

A buildingSMART International White Paper

# Liberating Built Asset Information to Achieve your Organizational Objectives



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# Overview

This white paper is written for executives who have responsibility for a portfolio of buildings and infrastructure assets. These executives are frustrated with having to make decisions about their organization's assets without access to complete, accurate, and timely information that affects decision-making and asset performance. New possibilities of how adopting an intentional information management strategy can unlock business value and reinvent how they manage their assets is causing much eagerness in the industry. buildingSMART International (bSI) recognizes that if owners and operators understand the options that are available, and how to enable them, then they will be more confident to set in motion strategies that will disseminate organizational value and efficiency throughout the shared supply chains.

The purpose of this white paper is to summarize the problems faced by executive decision-makers today, discuss new approaches to asset management through digital transformation and the use of open standards, and present case studies as examples of what is currently being achieved by two leading owners to drive optimal results from both their capital and operating budgets. This is the first of a series of three white papers that is focussed on the 'why' there is a business need and value proposition that will inspire executive leaders to require their organizations to make changes that move beyond the inefficient and costly status quo. The second and third white papers to follow will focus on the 'what' and the 'how' respectively. These white papers will detail information for further discussion and strategies for implementation that can be shared with asset managers and their teams within your organization in pursuing new approaches that will de-risk your decision-making.

Built assets can include buildings, transportation infrastructure, utilities, ports and waterways and even man-made land features (for example, embankments and water catchments). The scope of this white paper is applicable to all types and discusses the digital data and interoperable process strategies that support asset information management activities.

**New possibilities of how adopting an intentional information management strategy can unlock business value**

# Executive Summary

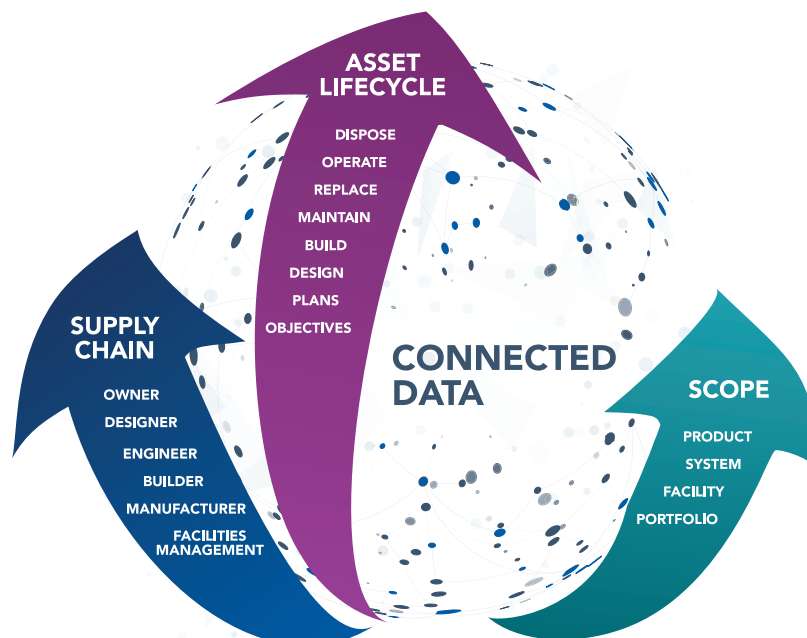
Having access to accurate, structured, and timely information about an asset is a critical enabler for effective whole-life asset management and is as important as the functionality and performance of the physical inventory itself. This white paper sets the context for how digital information capture and analysis can be used for better asset management decision-making and signposts a pathway to future connected data environments. As a core element of enabling this capability standards such as openBIM® supports the efficient management and interoperability of data as the key enabler.

Adopting digital asset information management has the potential to unlock tremendous value for organizations to:

- maximize the return on capital investments, optimise cost benefit and commercial impact and increase operational cost savings
- improve performance and resilience of the asset portfolio
- deliver a positive impact on environmental challenges (producing less waste, reducing energy consumption and fewer carbon emissions)
- enhance social outcomes (accessibility, wellbeing, empowerment, inclusion and sustainability)

Asset owners are facing ever higher expectations from stakeholders and shareholders with regard to the outputs and outcomes from their assets. In addition to lower cost, higher returns, higher resilience, and improved safety, there is increasing awareness of the impact of assets on an ever-warming planet and other important social outcomes. On the global scale, the manner in which organisations operate will affect the ability for the world to have future living spaces and smart cities that are sustainable for a growing population and increased urbanisation. There is

also opportunity for increased information sharing between organizations portfolios in what is referred to as the circular economy. Meeting these challenges simultaneously and efficiently requires a company-wide commitment to data capture, a strong capability in data analysis which in turn requires recording and maintaining well-structured and accurate data. The availability of better quality data and analysis provides an organization with the ability to make better informed asset decisions and encourages collaboration between multiple parties who have different areas of expertise which leads to better outcomes.



# Don't be content with the status quo

The world of infrastructure has enjoyed many years of growth often providing lifelong careers for professionals and experts focused on key assets or knowledge areas. Today, the ability to depend on this tacit and institutional knowledge in the workforce is becoming more challenging and can often be a high-risk strategy for rapidly evolving organisations. This 'bounded rationality' tends to drive an asset management strategy that is championed by either the most knowledgeable or most persuasive person, rather than one that has an unequivocal acceptance from all those required to implement it.

This has led to more of a focus on data and technologies to help mitigate this risk. New drivers such as sustainability, weather, pandemics and transparency are putting more pressure on the

ability to make key decisions in a timely and agile manner and with less predictability about the future environment that will have incremental impact on the value that those current decisions can realise.

Today, the most effective organisations with asset portfolios will have a good mix of people and data to realise the lifecycle challenges they need to deliver on a daily basis. However, many organisations may not be fully realising the full efficiencies or even additional value streams that could be unlocked from further investment and focus on the data they both currently have available today or could easily generate or capture tomorrow. Some organisations may also be challenged by a lack of executive leadership, by under-estimating the strategic importance or simply not having skilled staff with knowhow in leveraging and realising this potential future value.

Fig. Connected data flows



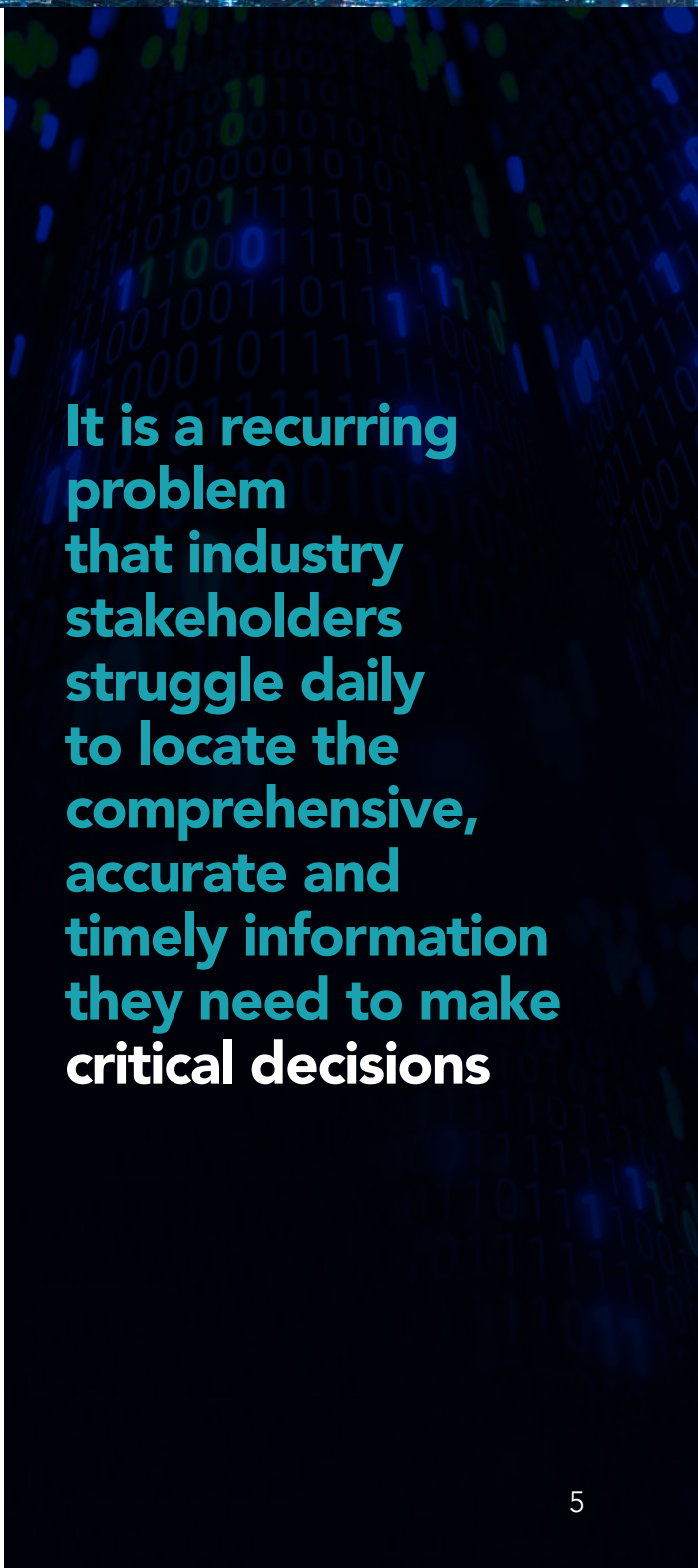


# What is the problem?

It is a recurring problem that industry stakeholders struggle daily to locate the comprehensive, accurate and timely information they need to make critical decisions pertaining to operations and/or maintenance and/or repairs and/or modifications to the built assets they are responsible for. It is also a problem to obtain the correct data from the operations and wider ecosystem of usage to inform the bigger strategic decisions regarding what to invest in next.

Organisations often have many fragmented silos of information (inherited from designers, engineers, contractors, sub-contractors, suppliers and installers) that cannot be relied on due to concerns about currency, completeness, validity and accuracy. All of the information about an asset is typically a mixed collection of paper-based documents, digital (.pdf) files, CAD drawings, BIM, GIS data, etc. This fragmentation of built asset information at its source is and will remain a fact of life in the built asset industry. The project delivery process and the complexity of project teams comprising of more and more specialization and the different technology (software products) they use for their role in the process add to this fragmentation. This often creates inconsistencies, promotes inefficiency, and leads to the poor decision-making.

Expectations of complex issues and the problems they bring require 'data freedom' to solve them efficiently. The ability to have an efficient clear view through the whole lifecycle of a built asset is not possible unless all stakeholders operate on a set of commonly defined data standards from concept to disposal. It is impractical on simpler projects to enforce one version of proprietary software (or a common technology stack) and co-locate an entire project team as has been achieved on mega projects to solve this problem. Even if this is achieved it is not realistic to expect that the capital project proprietary software will be able to provide the support required after handover to operations and for the rest of the assets life.



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# Is there a path to a solution?

The use of open data standards supported by different software solutions provides a pragmatic and affordable strategy for data collection, aggregation and sharing that can support lifecycle asset management.

This paper provides clear guidance and two best-in-class practical examples to cut through the rhetoric regarding digital transformation. Alongside parts two and three of this series of white papers, asset owners and developers will have a framework to guide their asset management strategies in a way that optimizes project delivery, enhances operational efficiency, and provides reliable data for enhancing full-lifecycle decision making; inspiring a more sustainable built environment for all.

Open data availability is now critical if we are to achieve optimal utilization of built assets and

resources (both labour and materials) to meet the demands of increasing populations, whilst simultaneously making significant reductions to the environmental impact with built assets being the single largest contributor to greenhouse gas emissions today.

The value of an organisations' data is a very significant proportion of the value of their entire asset base but typically much of it is 'dark data' and therefore not available for use. Open data is now critical for flexibility, future wealth, healthy ecosystems and fit for purpose living spaces. Open, neutral data standards are the key to unlocking this required future state.



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# What standards are available?

The publishing of ISO 55000 in 2014 has enabled a global consensus of what asset management is, core terms and concepts in use, however, the ability to share approaches and data is not as advanced.

Many portfolio owners have adopted the ISO 55000 Asset Management series as a structure for managing whole-life asset value. These clearly defined aspirations, by forward thinking asset owners and developers, provide real world evidence of the industry's need to address the shortfalls that exist today in traditional approaches to asset lifecycle management. However, what all of them are still missing is the ability to unlock their data and use it freely to drive real strategic improvements. Without open data standards that support data sharing, data exchange and interoperable processes the same fragmentation that exists today will persist and siloed information will become obsolete or inaccessible over time. There are two major hurdles to the availability of well structured, usable and available data. The first is the fragmentation, inefficiency and poor decision making that often exists within the end-to-end built asset lifecycle process. (Few, or no single person, within an organisation requires a full lifecycle view of asset data.)

The second is that there needs to be a shift towards an 'owners' mindset' in which people understand that the way they capture and manage data now, impacts someone else in the future.

These are the 'internal' challenges faced by the infrastructure and asset sector. The sector looks to homogenise across the process and develop capabilities by establishing standards such as Asset Management in ISO 55000. However, the standards are not always specific about how the data required to support the process should be structured and managed. Therefore, what is required are open data standards that connect the various standards at the data level.



# Why bother?

Data management can be seen as an additional, perhaps unnecessary cost and the departments responsible for CAPEX and OPEX often work in different regimes. Asset management thinking acknowledges the benefits of a systems approach however a systems approach to digitisation is also required.

The holistic evaluation is complex. Having a TOTEX view of all expenditure (CAPEX + OPEX) can not only provide leaders and organizations with greater transparency into operations and project delivery, but helps to provide more opportunities to realise better commercial and sustainability results.

The pace of technical advancement means that to realise maximum value, decision-making information and therefore decision-making ability has to keep pace also. Vice versa to take advantage of new material combinations or methods (say) having reliable, cohesive data will enable decisions for better quality solutions that would otherwise be deemed to contain too much risk (whether that risk be commercial, safety or reputation). Better data will allow the industry to move on from doing what it has always done.

The rapid and diverse ways that the world is changing requires an approach to asset management that can keep pace and use the developing technologies in agile ways. As well as increasing population size, climate change and extreme events, our industry needs to take a proactive approach to managing these social responsibilities.

For example, the opportunities to re-use materials from expired assets, will benefit the sustainability agenda, but this needs clear information about what the material to be re-used is, its condition, its location, and how to access it safely. This circular economy thinking is going to play a significant role in how we repurpose building components that would be traditionally disposed of can instead be used for building the spaces needed to accommodate our ever growing cities, without unnecessarily using non-renewable resources. Open and linked data systems are key components to making this possible.

## Industry Roadblocks

Existing assets are a huge challenge for asset owners. Aligning approaches to exploit value from historical data and project information trapped in legacy formats is a significant task. How to retain and access the value of legacy data while at the same time adopting new approaches and technologies is a very difficult problem to solve. This barrier can limit exploitation opportunities and increases a technology risk while navigating the challenges of locating reliable information and developing appropriate insights for current day decision-making. Accessibility to reliable federated information in a secure way also remains a barrier to effective asset management. Legacy data hinders the progress of bringing together all the data, knowledge, learning and wisdom to develop the long-term views needed for effective asset management.

To confront the big challenges ahead more systematically, strategic approaches are needed. Long-term models are not robust enough because more rigour is needed through planning across sectors. Aligned, shared and reliable data is an imperative for effective societal planning and adaptation to climate change and resilience to the demands of an increased population.







**A mission-critical component for any significant organizational or cultural change to be successfully implemented is strong executive leadership**

## The Cultural Roadblocks

Organizational culture and systems which view built assets through the separate lenses of project delivery and operation are not supportive of asset management approaches providing strategic competitive advantage, fiscal discipline and environmental sustainability. A strategic data plan led and specified by executive sponsorship from the asset owner is required. Some organizations see the adoption of BIM as a better way of working for project design and interdisciplinary coordination to support project delivery. However, this is still arguably a silo, a proprietary model file optimized for communicating design intent that does not capture constructability, cost, schedule, warranties, commissioning, planned maintenance, operating performance metrics and so on. Of all the catalysts for dealing with these roadblocks, industry alignment and informed, proactive leadership is the most essential.

## Executive Leadership is Essential

A mission-critical component for any significant organizational or cultural change to be successfully implemented is strong executive leadership. Digital transformation is no exception. It will require executive leadership not only to pro-actively mandate change but leaders need to champion a strategic management plan that defines built asset information as a valuable business asset that supports critical decisions about capital investment and operating expenses by the organization in order to achieve its mission, goals and metrics. This requires a company-wide, strategic agenda which necessitates a holistic approach and not merely a task to be delegated to the functional facilities management and IT departments.



## Case Study

### Network Rail

Network Rail is the owner, operator, and manager of the United Kingdom's rail network. Its assets have a modern equivalent replacement value of £500 billion and comprise track, signals, structures, earthworks electrification, telecoms and drainage forms. In common with many sectors, the technology platforms to support asset management activity have been developed organically over time leaving a legacy estate of several dozen separate databases.



Whilst a level of performance is required within all asset categories, the track asset and its associated interface to train vehicles is a key enabler to the provision of safe and reliable services to customers. Creating aligned data for track assets requires teams to integrate data covering several areas of condition, age, past work, new project work, changes in response to train traffic and equivalent datasets for related assets such as earthworks and drainage. Additionally, Network Rail has to align this to data on how the overall train service is performing. Sharing data is required across internal systems, and in a reciprocal way with suppliers. The gathered data is used in performance reports, modelled changes, and analytical insights, helping to identify defects at earlier points prompting lower cost maintenance interventions and securing improved reliability and availability of the assets. The alignment of data over the past decade has revealed new 'discoveries' to us that has helped to change the blend of interventions used and thereby improving both the life of the network as a system. This helps with improving or sustaining the level of performance of the track system for reduced costs of approximately 8% (when measured across the full track life). The supply chain has invested in bespoke technologies

to support specific datasets, and new conventions are in development including remote inspection technologies and real-time operational solutions. Going forward, no one technology solution will cater for all the track asset data needs and as teams need to be able to combine asset data from multiple sources in an accurate and reliable way. Interoperable standards for data have been and will continue to be essential to allow Network Rail to define data requirements in open formats and progressively deploy automated data exchange processes that provide up-to-date, aggregated datasets of the highest quality.

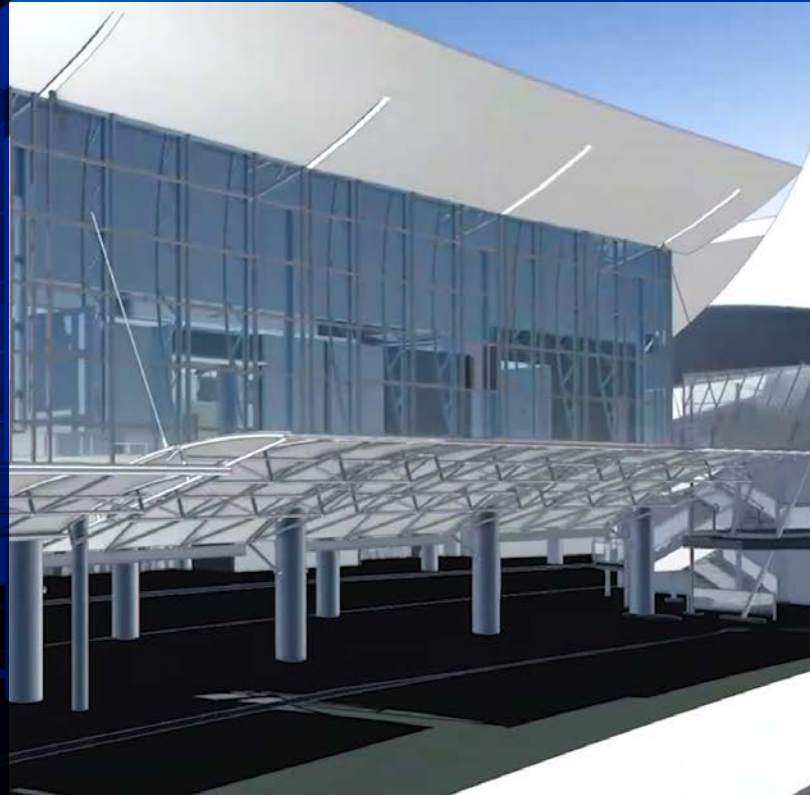




## Case Study

### Auckland Airport

As an owner, operator, and developer of an entire airport campus that consists of a full range of built asset typologies, Auckland Airport acknowledges that no one technology solution will cater to all asset management activities. By taking an open standards approach to built asset information management, the airport can focus on data requirements and automated data exchange processes, rather than having to waste effort on aligning the entire supply chain to a proprietary solution.

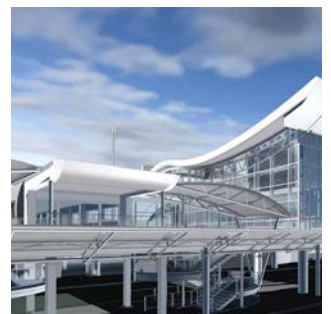
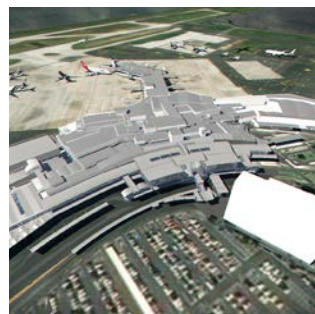
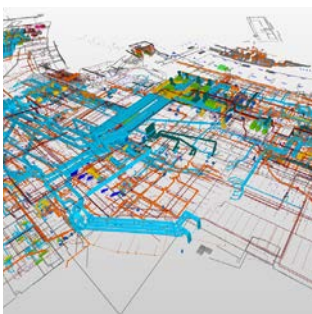


Instead, the focus is on clear data requirements in open formats that are well documented for suppliers. This enables the supply chain to choose the best tool for the job, with the added advantage of the client not becoming a bottle neck to innovation.

Auckland Airport's focus is on developing a connected ecosystem of data and technology components that can evolve and change at a component level without impacting the overall strategic direction of the business. Data captured today must be usable tomorrow and for 50 years in the future. Therefore, being open is key to proving the confidence to select tools to solve today's

problems, while understanding data will be reusable in other systems as technology evolves to solve the problems we don't yet know exist.

Data from asset information models can be used to inform future capital planning, aid maintenance planning, provide the 3D context for detailed simulation of people flow or smoke particles, improving the quality of cleaning procurement processes, enabling more detailed asset accounting practices, and for better situational awareness in emergency planning, to name a few. The possibilities are endless once well-structured asset information is made available across an organization.



# Adopting an open digital approach

The best digital environment for whole-life decision making is an ecosystem of many different software products that are interoperable through the use of supporting an international open data standard. This connected data allows real freedom to access all necessary information as appropriate and at the correct time and to see data itself as an asset to be used. buildingSMART International promotes the use of openBIM® and is a user-led community creating openBIM standards.

openBIM is a vendor-neutral collaborative approach and the standards generated enable shareable asset information for all the participants that play a part in an asset's life and address the current constraints that are faced by asset managers.

The adoption of an openBIM approach by asset owners, through their asset management structures, is the most effective way of disseminating the improvements throughout the supply chain, as this acts as a mandate for change.

## Raise your confidence level in your organisation's decisions

By capturing and organizing your asset data you will be empowered to make better decisions that are supported by empirical evidence obtained from analysing and mining that data. Effective asset management is ever more reliant on data, both to facilitate successful project delivery, but also as key asset management enablers over the whole-life of the asset. This means that a number of different attitudes and beliefs are required:

- Projects recognise that they are delivering both a physical and a virtual asset (perhaps a digital twin)
- Everyone has a part to play in good data either through providing good data or initiating corrections when poor data is discovered
- Data supports strategic decision making but relies on domain knowledge and awareness of data quality to be optimal
- Procurement specifications should reflect the importance of data by ensuring it is a defined deliverable
- Project management approaches should ensure that sign-off/ payment is not initiated until the asset and all supporting information has been provided against requirements
- Similar to physical assets, data can degrade as a usable asset if it is not managed correctly and, if degraded, may require much time and expense to recover, if that is possible

# Some Conclusions

- 01** **Executive leadership that is well-informed** about the possibilities of better data and confident that technology exists to bring about eventual positive outcomes, needs to set the agenda.
- 02** **A strategic management plan for built asset information** that works with software agnostic solutions, is a critical aspect of any building or infrastructure owner's portfolio.
- 03** **Whole-life asset management continues to mature** and further adoption of the use of open data standards will unleash additional value.
- 04** **Evolving open digital exchange standards** is a key enabler to allow multi-disciplinary and inter-organizational teams to collaborate efficiently on all phases of an asset lifecycle.
- 05** **Contractual arrangements** and the legal aspects are a very important dimension of this discussion and should not be ignored. [These will also be addressed in more detail in a following white paper.]
- 06** **Data is the enabler to value** and will thrive with open data workflows and competencies.
- 07** **Building organizational capability** is essential for success. To be successful requires strategic planning, measurable goals, performance incentives, executive leadership, adopting open data standards, deploying new technology, education, and training.
- 08** **Adopt digital workflows company-wide** by leading from the top to engage all departments and recognising that this is not something to be merely delegated to functional groups.

# What next ?

As stated in the introductory overview, this is the first in a series of three white papers discussing the need for and advantages of digital asset information management.

White paper number two will elaborate on the standards and technology that are available to support a digital asset information management strategy and share some best practices on how to apply them. Various standards and methodologies (such as ISO 55000, ISO 19650, ISO 8000 and bSDD) that provide guidance on the development of suitable management systems and approaches will be explained.

White paper number three will be more forward looking and discuss emerging technologies that will provide positive benefits such as IoT (Internet of Things) sensor capture, AI (Artificial Intelligence) for simulation and predictive analysis and how Digital Twins (a virtual twin of a physical asset) can be utilised not only to support efficient operations and maintenance but also as a current record of the asset for use to plan and execute refurbishment, extensions or replacement.

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## Supporting Organisations

Institute of Asset Management Patrons



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