

**Operational Analytics and AIM:
*The Foundation for Operational Excellence in
Process Industries***

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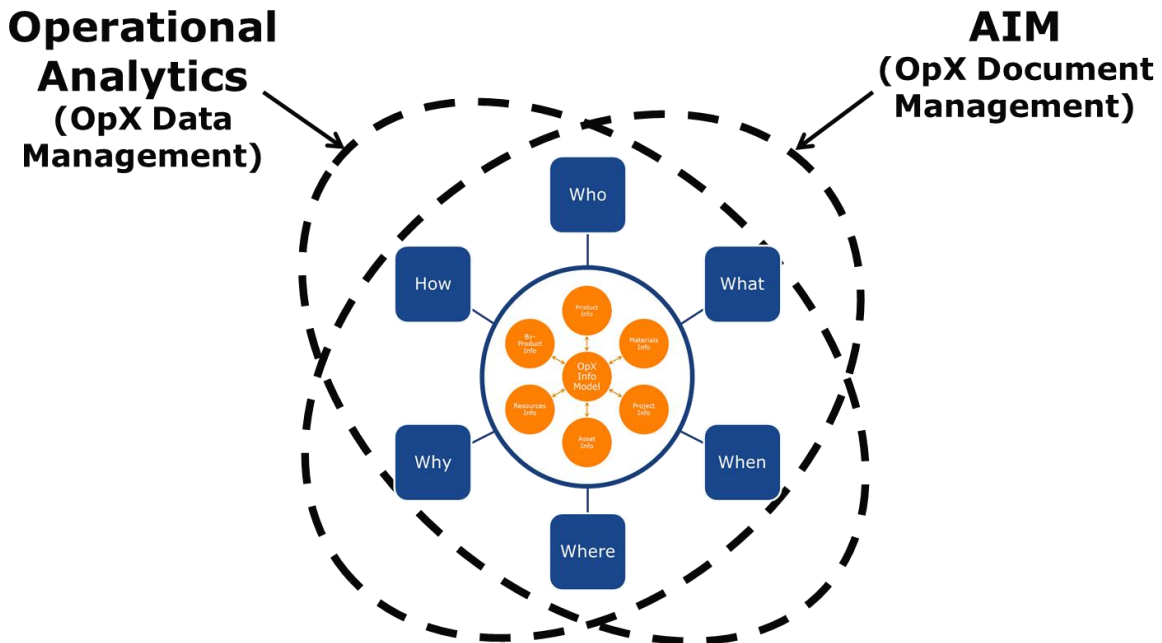
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Good OpX Programs are Comprehensive and Balanced



OpX Needs "Fit-for-Purpose" Information Management Tools

Executive Overview

Success in the process industries requires a solid operational excellence program. Research shows that information is fundamental to every successful OpX program and organizations need to ensure that their people have convenient access to trustworthy information.

Research shows that information is fundamental to every successful process industry OpX program. But many organizations struggle to provide a proper OpX information platform. This report shows what is required and how organizations can leverage “Fit-for-Purpose” solutions to ease and accelerate the effort.

While some process enterprises recognize this need, many do not. Their OpX programs languish for lack of trustworthy, actionable information and this limits progress and frustrates everyone’s efforts. Even when organizations understand the problem, many don’t know how to solve it. Others are reluctant to launch what they perceive to be another massive IT effort.

This report addresses all of these issues. It shows what is required for a solid OpX information platform and how organizations can leverage “Fit-for-Purpose” solutions to ease and accelerate the effort.

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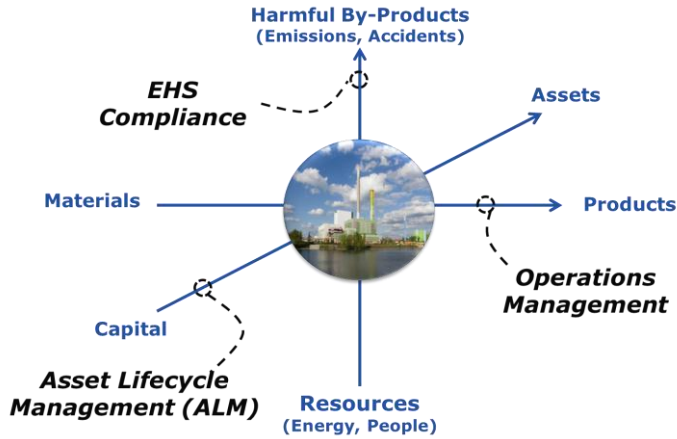
Process Industry Enterprises Need Operational Excellence

Operational excellence (OpX) is the path to market leadership in process industries, like oil and gas, metals, bulk chemicals, and power generation. Most companies in these industries produce indistinguishable products in bulk and deliver them to customers under high volume, long term contracts. Consistent quality and low costs are critical to sustaining relationships and satisfying requirements in sectors that are regulated.

Complex, expensive plants are a distinguishing feature of process industries. Not surprisingly, managing the operations of these facilities is a central focus for every process industry organization. This includes the acquisition and storage of raw materials and, in many case, the storage and distribution of finished products to customers.

OpX is More than Excellence in Operations

While ensuring high utilization of production assets is important, OpX is more than operations management. Process enterprises have other, equally important challenges that they must overcome to survive and thrive.



The capital used in building and sustaining process plants is enormous and investors expect to receive good returns for many years. Tight management of every CAPEX dollar and caring for every asset are just as important to stakeholders as maximizing today's performance.

Process Orgs Need to Excel in 3 Critical Dimensions

Processes industries also face stiff environmental, health and safety (EHS) challenges. The products they produce and the processes they use represent significant risks for people and the environment. Governments and regulatory agencies have established strict operating rules that must be followed and compliance is critical to avoid stiff penalties and preserve the organization's license to operate. Many process organizations also have sustainability goals that stakeholders expect them to achieve.

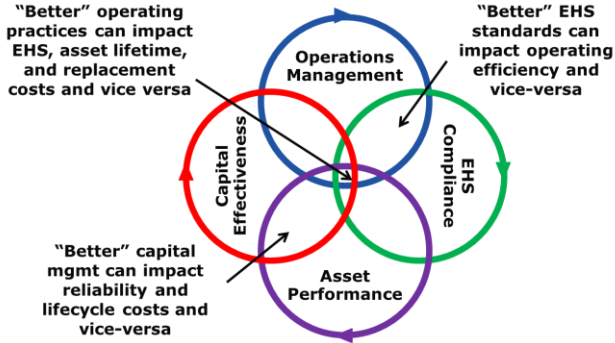


Good OpX Programs are Comprehensive and Balanced

Good process industry OpX programs recognize all of these goals. They also reflect the need to balance asset productivity with good risk management and sustainability of the environment and the enterprise.

Overlapping Goals Make OpX a Team Effort

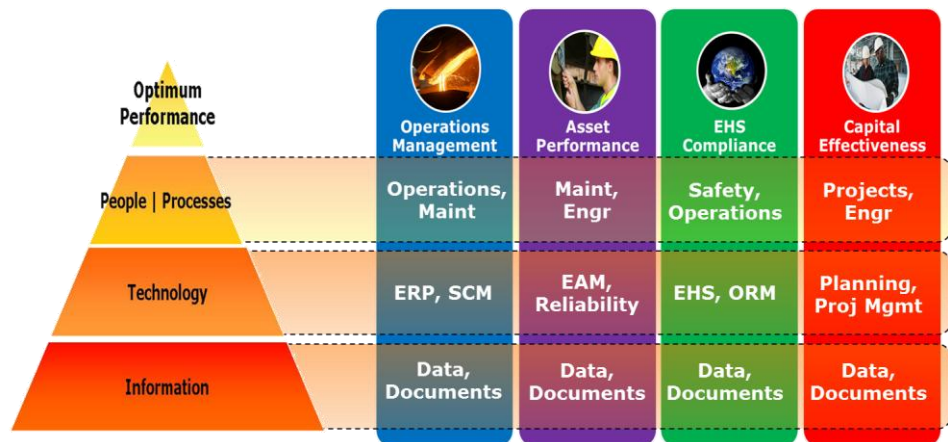
OpX goals are highly interdependent and this frustrates efforts to excel. Changes to operating practices may improve throughput or cost but they



can also impact equipment reliability. Likewise, they can introduce new risks to personnel and undermine the organization's efforts to control the release of harmful by-products. In the same way, efforts to improve employee health or reduce emissions can impact operating performance and place additional demands on maintenance teams.

Overlapping Goals Complicate OpX Efforts

Less obvious but equally troublesome interdependencies exist between CAPEX and OPEX activities. Project managers and engineers are charged with minimizing the costs and time for new facilities and shutdowns to repair and upgrade existing plants. But choosing the least costly equipment and construction materials can result in higher operating and maintenance costs. While these may be recoverable missteps, others are not. Few organizations have the time and people to fully recover from premature startups that neglect proper handover of information and training of operating and maintenance personnel.



OpX Needs Integrated Strategies

To overcome these challenges, smart process enterprises integrate OpX strategies to facilitate collaboration and teamwork. This includes consistent

information, compatible technology, and complementary people and processes that ensure efficient communication and coordinated workflows.

OpX is a Journey, Not a Destination

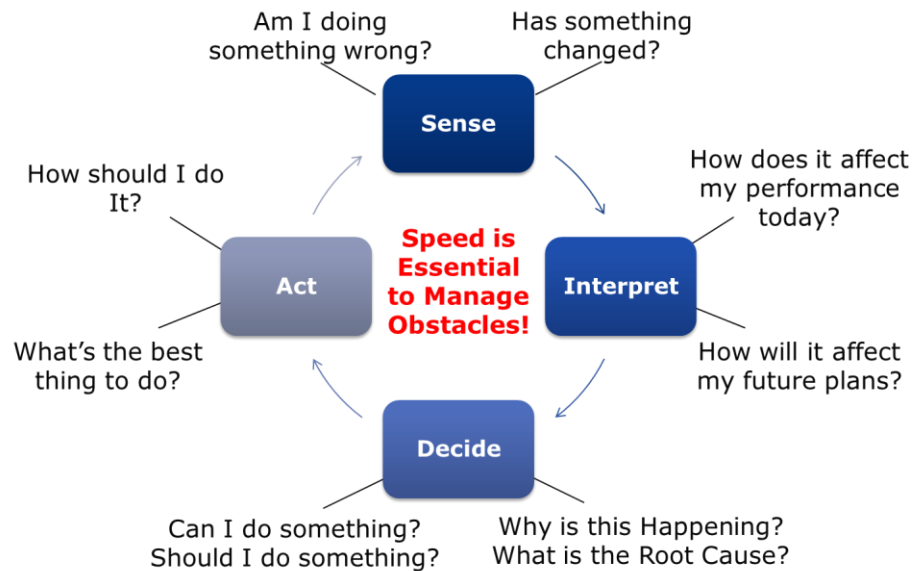
Smart organizations understand that OpX is a never-ending journey. Few organizations excel in every category when they launch OpX programs and



it takes time and effort to make real improvements. Also, excellence is a moving target that changes when competitor OpX efforts raise the bar and regulators redefine compliance requirements.

Continuous Improvement is the Vehicle for OpX

Organizations manage OpX with continuous improvement programs built on three basic principles: establish control so that performance is consistent and opportunities for improvement can be identified; make changes in small, incremental steps to avoid major disruptions while ensuring constant progress; monitor the environment periodically to keep the organization ahead of the competition.



OpX Also Requires Real-Time Surveillance and Agility

Smart organizations also recognize that continuous improvement is not enough. Obstacles and opportunities arise throughout the journey and or-

ganizations must be quick and agile to stay on course. So, interest is high for systems that enable real-time, Sense-Interpret-Decide-Act management .

OpX Requires Trustworthy, Actionable Information

Trustworthy, actionable information is the foundation for OpX. Simply put, you can only control what you measure and driving improvement requires even more information. Progress is also impeded when people don't trust or understand what their information is telling them. Unfortunately, there are still organizations that ignore these facts, build OpX programs on shaky foundations, and struggle to understand why their programs fail.

Regardless of the OpX goal, organizations need to have a lot of data and documents to ensure effective efforts. Data provides quantitative feedback on performance, enabling people to monitor performance and identify opportunities for improvement. Documents provide the information they need to make the right changes.

OpX Goal	Data	Documents
Operations Management	Current and historical process, product, quality, materials, energy, and cost data, etc.	Recipes, O&M procedures, safety procedures, inspection reports, incident reports, calcs & models, P&IDs, etc.
Asset Performance	PM, inspection, work order, work request status, materials inventories & use, equipment failures, downtimes, etc.	Drawings, calcs, vendor manuals, work orders, inspection reports, reliability analyses, warranties, material specs, suppliers, etc.
EHS & Sustainability	Current Energy Use, Emissions, and Incidents data; training & reporting status, etc.	Audit reports, incident reports, regulations, design calcs, procedures, training manuals, compliance filings, etc.
Capital Effectiveness	Project budgets, schedules, POs, plant performance data, etc.	Capital requests, asset histories, asset valuations, asset technical documents, project histories, contracts, POs, etc.

Information is the Foundation for Every OpX Goal

Information Management Goals Should be the Same

Managing data and managing documents are different challenges. But, the overall goals that organizations set for their IT organizations should be the same for all OpX information - everyone in the OpX program should be able to trust and act on all of the information they receive.

Managing data and managing documents are different challenges. But, the overall goals that organizations set for their IT organizations must be the same for all OpX information. Everyone in the OpX program needs to be able to trust and act on all of the information they receive. This only occurs when information satisfies two criteria: good quality and good usability. Good quality information is:

- **Complete** - All information for every topic of relevance to OpX
- **Accurate** - With respect to the existing situation
- **Timely** - Reflects the current situation
- **Consistent** - Across all documents, processes and views
- **Secure** - Access is properly controlled based upon user rights

Information with good usability is:

- **Accessible** - According to every user's and application's need
- **Understandable** - Presentation aligns with user's perspective
- **Actionable** - Supports the user's workflows and decision-making
- **Easily Shared** - Across every user and relevant OpX application

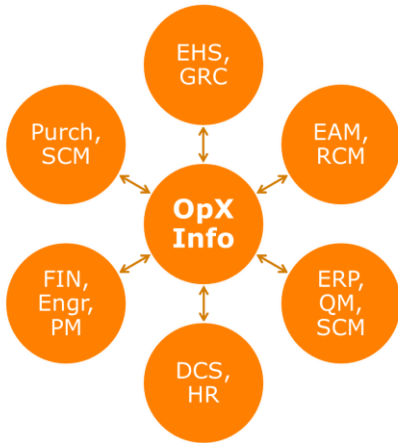
Achieving OpX Information Goals is Challenging

OpX programs require a lot of information. KPIs are generally established for every aspect of performance and the associated data needs to be collected to assess current performance and stored for analysis of trends. Many organizations also collect data on contributing factors to isolate the cause of performance deficiencies and for leading indicators of pending problems. Documents are needed for everything from procedures and regulations to technical information on the equipment and how it is configured. Overlap-

ping OpX goals add further complexity as anyone may need information from anywhere. And, they expect to find it easily and apply it in their own workflows without validation or complicated transformations.

Integration and Context Management are Vital

The good news for organizations that want to build a solid foundation of OpX information is that the information they need already exists in the systems and software applications they use to manage their operations. This includes process automation systems, ERP suites, and modules like enterprise asset management (EAM), etc¹. The bad news is that this information is generally inconsistent, with different data models, etc. Application integration can enable physical access, but organizations also need a common data model for all OpX data to support usability and quality requirements.



Integration and a Common Data Model Enable Mgmt of All OpX Info

Context is another issue that needs centralized management. Individual applications may provide contextual support in their primary user faces, but this is not enough for OpX efforts than span departments. For example, knowledge of products and operating practices may be critical for a reliability engineer to diagnose problems and improve equipment performance. And, as with the information, context managed by individual applications can be inconsistent and incomplete.



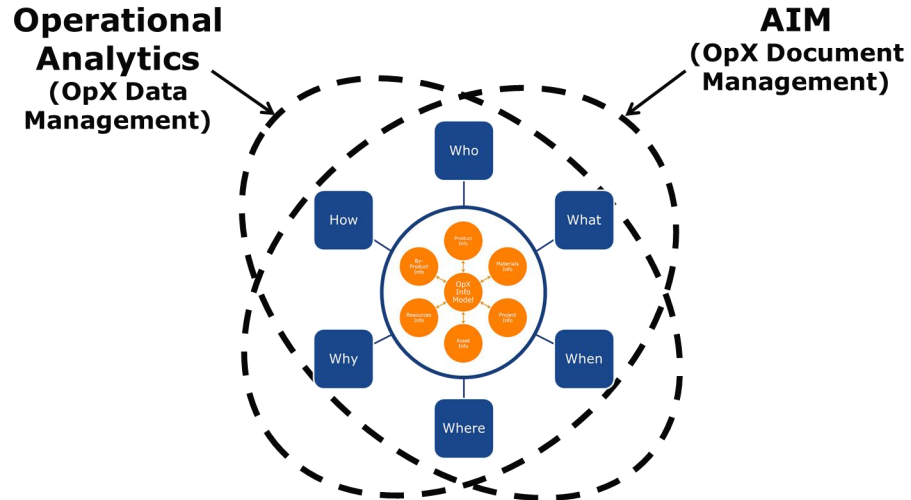
Context Management is Vital for Understanding and Insight

A common OpX data model solves some context management issues, but not all. Context management for documents is just as important and requires use of proper context management software throughout the organization.

¹ See list at the end of this document for a definition of acronyms

“Fit-for-Purpose” Solutions Provide a Solid OpX Foundation

Building a solid OpX information foundation can be a daunting effort, which may explain why some process enterprises neglect to address this critical issue. But they pay dearly for this decision.



OpX Requires “Fit-for-Purpose” Data and Document Management

ARC’s research shows a direct link between OpX information and asset productivity. For example, a typical process plant loses 1.5% of their revenues each year simply due to poor management of the documents needed for asset management. The impact of poor data management is likely larger, as organizations suffer unnecessary plant disruptions and miss opportunities to revise inefficient processes. Poor OpX information also increases the risk of EHS incidents - no one should trust HAZOP analyses and safety procedures that are not grounded in trustworthy information.

These losses alone should be enough to justify IT investments to ensure good information for all OpX activities. Recent developments in “Fit-for-Purpose” software packages can also help as they greatly reduce the effort and accelerate the benefits.

“Fit-for-Purpose” Tools for OpX Data Management

Processes enterprises have several options when it comes to tools for management of OpX data. Manufacturing and operational intelligence

products can provide better visibility of current operations and ease the challenges of integrating information spread across disparate manufacturing IT applications. They include tools for building common data models, transforming and aggregating information and designing user dashboards with alerts, meters and icons. But they lack an industrial strength data warehouse, so their capabilities for analyzing trends and correlating data, which is critical for driving improvements, are limited.

Business intelligence and Analytics solutions fill the data warehouse gap and they provide extensive capabilities for integrating applications and managing data quality. They also offer full pallettes of powerful analysis tools that can enable the organization to fully leverage their OpX information for better performance. On the downside, these packages are designed for general business use in areas like sales and finance, so they generally require extensive customization for use in operations.

Fortunately, some software suppliers have recognized the market opportunity for data management solutions for OpX. They understand the weaknesses of intelligence and analytics solutions and have developed solutions that fill these gaps. We refer to these solutions as Operational Analytics². They provide powerful data warehouses with operations-centric data models, standard connectors for integration to popular process industry IT applications and a powerful set of analytics that can support every OpX control and improvement need. Some also offer pre-built user-interfaces with KPIs for key OpX areas like operations, maintenance, and EHS.

Issue	Operational Analytics
Data Models	Pre-built to support asset-centric data and OpX context
Data Storage	Industrial Strength data warehouse for historical data
Integration	Pre-built connectors for popular manufacturing IT applications and automation systems
Dashboards	Pre-built metrics and views for all OpX Goals
Analysis	Full palette from slice-and-dice to advanced analytics

Operational Analytics is More Specific than BI, More Powerful Than MI

² See ARC Strategy Report *Analytics for Industry*, January 2012, for a complete review of Operational Analytics solution capabilities.

“Fit-for-Purpose” Tools for OpX Document Management

OpX documents come in many forms and flavors. Standard content management solutions are adequate for managing some of these documents, but not all. In particular, fit-for-purpose software is required for proper management of the multitude of technical documents associated with every process plant.

Technical document management is unique in many ways, such as the following:

- Technical documents contain specific information about the plant’s physical assets. They are vital for troubleshooting problems and designing needed plant changes. These documents need to be updated whenever modifications are made to the facility and the basic check-in/check-out capabilities in content management tools are insufficient to manage the multiple versions created throughout the planning, design, and implementation stages. Management of change is further complicated by the need to support multiple, simultaneous, changes that may have overlapping changes on the same piece of information.
- Extensive cross-referencing is common in technical information and linkages between related documents must be carefully managed to support efficient document navigation and propagation of changes to ensure that all information is consistent. General meta data capabilities are not rich enough to support these needs.
- Content management solutions may be adequate for managing scanned images of old paper-based technical documents, but they are not adequate for managing new electronic, technical information. Owner/operators need to maintain this information in their native, proprietary file formats for future plant changes. This creates the need for special viewers and special information management tools that understand the object data models of the design tools used by engineering contractors.

The following table summarizes the key issues that process enterprises need to address to ensure a proper document management foundation for OpX. Fortunately, there are software vendors that offer “Fit-for-Purpose” solutions to ease this effort. ARC refers to these kinds of products as AIM for Engineering solutions in our model for Asset Information Manage-

ment³ (AIM). In general, organizations will have to integrate several AIM for Engineering solutions to meet all of their requirements.

Issue	Asset Information Management (AIM)
Info Models	Supports asset-centric and OpX info access & navigation
Doc Mgmt	Supports native formats for all kinds of technical documents and federated content management
Visualization	Viewers for all technical documents from dwgs to 3D
Workflow	Supports std project and other collaborative processes
Quality Mgmt	Supports Handover and Complex "Engineering" MOC

AIM Extends Content Management To Address Special OpX Needs

Recommendations

Success in the process industries requires a solid operational excellence program. Information is fundamental to every successful OpX program and organizations need to ensure that their people always have convenient access to trustworthy information. While some organizations have addressed this need, many struggle to make the required IT investments. They aren't sure about what they need to do and are hesitant to begin something that they view as a costly, overwhelming effort.

Based on ARC research and analysis, we recommend the following actions for owner-operators:

- Make an internal assessment of the impact that poor information management is having on your performance and improvement efforts. If you are like most process enterprises, you will find that the impact is staggering and merits immediate attention.
- Develop an integrated information management strategy that supports all OpX goals and enables effective collaboration across all OpX teams.
- Include Operational Analytics and AIM in your OpX information management strategy. These "Fit-for-Purpose" tools can ensure

³ See ARC study on *Asset Information Management and Information Handover* for a complete review of AIM and AIM for Engineering solution requirements.

that you provide users with the required functionality and minimize the cost and effort of building a proper OpX information platform.

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

API Application Program Interface	FIN Finance
B2B Business-to-Business	GRC Governance, Risk & Compliance
BPM Business Process Management	HR Human Resources
CAGR Compound Annual Growth Rate	IT Information Technology
CAS Collaborative Automation System	OpX Operational Excellence
CPM Collaborative Production Management	PAS Process Automation System
DCS Distributed Control System	QM Quality Management
EAM Enterprise Asset Management	PM Project Management
EHS Environmental, Health & Safety	Purch Purchasing
Engr Engineering	RCM Reliability Centered Maintenance
ERP Enterprise Resource Planning	ROA Return on Assets
	SCM Supply Chain Management

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 Tel: 781-471-1000, Fax: 781-471-1100
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