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The Next Generation of ALIM: Connecting the Digital Asset

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Keywords

ALIM, CAPEX, OPEX, TOTEX, Digital Asset, Asset Reliability, Asset Performance, Predictive Analytics, Internet of Things, Smart Connected Assets, Cloud Infrastructure, Engineering Information, System of Record

Summary

Global demand for new infrastructure, utilities, and process plants is increasing steadily with the growth of regional economies and the business and industrial requirements that accompany this growth. Along with this demand, comes increased risk for new projects that tend to be larger and more complex. This makes it more difficult to meet time and cost constraints and deliver plants that can operate with maximum efficiency and safety, as well as being maintained for reliability.

One of the single most significant issues associated with capital projects is the lack of accurate, complete, and timely project and engineering information. Not having access to the complete set of engineering and construction information can add substantial project and operational risk in terms of cost, time, and safety. Furthermore, accurate engineering information must be available and accessible to feed documentation needed for the OPEX (operations- and maintenance-related) cycle. EPCs, project managers, and owner-operators all concur that access to information throughout all phases of capital projects is critical to meeting schedule and cost goals.

One of the single most significant issues associated with projects is the lack of accurate, complete, and timely information that can add substantial risk to the project in terms of cost, time, and safety.

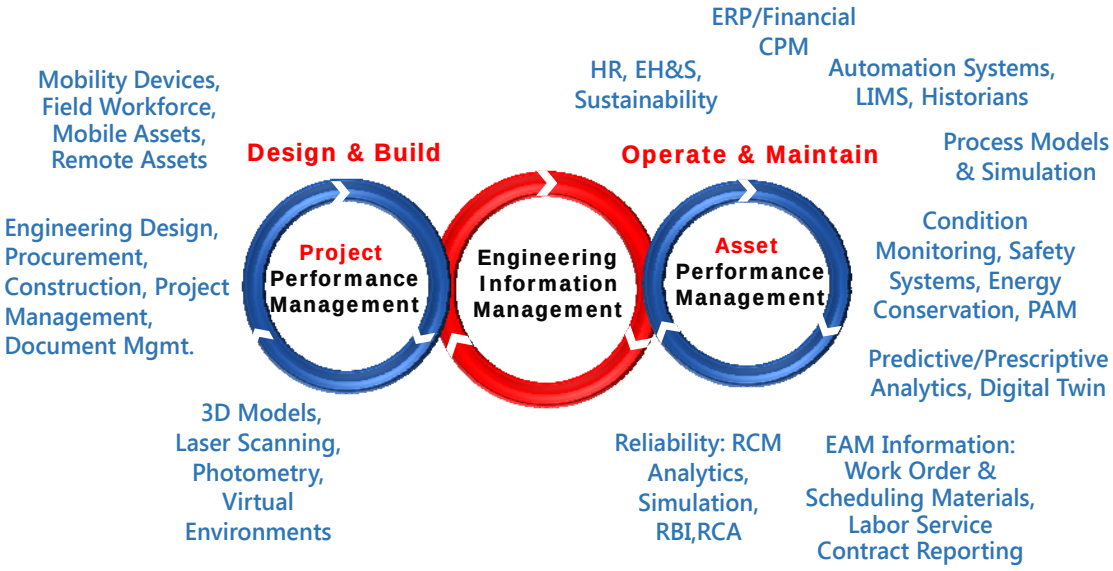
According to ARC Advisory Group research in the power, process, and utilities sectors, information management and access is equally important to EPCs and owner-operators. Nearly all owner-operators want information turned over in a form that they can import into asset management/maintenance management systems that they use to operate

and maintain the facility. Also, according to ARC, access to and management of information is equally important to the EPC responsible for designing and building the facility and the owner-operator that needs the information to operate and maintain the facility and production assets more effectively following handover. The EAM/ERP systems used to maintain and operate facilities are not best suited to managing this information so Asset Lifecycle Information Management (ALIM) systems are increasingly becoming the system of records for companies. The current trend is to make the ALIM system the system of record that supports and continually updates operations and maintenance, IT, and ERP for accounting and financial systems.

While the need to provide all stakeholders with access to timely and accurate information from capital projects to operations remains the issue; the emergence of a range of disruptive technologies is having and will continue to have a transformative impact on how this information will be presented, accessed, and made available to EPCs, owner-operators, contractors, equipment suppliers, and service providers.

Continuous Flow of Information Remains the Key to the Digital Asset

The purpose of an ALIM system is to provide a framework that optimizes the availability of and access to all information across the CAPEX and OPEX lifecycle phases of plant infrastructure and all its assets. Additionally, an ALIM system must provide a continuous flow of



Integrated ALIM Platform: Single Source for All Design/Build/Operate/Maintain Information

information to stakeholders from the early stages of design, through construction, handover, commissioning, operational readiness, and to sustainable operations and maintenance. Thus, the handover process ceases to be a single event or milestone in the overall project, but becomes a continuous flow of information throughout the project lifecycle. Having access to and being able to act on all of the information across the CAPEX and OPEX lifecycle phases, i.e., engineering design, asset information, and operations and maintenance information, help reduce "TOTEX," the total cost of the asset. It is within the ALIM system that owner-operators will be able to define requirements for operations and maintenance service and support documentation early in the project.

Meeting the Requirements for Operations and Maintenance

Businesses in the power, process, and utilities sectors typically waste a significant amount of time and money attempting to retrieve and recreate existing data. In the design phase of a project, engineers routinely spend a significant amount of their time searching for existing design files, models, and other project information. As-designed and as-operated designs may conflict. On the operations side, operators not having access to critical information can cause downtime and production delays. Today's knowledge workers cannot make accurate critical decisions and react effectively to unplanned events without access to accurate and timely operational and asset information.

This situation is often not a case of non-existent information, but rather the impact of unreliable, inaccessible, or incompatible project and operational information. The challenge of access to the right information at the right time is an issue that impacts all stakeholders across the project design and operation phases.

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In a typical plant environment, operational and asset information resides in multiple applications and systems, and come in a variety of formats with multiple mappings between the systems. One of the fundamental concepts of engineering design is reuse. An inefficient flow between people, systems, and applications significantly obstructs efficient reuse of information for both capital project and operational plant lifecycles.

Even in the current era of easy access to information, efficient information flow presents some very real challenges for EPCs and owner-operators. Fundamentally, access to asset information is equally important to each stakeholder in the lifecycle, whether it's the EPC that needs information from multiple design applications, or the owner-operator that needs equipment drawings and service bulletins. The common challenge is disparate information systems for design models, engineering, and asset information. Lack of interoperability between these disparate systems can ultimately result in the inefficient flow of information between people, systems, and applications causing capital project cost overruns and delays.

As a capital project progresses, the number of stakeholders increases. So does the volume of information that must become part of a collaborative digital environment in which information flows freely and among the multiple stakeholders. Both historical and newly created information must be accessible and shared in real time across all processes in the lifecycle.

Project information should be regarded as a digital asset representative of the plant infrastructure and all of its physical assets that is shared among stakeholders. As-designed project information, along with as-procured, as-constructed, as-tested, and as-commissioned would comprise a system of record that provides a baseline for the operate and maintain phase of the plant's life. Moreover, a system of record represents a single source of all information across the CAPEX and OPEX lifecycle, a fundamental characteristic of a good ALIM system. In essence, the digital asset becomes as valuable as the physical asset by making it easier to virtually discover, access, exchange, and change the digital asset before designing, building and operating the physical asset. This provides clear business value for all stakeholders in the process.

Asset Reliability and Performance Requirements Start Early

At the most basic level, a plant or any piece of equipment within the plant becomes an operational asset when the owner-operator places it into service. Incorporating asset reliability requirements in the FEED stage of a project helps ensure operational readiness and can save millions in maintenance costs over the life of a plant.

Designing reliability best practices in this stage not only reduces maintenance costs, it will also make for a safer environment to help plants

attain operational excellence. In addition, reliability becomes engrained in the organizational culture.

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Applying emerging technologies such as 3D simulation, drones, and geospatial technology enables development of realistic simulations down to the asset level that facilitate diagnosis of impending failures. Mobile solutions enable technical documentation to be delivered at the point of work, where it is most needed.

In the operational phase, personnel need access to information on all aspects of plant operations to meet business objectives for production capacity, quality standards, safety, environmental performance, and profitability. This includes everything from the physical infrastructure to all the equipment installed in the plant as well as an indication of current performance versus targets. Making this diverse range of information available to stakeholders in a seamless and cohesive manner is the universal challenge.

Emerging Technologies Will Transform the Digital Asset and ALIM Platforms

A digital transformation is under way driven by an emerging set of disruptive technologies. These technologies are having a significant impact on how plants and infrastructure are designed, built, maintained, and operated. New solutions, applications, and platforms that accommodate Big Data, analytics, cloud computing, the Industrial Internet of Things (IIoT), mobility, laser scanning, and virtual modeling are converging to combine the physical with the digital.

Plant and infrastructure design for the power, process, and utilities sectors are experiencing this digital transformation. Today, companies have access to technology and solutions that allow for a completely connected digital enterprise in terms of an end-to-end virtual lifecycle of plant design, construction, operational processes, and asset maintenance. This instance of the digital enterprise is being referred to as the "digital thread" which ties all aspects of the plant lifecycle together and enables all engineering design/construction and operations/maintenance stakeholders to work from a common repository of digital information. Going forward, the

fundamental information access and availability architecture of an ALIM platform will be enabled through the digital thread that connects the physical and virtual asset.

Moreover, there will be a new design/build concurrency when the digital and physical assets can essentially be built at the same time. The digital asset engineering can be updated concurrently with discovered improvements and optimization of the physical asset. The new norm will be to deliver a complete asset registry with the digital engineering model built in. Additionally, reliability and maintainability considered in the design phase can enable operational readiness and superior asset performance once commissioned.

- **Big Data / Predictive Analytics**
  - Understanding All Elements of the Project/Process

- **Cloud**
  - Information Infrastructure

- **Asset Management / Internet of Things / Digital Asset**
  - Intelligent, Connected Assets

- **Mobility**
  - Portability, Real-time Interactions

- **Laser Scanning / GIS Technology**
  - Brownfield/Greenfield/Geosystems Model Information

- **Virtual Reality Environments: Plants, Buildings, Infrastructure**
  - Virtual Modeling, Digital Photometry, Virtual Training, Augmented Reality

Emerging Technologies Support ALIM

Today, a growing number of owner-operators want to own the digital asset earlier in the lifecycle, as it is being designed. There is also a movement to make the ALIM system the system of record for IT, operations and maintenance; and ERP the system of record for accounting and financial purposes.

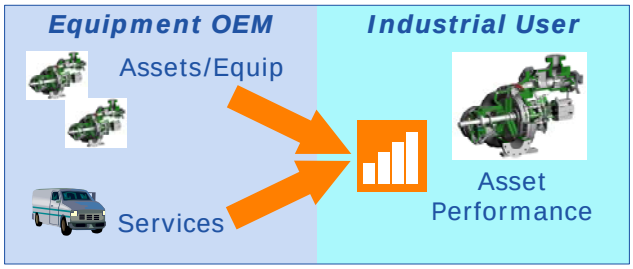
An important aspect and enabler of the digital asset is the concept of the "digital twin," where the physical and virtual worlds of the plant including its engineering design, operational processes, and maintenance functions are connected and merged to enable everything from design improvements, procurement, material management, construction, commissioning,

conditional states of assets and equipment, to operations and maintenance. The collaboration and connection that enables these two worlds can be implemented incrementally in staged knowledge-based improvements based on accumulated historical data; or concurrently improved and optimized based on real-time data streams from specific assets and operational environments.

For asset management, owner-operators are employing virtual simulation technologies to assess the condition of existing assets in the field. Simulation models of the physical structure and equipment is allowing asset owners to determine damage caused by environmental conditions or accidents, as well as assess long-term deterioration over the asset life cycle.

Industrial IoT Adds Value to the Digital Twin

Actionable information will be the lifeblood that will run smart connected assets and enable process optimization and improved asset performance. Advanced analytics will now be able to use this information to determine both quantitative and qualitative process improvement and validate that the asset and the facility is functioning and operating as designed and as built. This is where the notion of the digital twin really comes into play, where the virtual design models are integrally connected to the physical asset. In this environment, assets will have levels of connectivity and intelligence that will allow them to follow an evolutionary path from *predictive* methods to *prescriptive* optimization, and ultimately to *autonomous* operations.



Traditional Business Model:

OEM provides — *Industrial User provides*

Equipment + Services + Operate + Maintain = Asset Performance

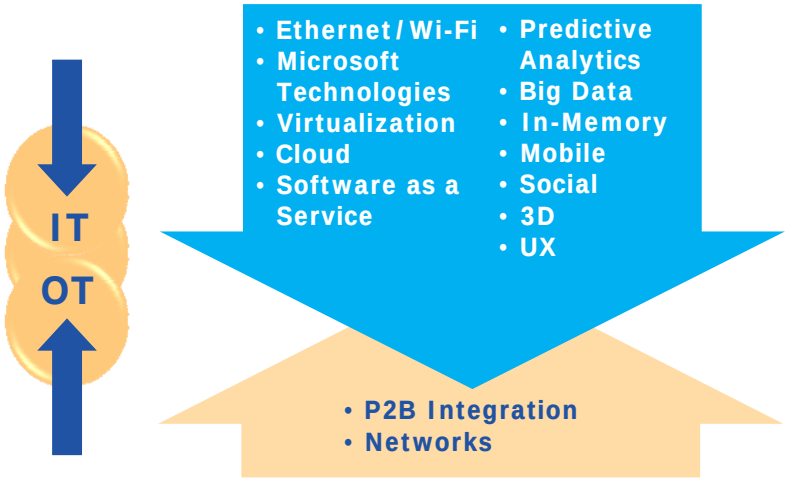
Emerging Business Model:

OEM provides

Digital Twin & Extended Support = Optimized Asset Performance

Profits — Costs

Connected smart plants, utilities, and infrastructure will lead to new business models that significantly benefit owner-operators in the area of asset performance. For example, a service that includes both the physical and digital elements of assets could provide new analytics and information to help extend asset operational life and optimize its performance. New business models for equipment providers might include one-time charges for purchasing smart connected equipment, pay-for-results, subscription models, and pay-as-you-go. Another interesting development would be the emergence of new business models that defray the cost of development and including connectivity and intelligence through a service that charges customers for being connected. Rather than selling capital equipment, suppliers could now offer business models that comprise operational-based revenue predicated on equipment that could be monitored for both performance and maintenance status.



"Convergence" = The Digital Tread Across the Design / Build / Operate / Maintain Lifecycle

Plant and Infrastructure Design Tools Providers Respond to the Connected Enterprise

Engineering design tools (EDT) suppliers for plant design and infrastructure are offering applications and solutions that enable both EPCs and owner-operators to access and exchange the full range of TOTEX information. Moreover, by embracing emerging technologies like cloud infrastructure, Big Data/predictive analytics, Industrial IoT, smart and connected assets, mobility, and virtual modeling; EDT providers like *Bentley Systems* are enabling customers to leverage the benefits of leading edge technologies in their solutions. For better performance management, the owner-operators of costly, complex, and mission-critical assets need to

be able to leverage cutting edge technology to maintain assets effectively and optimize operations.

Asset management, both in terms of maintenance and asset performance, remains the primary focus of most owner-operators. With the emergence of predictive/prescriptive analytics solutions, connected and smart assets, and more expansive and comprehensive ALIM platforms, owner-operators will be able to better address their overall maintenance and asset performance challenges.

Conclusions

Clearly, all companies across the energy, process, utilities, and infrastructure sectors are focusing on methods, best practices, and emerging technologies to control costs and improve efficiencies both in capital projects and operations and maintenance. To address these issues, owner-operators need a system of record that provides accurate, relevant information for operations and maintenance while maintaining a continuous flow of engineering and asset information across the entire plant lifecycle. Today's ALIM systems are becoming that system of record for many companies.

Specific industries like oil & gas and the upstream exploration & production sector in particular are refocusing attention on their capital projects to improve efficiency, optimize processes, and reduce overall costs. Given the recent, and seemingly persistent downturn in crude oil commodity prices, oil & gas companies are making it an imperative to control costs by closely monitoring capital projects for overruns in materials management and procurement, change orders, construction and work packages, and transition costs (commissioning, handover, and asset management).

These companies have recognized they can only achieve their goals by implementing an ALIM platform and adopting emerging technologies like those mentioned above. ARC believes this will represent the future of the plant design and infrastructure business.

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