elsewhere, due to the success of the NABERS energy rating scheme. By creating a market demand for buildings that are energy efficient in operation, NABERS has driven a transformation not only of design and construction, but also of operation. Evidence from the Australian market demonstrates the potential benefits of a similar transformation here in the UK. Analytics firm Bueno have looked at outcomes from working with their circa 1000 clients in Australia to demonstrate the benefits of a more data-driven approach to facility management.

Reliability and satisfaction

Adopting a data-driven, condition-based approach to systems maintenance improves reliability and reduces reactive maintenance calls, which improves occupant satisfaction as well as maintenance workflows. Bueno found moving to a condition-based approach typically reduces reactive calls by 70–75%.

Energy efficiency

In Australia, Bueno have found applying analytics and a condition-based approach saves 15-20% of energy consumption. In the UK, Demand Logic, provider of systems analytics solutions, has found savings in the range of 10-30%. The potential for higher savings in the UK market is in line with findings from the Design for Performance project (see box, right) regarding the extent of the energy performance gap in UK commercial property.

Maintenance costs

An important benefit of a move to condition-based maintenance is a significant improvement in the effectiveness of maintenance activities. Moving away from conventional schedule-based maintenance to active condition-based maintenance ensures that maintenance labour is applied where it is needed. Anecdotal evidence from systems analytics providers suggests reductions in maintenance costs of 20-30% are possible, although as yet there is little independent research to support this.

These savings are not just about cutting unnecessary maintenance. Having O&M information at their fingertips also helps maintenance contractors resolve issues more quickly. Conventionally, it often takes three visits to resolve a reactive call-out. With access to an integrated data platform, this can be reduced to a single visit.

Design for Performance: bringing NABERS to the UK

The Design for Performance project aims to create an operational energy performance rating scheme for commercial buildings in the UK. The project is led by the Better Buildings Partnership, working with a number of leading developers and industry partners including Arup. The new rating scheme will be based on the Australian NABERS energy rating scheme, which is credited with halving the average energy intensity of commercial property in Australia over the last 15 years.

The road to a digital future

There are many challenges to be overcome in order to make a transition from the current approach to facilities management to the new FM 2.0.

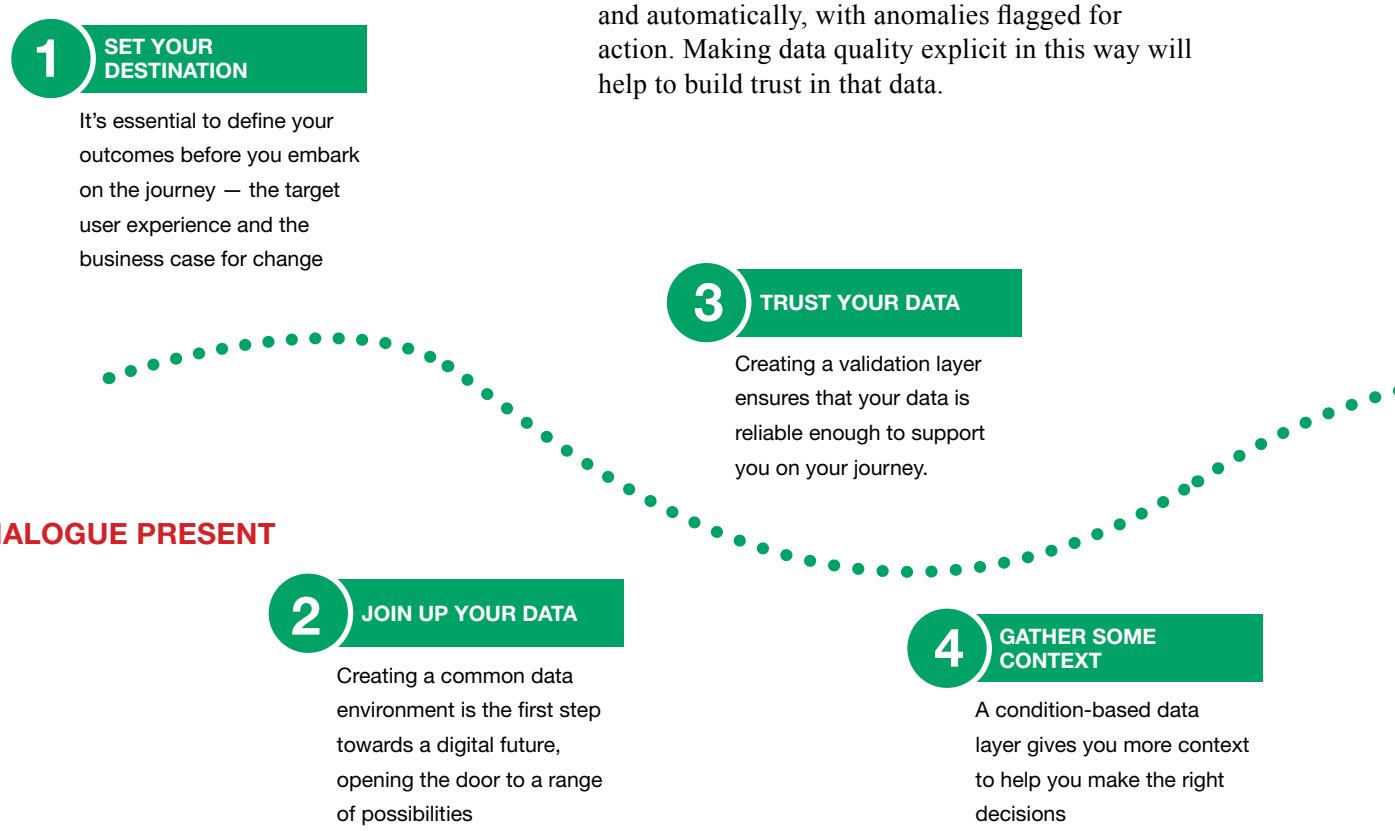
Why digital?

To be effective, a digital transformation needs to be a means to an end. Defining that end point clearly before you start is essential if the transformation is to be effective. As well as the business objectives, undertaking detailed user experience mapping gives an understanding of how these new digital tools will be used, by whom and to what end. Digital transformation is not just about technology, it needs to embrace people too, and needs to encompass changes in skills and ways of working.

Key concept: validation layer

Buildings produce more and more data. But we can only get value from that data if we know it is accurate. A lack of trust in data, particularly energy data, was a consistent message in our research. The concept of a validation layer is that by comparing different datasets we can establish the validity of data and identify and action any anomalies. At its most simplistic, a validation layer could be a set of check-meters in an energy management system, but the real potential comes through layering data from different systems, enabled through a common data environment. Arup's Our Workplace in the Cloud project is drawing data from HVAC, lighting, security and IT systems with the aim of getting reliable presence data for desks and meeting rooms without the need for extra sensors.

The key principle of the validation layer is that these alternative data sources are compared continuously and automatically, with anomalies flagged for action. Making data quality explicit in this way will help to build trust in that data.



Key concept: condition-based data

Information on the condition of equipment or spaces within a building is an important part of the transition to active maintenance. Data on equipment that is not operating as it should help us to prioritise maintenance activities, intervene before equipment fails completely, and improve performance. Data on use of spaces help us optimise cleaning routines, so a space that's not been used isn't cleaned as regularly, and one that's been used more intensively is cleaned more often.

Condition-based data can be data from existing systems used in a different way, or from sensors installed specifically for that purpose. Use of acoustic, vibration or temperature sensing to diagnose the condition of machinery is a common technique in industrial applications, but is rarely applied in buildings. Self-check routines have historically been included in BMS systems, but have fallen out of favour in recent years.

Key concept: active maintenance

Building maintenance in the UK,whether hard engineering or soft services, is traditionally schedule based, or planned maintenance. Equipment is inspected on a fixed schedule, and a fixed set of activites undertaken. Reactive maintenance is undertaken in response to a failure alarm or a user complaint. The unplanned nature of this can be disruptive to both user and contractor.

'Active' condition-based maintenance is an alternative approach intended to reduce planned maintenance and minimise the need for reactive maintenance by improving reliability. In an active maintenance scenario, maintenance labour is allocated flexibly based on analysis of the performance and condition-based data. Labour is deployed to solve problems, rather than carry out checks, which requires different skills and results in more rewarding work.

The transition to active maintenance is a major shift in the way of working. The transition needs to be made gradually, first establishing the active approach, before incrementally reducing passive maintenance.

6 EMBRACE AUTOMATION

From chat bots to robot vacuum cleaners to control of whole building systems, AI can transform performance in a broad range of ways

5 MOVE TO ACTIVE MAINTENANCE

Using your data to drive an active condition-based maintenance approach means your contractors spend their time where it's needed, and so have a bigger impact on performance

7 TALK TO MY BUILDING

The final step on the journey is creating interfaces that allow users to communicate directly with their buildings, taking control of their experience.

Transition from today to tomorrow: leading edge case studies.

Whilst FM 2.0 might feel like a long way from current practice, the transformation is already underway. There are examples starting to emerge of new digital technologies and approaches either being successfully put in practice or actively being developed.

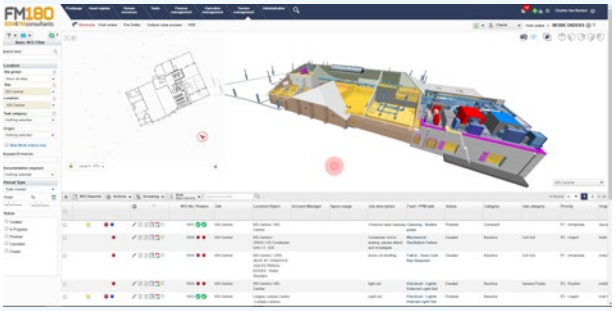
In some cases, the technologies and ways of working we propose are already in use in other sectors, so the question is more about demonstrating their effectiveness in buildings rather than their fundamental viability.

COMMON DATA ENVIRONMENT

New digital buildings are being designed with a common data environment in mind, and are adopting common internet data standards across all building systems. In older buildings with legacy systems, creating this common environment can be more challenging. Systems analytics providers are now routinely pulling together data from BMS and energy management systems into cloud platforms. Increasingly, techniques are being developed to pull data from a broader range of legacy systems, including lighting control and security for example.

Translating BIM from construction into operation remains challenging, but if implemented successfully opens up exciting possibilities for how buildings are managed and maintained.

COMMON DATA ENVIRONMENT



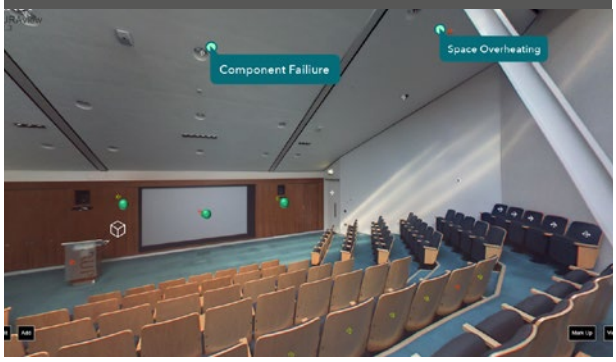
FM180: BIM for FM

Slough Council are the first public sector organisation to take 3D BIM into the operational environment. The federated model exists within the FM system and asset information is automatically mapped to system functionality. This process saves significant amounts of time in creating a more effective planned maintenance regime for many more assets than traditionally accounted for. The opportunity exists to tie all related information to an asset through the linked document library, including O&Ms, H&S information, risk assessments, video servicing guides and the full service history for the item, all available at a mouse click on the relevant visual object. This information is passed to engineers via a ‘smart device’ app, linked directly to the system, creating a digital pathway for works and a cast-iron audit trail for statutory and mandatory compliance issues

VALIDATION LAYER

The concept of a specific validation layer, using multiple datasets to demonstrate data validity and identify anomalies is not yet widely applied. Feedback from our research however showed that frustrations over poor quality data, particularly energy data, is a key concern.

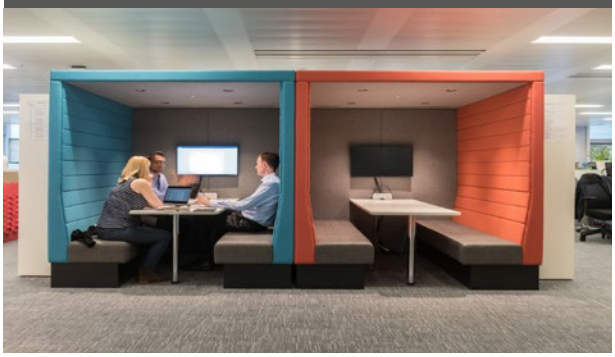
COMMON DATA ENVIRONMENT



Arup: PURAview

Arup's PURAview software provides a low-cost entry into the creation of a 3D visualisation environment for existing buildings and estates. The software allows users to tag assets within 3D photographs, accessible through a floor plan. The tags link to an open source database, and so can be linked to a range of data from live performance BMS data to O&M information.

VALIDATION LAYER



Arup: Our Workplace in the Cloud

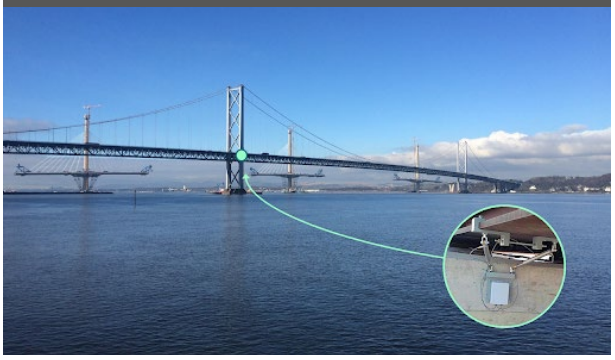
There are a range of software solutions on the market to manage hot-desk and room bookings. Many require the installation of proprietary sensors on desks or in meeting rooms to gather usage data.

Arup's project is looking at what existing data can be used to gather presence information, so avoiding the need for additional sensors and reducing the cost of the service. The project includes extracting data from lighting controls, and from network point traffic, and correlating this with BMS data showing changes in temperature and CO_2 levels to establish an accurate picture of utilisation.

CONDITION BASED MAINTENANCE

Condition-based maintenance, where equipment maintenance activities are dictated by condition or performance data, rather than fixed schedules, is common practice in many other sectors, from aviation to utilities. Companies like Rolls Royce Aerospace for example have a long history of collecting operational data from their engines to inform maintenance.

CONDITION BASED MAINTENANCE



Arup: condition-based maintenance platform for the Forth Road Bridge

In 2015, the Forth Road Bridge was closed for 6 weeks following the discovery of a crack in a major structural element. The cost of the closure to the local economy was substantial. In response to this incident, Arup worked with the bridge operator to install strain gauges across all structural elements. Data from the sensors is uploaded to the cloud, and a dashboard was created to allow engineers to monitor the data live. Analysis from the dashboard helps to target maintenance work in order to ensure any issues are picked up and resolved early so as to avoid any further failures.

CONDITION BASED MAINTENANCE

AstraZeneca: condition-based maintenance at Cambridge research facility

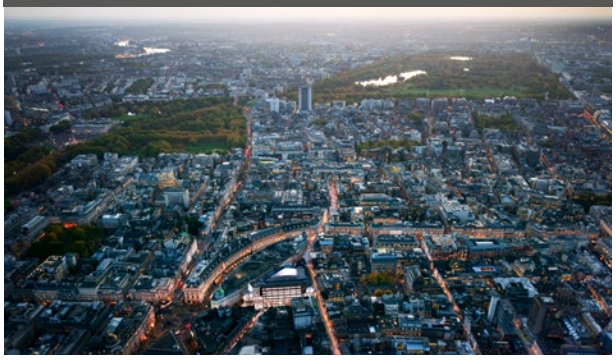
AstraZeneca, at it's new research facility in Cambridge, will be applying condition-based maintenance techniques common in manufacturing to the maintenance of building systems.

Maintenance strategy will be determined for each piece of maintainable equipment based on a criticality assessment and risk profile. Condition monitoring will be used routinely, including deployment of acoustic, vibration and thermal sensors. These, combined with performance data from the BMS, will drive the maintenance approach. Planned maintenance will be minimised, and the majority of maintenance activity will be scheduled on the basis of the performance and condition data. This approach will ensure that maintenance resources are used effectively to deliver the required high level of resilience, whilst keeping maintenance costs down.

ACTIVE MAINTENANCE

Moving away from schedule-based maintenance to a more flexible approach based on performance data is a major shift. There are a number of companies in the property sector using Systems Analytics software solutions to drive an active maintenance approach. Initially this is generally on top of scheduled maintenance activities, until confidence grows in the active approach.

ACTIVE MAINTENANCE



Systems analytics: The Crown Estate

On The Crown Estate's Central London portfolio, managing agents BNP Paribas and JLL are using systems analytics software provided by Demand Logic to identify actionable insights across a number of key assets. Additional BMS specialist maintenance labour is available over and above the standard scheduled maintenance to respond to the issues that are raised, which to date has focused primarily on optimising plant run-times and comfort conditions. In addition, the systems analytics approach has supported a range of remedial works projects delivered by the managing agents working in partnership with Arup. In these projects, systems analytics data has been used both to target remedial works in problem areas, and to validate the outcomes.

ACTIVE MAINTENANCE

Systems analytics: The Royal Academy

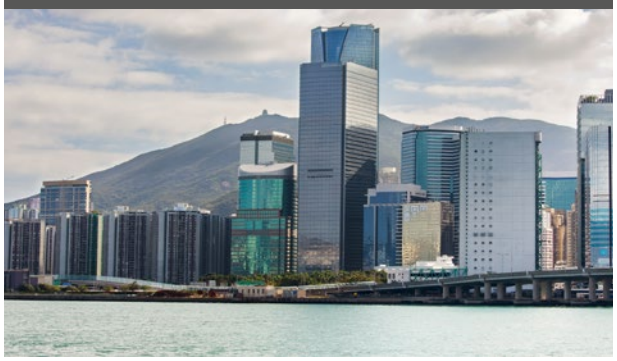
At the Royal Academy, maintaining correct conditions in gallery spaces is important as much for the conservation of the artworks as the comfort of the visitors. Arup is working alongside systems analytics software provider Demand Logic to validate the outcomes of the extensive refurbishment works carried out over recent years, and to support an active maintenance approach. Systems analytics data is used to validate the performance of plant and systems as part of the handover to operational project teams.

In operation, systems analytics supports on-going maintenance, providing insights into operational problems. To date, the labour for responding to the issues is additional to standard scheduled maintenance. The proposed next step, however, is to gradually reduce the scheduled maintenance, now that the client is confident in the active approach.

AUTOMATION

Automatic controls in buildings are nothing new, but the new generation of AI and machine learning applications offers a step change in capability. Traditional controls use linear processing responses based on one or two variables, whereas machine learning can optimise the performance of complex systems taking into account a whole range of variables, and using historic data to predict future demand. When Google applied its Deep Mind AI to the cooling systems for its data centres it reduced energy consumption by 40%, from a baseline of what were thought to be well-optimised systems.

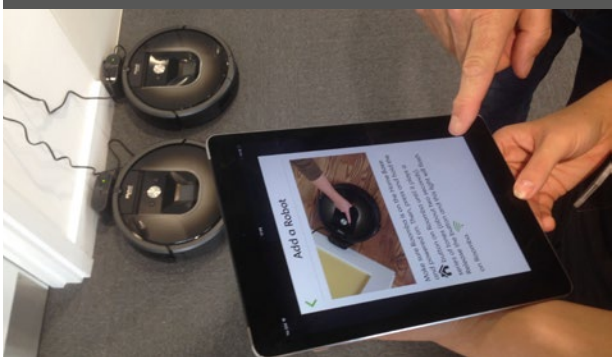
AUTOMATION



Arup Hong Kong: AI-driven optimisation to cooling and ventilation plant

Arup has been working with a Hong Kong commercial developer to pilot the use of AI in the control of cooling and ventilation systems in a commercial office building. By gathering a wide range of historic as well as live data, the software is able to predict demand ahead of time. The software effectively creates a Digital Twin of the cooling system, which it uses to test a range of potential responses in real time, and ensure that it responds to demand in the most efficient way. The software was developed by Arup, using Google's Deep Mind AI.

AUTOMATION



BAM FM: robot vacuum cleaners

BAM FM has introduced robot vacuum cleaners into several of its cleaning teams in the UK. The robots enable the cleaning staff to complete complex and intricate tasks, by taking on simple floor-vacuuming activities, and so improve both quality and efficiency of the work. The cleaning teams have been upskilled to deploy the robots, and they use smart devices to monitor the robots and any alerts or alarms. Because some cleaning activities are carried out during occupied hours, the robots have also attracted the curiosity of occupants and stimulated new interest in cleaning and other facility management activities.

AUTOMATED USER INTERFACE

Whilst we all deal regularly with automated user interfaces, every time we call up our bank for example, they are not yet regularly deployed in buildings. Whilst being able to speak to someone is important in some cases, there are many instances where an automated user interface can be more effective both for the user and the facility manager.

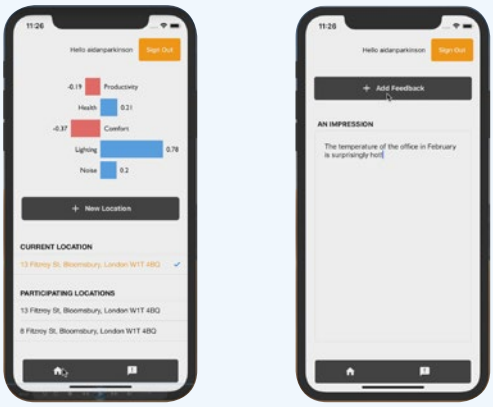
AUTOMATION: DIGITAL TWIN

Arup Netherlands / Officevitae: County Hall, The Hague

Arup is building a ‘digital twin’ of the Dutch government’s County Hall building in The Hague — a virtual representation of a 16,000sqm office building — to improve its comfort, energy efficiency and space utilization. This is part of a Government initiative to make the building carbon neutral to help meet 2040 carbon reduction targets.

A digital twin is a new modelling paradigm, one that uses a convergence of IoT sensor data, modelling, simulation and artificial intelligence to provide previously unthinkable levels of ongoing operational control, asset performance management and insight. It will create a living digital counterpart to the real building, that is subjected to the same environmental and user demands. Once calibrated to mimic the real building’s performance it can be used to quickly test the impact of a broad range of improvements, so optimising the building’s performance.

AUTOMATED USER INTERFACE



Arup: Intelligent Asset Management App

Arup is in the process of developing a feedback app, with the capability of receiving and processing free text feedback from building users. The App automates feedback classification and sentiment scoring using machine intelligence trained on the BUS Methodology database of occupant satisfaction evaluation response records. This is used to develop quantitative signals for directing attention. Any feedback collected forms a topic leading to a subsequent 2-way communication between user and operator, demonstrating that user feedback is valued and being acted upon.

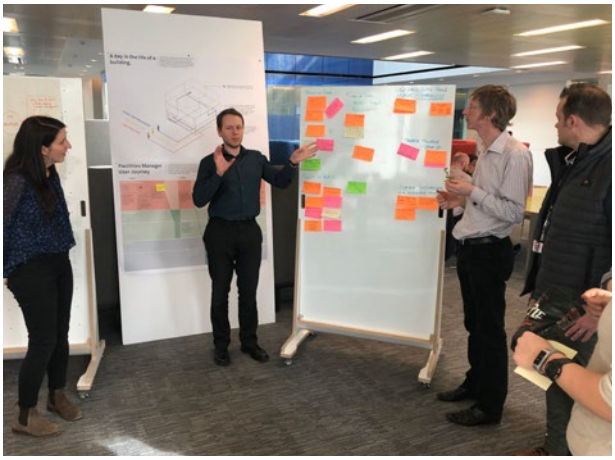
Our research

The research that led to this publication has been carried out in collaboration with a diverse group of practitioners in the facility management industry.

In our workshop in November 2018, we collaborated with this group to understand the nature of facility management now, what works well and where there is room for improvement. This process identified four key problem areas - energy management, maintenance, cleaning and tenant communications.

We took these problem definitions to a design sprint in March 2019, where we focused on developing a digital vision that responds to them. We then explored the challenges in implementing the vision, and how this journey towards the vision can be broken down into manageable steps. We tested the outputs on our collaborators to ensure that our vision is well grounded in reality.

Many of our collaborators have contributed case studies to this publication, which demonstrates that they are all pushing towards FM 2.0 in their own areas of expertise.



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