



Best Practices for Operationalizing  
**Data-Driven Decisions**  
**Across the Enterprise**



# The challenge is no longer technology, but organizational capability.

Organizations in all industries are awakening to the value that operational data can bring to the enterprise.

Combining operational data with other business information allows organizations to make data-driven decisions that optimize performance. However, different people use the same data in very different contexts and need information in a format that they can easily consume.

## By consolidating operational data into an enterprise PI System, your organization can:

- **Provide business stakeholders with the data** they need, in the form they require, at the frequency they need to move to a proactive operating environment.
- **Supply clean, trustworthy operational data** to specialized modeling solutions, advanced analytics, and machine learning tools.
- **Operationalize insights** from these analytics tools.





## What is Operational Data?

Operational data is the data gathered by sensors and control systems during operations to understand the health of the process and the associated equipment. These data streams, often known as “time-series data,” are collected frequently, often at second or sub-second intervals. Historically, business stakeholders have not had real-time access to this data and have instead made decisions based on data from yesterday, or last month

or last quarter. The result can be a reactive approach to managing operations.

Integrating operational data into business systems in real time provides the opportunity to see emerging issues and address them as they occur, greatly reducing the risk of extended downtime and associated loss of revenue. It can also help the business optimize processes for more efficient and productive day-to-day operations.



# One Data Point, Many Uses

Operational data impacts many day-to-day corporate decisions. Traditional relational databases are not well equipped to manage real-time data streams and make that data available for the user community. The PI System was specifically designed to manage operational data, and an enterprise approach to operational data with the PI System offers opportunities to deliver standardized, validated information to multiple decision-makers across the organization in the format and at the frequency that they require for proactive operations.

For example, a single flow tag on pump discharge can support many decisions from a variety of users, including:

- **Process engineers** decide if a system can be optimized
- **Maintenance specialists** can determine when the pump needs repair
- **Operations managers** can confirm the total production is meeting the forecast
- **Accountants** can confirm throughput to better forecast and track revenue
- **Environmental specialists** can ensure there is regulatory compliance
- **Data scientists** can mine data to spot new patterns and correlations between discharge flow, other process variables and information from other business systems.



## How Different Parts of the Organization Look at a Single Data Point

? Why do they want to see the data?

🔍 How do they want to view it?

🕒 What frequency of data do they need?

💻 Where do they want to view it?

### Corporate Accounting

- ? Are there any unknown correlations between this data & other data sets?
- 🔍 Normalized, easily accessible, validated data
- 🕒 Low granularity
- 💻 ERP Systems

### Regulatory Reporting

- ? Are we compliant with regulatory requirements?
- 🔍 Aggregated data for reporting & real-time notifications of potential issues
- 🕒 Varies depending on regulations
- 💻 PI Vision & specialized compliance reporting tools

### Plant Manager

- ? Are we meeting targets?
- 🔍 Consolidated data in context of other data sets, such as health and safety statistics
- 🕒 Low granularity
- 💻 PI Vision & reporting tools such as Power BI

### Data Scientist

- ? Are there any unknown correlations between this data & other data sets?
- 🔍 Normalized, easily accessible, validated data
- 🕒 Varies depending upon the situation
- 💻 Advanced analytics & machine learning

### Process Engineer

- ? Where is the process not performing as designed?  
How can we optimize the process?
- 🔍 In the context of the overall production process
- 🕒 High granularity
- 💻 PI Vision/modeling applications, advanced analytics & machine learning

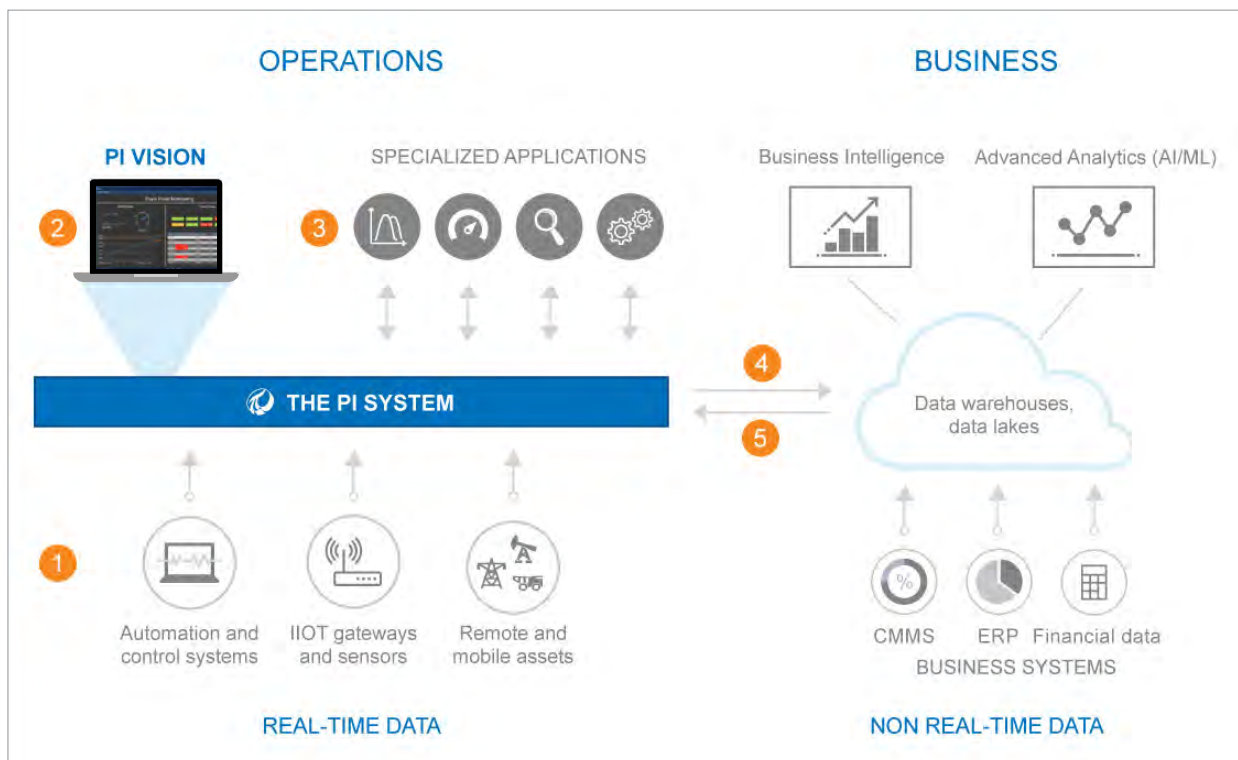
### Maintenance

- ? What is the health of the equipment?
- 🔍 Early identification of emerging issues to support predictive maintenance
- 🕒 High granularity
- 💻 PI Vision & specialized analytical solutions

# The PI System: A Real-Time Tool to Turn Insights into Value

The PI System plays a central role in transforming operational data into actionable insight. It acts as a repository for operational data that can consolidate, standardize and make data available to support informed decisions.

As an operational data system of record, the PI System works in tandem with the growing number of specialized modeling solutions and big data advanced analytics tools (e.g. machine learning, artificial intelligence, advanced pattern recognition) to solve complex operational challenges and identify new opportunities.



- 1 **Consolidate operational data** from disparate sources in the PI System.
- 2 Create fit-for-purpose **real-time dashboards** for operations with PI Vision.
- 3 Layer **specialized point solutions** as needed to address specific use cases.
- 4 **Integrate operational data** with big data tools (e.g. data warehouses, lakes, and business intelligence tools) for predictive and advanced analytics.
- 5 **Validate insights** from specialized solutions and big data tools with Event Frames, **operationalize insights** in the PI System through Notifications.

# Real-Time Dashboards and Analytics for Your Operations



Using operational data to move from reactive to proactive operations, tends to be an evolution that begins in the PI System. PI Vision dashboards are ideally suited to situations that are primarily based on high frequency, operational data with role-specific visualizations. With Asset Framework (AF), a component of the PI Server, operational data is augmented with data from other business solutions for added context to support optimization and troubleshooting.

In the example above, a solution hierarchy allows the pump specialist to identify an emerging issue and navigate in a couple of clicks to a detailed graphic to diagnose the situation. This templated graphical view is specifically designed to meet the rotating equipment specialist's needs—bringing the operational and business data together to allow that specialist to quickly understand the current status and address the issue. A rotating equipment specialist will usually want to have the following data in a single view:

- **Make, model and serial number** from the maintenance management system to confirm the exact pump
- **Available P&IDs** to understand the pump's physical location in the process
- **Open work orders** to understand if there is planned work to address an emerging issue
- **Reliability information** to understand the history of that particular piece of equipment
- **Additional specific PI System analytics** to determine pump performance or efficiency compared to design specifications to diagnose emerging issues

With the PI System templating capabilities in Asset Framework (AF), all of this is available in a couple of clicks and is highly scalable across the organization. PI Vision dashboards provide significant opportunities to proactively identify emerging issues to reduce downtime and hence production losses.

# Specialized Modeling and Analytics Solutions

From real-time dashboards, typically the next step in the evolution to proactive operations is to invest in specialized analytics and modeling to address a specific challenge. These specialized analytics could include tools such as PID loop tuning, regulatory reporting, or a modeling solution.

OSIsoft has always offered interfaces to allow the PI System to provide the required operational data sets to specialized analytics for further analysis. The PI System

can pass data to any application in the format required by that given application. In this way, the specialized applications can securely consume data from the PI System in near real time. This prevents numerous applications potentially compromising security by accessing the control systems directly while still providing the data in a timely fashion. With a standardized, validated Enterprise Asset Framework, incorporating and sharing data with point solutions is greatly streamlined.

## The OSIsoft Marketplace

OSIsoft has a Partner EcoSphere of over 300 partners and 2600 third-party developers. In the OSIsoft Marketplace, browse specialized modeling and analytics solutions, advanced analytic services, and more partner offerings.

<https://partners.osisoft.com/solutions>





# Big Data Tools: Scaling Predictive Insights to Operations

As companies become more mature in data-driven decision making, they often embrace the advanced analytic capabilities of big data tools. This involves increased collaboration between subject matter experts, IT specialists, data scientists and operational data specialists to address more complex challenges. In these solutions, we find some of our clients incorporating operational data with data from other systems to determine if there are patterns in the data that can be identified and used as leading indicators to minimize future upsets or failures. The PI System provides standardized, real-time operational data, dramatically reducing the time required to prepare the data for Big Data analytics.

For example, a Canadian-based company could not diagnose why they had compressors go down early in the spring. In Canada, extremely cold weather in the winter is normally followed by equally extreme hot weather in the summer. By combining data from the PI System, the maintenance system and environmental data, they determined that the louvers in a building were not opened for summer and the building overheated on hot days. A simple change to the planned maintenance routine for buildings in the spring solved the problem. This is a simple example but demonstrates how trusted data from multiple sources can identify new patterns that can prevent downtime.

## Advanced Analytics Success Stories



### Boehringer Ingelheim: The Multivariate Quest for the Golden Batch

Applied multivariate data analysis to process and attribute data to reduce production variance, generate greater batch potency and increase yield.



### Petronas: Bye, Bye Spreadsheets

Developed 360 degree view into asset health with automated alerts and are moving from scheduled maintenance to condition-based maintenance.



### Ciner: Advanced Pattern Recognition

Advanced pattern recognition from Falconry uses PI System data to detect bad ore grades, mechanical issues, and reduces outages costing \$30,000/hour.



### Cemex: Automating Data Preparation

By using PI System data and PI Integrator technologies, data gathering and preparation time reduced from 816 hours to six minutes.

# Operationalize Analytics with PI System Event Frames



To truly capitalize on learnings from big data tools and specialized modeling and analytic solutions, the most successful companies we work with use a combination of advanced analytic tools and vertical solutions to drive initial insight from analytics. They then validate and operationalize that insight within the PI System and when fully confirmed—move it into the control system to become a standard operating procedure.

Because the PI System can maintain high granularity data for the life of the asset, Event Frames can be

used to analyze how many times that event has actually occurred historically. Once a hypothesis has been confirmed, an Event Frame can be developed to identify when this happens in the future and Notifications can be sent to the people responsible to intervene and proactively address the issue. In short, the learnings are confirmed and operationalized. Once confirmed in the PI System, they can potentially become part of standard operating procedures in the control system.

# What are Event Frames?

An event is anything with a start or stop time. Within the PI System, Event Frames mark time periods that represent important incidents impacting your assets, process, product, or business operations. Event Frames can include simple occurrences on a single data point—runtime for example. They can also group common data sets that are only an event when combined—gas analysis for example that has multiple data points gathered together at a point to become a new analysis.


## Where do Event Frames sit within the PI System?



### PI System

Stores and enhances operational data

## What is an example of an Event Frame?

 Gearbox overheating



 User defined trigger



Users can view, acknowledge and comment on the event

## Other examples of Event Frames include:

- Asset downtime
- Operator shifts
- Equipment startups or shutdowns
- Gas analysis
- Product batches
- Process or environmental excursions

As shown above, taking full advantage of today's technology requires an ecosystem of people, processes and tools to ensure the users have access to the data they need in their tools to meet the business challenges and take advantage of the opportunities. Truly successful organizations develop cross functional teams of operational data specialists, IT specialists, data scientists and subject matter experts to determine the best way to leverage the company's data and tool sets to address complex operational opportunities. The technology exists, the challenge is to effectively build the organizational capabilities to leverage the data and tools.

The PI System is a key component of the ecosystem required to leverage operational data more effectively. An enterprise PI System designed to meet an organization's specific business needs, can greatly simplify secure access to trusted operational data by users and applications, reducing support costs and making it much easier to deploy best practices across the company. More importantly, it allows complex operational challenges to be solved by engaging a team of specialists that foster cross-functional collaboration to choose the best combination of tools and data to address the opportunity and add value.

## About the Author

**Heather Quale** is the President of Mera Group and an accredited system integrator. She has implemented PI Systems for industry leaders in oil and gas, pipelines and mining organizations for the past 18 years. The deployments vary from small site solutions with hundreds of tags to complex enterprise PI Systems with millions of tags. Mera's cross functional team of engineers, analysts and IT professionals work collaboratively with our global clients to use their operational data more effectively to address their specific needs.



## About OSIsoft

For over 38 years, OSIsoft has been dedicated to helping people transform their world through data. Our software turns the vast data streams from sensors and other devices into rich, real-time insights for saving money, improving productivity or developing new products. Over 1,000 leading utilities, 95 percent of the largest oil and gas companies and more than 65 percent of the Fortune 500 industrial companies rely on the PI System to get the most out of their businesses. You'll find the PI System in oil refineries, mining sites, wind farms, national labs, pharmaceutical manufacturing facilities, distilleries, data centers and even stadiums helping people save energy, increase productivity and make better decisions. Worldwide, the PI System handles more than 2 billion sensor-based data streams. Founded in 1980, OSIsoft has over 1,300 employees and is headquartered in San Leandro, California. To learn more, please visit [www.osisoft.com](http://www.osisoft.com).

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