AVEVA's Digital Asset Approach

Defining a new era of collaboration in capital projects and asset operations

An AVEVA Business Paper

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Introduction

There is constant, intensive change in the capital engineering industries in both project execution and asset life cycle management. New challenges and opportunities are continually appearing thanks to dramatic developments in technology, uncertainty in global markets and the reduction in accessible energy and raw materials.

Added to these challenges are the issues that the lack of collaboration between Engineering, Procurement and Construction companies (EPCs) and Owner Operators (OOs) causes. The adversarial nature of contractual relationships between EPCs and OOs is a major obstacle to collaboration. For example, in the CAPEX phase of the project, uncaptured communications and decisions about changes can have a huge impact on a project. Operators and contractors need effective communications and decision making if they are to achieve predictable outcomes for the project and to be able to feed back valuable lessons from operations into the next project.

Software and carefully applied innovation have a role in supporting this change and can help organisations to overcome the significant challenges they face. The old ways of doing things, the old 'point' applications, are outmoded and a new approach is required.

This paper introduces the concept of the Digital Asset and describes how it is created and used. It outlines the huge impact which the Digital Asset, properly employed, can have in enabling more efficient, more collaborative and more agile business processes at every stage in the life cycle of the physical asset.

'There is constant, intensive change in the capital engineering industries in both project execution and asset life cycle management…'

What is the Digital Asset?

The Digital Asset is not a software application or solution. The term refers to the aggregated information that describes a physical asset, and to the technology framework that brings this information together. The Digital Asset approach to engineering Information Management is new in that it uses advanced technology which can function with data from any source (it is 'data-agnostic'). In fact, every physical asset already has at least some digital information that describes it, and digital information is being created from the very start of a project. The Digital Asset approach unlocks the potential value of this information and enables further information to be continually added, managed and made use of.

Common practice is to use point solutions for different Engineering & Design purposes. Some solutions offer a level of application integration, but most asset information is locked away in separate data repositories ('silos'). This is a result of differences between these individual applications, file formats, data libraries and so on, and causes difficulties in accessing and connecting (contextualising) the different types of information.

While many organisations use Document Management systems, which have made significant improvements to the ability to aggregate information, they do not go far enough to overcome the problem. A single document may contain many items of data that cannot be cross-referenced with other data items of different types, held in other systems or documents. While documents are easy to control, the information held in documents cannot be controlled, unlike information held in databases.

Information can be defined as:
Data + Context = Information.

A value of, say, 10m³/hr is just a single piece of data. But associate it with a pump, and link that pump with its location in a P&ID, and the data has gained context, which gives it meaning. It becomes information.

In the same way:
Information + Accessibility = Knowledge.

By making information easy to access, we turn it into useful knowledge. A maintenance engineer, for example, can take informed action if he can see that a 20m³/hr pump output fell to only 10m³/hr after a filter replacement was completed.

The Digital Asset approach overcomes this by using Information Management technology that brings together all types of data from any source system, and can validate data automatically against predefined standards, and make it readily available to users across the entire enterprise.

Why is the Digital Asset approach so important in capital projects industries?

Unlike manufacturing industries, AVEVA's customers design, build and operate very complex one-off assets. Creating these costly assets requires that the engineering, design and construction phases significantly overlap in order to achieve early commissioning and return on investment (ROI). For this reason, effective solutions for plant design have always been based on a single technical infrastructure that supports highly concurrent engineering, design and construction. These design systems are the core enterprise system in any project's Engineering & Design phase but, unlike a product team, which can use a single corporate tool set, individual projects may be required to use different tools as mandated by individual clients.

Even when completed and handed over to the operator, plant assets cannot be treated as products. This is because they have unique characteristics that require unique maintenance and management strategies to sustain optimum operation throughout their service lives. Unlike mass-produced products, they also undergo continual change and modification. For these reasons, these industries need a different approach.

Chemical Engineering Magazine estimated that engineers working with stand-alone programs spend 50–80% of their time moving and organising data between programs.

The Digital Asset approach brings together data from different sources by creating a central repository of validated information from all sources. It turns data into information by setting it in context with all other related data items regardless of which documents or software systems they reside in. This approach converts information into knowledge by making the entire information asset accessible to all business functions, in a flexible but well-controlled manner. It is a true business enabler, both for the EPC and the OO.

It enables new and more efficient working relationships between the contracting parties, which benefits both of them. But what does this mean for organisations working in the capital projects industry?

The Owner Operator's perspective

OOs face a number of increasingly severe challenges. Unstable political or market conditions, such as global prices for energy or raw materials, are outside their control but they can greatly change the business case for a proposed investment project. This requires both efficient project processes and the ability to minimise risk. Now, more than ever before, OOs need to reduce risk to their capital investment plans. Consistently achieving this, however, requires a complete change in the way in which projects are executed.

Over the last forty or fifty years, in attempts to reduce risk and to deal with increasing project size and complexity, project structures have changed from being fully integrated to being highly fragmented, then back again to a more integrated approach. These changes led to corresponding changes in the quality of project information. Poor information quality leads to errors, miscommunications and rework, and hence to overruns in time and cost.

In 2012 over 71% of those with responsibility for project delivery stated that growing project complexity was a major concern to successful project delivery. This is twice as many as were recorded just four years earlier. The same research showed that 63% of projects are over budget and 75% are behind schedule. Not surprisingly, over a period which has seen a 15% increase in oil production and a 49% increase in gas production, CAPEX costs have risen by a massive 387%. Liberum Capital found that 'one of the major reasons for the [oil & gas] sector's underperformance in 2013 has been fears over capital discipline.'

For OOs, failure to bring an asset on stream on time can result in production losses running to tens of millions of dollars per day. Even a delay in safely achieving full nameplate capacity represents a significant lost revenue opportunity. In good times, this can dramatically reduce ROI; in bad times it can make a project economically unviable. OOs need better ways of working with their EPCs to overcome this. Information, and the sharing of information, is the answer here, too. Access to trusted information facilitates better communication between EPCs and OOs. Better contract transparency means less time spent on legal disputes and more time on getting the facility to first production.

Problems do not go away once a new asset is in operation. The challenge then is to sustain full production while optimising operating costs and complying with safety, environmental and regulatory requirements. This can be costly and here, again, information is the key to meeting this challenge.

High-profile incidents are rare, but they are just the most visible signs of the difficulty of operating complex facilities. Less easy to see are the day-to-day consequences which can be measured in unplanned outages, overruns on planned ones, and poor utilisation of skilled labour. ARC Advisory Group has estimated these hidden costs to be around 5% of lost production. 80% of these losses are preventable and almost 40% are due to operator error. In a 2008 presentation to the UK's Institute of Engineering Technology, Colin Pearson of ABB Technology explained, 'The biggest revenue loss in all plants around the world is due to operator error. That is not operators making mistakes; it is operators not having the information on hand to make the right decisions at the right time.' The relationship between information integrity and operational safety and reliability is fundamental; without fast access to trusted information, operational teams will find it difficult to make the right decisions.

OOs need a Digital Asset containing information which is comprehensive, trustworthy and readily accessible, and which describes every aspect of the operating asset. Access to reliable information supports the OO in maximising output and proving their reliable regulatory compliance during the continual changes, repairs, modifications and upgrades that their assets require.

This is why leading OOs are already building an approach that delivers a Digital Asset, even if they do not think of it as such. They are doing this by comprehensively as-building their existing assets and working more closely with their EPCs on the creation of new assets. They are also establishing information standards and defined information requirements in their contracts because they understand the importance of the information for them later in the asset life cycle. In maximising the return on capital employed, they are also starting to feed back lessons learned in operations into the design process.

The EPC's perspective

Although OOs and EPCs all work towards the same final goal – safe, operating plants – EPCs have different business drivers. Their focus is on the completion of a project with minimum risk to cost and schedule. This means increasing efficiency and productivity while continuing to deliver value to their clients. In practice, of course, the situation is not always so simple; there are many working relationships between OOs and EPCs. The traditional one is simply that of buyer/seller. In more sophisticated arrangements the 'EPC' may actually be an operating division of the OO, with much more closely related business objectives. But efficiency and productivity are important, whatever the relationship.

For EPCs, too, information is key. The EPC begins creating different types of project information from the outset. But this information changes rapidly and extensively as an initial engineering concept is developed and refined over and over towards the final, fully defined and constructed physical asset. It is this rate of change, combined with the huge scale and complexity of the information asset, which creates the EPC's biggest challenge. Every discipline and every project member must have ready access to all relevant information and its current maturity status, in order to be able to make well-timed, correct contributions to project progress.

Poor decisions made by the EPC can have an effect on later activities. Procurement, especially of costly, long-lead equipment, based on unreliable or incomplete information can incur significant overruns of time and budget. It is generally accepted that the impact of an error increases roughly ten times at each successive stage of a project. So, for example, a minor clash, which might cost $10 of a designer's time to correct at the 3D modelling stage, may cost $100 to correct at the drawing output stage, $1,000 to correct in fabrication rework and $10,000 if it gets through to on-site construction.

The impact on the EPC's profitability is clear. Changes requested by the OO add greatly to the Total Installed Cost (TIC), because the EPC has to alter its delivery plan to accommodate the additional work required, or perhaps even undo work already undertaken. Access to trusted information enables the EPC to more accurately assess the impact of a proposed change, make an informed decision and then execute it on time and on budget.

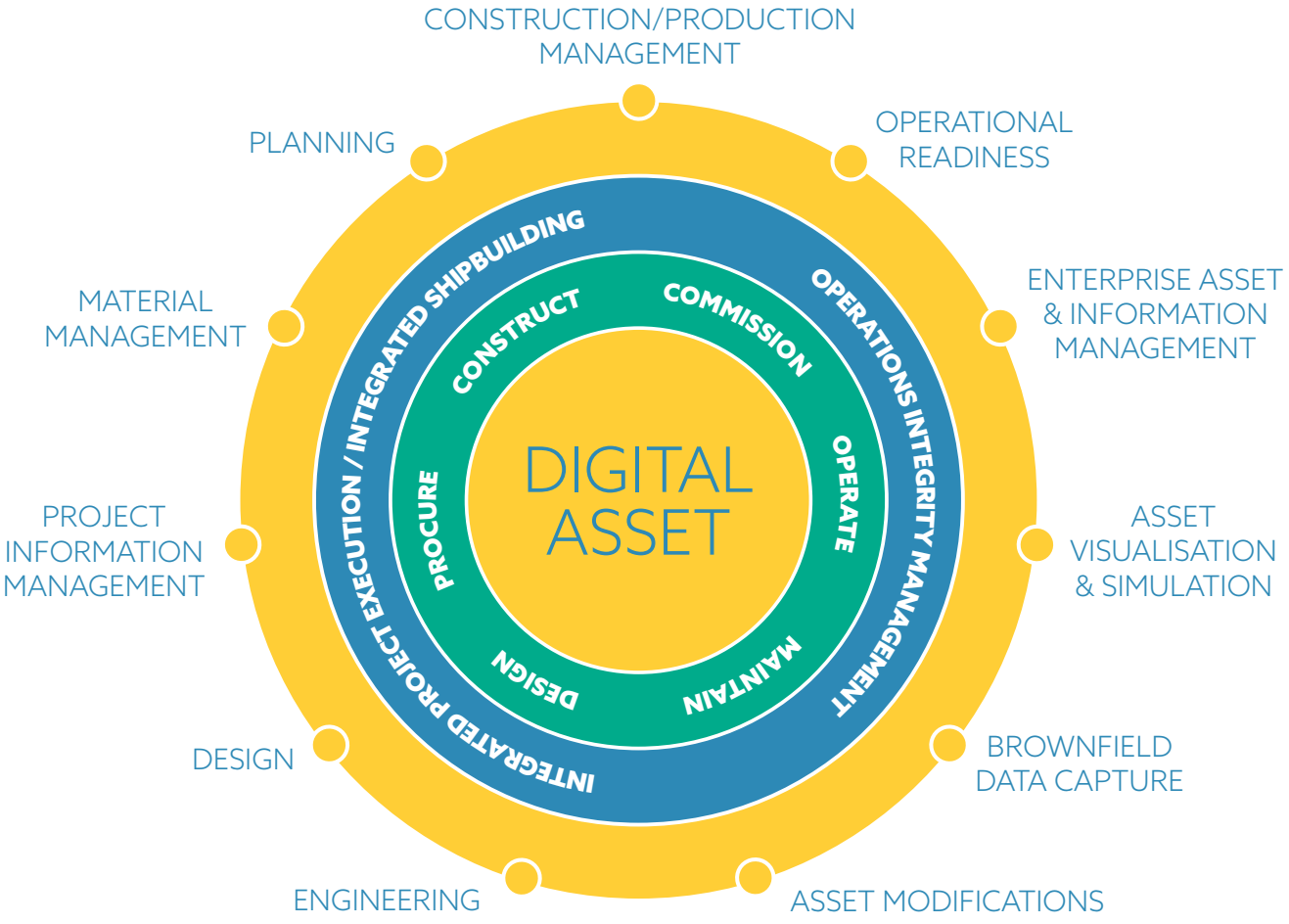
In a market where EPC services can be hard to differentiate, such a capability provides a significant way for an EPC to stand out from the crowd. OOs may be happy to pay a higher price for reliably on-time, on-budget delivery with the right quality, rather than a cut price for a project delivered 30% late or of poor quality.

Project handover to the client in the past was an 'over-the-wall' event involving just a set of keys and a truck-load of documents. It was regarded by the EPC as a non-value-adding contractual obligation, so there was little incentive to ensure the quality, completeness or organisation of the information provided. Even the move to electronic transmission did not materially change this; it just replaced the truck with a few DVDs. While contract terms could oblige the EPC to deliver specified information, in practice it became the job of the client's CAPEX team to process a massive 'information dump' to populate the OPEX team's systems; and this at a time when the business needs to get the new facility into production as quickly as possible. To make this job harder, by this point in the process the original project team will have been dispersed. Any queries from the CAPEX team may therefore find that the relevant expert is no longer available; the EPC would then need to charge for the man-hours spent in resolving the query. Moreover, the OO team would very often not have the required skills or software to review many of the deliverables, such as the 3D model.

Ensuring a good working relationship with the OO can have many benefits for the EPC. For example, the EPC that built the facility is most likely best suited to expand or revamp it. Therefore, risk later in the life cycle could be damaging to that relationship. A new approach to information handover is required, and is being employed by increasing numbers of OOs and EPCs who have used the Digital Asset approach to establish progressive handover. A leading, global EPC has stated that digital handover of the project is becoming a must-have for new projects. The business value is considerable for both parties. EPCs using their own progressive handover solution can ensure that they are fully compliant with their contractual requirements in terms of information delivery and can prevent opportunities for disputes or failure to release any hold-backs. This can also be a valuable differentiator for an EPC, as OOs can achieve massive reductions in handover costs.

How the Digital Asset approach supports the entire asset life cycle

To understand how the Digital Asset approach is improving the relationships between OOs and EPCs it is first necessary to understand how it supports the asset life cycle.



A physical asset passes through six distinct phases:

- Design
- Procurement
- Construction
- Commissioning
- Operation
- Maintenance.

This sequence is repeated continually, on larger or smaller scales, throughout the asset life cycle, as modifications or upgrades are made.

Each life cycle phase creates, changes and uses information of different types and in different source applications.

The phases also require different capabilities:

- Engineering
- Design
- Project Information Management
- Material management
- Planning
- Construction/production management
- Operational readiness
- Enterprise asset and Information Management
- Asset visualisation and simulation
- Brownfield data capture
- Asset modifications.

These capabilities are provided by a range of AVEVA products and solutions. Third-party solutions can be used alongside some of these; the AVEVA approach is inherently open and its Digital Asset technology is data-agnostic. It fits in seamlessly with existing IT investments and infrastructure. AVEVA's open, flexible approach enables its Information Management solutions to co-exist with existing systems. It significantly improves the quality and accessibility of their information, without disruption to the Information Management processes within the business.

The customer can retain any preferred or contractually required point solutions, while now extracting greater value from sharing, validating and reporting on the information that flows through them.

AVEVA's Digital Asset approach supports two essential strategies: Integrated Project Execution (IPE) for the project phase and Operations Integrity Management (OIM) for the operations phase. But these are not separate; a key feature of the Digital Asset approach is its ability to support an asset's EPC-driven CAPEX phase and its subsequent OPEX phase on a common Information Management platform.

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New era of close collaboration

Through increased transparency, collaboration, quality and predictability, EPCs and OOs can become much more like partners in the delivery of world-leading assets.

By adopting a Digital Asset approach across its own network of departments and assets, and across its associated network of EPCs and key suppliers, an OO can achieve more consistently on-time, on-specification and on-budget completion of projects. The Digital Asset approach also improves safety and reliability gained from easier, faster access to better quality information. This reduces business risk and strengthens the OO against challenging market forces. In turn, supporting the OO more effectively also benefits the EPCs, who can gain preferred bidder status on new projects and, by being more productive, can increase their earning capacity.

Practical benefits of such an arrangement include the ability:

- to define and deploy information standards at the outset
- to reduce project risk, by removing many causes of miscommunication and poor decision making
- to reduce design iterations, saving time and cost
- to pre-populate the OPEX systems with trustworthy, compliant data as soon as it has reached the necessary level of maturity
- to compile high-quality regulatory submissions well in advance of the planned commissioning date
- to gain increased confidence in starting up the new or revamped asset and in achieving full production
- to operate and maintain the asset more efficiently, based on trustworthy and readily accessible information
- Design to Operate, i.e. feeding lessons learned in operations back into design.

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Some OOs have already successfully begun more collaborative relationships with their EPC community. However, many EPCs may understandably be worried about what they might see as an intrusive way of working, particularly where they have valuable proprietary expertise. The solution to this lies in good Information Management, with controllable access to information, and with greater information transparency where suitable.

The ability to share mature, validated information right across the project, from the originating design engineer to the client's operations team, provides a new level of empowerment that can transform project delivery. Instead of being just 'hired hands', EPCs and their subcontractors can now become full participants in the success of the investment.

AVEVA's Digital Asset strategies

As outlined above, the Digital Asset approach supports key strategies for asset design, construction, handover, operation and maintenance.

It enables Integrated Project Execution for EPCs and Integrated Shipbuilding for shipbuilders. Here, the principal benefit is predictability; confidence that a project can be executed on budget and on schedule. It also gives the EPC early insight into what problems might arise that could jeopardise the budget or the schedule.
The IPE strategy employs best-practice standards to maximise efficiency, productivity and quality. For example, the ability for all disciplines to access project information of known status enables efficient control, communication, work prioritisation and management of changes. This strategy embodies two key elements.

First, AVEVA's Integrated Engineering & Design solution provides a self-integrating suite of essential tools for multi-discipline, multi-site collaborative engineering and 3D design. It can be easily extended, both in the number of users it supports and by the addition of extra products for specific purposes. Importantly, its built-in data-management capabilities and its unique Compare & Update function support the highly iterative 'design spiral' nature of capital projects, ensuring a Lean approach to project execution.

Second, as asset operation becomes ever more data driven and increasingly reliant on a digital as-built baseline, a consistent approach to life cycle Information Management is required, even though asset information may have been created in a variety of software applications. To meet this need, the IPE strategy also covers project Information Management solutions. These solutions capture, connect and validate all project data to provide users with ready access to contextualised, trustworthy information, and to create a global layer of information governance. The Digital Asset supports solutions for Catalogue & Specification management, data visualisation and data assurance, materials management, production and construction management, and progressive handover.

Together, these elements provide an unrivalled set of capabilities for efficient project delivery.

For asset Owner Operators, AVEVA's Digital Asset approach supports Operations Integrity Management. The objective of OIM is to improve safety and operational reliability. It achieves this by enabling our solutions to unlock the data silos of incompatible, non-contextualised, unvalidated and inaccessible information. These solutions provide the data collection, validation and access functions described above. Importantly, they drill down into unstructured sources, such as documents, to extract individual data items, ensuring that information is managed and controlled.

The result is an intuitively accessible resource of information of known quality that can support all aspects of asset operation and life cycle management. By eliminating, or at least reducing, the 'unknown unknowns', operations can be made safer and more efficient. Tasks can be carried out with complete and reliable information, minimising planned downtime and accelerating the response to unplanned downtime or incidents. Continuous improvement programmes can be based on reliable information and their results measured accurately.

The OIM strategy can be implemented on existing assets for which the available information assets may be incomplete or of uncertain quality. AVEVA's solutions that support the OIM strategy identify where information is missing or inconsistent, enabling informed prioritisation of actions to resolve such deficiencies. From even small beginnings, a complete Digital Asset can be built up, bringing incremental benefits at every step. Not surprisingly, OOs are grasping the opportunities this technology creates to bring aging assets up to date with comprehensive as-building programmes.

In asset operations, change is continual, whether from small-scale repair and maintenance tasks or from major CAPEX projects. The Digital Asset approach enables this entire spectrum of changes to be managed effectively, separating uncommitted changes from the true current as-operating condition of the plant. It supports a range of AVEVA solutions for OOs, including progressive handover, asset visualisation, asset life cycle Information Management, Control of Work, immersive training and simulation, and brownfield data capture.

Beginning the journey

The Digital Asset approach is a continuous journey that transforms business processes and relationships. The best strategy is therefore to begin with well-defined first steps and progressively add new capabilities, consolidating the benefits at each step.

For the EPC, a good starting point is AVEVA Engineering™. This can be used with any 2D or 3D design tools and can successfully tackle the common issue of chaos in engineering tag data. AVEVA Engineering can be used as an engineering tool as well as the first step in assuring engineering data. Incremental improvements can be achieved by adding further applications or a solution such as AVEVA's Integrated Engineering & Design suite. A subsequent stage would be the deployment of a project Information Management solution as described above.

For the OO, the obvious strategy is to begin with a data assessment programme. Aggregating information and carrying out brownfield data capture using 3D laser scanning enable the true as-operating condition of an asset to be modelled, while Information Management and asset visualisation enable existing asset data to be brought together into a Digital Asset. Subsequent developments could include rolling out the Digital Asset approach across all the company's assets, and insisting that selected EPCs use AVEVA technology to enable progressive handover of new projects.

Typical benefits achievable include:

- reduction in time wasted in finding and validating information before beginning a task
- enhanced data quality, reducing errors, delays and rework
- better, faster and more reliable decision making
- reduced costs of compliance with applicable information standards or regulatory requirements
- more efficient collaboration across functional teams
- better application of lessons learned from operations.

In time, the journey will take the capital engineering industries into a new era of more efficient, closely collaborative working. AVEVA's Digital Asset approach is laying the path for this journey.

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