ARC WHITE PAPER

By ARC Advisory Group

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Asset Information and Analytics:
Drivers of Process Industry Operational Excellence

Executive Overview

Operational excellence (OpX) is fundamental for success in the process industries. Every leading company has an OpX program and most include a broad set of financial, safety, environmental, product and customer satisfaction goals. But many of these are by-products of how well the organization manages their enormous investments in high volume, heavily-automated plants. So, asset performance management plays a central role in every OpX program.

Operational excellence (OpX) is fundamental for success in the process industries and asset performance management plays a central role in every OpX program.

This report reviews how poor asset information is constraining asset performance and what organizations can do to overcome these problems and significantly improve their asset performance.

Recent studies conducted by ARC Advisory Group have identified poor Asset Information Management (AIM) as the root cause of many asset performance problems, such as poor asset utilization, low maintenance efficiency, high maintenance, repair, and operations (MRO) costs, and others. ARC estimates the financial costs of poor AIM for a typical asset-intensive organization to be 1.5 percent of sales revenues – a staggering burden for any company today. Poor AIM also increases the risk of safety, health, and environmental incidents, which can jeopardize an enterprise's very survival.

AIM problems take many forms, but there are two root causes for this situation - poor information quality and poor information usability. Poor quality leads to inefficiencies and errors. Poor usability adds to these problems and limits the ability of managers to avoid problems, identify the root causes for poor performance, and improve their facilities and business processes. Both prevent companies from implementing emerging, collaborative problem solving strategies that can drive better asset performance.

While the opportunity for improvement is incredible, many organizations continue to suffer the pains of poor AIM. Some do not recognize the opportunity. Others understand that they have problems, but do not know how to solve them or cannot justify the required investments. This report is intended to help them overcome all of these issues and launch an effective AIM improvement program. We also describe how Rolta's OneView™ Enterprise Suite can help organizations overcome some of the key hurdles that they will encounter in their AIM journey.

Process Industries Still Need Operational Excellence to Win

Business has clearly become more challenging. Today's competitive landscape is more complex, with more competitors, more products, global supply chains, shorter product lifecycles, fluctuating material costs, and better educated, more discerning customers. Connectivity has made the world more dynamic, as it enables customers to quickly share every bad experience with a company and competitors to respond faster to every change in product and corporate strategy. Political upheaval, environmental catastrophes and financial defaults have added uncertainty to every business decision and increased the risk of every capital investment.

Business has become more challenging today and every business needs to become more vigilant and agile to survive.

For the process industries, the critical factors of competition remain the same and excellence remains the key to long term business success. But the bar for excellence has risen and companies need to find even more ways to improve their performance if they want to survive and thrive.

But what is the real impact of this on business strategy? Certainly, every business needs to become more vigilant and agile to survive. For some industries, like publishing and retail, the basic factors of competition have also changed and survival requires completely new business models. But, for most industries, the critical factors of competition remain the same and excellence remains the key to long term business success. So, this simply means that the bar for excellence has risen and companies need to find even more ways to improve their performance if they want to be the best.

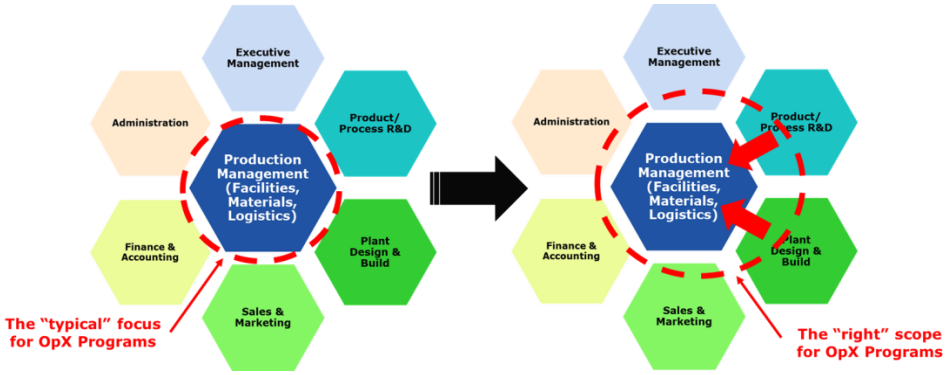
Operational Excellence is Key for Process Industries

Excellent companies do everything well and surpass competitors in the factors of most importance to their customers. For example, electronics manufacturers like Apple have to provide good service and maintain good relationships with supply chain partners, but the ultimate determinant of their stellar success has been excellence in designing products that people really want. While this formula for success is the same for all industries, the critical factors vary. In retail, Walmart dominates because of their supply chain excellence. In automotive, Toyota has used quality and manufacturing efficiency to become the world's leading automaker.

Operational excellence (OpX) is the path to market leadership in process industries, like oil and gas, metals, bulk chemicals, and power generation.

Companies in these industries produce indistinguishable products and deliver them in bulk, often with large, long term contracts, so consistent quality and low costs have become the key competitive factors. And to lead the market an organization has to have tight control over the quality and cost of every factor of production, including people, materials, energy, and logistics.

Not surprisingly, production is the central focus for most process industry organizations. This includes all of the activities related to the use and care of production facilities as well as the management of materials and the logistics involved in acquiring raw materials and distributing the facility's output. And, many people naturally think of OpX as a program focused solely on optimizing this central activity and achieving the best possible production metrics like throughput, unit cost, quality, safety, etc. While achieving these goals is obviously important, this limited view can restrict organizational performance.

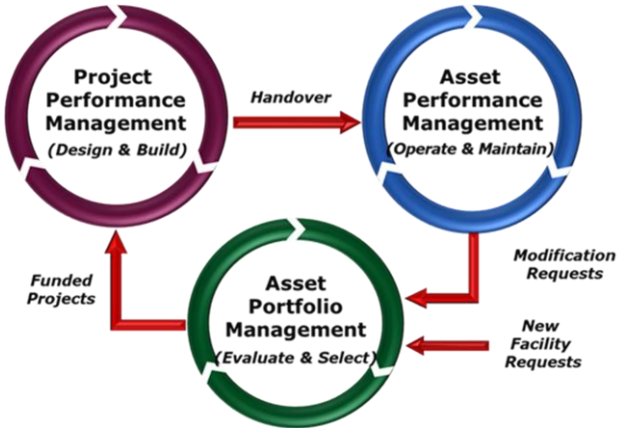


Scope for OpX in Process Industries

Process industry organizations have various support departments like product/process R&D, Plant design & build, sales & marketing, finance & accounting and general administration that place significant constraints on production activities. For example, a Product/Process Engineering group might dictate the use of a certain process that is inefficient or creates bottlenecks that limit output, adds costs, etc. The same is true with Plant Design & Build groups. They can make poor design decisions, select unreliable equipment that constrains performance, or have budget and schedule overruns that make it impossible to ever generate acceptable ROA. Including these groups in the OpX program makes it easier to recognize problems and rapidly resolve them. This also enables use of broad, shared metrics, like ROA, TQM, and Balanced Scorecards as the basis for OpX and ensures that everyone feels a direct responsibility for performance.

Asset Performance Management is Essential for OpX

Process industries are also noteworthy for their extensive investments in high volume, heavily-automated plants. These industries offer tremendous economies of scale and optimizing the use and care of these facilities is critical. The ability to efficiently design and build new plants in areas that offer logistics and market advantage can be another competitive advantage. To achieve these goals, every process industry organization needs a good Asset Lifecycle Management (ALM) program like the one illustrated in the sidebar.



ARC Model for Asset Lifecycle Management

Most companies recognize the importance of ALM, but many have an overly restricted view of what this means. Some see ALM as simply the management of equipment reliability, and forget that asset performance also depends upon how well the asset is utilized when it is available. Both of these concepts are included in the single ALM process that we call Asset Performance Management (APM). But, even those that include operations are still forgetting that projects play a major, recurring role in the lifecycle of every industrial facility and that the selection and timing of these projects is essential to controlling investment costs and exploiting limited windows of market opportunities. Some organizations also have an overly restricted view of their assets. They forget that their facilities can only operate well when they are staffed with knowledgeable, well-trained people and that these people need good asset information to do their work efficiently and effectively. So, both of these "hidden assets" need to be considered in an ALM program if the goal is asset performance.

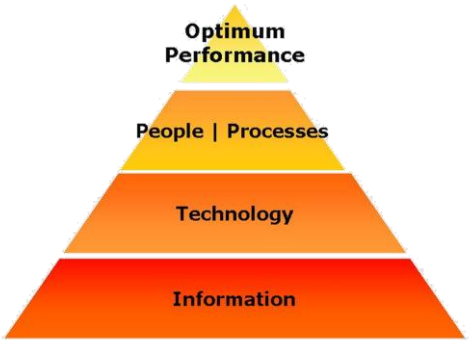
ALM is so important for process industries that it can be reasonably argued that ALM, or APM, is the model for OpX that companies need to adopt if they hope to become an industry leader. Organizations may have OpX goals that go beyond the facilities, like those related to products, customers and shareholders, but performance in these areas is often a byproduct of how well the organization manages their assets. For example, ensuring a consistent flow of products with consistent quality and low cost is often

enough to satisfy customers and ensure an ongoing revenue stream that make shareholders happy. Operating pants safely, with minimal environmental impact, is likewise the key to satisfying other constituents, like regulators.

Whether or not you accept ALM/APM as OpX, there should be little doubt that ALM/APM performance has a direct impact on OpX performance. Anything you can do to improve ALM/APM performance will therefore have a direct impact on your long term success in the process industries.

Information is a Key Factor in ALM/APM Performance

Management researchers and consultants generally agree that the performance of any business activity is jointly determined by the mix of people (which includes organization and culture), processes and technology that is applied. Furthermore, an organization can improve performance by making changes to any of these factors, within certain limits and constraints.



ARC Performance Pyramid

ARC's research indicates that information (asset information in this particular case) is another, equally important performance factor. We have also found that these factors are all interrelated and have a natural precedence that must be respected as you consider ways to improve performance. This precedence goes from the top to the bottom of the performance pyramid as improvement plans are developed and bottom to top during implementation, as capabilities at each level rely upon the presence of those below. So, good asset information is the foundation for ALM/APM performance and efforts to improve performance need to begin with better AIM.

Asset Information Management Enables APM Excellence

Investments in IT can be hard to justify and this is true for AIM as well. A major challenge in the case of AIM lies in the fact that asset information is a "hidden asset". It is fundamental to the performance of every person, activity, and system in a modern process facility, but no one sees it.

People may complain when asset information is unavailable or inaccurate, but many have come to expect that and have developed wasteful workarounds to accomplish their work. While this lowers overall performance, the impact that poor information is having has been buried. Identifying these problems is essential to enabling real performance improvements.

Industry	Typical Facility Revenues (M$)	Annual Cost of Poor AIM (M$)
Refining	11,855	177.8
Chemical	210	3.2
Power	203	3.1
Steel	3,433	51.5
Mining	28	0.5

What Can 1.5% Savings Mean?

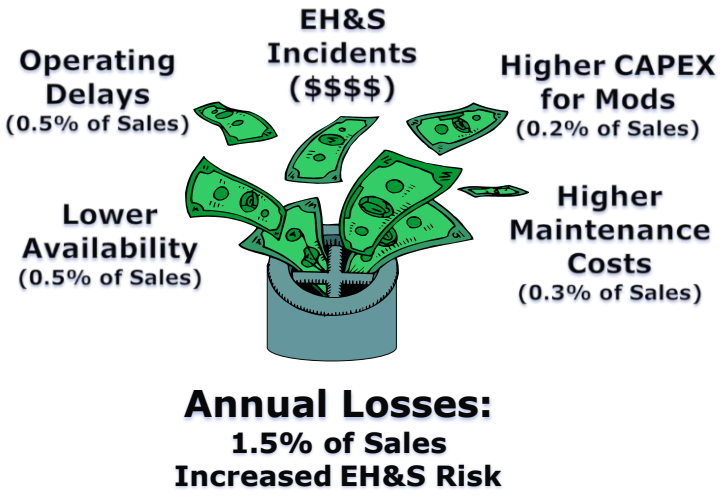
ARC's research into this issue indicates that better AIM can improve the performance of most process plants, financially and otherwise. Furthermore, the typical process plant can reap annual savings equal to 1.5 percent of its sales revenue. As the table in the sidebar shows, this represents a staggering opportunity for process industries, like refining and steel production, with large integrated facilities. The rewards can be just as incredible for large organizations in process industries with smaller, distributed operations, as they can implement AIM enterprise-wide. As the savings are annual, even smaller organizations can benefit by including AIM in their continuous improvement programs.

Evaluating the Opportunity

To assess the financial impact of poor AIM on asset performance, organizations need to consider three different areas – revenues, operating and maintenance costs (OPEX), and the capital costs of modifications and upgrades (CAPEX). Poor AIM significantly impacts all three and the effects are cumulative with respect to overall financial performance.

The opportunity will be different for every organization, according to industry, scale of operations, existing IT situation, etc. We have done an analysis of the costs of poor AIM for what we believe to be a typical industrial organization[1]. The results of that study are summarized in the following figure and indicate potential savings of 1.5 percent of sales. Our report on these savings also documents our analysis so that organizations can use our methodology to make an assessment of their own situation.

[1] See ARC Strategy Report - ***Asset Information Management (AIM): Part I – The Case for Developing an AIM Strategy***, July 2010



Poor AIM Means Money Down the Drain

Comparison of our estimates with related studies indicates that losses due to AIM may be even larger than our estimates. This may be due to factors we did not consider or our use of overly conservative assumptions of the impacts. In either case, these other studies clearly support the call for immediate action.

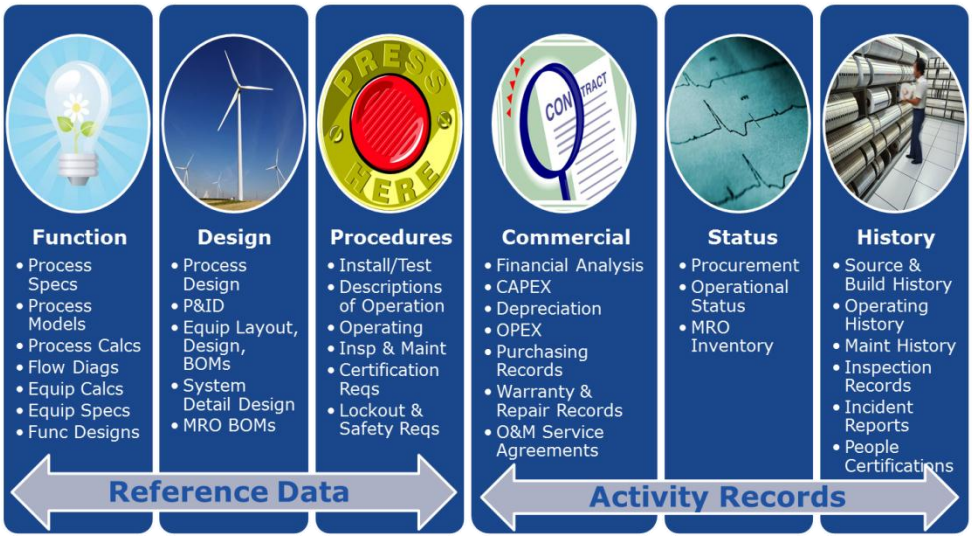
AIM Impacts All Asset Performance Metrics

While the above discussion focused on financial benefits, it is important to recognize that a good AIM strategy can improve asset performance across all performance metrics including EH&S (environmental, health, & safety) and sustainability. Too often organizations discount non-financial performance benefits in their evaluation of IT opportunities. In the case of AIM, a good strategy can help the organization avoid significant financial penalties and other effects that might jeopardize the organization's reputation and very survival.

AIM Challenges and Goals

To avoid these losses, organizations need an AIM strategy that ensures everyone convenient access to all of the information they need to execute all of their tasks efficiently and effectively.

Developing the right information content is the first challenge. Requirements vary but the following figure provides a general checklist of the kinds of information that a typical organization needs.



Asset Information Spans Many Information Categories

Ensuring that this information is always complete, accurate, consistent and timely is the next AIM challenge. Asset information only generates benefits when people use it in their decision making and this only occurs if they consider it trustworthy. So, it is mandatory that every AIM program includes the information management processes and technology to establish and sustain information quality.

Information benefits also depend upon the usability of the information and the AIM technology that is deployed. Technically, good usability means that information is accessible, understandable, actionable, and easily shared. But usability in the real world is in the eye of the beholder and depends upon the user and the work they are doing.

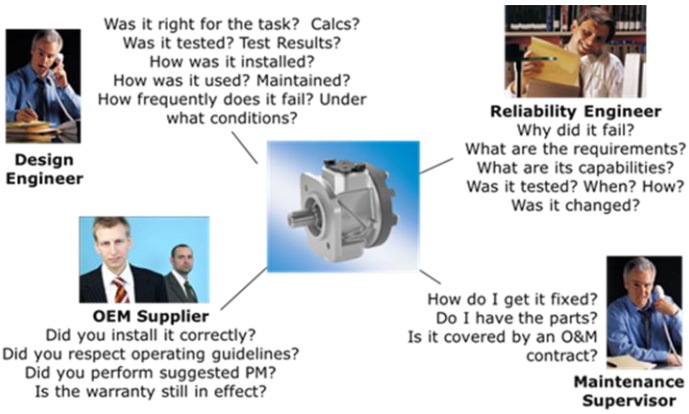
	AIM for Engineering	AIM for Operations
Key Information	Engineering Asset Information: • Facility Technical Information • 2D/3D Drawings, P&IDs • Design Data & Analysis • Documents, Images, Maps	Operational Asset Information • Procedures, Practices, Recipes • Equipment Specs and Parts info • Current Status and Performance • Historical Data
Primary Information Management Challenges	• Information Handover Mgmt • Engineering Change Management • Project Technical Info Support	• Common Data Models/Integration • Visibility & Analysis Tools • Historical Recordkeeping
Primary Users	• Engineers • Project Managers • External Contractors	• Plant Management/Supervisors • Operating Staff • Maintenance/Reliability Staff
Key AIM Technology	• Content/Data Management • Plant Design Tools • Process Models • Project Management Apps • Survey & Scanning Systems • GIS	• Content/Data Management • ERP/Purchasing • EAM/Reliability Management • EH&S/Compliance Reporting • Control Systems • Asset Health & Status Monitoring • GIS

In the case of AIM, there are many different stakeholders and use cases. But two define the limits of what is required: AIM for Engineering and AIM

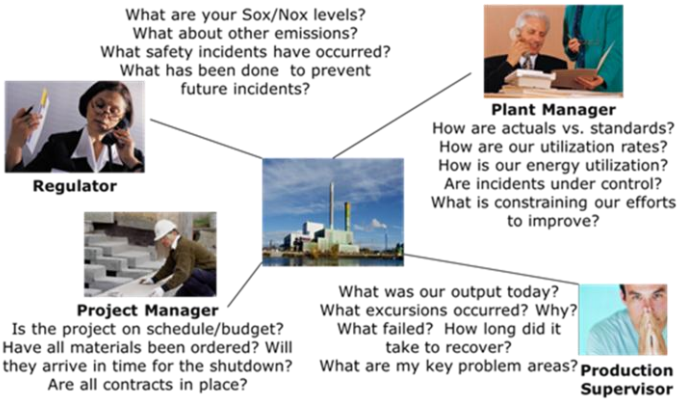
for Operations. Both of these cases use the same asset information, but the information management challenges and technology are quite different. So, treating them as separate initiatives is a common approach to building a complete AIM solution. As AIM for Operations is the use case that aligns best with APM, it is the focus for our discussion in this paper.

Building an AIM Solution for Operational Excellence

AIM for Operations enables better APM and OpX in two ways. It increases the efficiency of everyone involved in the use and care of the facilities. It enables management to control and improve performance.



AIM Helps to Resolve Equipment Issues



AIM Helps to Resolve Performance Problems

Research shows that people throughout the APM organization need information they can trust to do their work efficiently and effectively. For example, studies of wrench time show that a typical maintenance worker wastes 15 to 20% of their time just looking for information and they waste additional time correcting errors caused by missing and inaccurate information. Obviously this adds cost, but more importantly it significantly lowers plant availability. Shutdowns take more time, scheduled downtimes have to be longer and breakdowns cause longer delays. Likewise, poor information leads to mistakes that waste even more time.

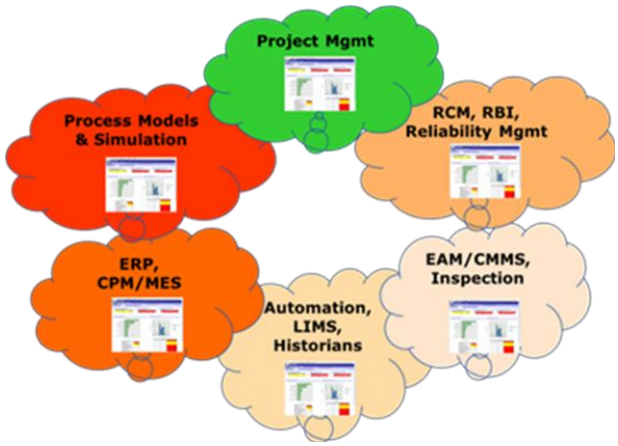
A good AIM for Operations program solves these problems by making sure that everyone has access to the right information within the context of their

normal workflows. This includes access from any mobile devices that may be used.

Latent problems in equipment and business processes can have an even greater impact on plant performance. Not only do they limit current performance, they lower everyone's performance expectations and create unnecessary constraints in the organization's best practices that limit management's ability to improve performance. AIM for Operations helps organizations overcome these problems by exposing recurrent problems and bottlenecks and by providing the tools needed to explore alternatives.

Integration and Visibility is the First Step to AIM

The starting point for addressing all these performance challenges is good asset information. But, unfortunately, many companies skip this basic step in their rush to build "management dashboards" with lots of cute icons. So it is not surprising that many of these dashboards have little impact on real performance management and are quickly abandoned by people who find the information neither trustworthy nor appropriate for their needs.



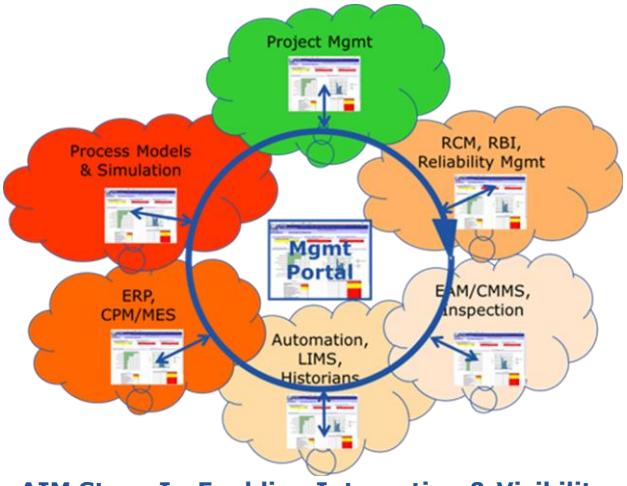
AIM for Operations Information is buried in Many Software Applications

A lot of the information that AIM users need is buried in the many applications that are used to operate and maintain a modern process plant. These applications have user interfaces that enable local workers to access and enter the information they use in executing their daily tasks. But they offer little access to information beyond this, so the potential benefits of coordinating activities across groups are lost. Constraints on information access also reduce management's ability to monitor and expedite work so that delays are averted.

These issues are not new and many companies have taken steps to address them by building point-to-point integrations between applications. But these integrations are often driven by specific, urgent requests and IT is forced to solve them with custom code that only exposes the specific information needed to solve the problem. As the organization sees value in this additional information, they ask IT to solve another specific problem which takes more custom code, etc. While these investments may make sense, this

incremental, shortsighted approach to AIM delays benefits and creates an IT maintenance nightmare.

The right approach is to appreciate the general value of asset information and recognize that there are many stakeholders who will use it and multiply the benefits. So every effort to expose this "hidden" information should also enable easy access for anyone who wants to use it.



AIM Stage I - Enabling Integration & Visibility

Choosing the right approach may cost more in the short run, but it produces many more benefits that generate a much better ROI. The right approach enables performance improvements in every APM activity by ensuring that everyone has access to information they need to work efficiently and coordinate their efforts with everyone else. It also provides management with better visibility into everyone's performance and enables them to implement performance metrics and end-to-end business processes that cross departmental boundaries and drive more collaboration and coordination that will improve performance even further.

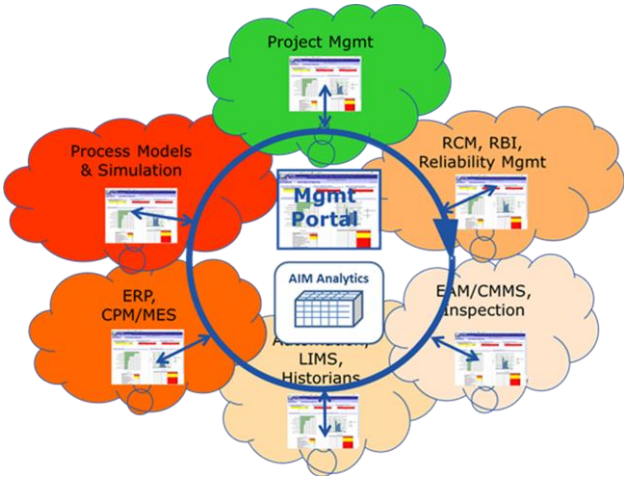
Of course, this approach is also more challenging. Most organizations currently lack standard information management practices across their APM departments and applications. So, different groups have different data models with different names for the same things, the same names for different things, different units, and even different views of the assets and business processes. So, alignment of data models is a precursor for integration. Fortunately, there are data models like S95 and S88 that can help organizations do this.

Other challenges include implementing the integration in a way that minimizes IT costs and implementing a common platform for building dashboards and user interfaces so that barriers in people using "foreign" applications, like CAD systems, are minimized. Again, standard approaches are available that leverage methodologies like SOA and standard information exchange schemas like OpenO&M and ISO15926. Many organizations choose to address these last two challenges by implementing a

single collaborative integration platform, like SAP Netweaver, Oracle Fusion or IBM websphere.

Enabling Analytics is the Second Step to AIM

Many organizations have already taken this first step and may believe that they have a good AIM solution. But, smart organizations realize that integration and visibility are necessary, but not sufficient to achieve APM Excellence. They understand that they also need to empower people with the information and tools to identify the root causes of their problems and explore ways that they can further improve their processes.



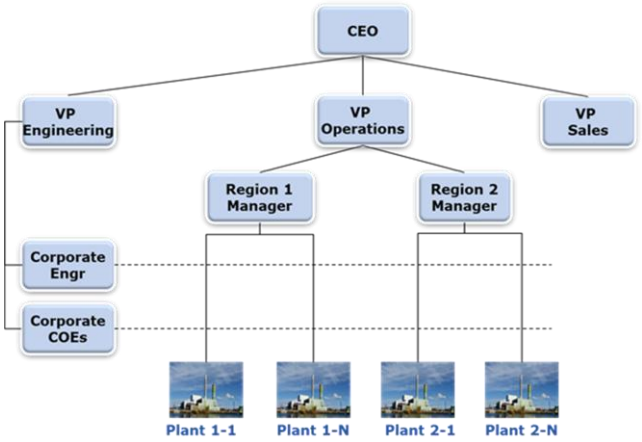
AIM Stage II – Enabling Analysis & Continuous Improvement

This is the second stage of AIM for Operations and includes the implementation of a data warehouse to manage the valuable history about everything that has occurred during the life of the facility and a set of analytic tools to allow analysis of past performance to identify opportunities for improvement.

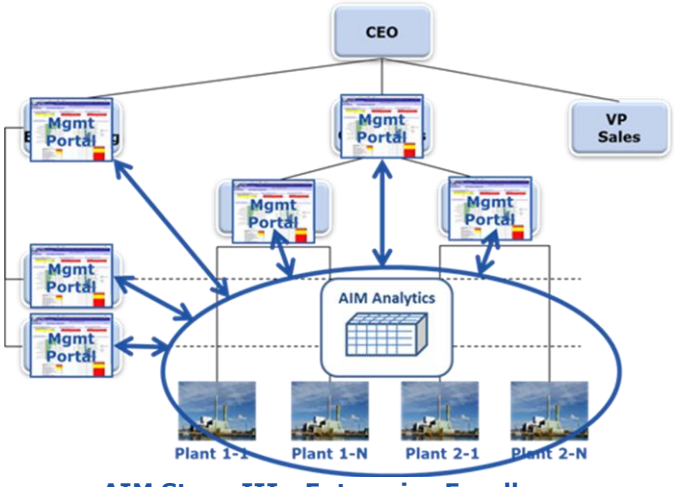
The benefits of this additional step can be enormous, but like the previous case, there are also challenges. First, there is the old issue of Data Models and this next step requires additional effort to develop dimensional data models that are consistent with standards like S95 and S88. The second challenge is enabling casual users to leverage the power of analytics. Standard Analytics packages offer tremendous capabilities, but these tools also require special skills. Suppliers of Analytics packages have addressed this problem for business users in areas where the focus is product or supply chain excellence. But none has yet developed screens for APM professionals, because OpX is just not a focus for them.

Enterprise-wide AIM is the Final Goal

While AIM Analytics enables OpX across all plant activities, this is still not the end of the AIM for Operations story. Many process industry enterprises have a global footprint, with multiple plants in different regions and corporate support functions that drive standardization and improvements across the organization. So, the final stage of an AIM for Operations so-



Real Enterprises Have Many Plants



AIM Stage III - Enterprise Excellence

lution occurs when organizations rollout these capabilities across all of their facilities and integrate them across the corporation so that everyone is enabled with integrated, corporate-wide visibility, performance management and analysis.

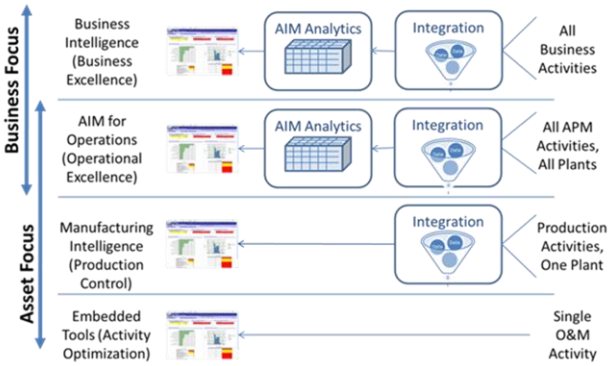
The benefits of this are two-fold. First, it enables the organization to reap the basic plant-level benefits we just discussed in every plant. Second, it enables cross-plant benchmarking and rollout of new and better practices to all plants to ensure that every plant is a Best Plant.

AIM Analytics Supports All Management Needs

There are many ways that people add visibility and Analytics capabilities to their information management systems, but they have different goals and provide different capabilities.

Some APM solution providers have added analytics capabilities to their local user interfaces to help local users improve performance. For example, a materials management package might include screens for analyzing inventory strategies and supplier performance. Reliability packages likewise include a lot of analytics capabilities. While this shows that there is significant value in analytics for APM, these local approaches have limited impact because people can only analyze the data locked in those applications.

Many automation and MES software suppliers also offer their clients operational or manufacturing intelligence solutions. These solutions help people aggregate information from many sources and develop management dashboards. But they do little to share information across applications and they are generally only used only for real-time performance tracking of KPIs and



AIM Analytics is more than Operational Intelligence

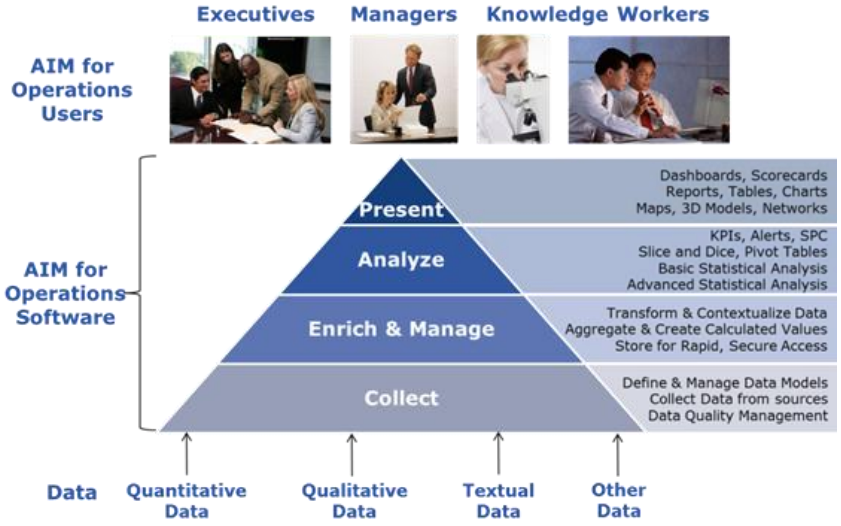
alerts. This is helpful and shows the value of information aggregation for management, but offers little support for understanding the root causes of performance problems.

AIM analytics offers the benefits of both of these approaches. You get the aggregation you need to manage and you have the capabilities to develop dashboards and special screens to suit everyone's individual needs.

Standard Analytics packages, like SAP Business Objects and Oracle OBIEE, offer the same fundamental capabilities, but their focus is different. This means that they often lack standard connectors for popular APM applications and end users are left with the task of building custom data models and interfaces for Operational Excellence.

AIM Analytics Supports All Management Needs

The figure below summarizes the requirements for a good AIM for Operations solution. Each level of this pyramid adds value and, like the performance pyramid discussed earlier, a full AIM solution has to be built from bottom up to ensure a solid foundation for performance improvement. This model also provides a helpful tool for evaluating the AIM capabilities of different software solutions.

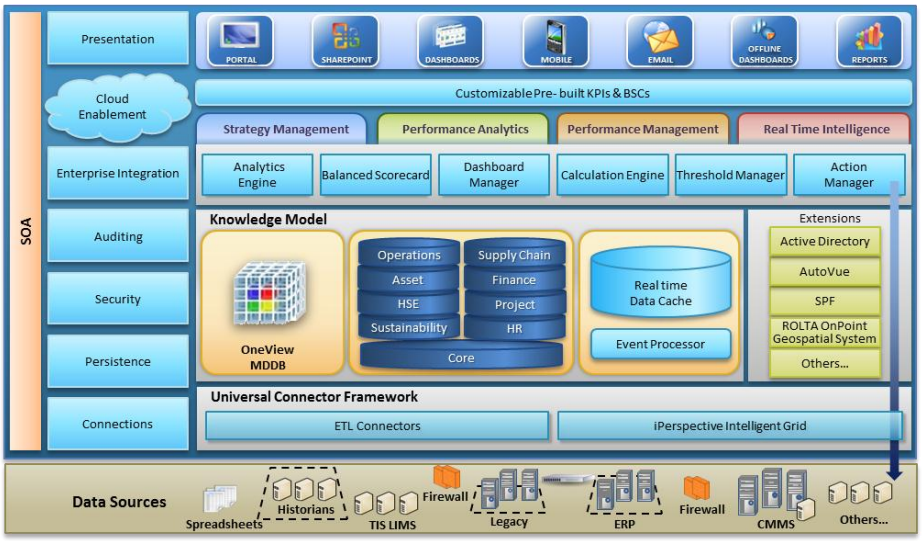


AIM for Operations Requirements

Rolta OneView™ Helps Companies Overcome Key AIM Hurdles

Rolta is one software solution provider that appreciates the need for AIM for Operations solutions and has the background to provide the right tools for companies to achieve these capabilities quickly and at minimal cost.

Rolta OneView™ enables operational excellence by providing users with a pre-built solution for collecting raw data from APM applications, organizing this into an operations-centric dimensional data model, and generating industry specific, cross-functional KPIs that provide actionable intelligence, data drill down and convenient, customizable reporting. OneView™ can also present plant operations as one fully connected ecosystem spanning the whole enterprise and enable executives to drive operational and reliability performance improvements through key initiatives like Balanced Scorecards, Six Sigma, and TQM.



Rolta OneView™ Logical Model

A comparison of Rolta OneView™ with ARC's model of an effective AIM for Operations solution shows that Rolta OneView™ satisfies key AIM requirements at every level of the pyramid.

For the bottom layer, Rolta OneView™ provides a set of standard ETL connectors for seamlessly capturing information from a variety of popular APM applications including enterprise resource planning (ERP) and supply chain management (SCM); operations management systems such as manu-

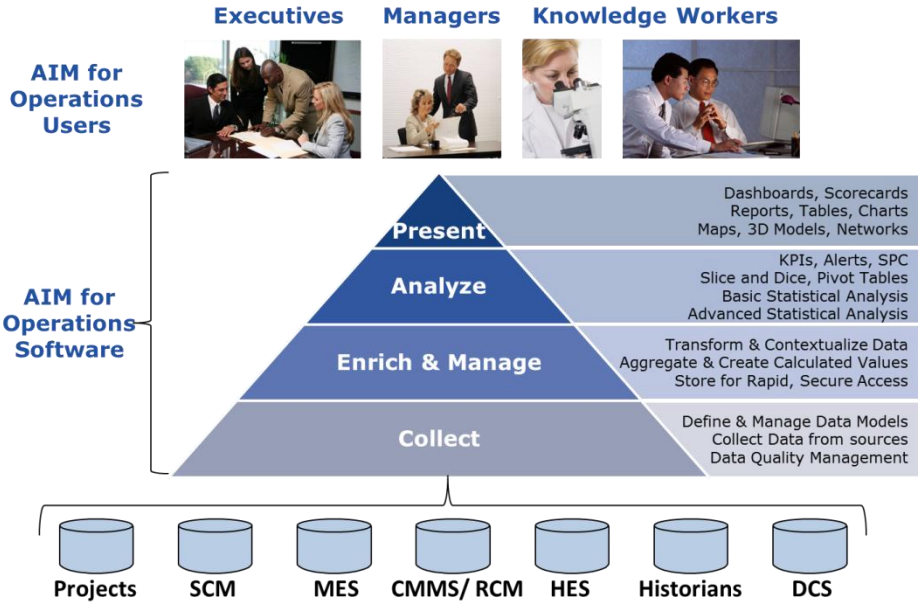
facturing execution systems (MES) or collaborative production management (CPM) systems; and plant automation systems such as distributed control systems (DCS) and programmable logic controllers (PLC).

Above this lies a feature rich, information processing environment that can enrich and manage both real-time data and data destined for analysis in a historical data warehouse. Information can be analyzed for thresholds and alerts, cross-functional KPIs can be generated, and information can be stored in an operations-centric, dimensional data model that supports rapid retrieval and analysis in the way that managers actually view their operations.

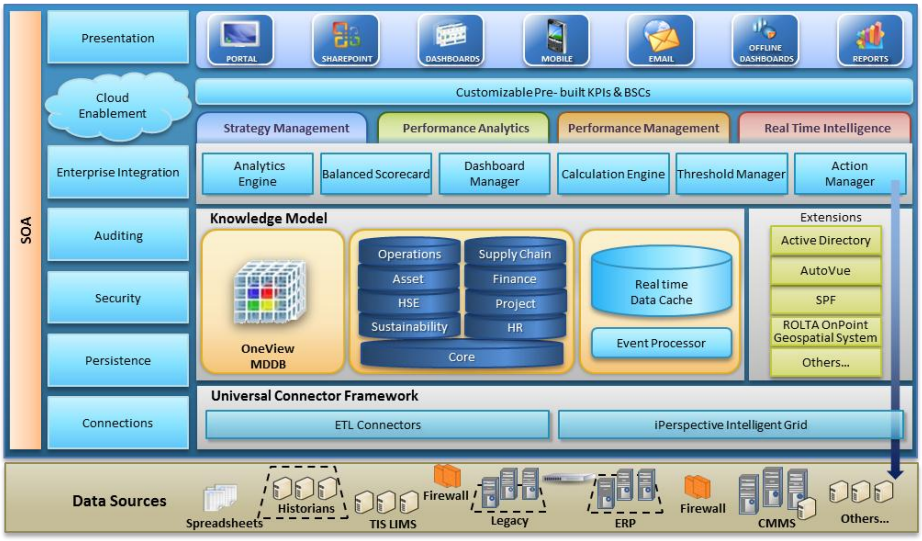
At the analysis level, Rolta OneView™ provides a full suite of analytics tools based upon solutions from leading Analytics suppliers like Oracle, SAP and Microsoft. These tools enable slice-and-dice, basic statistical analysis and advanced statistical analysis that enable users to quickly explore data, model relationships and forecast the effect of process changes.

At the top level, Rolta OneView™ provides a complete set of pre-built user interfaces, which they call Insights, that bring the power of AIM Analytics to users across the enterprise. Operational Insights spans industry-specific functional areas in operations such as Production, Maintenance, Reliability, HSE, Quality, MRO and Supply Chain. Rolta OneView™ also features pre-built insights for critical areas like Projects and Sustainability.

Rolta OneView™ was designed by domain experts with the mix of functional and industrial experience needed to understand what's needed to support the operation and care of modern process plants. Rolta OneView™ is a comprehensive integrated decision support system, built on a best-in-breed technology platform. The solution set is also scalable and can work with geospatial systems to further enhance the display of actionable information and key performance indicators.



AIM Enables Operational Excellence in Process Industries



Rolta OneView™ Helps Companies Overcome Key AIM Hurdles

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Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/Research/IndustryTerms/

AIM	Asset Information Management
ALM	Asset Lifecycle Management
APM	Asset Performance Management
BOM	Bill of Materials
CAPEX	Capital Expenditures
CPM	Collaborative Production Management
CRM	Customer Relationship Management
D&B	Design & Build
DCS	Distributed Control System
EAM	Enterprise Asset Management
ERP	Enterprise Resource Planning
GIS	Geospatial Information Systems
HAZOP	Hazard & Operability
IT	Information Technology
KPI	Key Performance Indicator
MDM	Master Data Management
MES	Manufacturing Execution Systems
MI	Manufacturing Intelligence
MRO	Maintenance, Repair, and Operations
O&M	Operations & Maintenance
OI	Operational Intelligence
OPEX	Operations Expenditure
OpX	Operational Excellence
P&ID	Process & Instrumentation Diagram
PLC	Programmable Logic Controller
ROA	Return on Assets
SCM	Supply Chain Management
QM	Quality Management
UI	User Interface

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