IMAC 2014

IBM Predictive Maintenance and Quality (PMQ)

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Agenda

- From Descriptive to Predictive
- PMQ Solution V2
- PMQ Use Cases
- Analytical Decision Management
- Maximo Integration
- Questions

Three types asset analytics answer three types of questions

DESCRIPTIVE
highlight status and history:

- Which team had the lowest MTTR?
- What is our MTBF for our most expensive assets?
- Which projects had the most costly over-runs in Q3?
- Which inventory parts have not been used in the past two years?
- Which location has the highest energy cost per month?
- Which location has the highest space utilization?

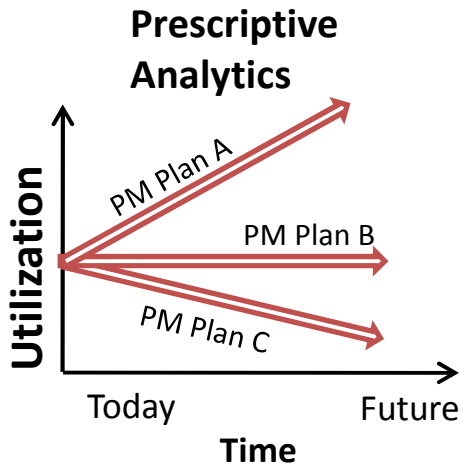
PRESCRIPTIVE optimize
outcomes within constraints:

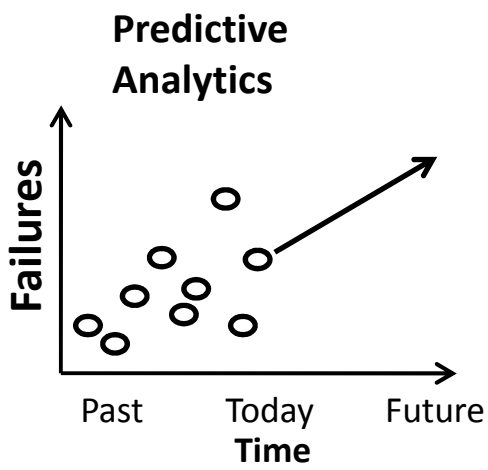
- Which PM schedule will increase technician utilization the most?
- For our budget, which warranty program will yield the highest production?
- Which re-order points should we change to reduce our excess inventory?
- For our construction budget, which plan will yield the highest utilization?
- Which energy savings project will yield the highest ROI?

PREDICTIVE
present trends and patterns:

- Which assets will most likely fail in the next six months?
- What type of service request will create the highest cost next year?
- Which parts are most likely to run out of stock?
- Which technician skills will we most need next year?
- Which technician skills will we most need next year?
- Which CAM items in our leases will most likely go unused?

Three most common types of asset analytics





Descriptive	Prescriptive	Predictive
Use Prioritize decisions	Use Optimize outcomes within constraints	Use Anticipate outcomes
Process Aggregate applicable values and apply operands to highlight outliers	Process Incorporates pre-determined variables, rules and decision criteria	Process Prioritizes relevant variables to create trends from historical time-series data
Math Standard: addition, subtraction, multiplication, division	Math Linear, quadratic and integer programming	Math Regression, vector, canonical correlation, multidimensional scaling

Customers validate IBM's analytics strategy

Predictive Analytics

- Sandvik wants a solution that will predict/project failure occurrences for specific asset types.
- Honda and GM want to prevent failures of critical assets in their painting process and predict poor quality electric batteries

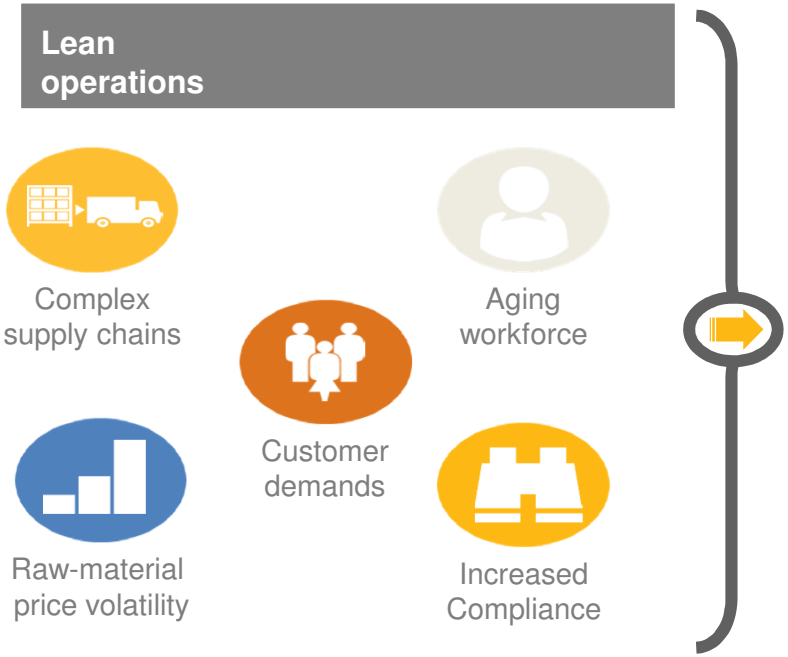
Prescriptive Analytics

- SNCF wants prescriptive maintenance plan scenarios, based on six-month resource availability.
- LIRR wants to create "what-if" scenarios on changes made to their preventive maintenance strategy.

Descriptive Analytics

- Luminant wants to know what is driving their high maintenance costs and what they can do to address this.
- Duke Energy wants to know how to reduce reserved material inventory due to work order backlog
- Southern Company wants to monitor the number and types of failures occurring to better address and reduce future asset downtime

Marketplace forces are amplifying day-to-day issues



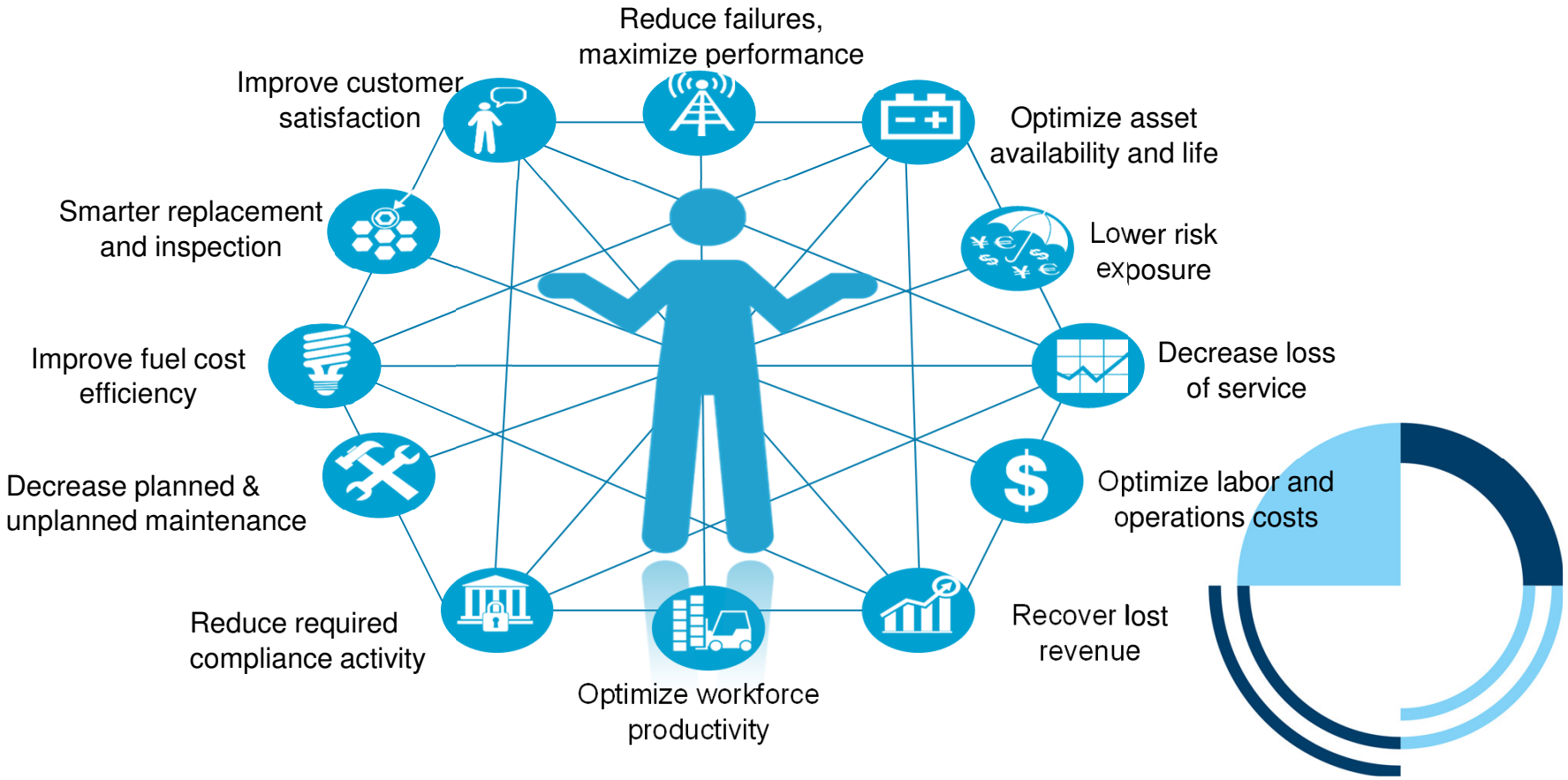
Poor asset performance

- Lack of visibility into asset health
- High costs of unscheduled maintenance
- Inability to accurately forecast asset downtime and costs
- Resultant unnecessary process proliferation
- Aging assets pushed to limits to meet consumer needs

Limited process integration

- Lack of visibility of predictors across organizational silos
- Difficulty synchronizing demand and supply
- Too many manual processes and information sources
- Losses in processes have become normal
- Resource complexity makes it harder to respond to changing needs

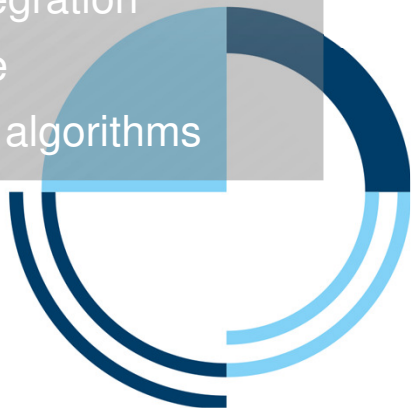
And….what if you could?



The IBM solution: IBM Predictive Maintenance and Quality

Accelerate time to value

- Real-time capabilities
- Big data, predictive analytics, business intelligence
- Quicker and more-accurate decision making
- IBM Maximo® integration
- Open architecture
- Advanced quality algorithms



IBM Predictive Maintenance and Quality enables better business outcomes

- Monitor, maintain and optimize assets for better availability, utilization and performance
- Predict asset failure and identify poor quality parts earlier to better optimize operations and supply chain processes
- Reduce guesswork and incorporate experiential knowledge during the decision-making process

Includes foundational models, dashboards, reports and source connectors

IBM PMQ V2 is here

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Enhanced Functionality

New Manufacturing Quality modeling
- Quality Early Warning (QEWS) algorithm
- Inspection Quality during production
- Warranty Analytics, Vintage tracking

Enhanced Maximo Integration
- Failure event capture

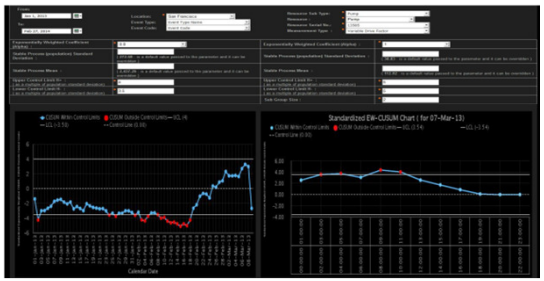
Analytic Foundation
- New Java-based APIs for Orchestration, database and data sources

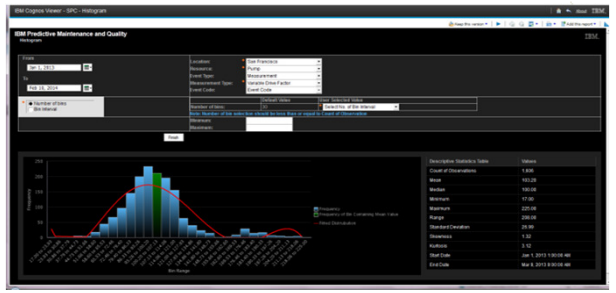
Reporting and Dashboard Enhancement
- Top Failure Causes Report and drill through
- Statistical Process Control Reports
- Equip Health drill down with RAVE

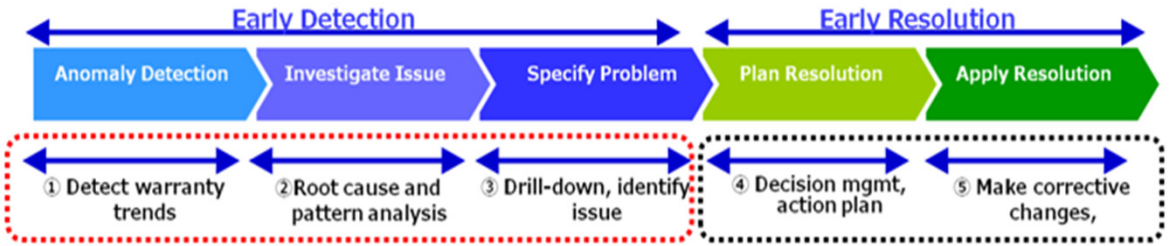
New Maintenance modeling
- New Algorithm (patent pending), combines Text, sensor, maintenance data
- Automatic re-training of models
- New Maintenance Dashboard

New Reports, Dashboards

What's new?







Case Studies

Smarter and Sustainable Mining

IBM

Australian mining company Thiess Pty Ltd uses predictive analytics to impr

Improves
mining equipment availabilit and uptime

Increases
revenue and production efficiency

Reduces
maintenance downtime, par inventory and costs

THIESS

Smarter Rail

IBM

A rail operator in New Z performance through pr

2x productivity
among maintenance crews through near-real-time visibility into assets

Increased safety
and asset uptime with proactive inspection and maintenance practices

~83% faster
generation of accurate quarterly compliance reports

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Major UK Utility improves asset maintenance & customer satisfaction

Increases Meter Read by 4x
Per hour meter reads, increased from once per quarter, providing increased visibility into energy consumption information

Improved
Asset maintenance and historical tracking to lower costs through improved preventive maintenance and decision-making

Enables
The company to develop better and more cost effective tariffs, intended to change customer behaviour toward energy consumption

Business Problem: To successfully achieve the requirements of a transformational program, this organisation had to roll out smart meters, reduce costs & improve efficiencies and customer satisfaction

Solution: Advanced analytics solutions give near real-time visibility into energy consumption across the grid via smart meters, enabling it to manage electricity flow more precisely. Combined analysis of consumption data with customer information enables call center agents to offer the most appropriate electricity or gas rate plan to meet a customer's needs. An advanced asset management solution that performs both preventive and reactive maintenance, provides critical information to enable this utility to drive down asset costs and improve performance.

PMQ analyzes data from multiple sources and provides recommended actions, enabling informed decisions

What is the cost of maintenance & failures?

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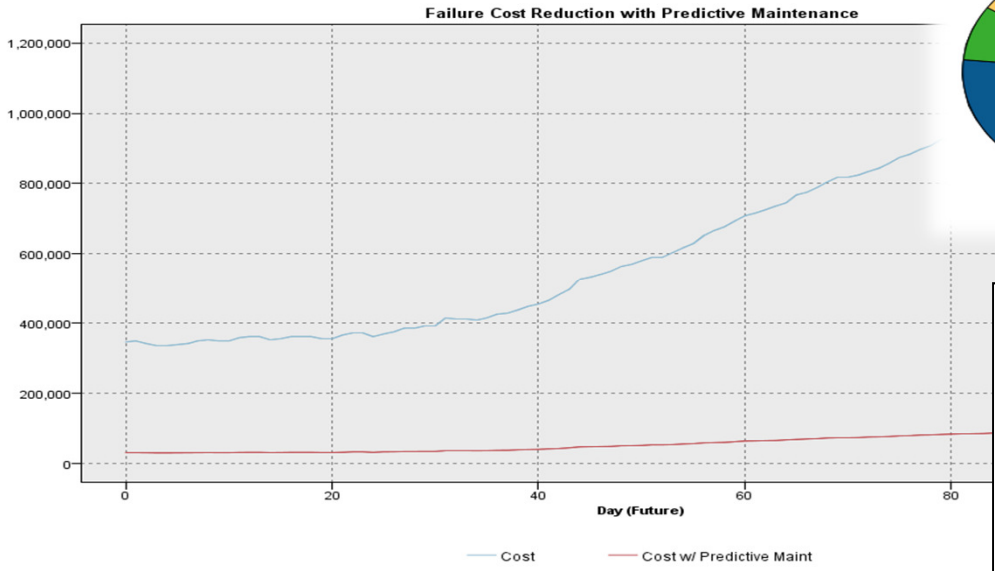
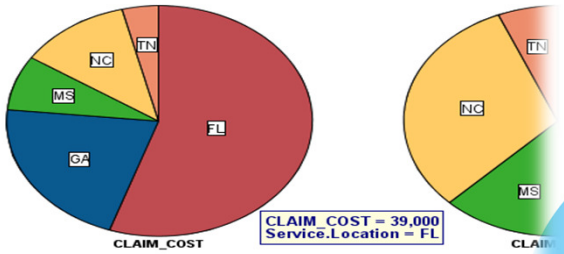
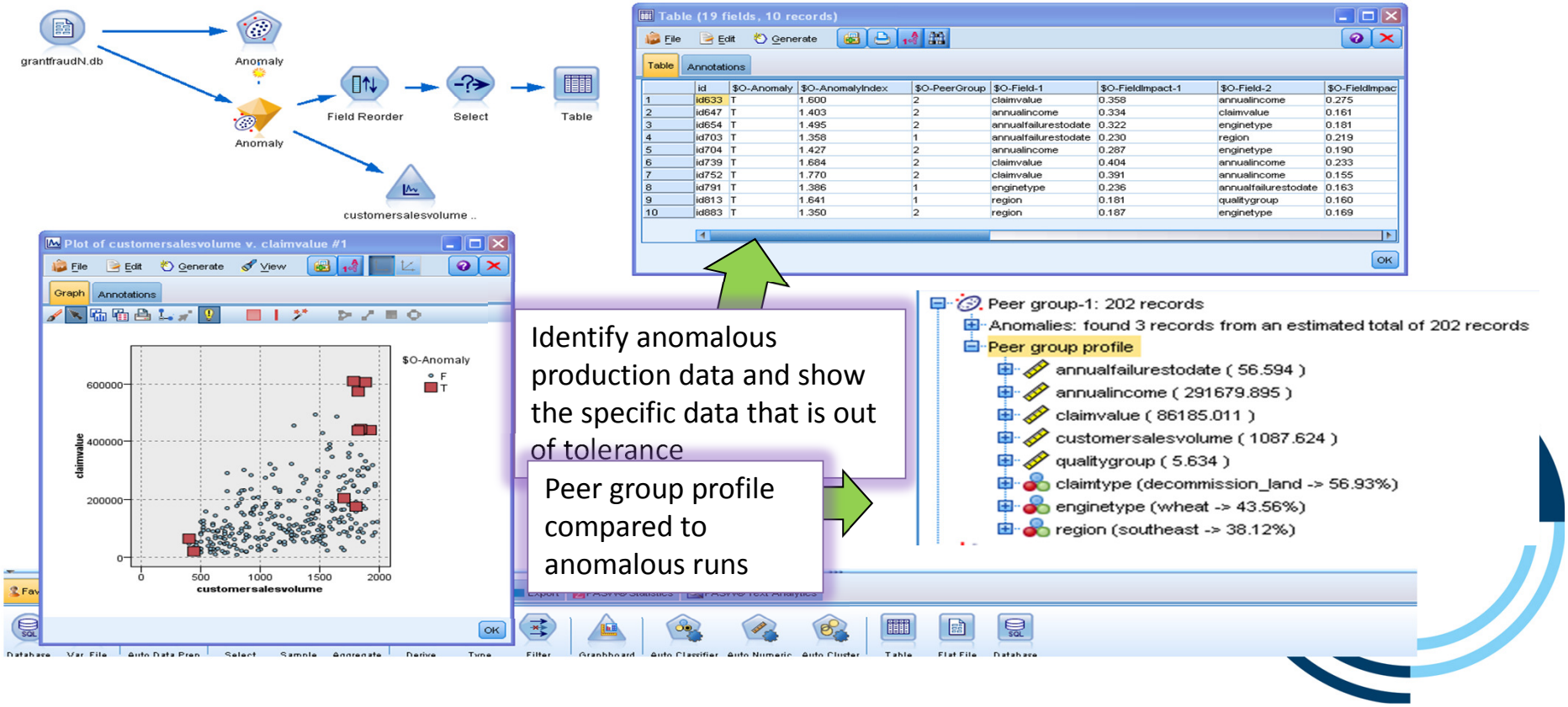
- How do costs vary by region? Why do they vary?
- What is the total cost of ownership of each piece of equipment?
- What will repairs cost me next year?





Schedule costs are greatly reduced, less service interruption and increased customer satisfaction

Anomaly Detection – how is it done?



Root Cause Analysis of Failures

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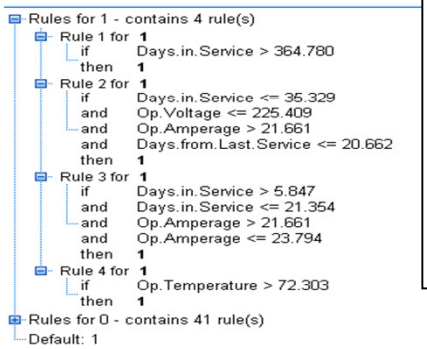
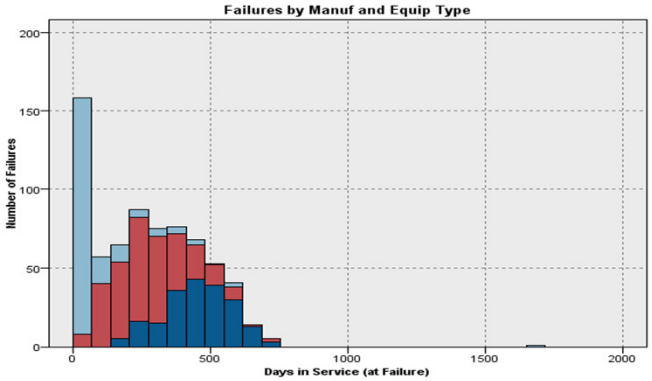
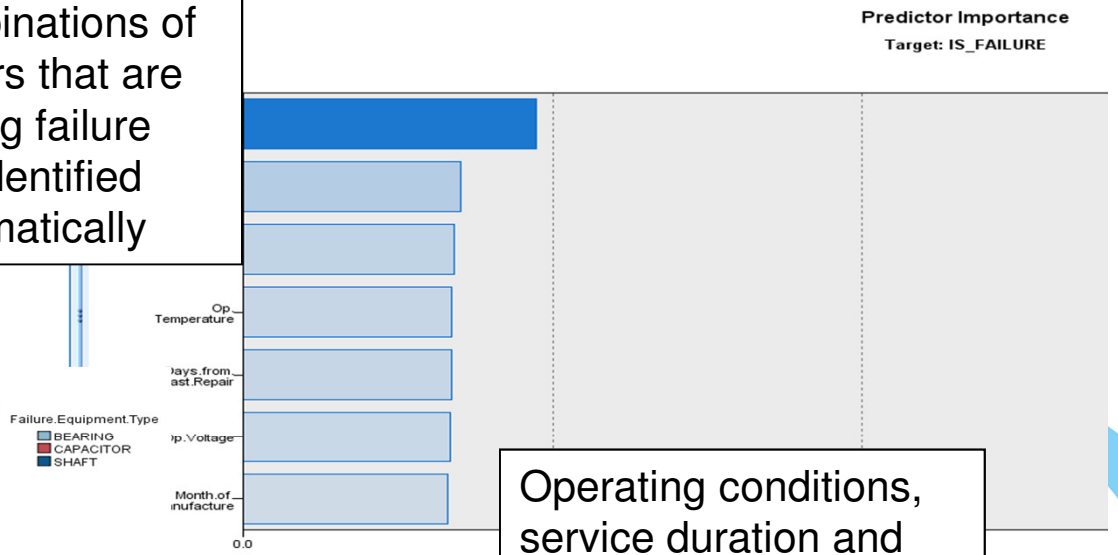
What is parts are failing? What is driving the failure?



4 specific combinations of factors that are driving failure are identified automatically

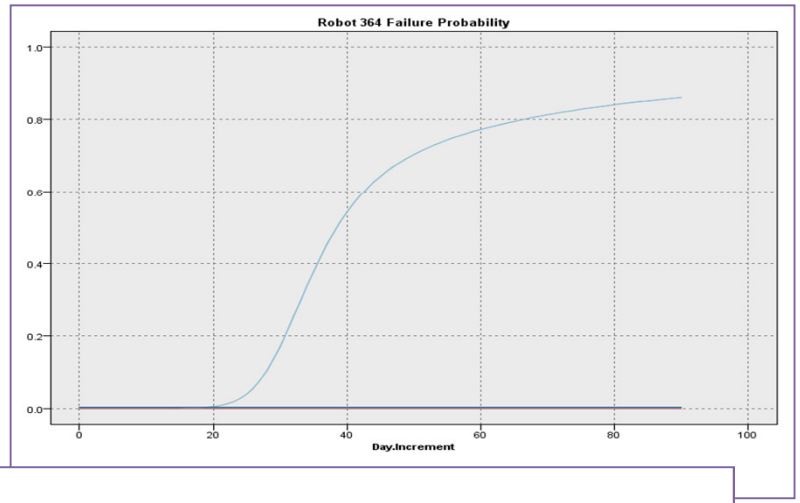


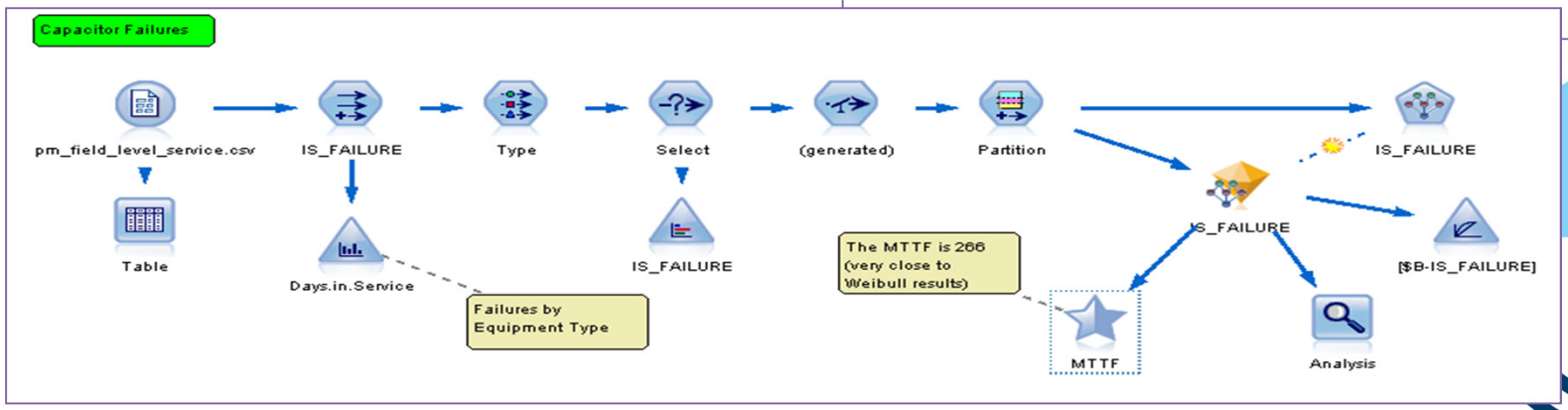


Operating conditions, service duration and manufacturing quality all play a role in the failure likelihood

How Likely Is a Failure at Time X?

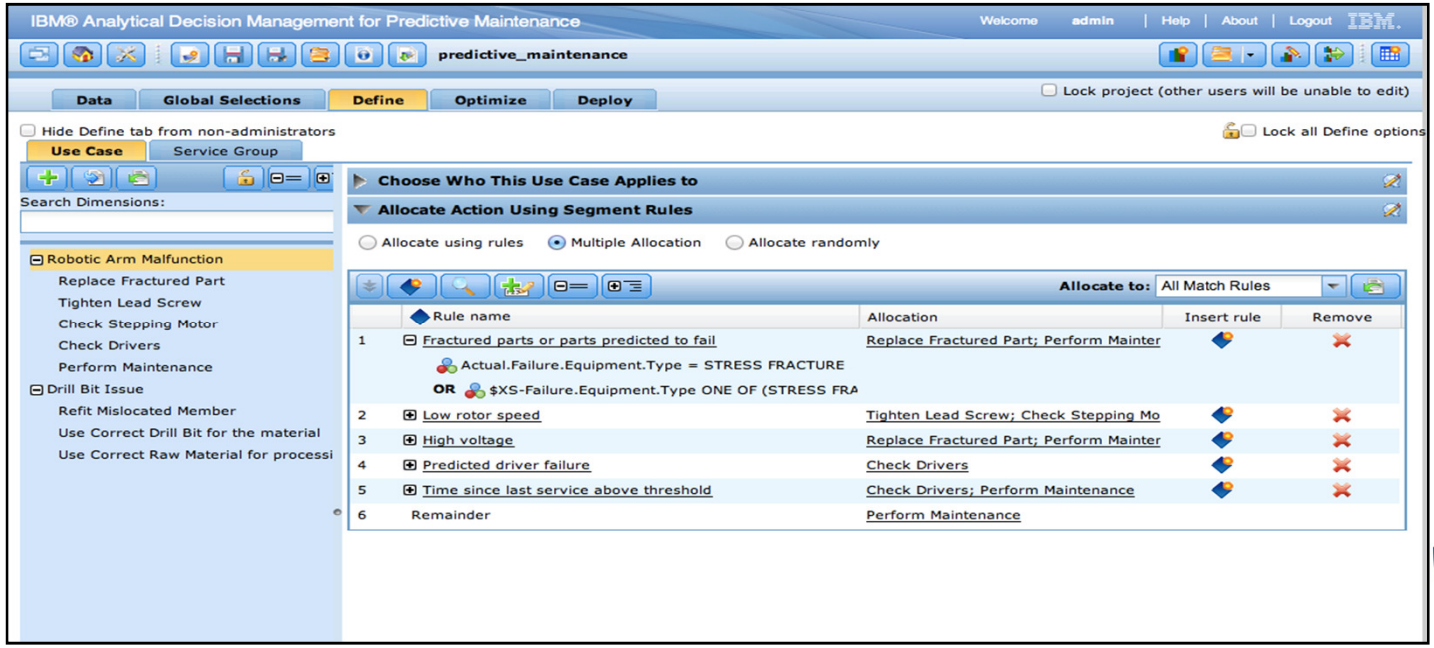
- **Leverage all available data**
  - Sensor logs, maintenance logs, condition monitoring data, etc.
- **Build predictive models**
  - Estimate the failure likelihood at any point in the future for every piece of equipment
  - Neural Nets, Logistic Regression, Decision Trees, SVM, SLRM, etc.
- **Apply models to new data**
  - Generate updated failure likelihood values

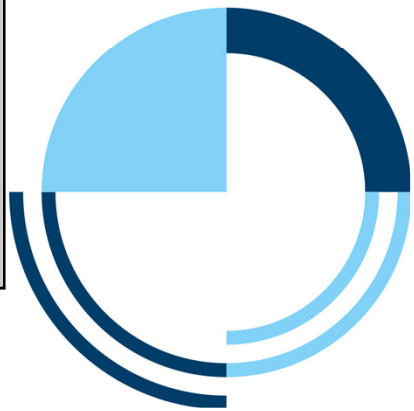




Decision Management

Define tab lists possible failures along with preventive actions





Predictive maintenance application

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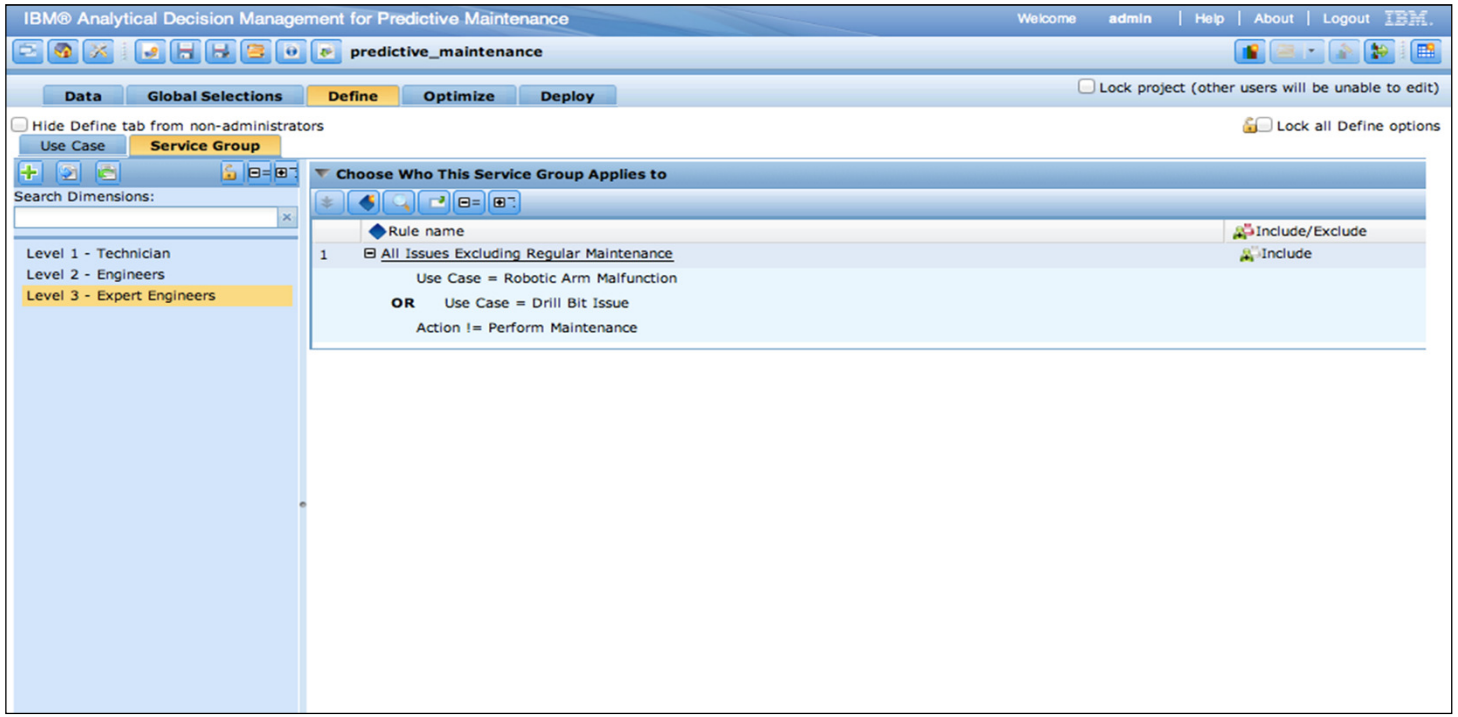
*A second allocation determines **who** can take action based on skill set, cost, and availability*



Predictive maintenance application

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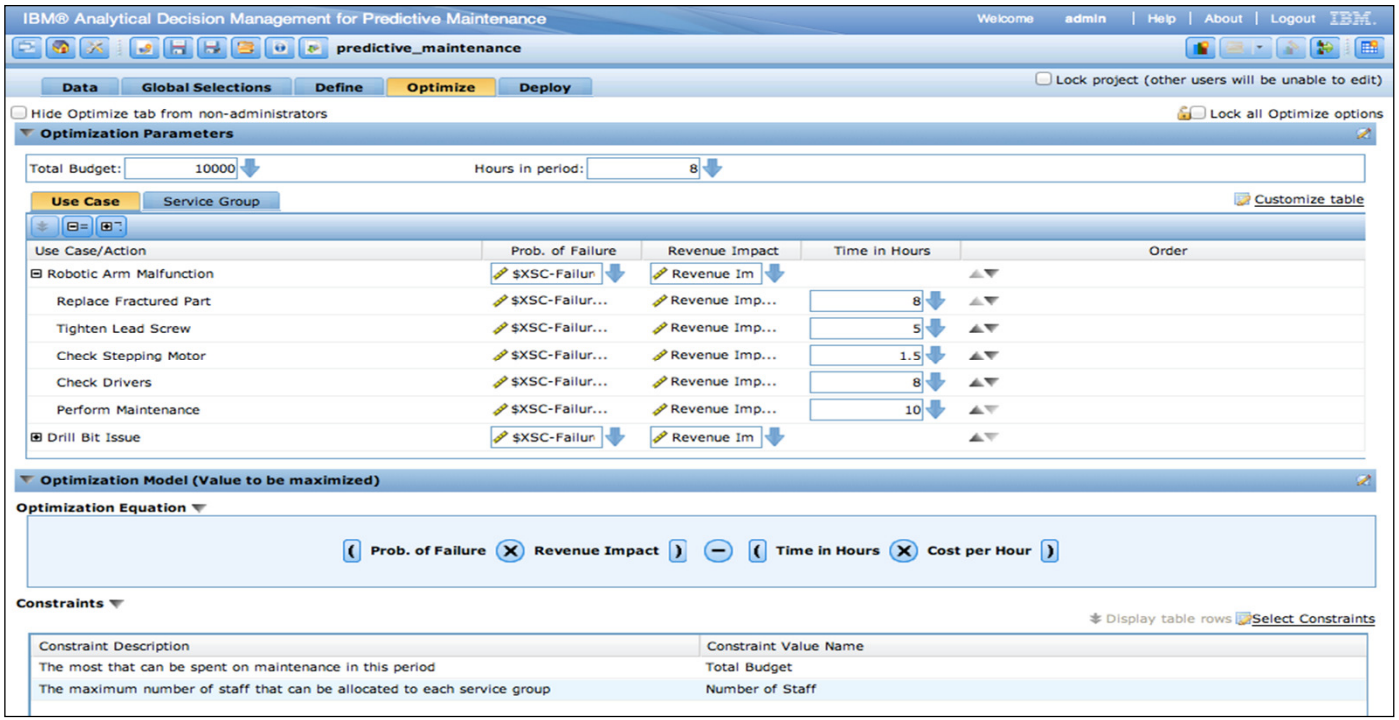
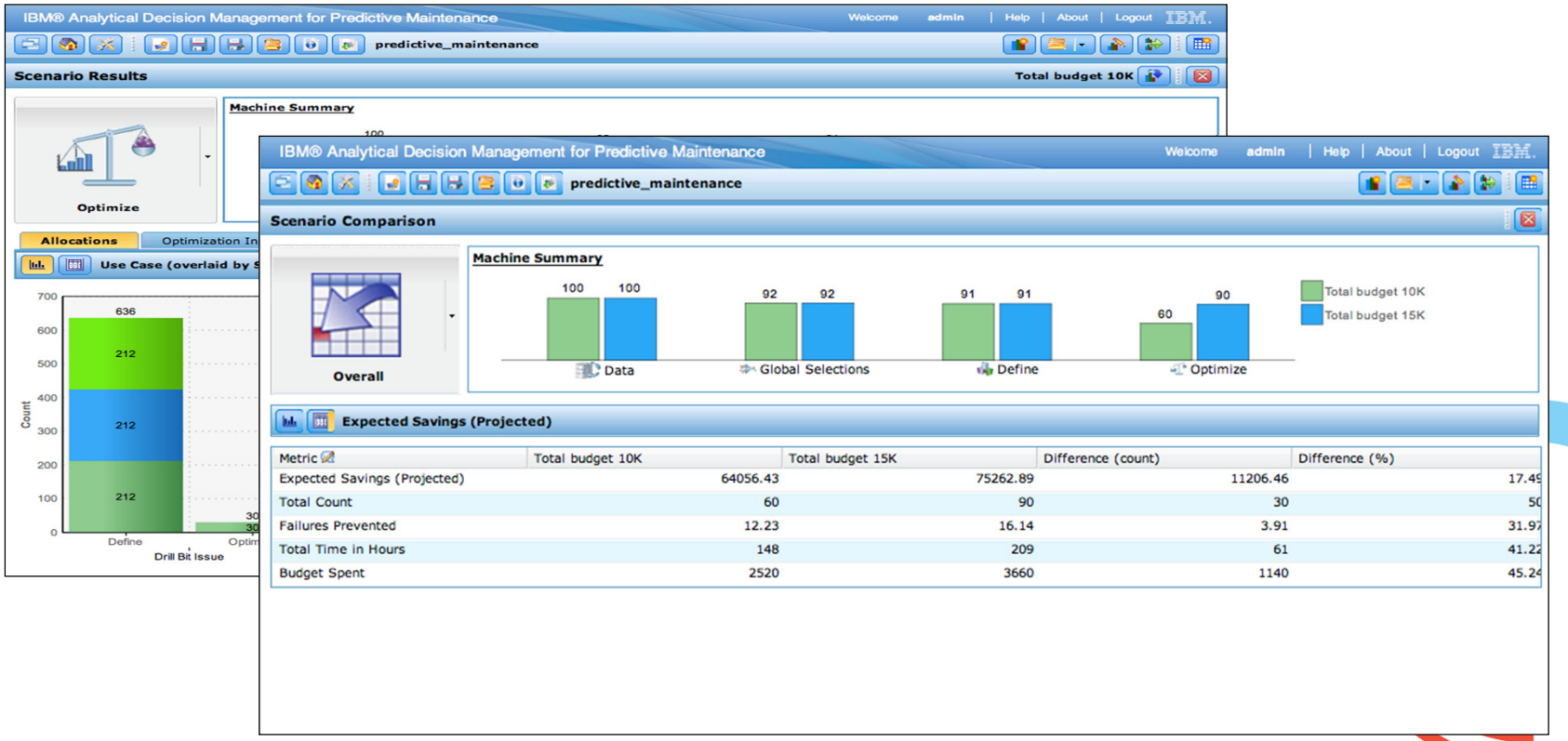
Optimization identifies the combination of actions that yields the highest cost savings



Predictive maintenance application

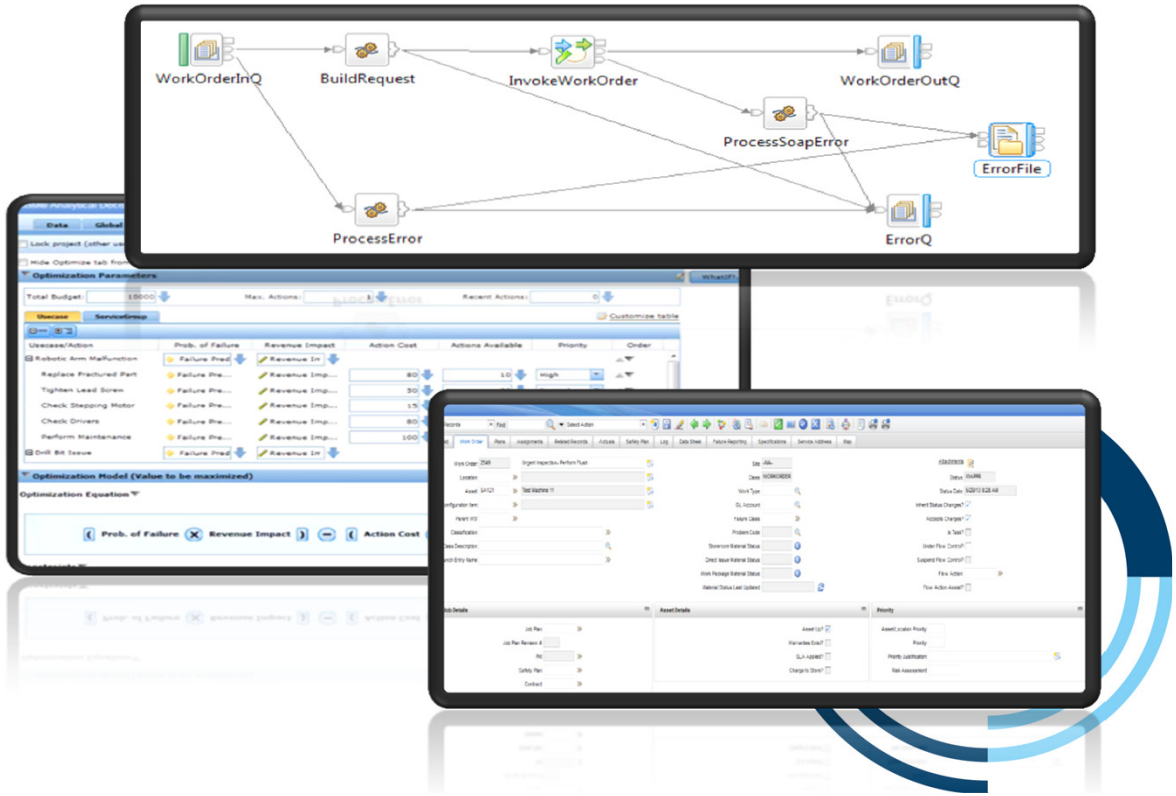
Scenario results show impact on the bottom line & comparisons of changes made



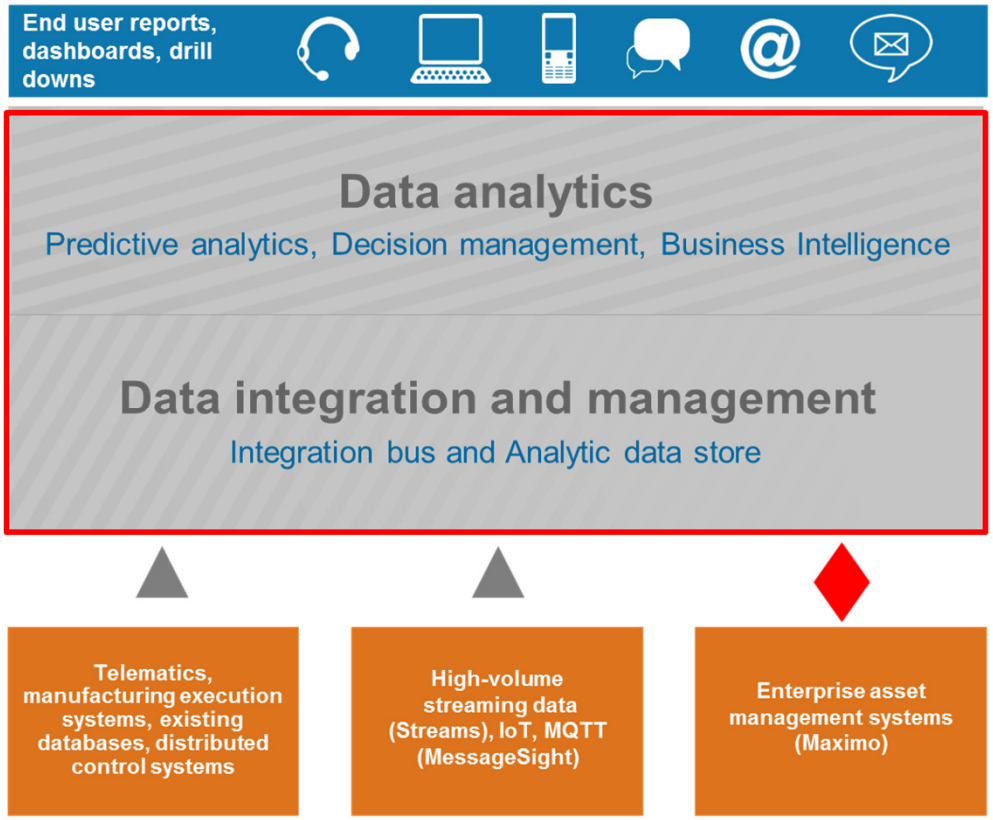
Maximo Integration

Features

- Integrate directly with Enterprise Asset Management systems, such as IBM Maximo
- PMQ leverages asset master and fault data from Maximo
- Master data is synchronized between Maximo and PMQ
- PMQ generates work orders based on analytic insight and business rules
- Directly act upon predictive insights with system of engagement



PMQ Architecture



Consume insight anywhere eg. mobile

Predictive analytics, decision management & reporting combined

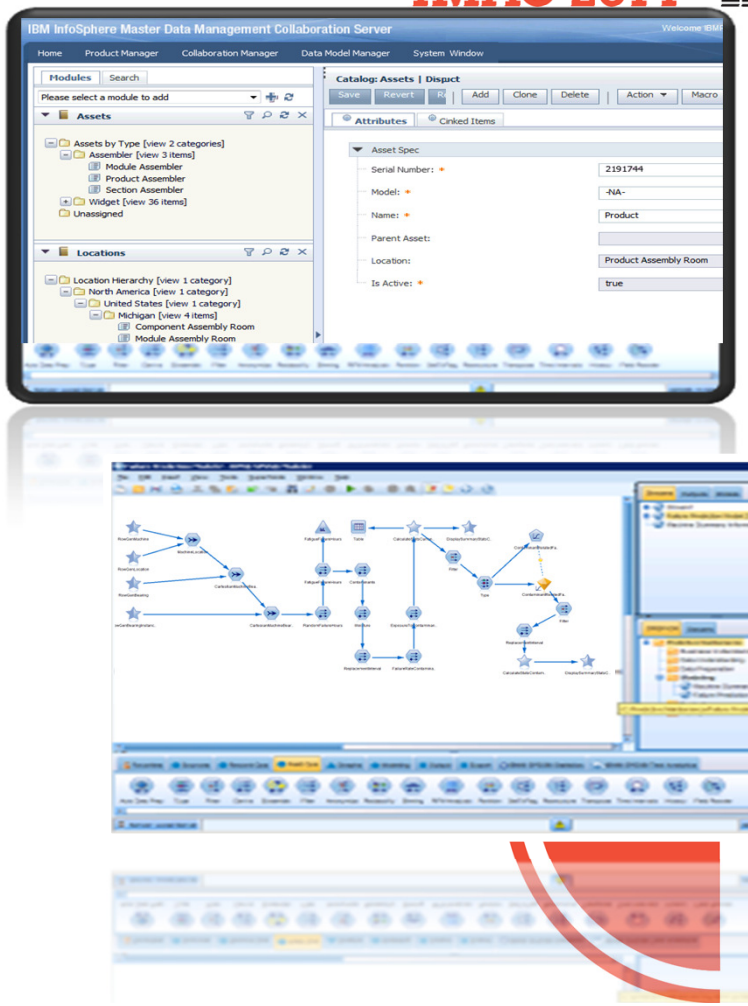
Industry specific blueprint for data layer

Bi-directional flow with Maximo

Accelerated Time to Value

Features

- Leverage easy-to-install, preconfigured software and content stack
- Utilize out-of-the-box data source connectors and models, dashboards and reports to reduce the need for additional services
- Quickly expand or modify included models for specific industry and business applications
- Easily access business user interface for master data entry and modification
- Seamlessly integrate partner provided content



Ultimately affecting the bottom line

Predictive Maintenance

- ✓ Averting unplanned downtime
- ✓ Scheduled/planned, predictive
- ✓ Addressing asset utilization
- ✓ Warranty capabilities

Quality – Lean Sigma

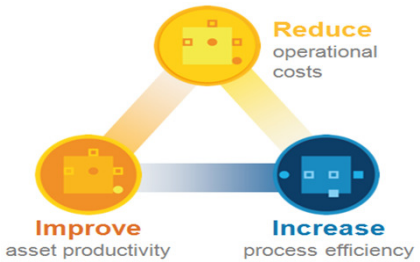
- ✓ Extend process improvement
- ✓ Root cause analysis & SPC
- ✓ Supply chain

Field Asset Monitoring

- ✓ Equipment monitoring for production
- ✓ Asset monitoring for new service(s)
- ✓ Field asset optimization
- ✓ Inventory management
- ✓ Fleet and facilities management

The Value of PMQ

1. Lowering Unit/Item Cost (Improving profit/margin)
2. Increasing Production “Yield”(Productivity)
3. Superior ROA and “Asset Optimization”
4. Higher Revenue due to Quality Improvement
5. Increased Competitiveness due to higher Quality
6. New Services for Health Monitoring of Assets
7. Lower Risks due to fewer or elimination of Asset Failures



Thank you.