

# FactoryTalk<sup>®</sup> Analytics<sup>™</sup> LogixAI<sup>™</sup>

Overview | April 2019



**Rockwell  
Automation**



# Production is down

# Reactive thinking during a downtime instance

Who's the expert?

What's the problem?

This has got to stop!

What tools to use?



# ANALYTICS

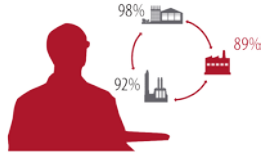
The *discovery*, *interpretation*, and *communication* of meaningful patterns in data. Analytics relies on the application of statistics, computer programming and operations research to quantify performance.

# Scalable analytics

The key differentiator for Rockwell Automation

ENTERPRISE

## DESCRIPTIVE



What plant performed the best?

## DIAGNOSTIC



Why is site A throughput below plan?

## PREDICTIVE



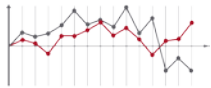
Will I meet plan today? Tomorrow?

## PRESCRIPTIVE

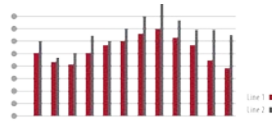


How can I change operations to improve profitability? Yield? Quality?

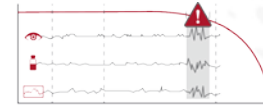
SYSTEM



Is Line 1 running ok?



Why is Line 1 quality poor?

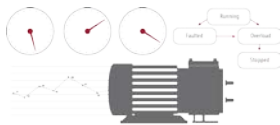


I predict that Line 1 quality is moving out of tolerance.



What action helps the operator to avoid poor quality?

DEVICE



Am I running ok?



Why did a fault happen?

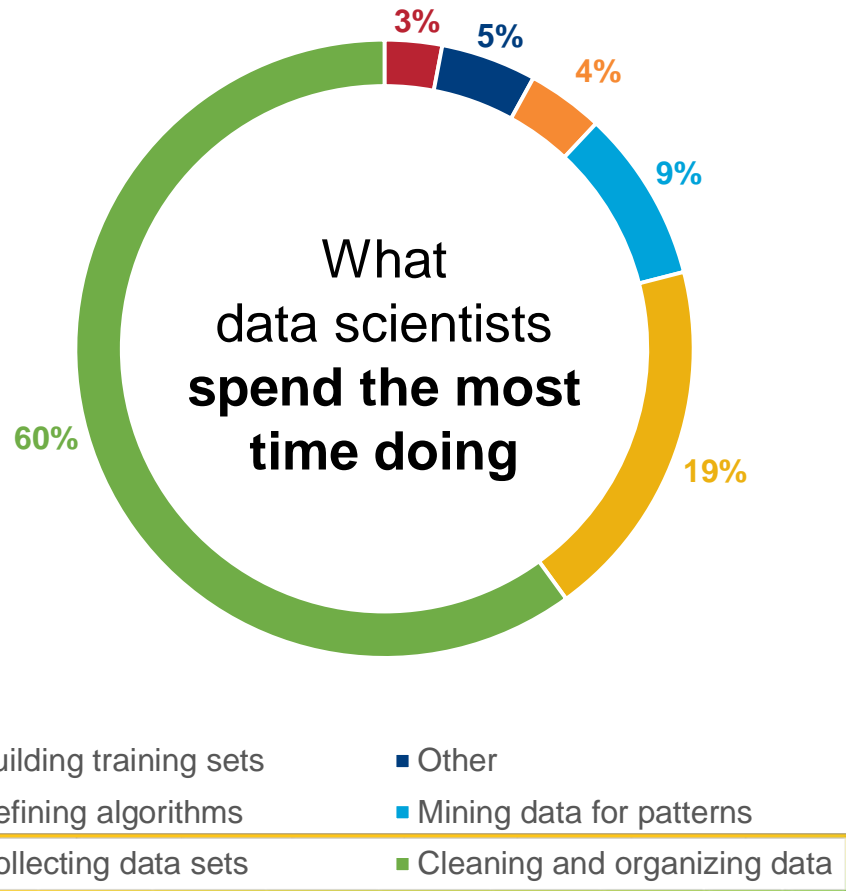


I predict a fault will happen soon.



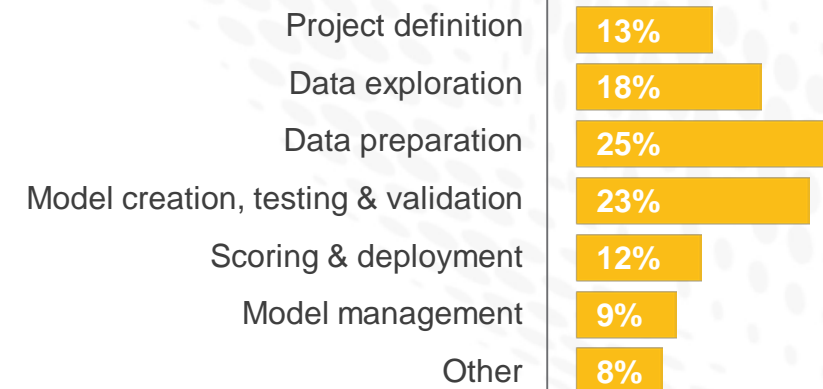
What action helps to avoid the fault?

# Building predictive models and change management



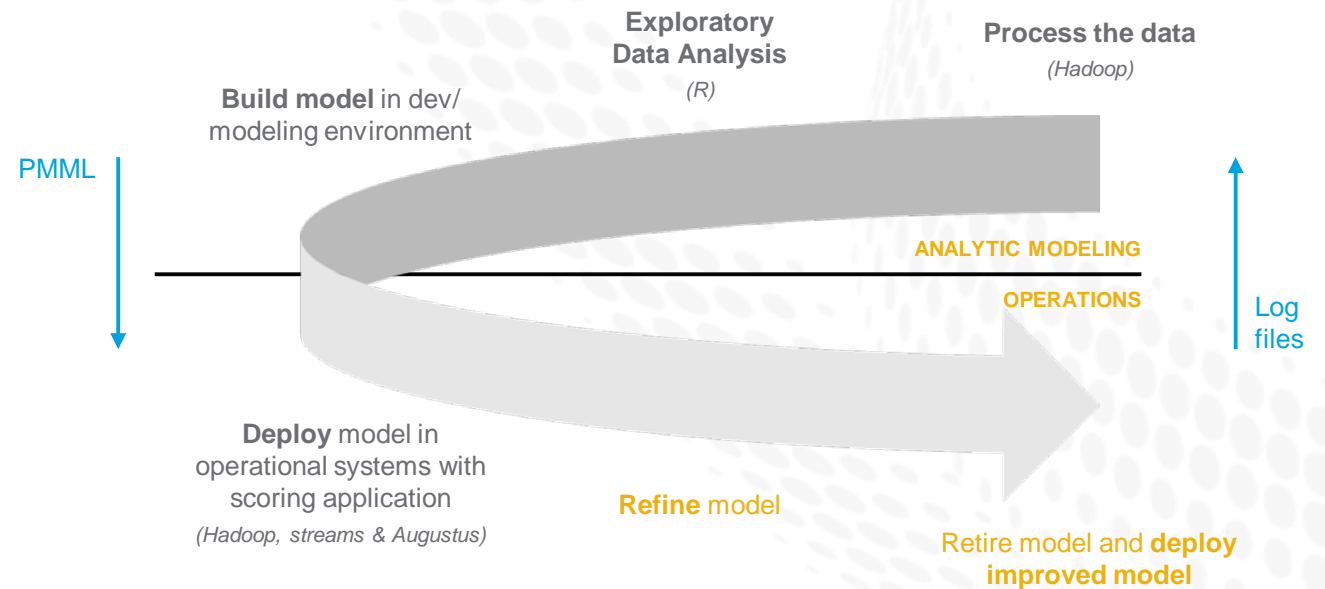
Groups spend this **percentage of time** on each phase in a predictive analytics project

*Based on 166 responses, adapted from Eckerson (2007)*



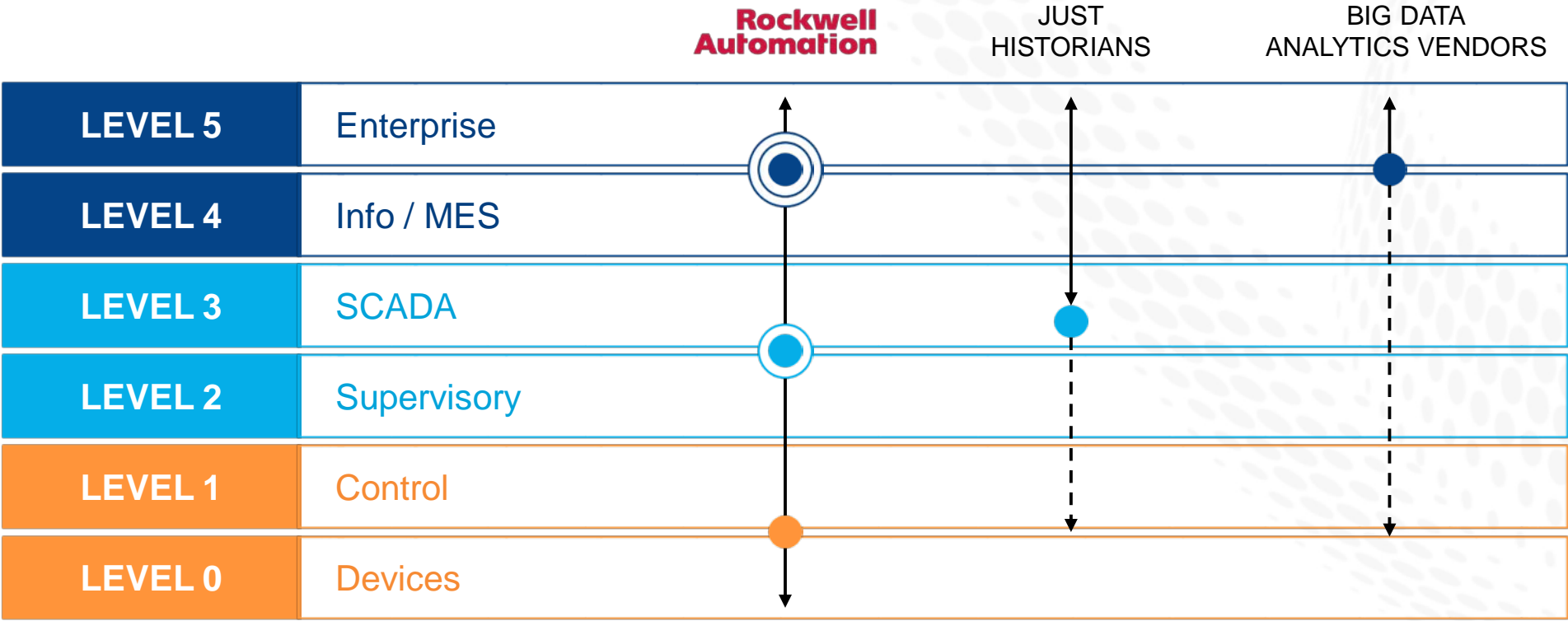
# Building predictive models and change management

## Lifecycle of a predictive model



# Scalable analytics & decision-making

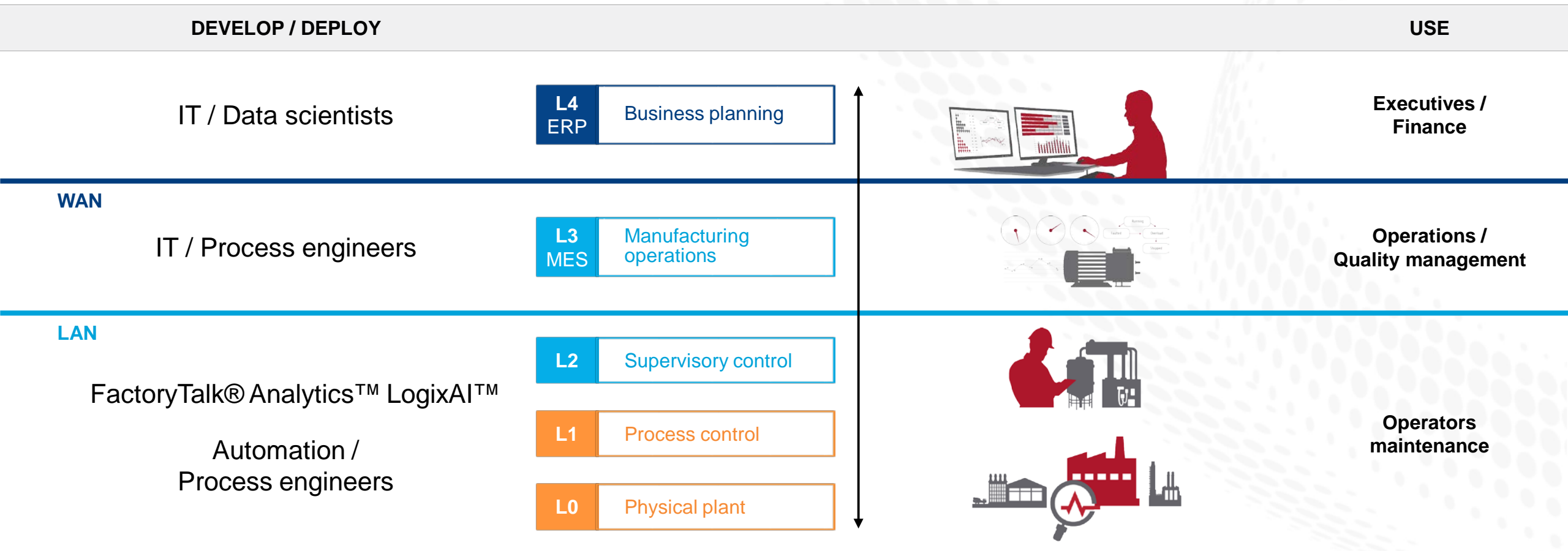
At the right time, at the right level



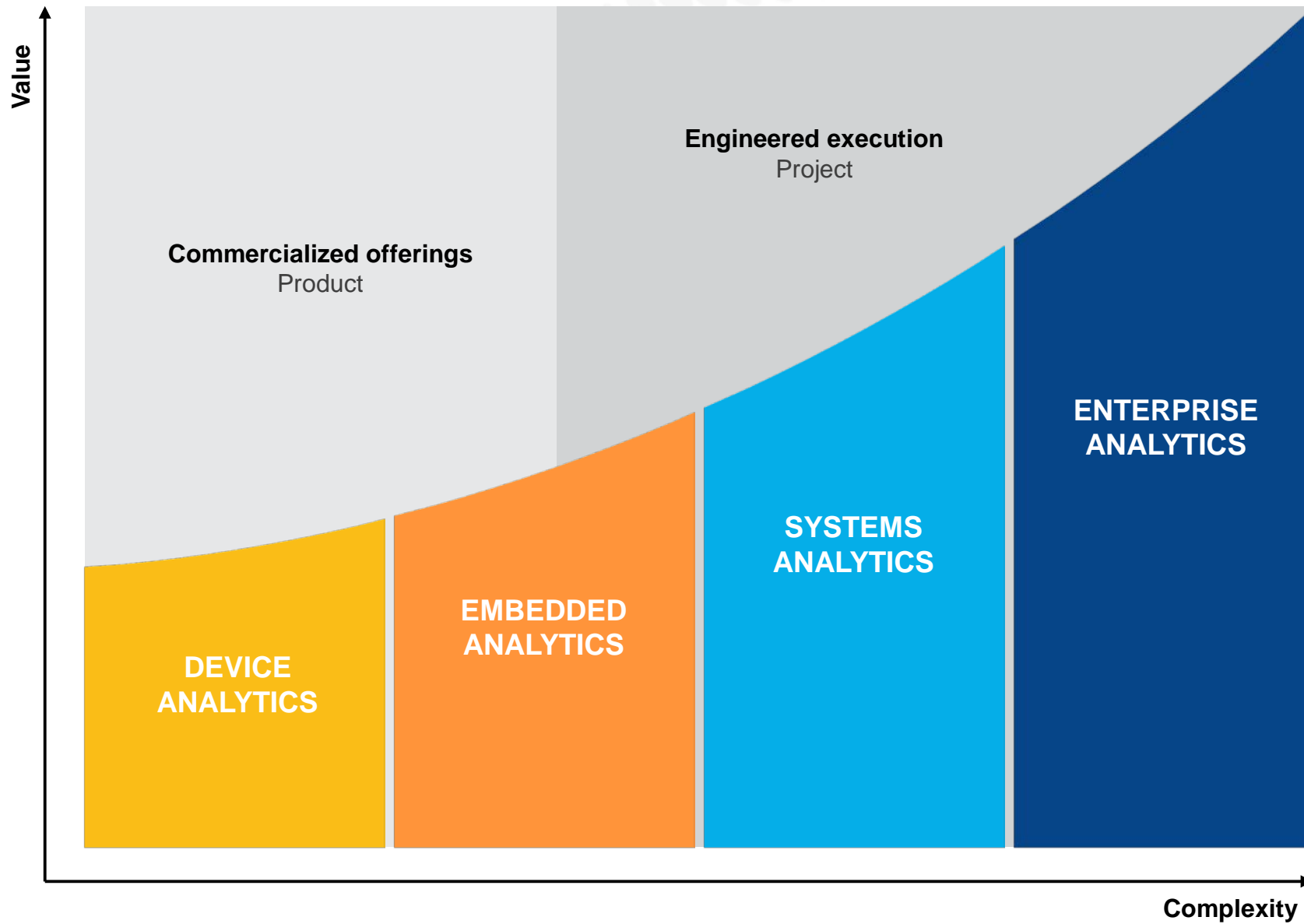
Produce, analyze and react to information **as close to the source as possible**



# Developing and using analytics



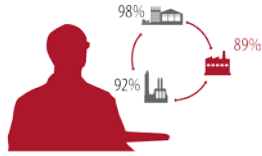
Control networks



# Scalable analytics

Where FactoryTalk® Analytics™ LogixAI™ fits into the ecosystem

ENTERPRISE



What plant performed the best?



Why is site A throughput below plan?

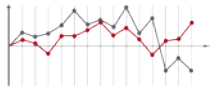


Will I meet plan today? Tomorrow?

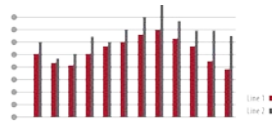


How can I change operations to improve profitability? Yield? Quality?

SYSTEM



Is Line 1 running ok?



Why is Line 1 quality poor?

+

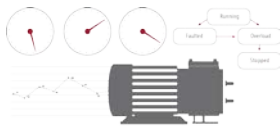
I predict that Line 1 quality is moving out of tolerance.

I predict a fault will happen soon.



What action helps the operator to avoid poor quality?

DEVICE



Am I running ok?



Why did a fault happen?



What action helps to avoid the fault?

# Two approaches to advanced analytics

## Expert driven analysis

- Tools like SaS, Pavilion®, SAP HANA
- Leverages human expertise – both in understanding the problem and the tools
- More powerful and flexible...
- But varied approaches mean different results each time you try



## Automated data analysis

- Systems like Cortana, Watson and now FactoryTalk® Analytics™ LogixAI™
- Leverages AI and a foundation of universally applicable physics-based modeling
- Still less intelligent than a human...
- Repeatable results each time

# Machine learning

## Paradigms

### Supervised learning

Given datasets and labels, predict a label for a new dataset

▶ **EXAMPLE**

Recommender system by Facebook or Google

### Reinforcement learning

Learn how to take actions in an environment to maximize some notion of cumulative reward

▶ **EXAMPLE**

Games, self-driving cars

### Unsupervised learning

Draw inferences from datasets without human-labeled responses

▶ **EXAMPLE**

Finding hidden patterns in clustering applications

### Active learning

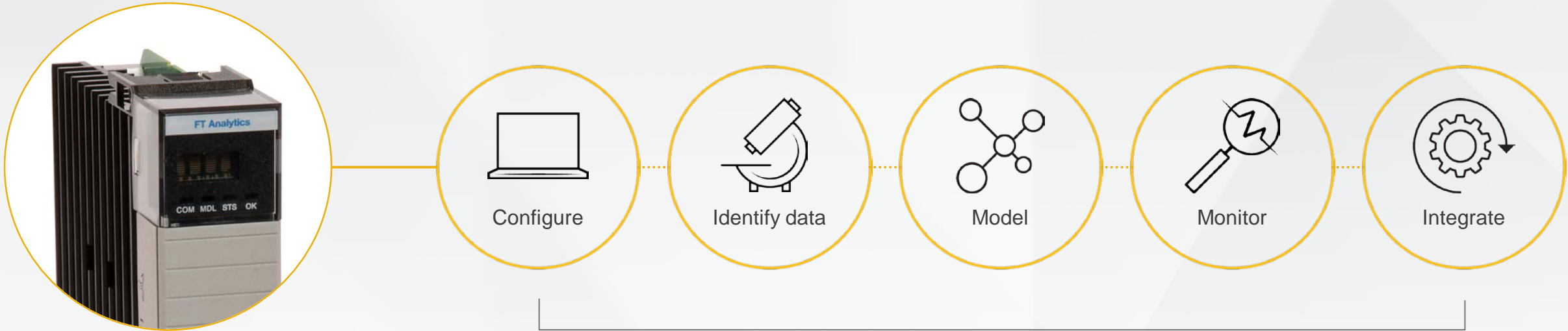
Learn by interactively obtaining the desired labels at selected new data points

▶ **EXAMPLE**

Medical applications

# FactoryTalk<sup>®</sup> Analytics<sup>™</sup> LogixAI<sup>™</sup>

Descriptive | Diagnostic | Predictive | Prescriptive



NO DATA SCIENTIST REQUIRED

# How FactoryTalk® Analytics™ LogixAI™ works

1 Define Prediction 2 Assign Tags 3 Review 4 Finish

## 1. Define Prediction

Select prediction creation method

Create new prediction

Add new prediction to existing model

Select the process you want to model

Boiler Generator Pump Advanced

Enter pump name  
myPump

Select the controller slot  
1

Select prediction type

Cavitation

Blockage

Other (requires advanced tag assignment)

Enter prediction name  
Cavitation5

Enter prediction description (optional)  
Predicting cavitation for the line 1 pump--version 5.

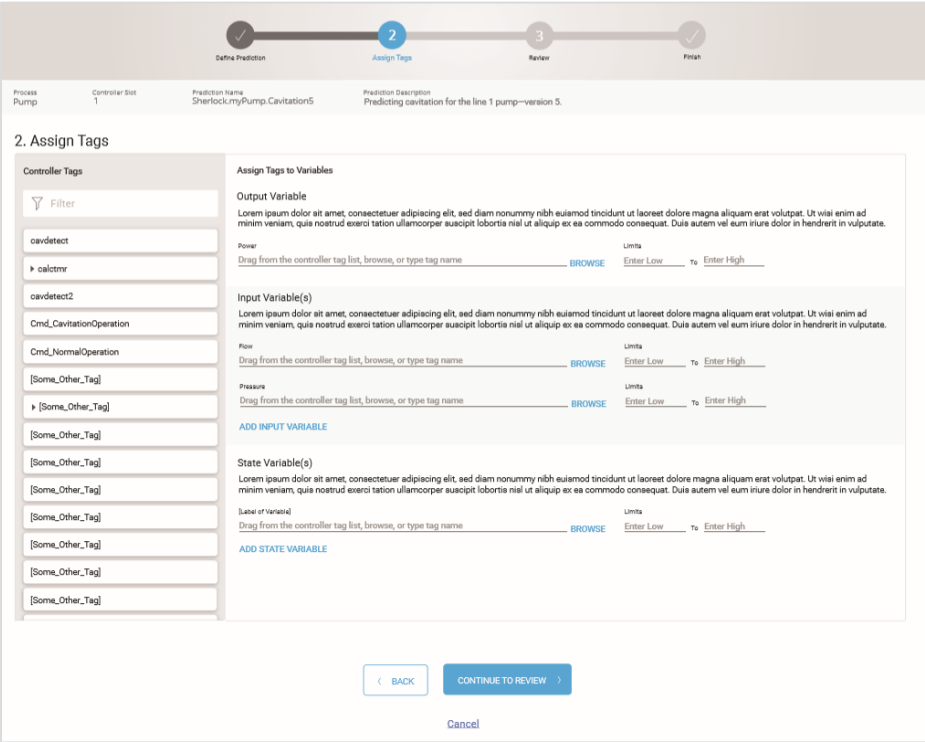
CONTINUE TO ASSIGN TAGS

Cancel

F1

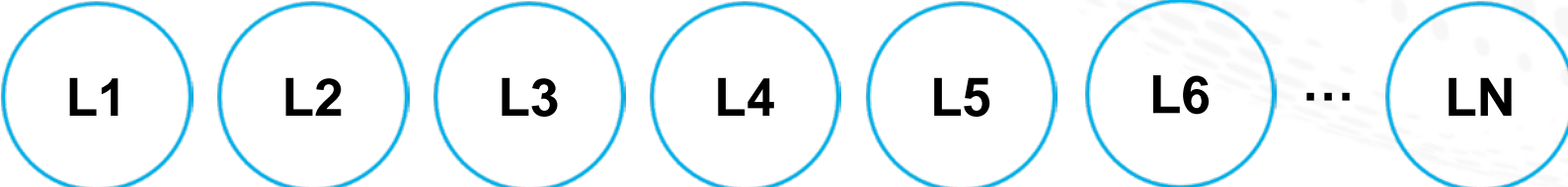
Select controller output(s) **you care about**

# How FactoryTalk® Analytics™ LogixAI™ works



F1

Select potential **inputs or variables** from controller tags

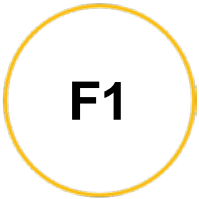




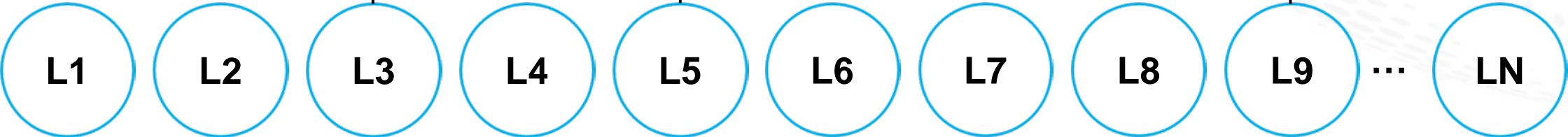
# How FactoryTalk® Analytics™ LogixAI™ works

The screenshot shows a web interface for the 'Review' step of a prediction workflow. At the top, a progress bar indicates four steps: 'Define Prediction', 'Assign Tags', 'Review' (highlighted with a '3'), and 'Finish'. Below the progress bar, the prediction name is 'Sherlock.myPump.Cavitation5' and the description is 'Predicting cavitation for the line 1 pump--version 5.' The main content area is titled '3. Review' and contains a 'Prediction Summary' table. Below the table, there is a 'Next Steps' section with a 'Watch' button and a 'Cancel' button. At the bottom, there are 'BACK' and 'FINISH' buttons.

Type	Process Variable
Output	Power
Input	Flow
Input	Pressure



FactoryTalk® Analytics™  
LogixAI™ determines  
inputs that relate to  
your output



# How FactoryTalk<sup>®</sup> Analytics<sup>™</sup> LogixAI<sup>™</sup> works

Get valuable insights for your plant's operations in just three steps.

[CREATE NEW PREDICTION](#)

How it Works  
 Watch (2:33) |  Read

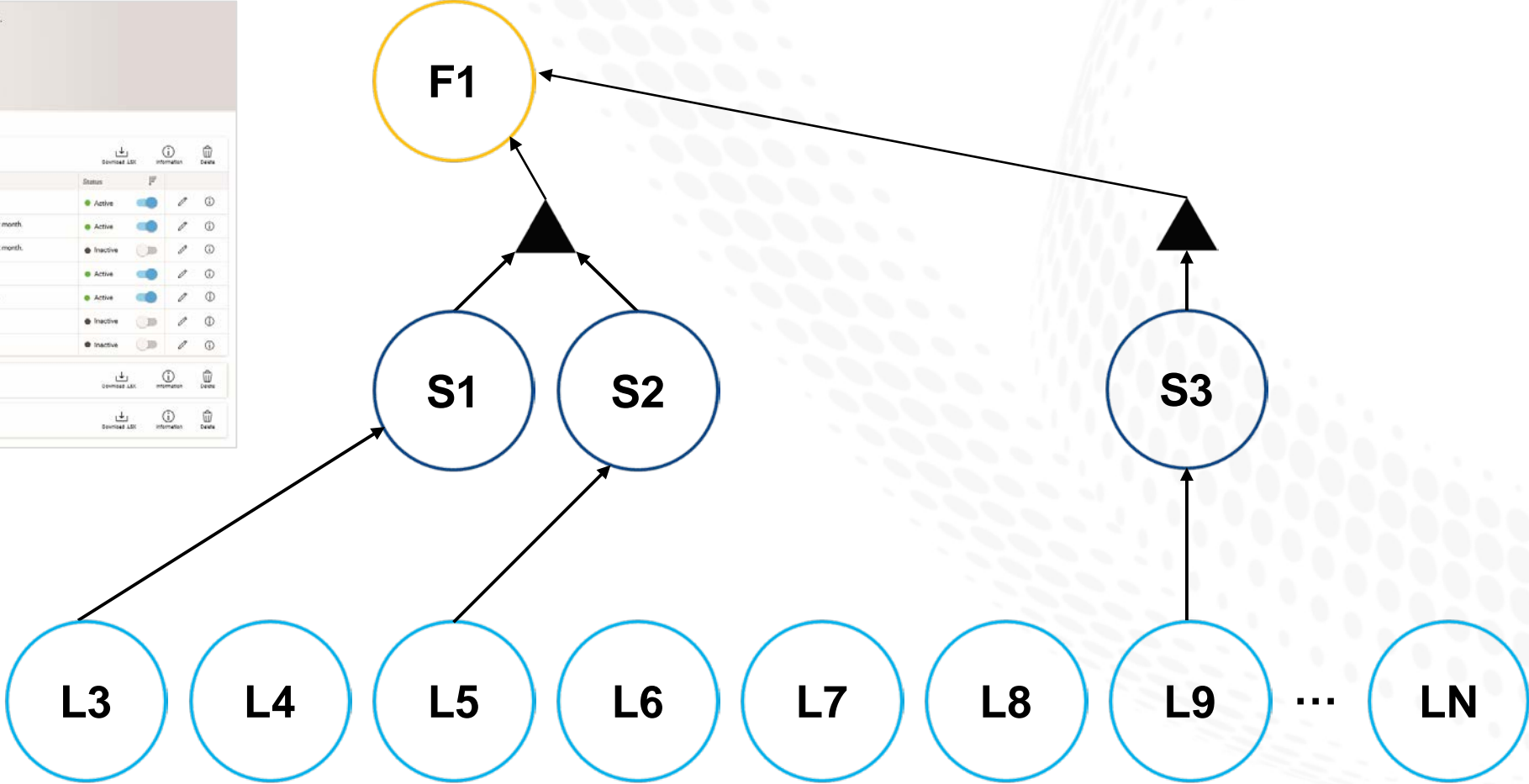
Prediction Archive

▼ Controller Slot 1 | Pump

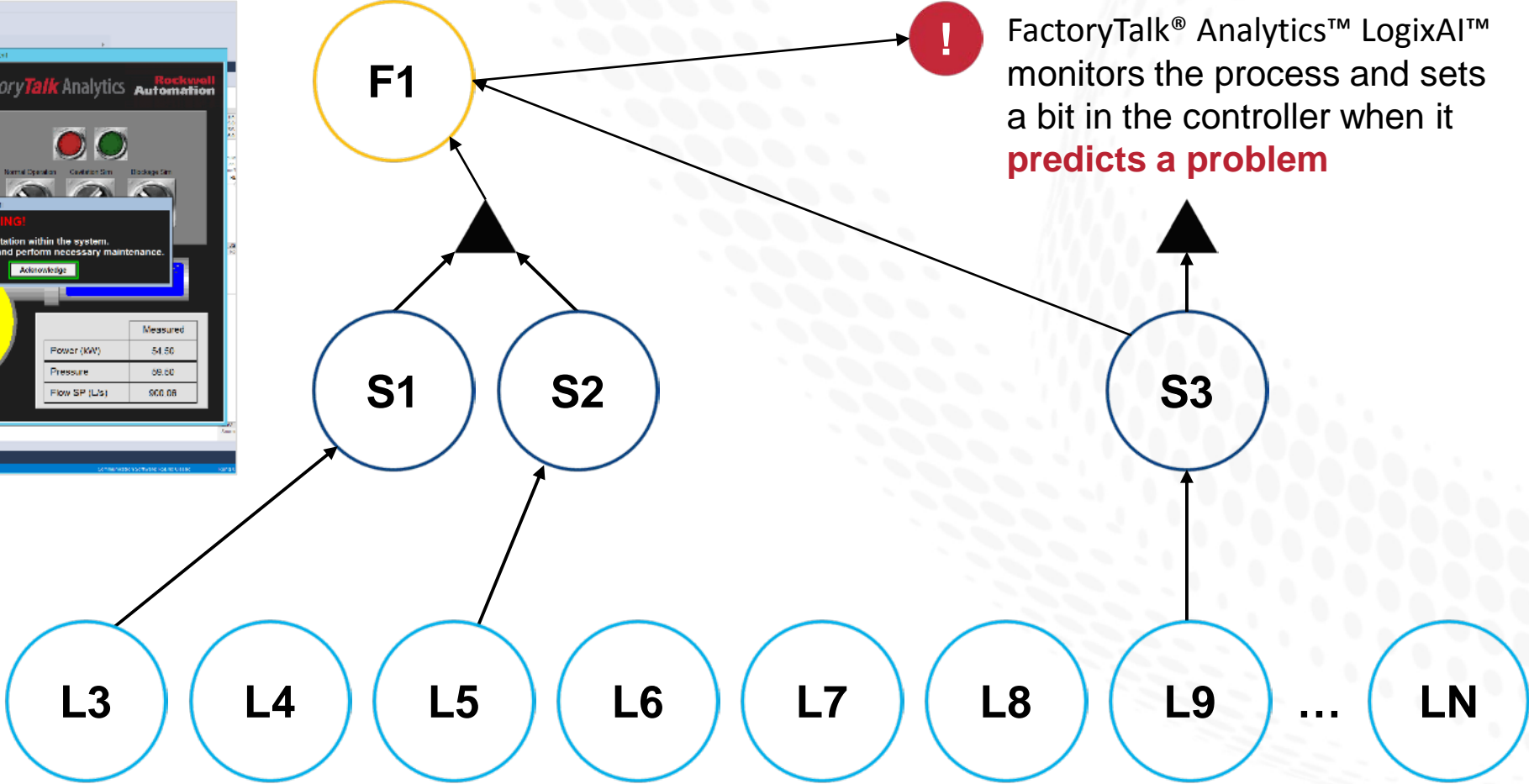
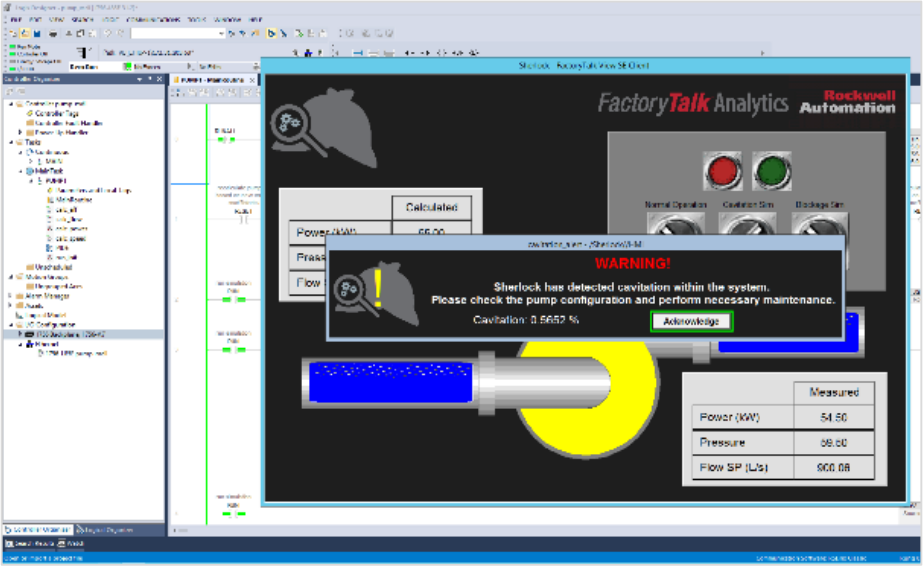
Date/Time	Prediction Name	Description	Status	Download LDC	Information	Delete
Apr 26, 2016 at 12:24 PM	Sherlock.my/PumpCavitation1	Predicting cavitation for the line 1 pump--version 4.	Active			
Apr 26, 2016 at 12:21 PM	(Sherlock.my/PumpBlockage1)	Take 3: Predicting blockage for the line 1 pump. Need to better understand why blockage happened last month.	Active			
Apr 28, 2016 at 1:35 PM	(Sherlock.my/PumpBlockage2)	Take 2: Predicting blockage for the line 1 pump. Need to better understand why blockage happened last month.	Inactive			
Apr 26, 2016 at 10:42 AM	(Sherlock.my/PumpCavitation3)	Cavitation happened with line 1 pump last month. Trying to predict cause (version 3)	Active			
Apr 27, 2016 at 11:49 PM	(Sherlock.my/PumpBlockage1)	Predicting blockage for the line 1 pump. Need to better understand why blockage happened last month.	Active			
Apr 27, 2016 at 8:05 PM	(Sherlock.my/PumpCavitation2)	Cavitation happened with line 1 pump last month. Trying to predict cause (version 2).	Inactive			
Apr 27, 2016 at 4:15 PM	(Sherlock.my/PumpCavitation)	Cavitation happened with line 1 pump last month. Trying to predict cause.	Inactive			

▶ Controller Slot 2 | Generator

▶ Controller Slot 3 | Boiler



# How FactoryTalk® Analytics™ LogixAI™ works



FactoryTalk® Analytics™ LogixAI™ monitors the process and sets a bit in the controller when it **predicts a problem**

# FactoryTalk® Analytics™ LogixAI™

Modes of operation

## Operational monitor

- “Anomaly detection”
- Create a model of normal operation, detect anomalies

## Value estimation

- “Soft Sensor®”
- Create a model from existing data to estimate another value



# Analytics is a word problem

What's your problem statement?

**Fill in the blanks** with this example statement:

**[Process X]** is known as our bottleneck. Every time key **[controlled variable Y]** of **[process X]** goes unstable, it relates to **[\$Z of lost production, scrapped product, etc.]**

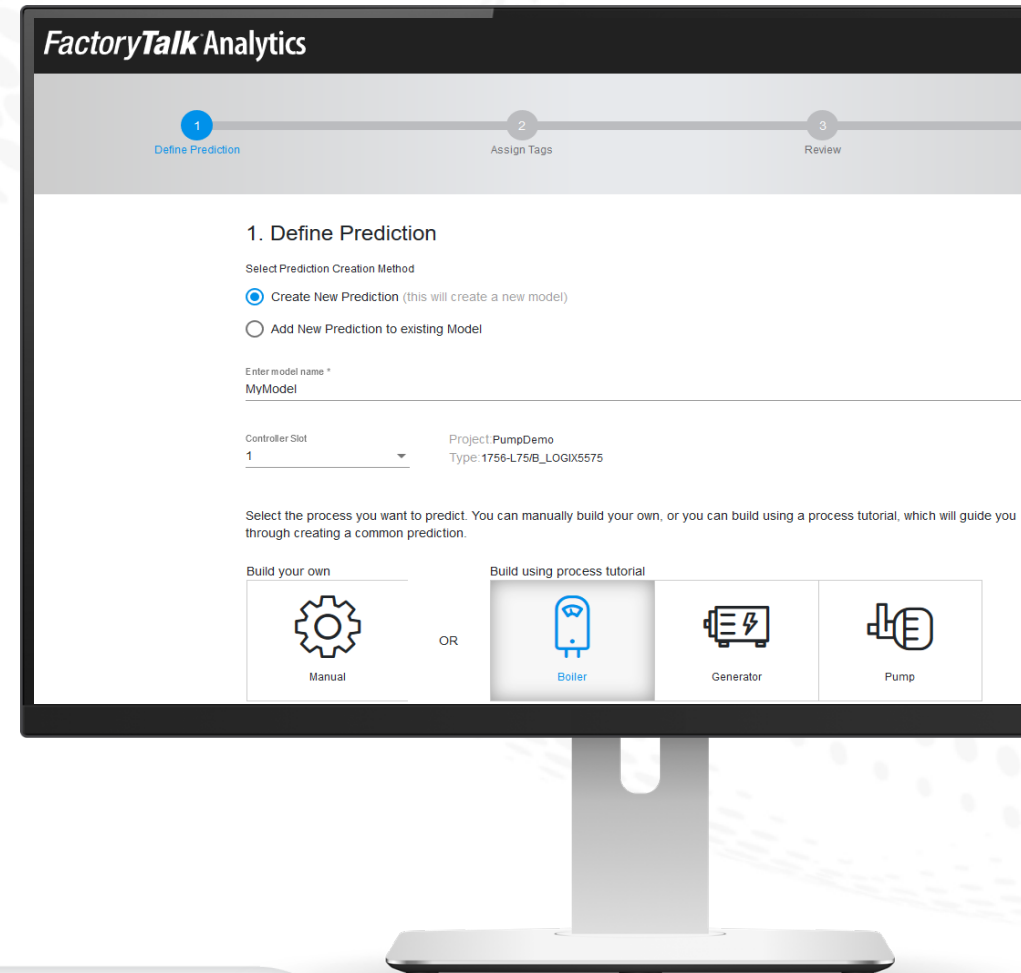
Several key manipulated variables are known to control **[Y]**; like **[A, B, C, D, E...ZZ]**. PID control works ok, but MPC is overkill.

If I could predictably monitor the control variable setpoint, when instability occurs; I would be in a better position to take action by doing **[1, 2, 3]**.

# FactoryTalk® Analytics™ LogixAI™

## Project charter concepts

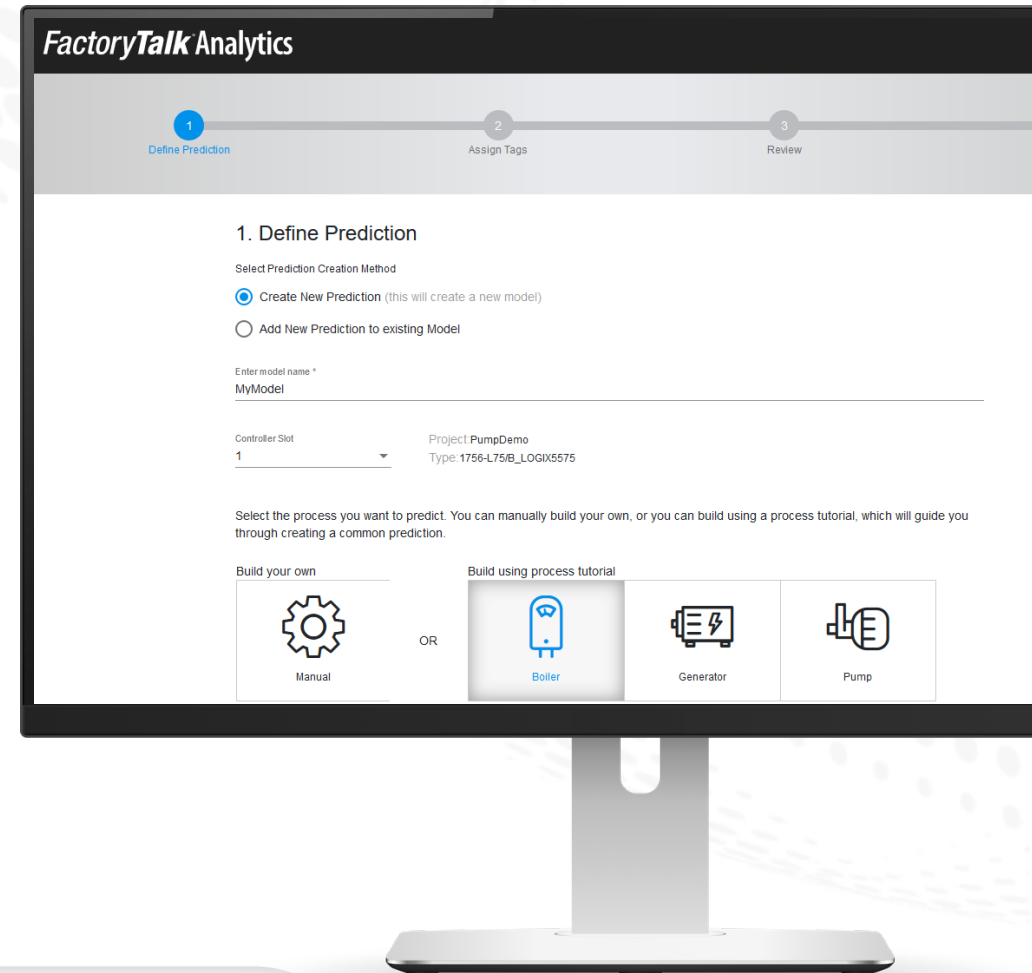
- **Operations / System focused improvements!**
- Targeting one key source of data / the controller code
- Target key control variables / stability issues
- Definition of key metrics – like Quality / Scrap %
- Capture baseline for measuring success
- Hypothesize the benefit
- Processes to leverage tool based on
  - **Anomaly Detection / Soft Sensing**
  - **What would you do with a prediction?**
- Process to assign financial impact – track ROI for future efforts.
- Process to share success internally (and with RA)



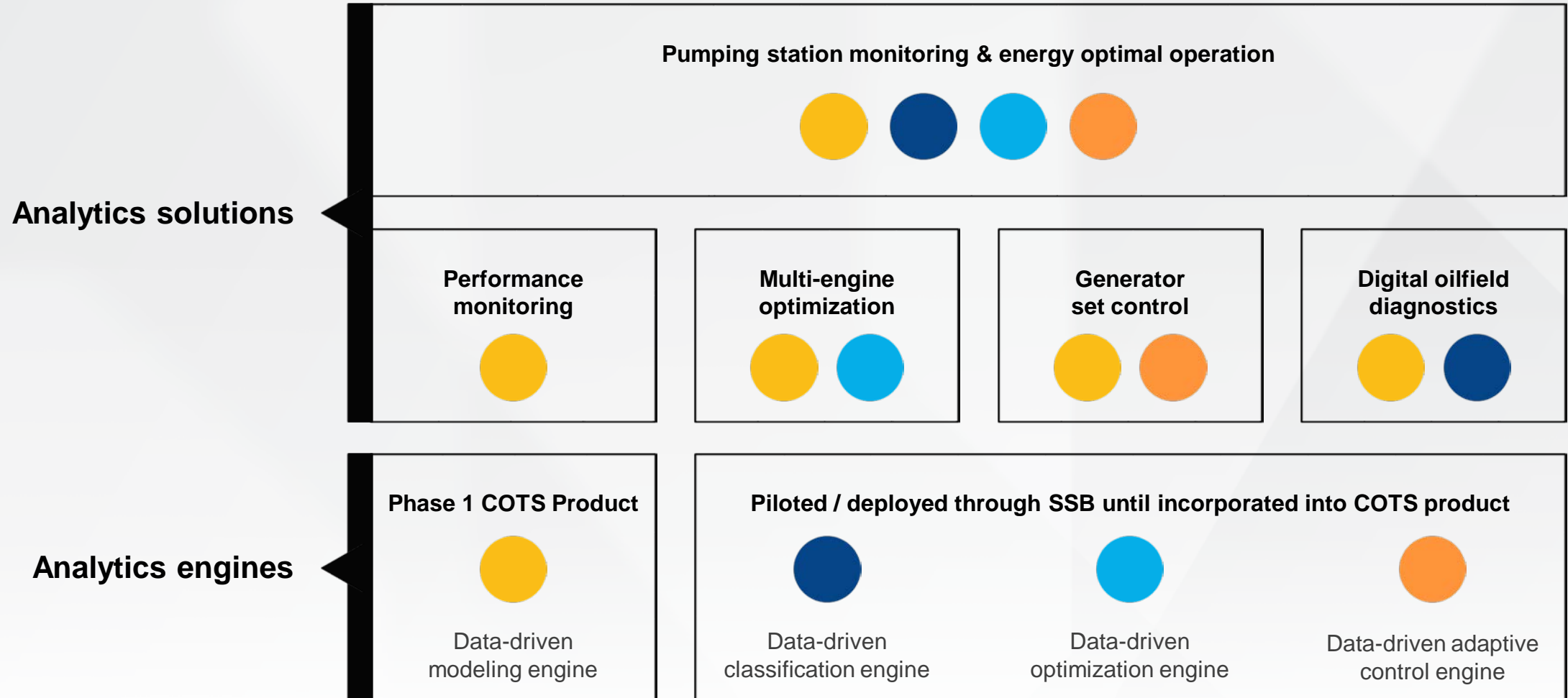
# FactoryTalk® Analytics™ LogixAI™

## Technical considerations

- **Data Scientist is not needed but an automation expert is**
- ControlLogix® L7 / L8 controllers
- Operations obey first unit operations principles – no human subjectivity
- One application code file contains all necessary data (phase 1)
- If used as a Soft Sensor® – where's the data?
- What to do with a prediction?
- Static modeling versus dynamic modeling?
- When is PID not enough?



# Future of FactoryTalk<sup>®</sup> Analytics<sup>™</sup> LogixAI<sup>™</sup>





Talk to us today about how we can  
qualify your use case!



[www.rockwellautomation.com](http://www.rockwellautomation.com)



**Rockwell  
Automation**