Pulse

IBM SolutionsConnect 2013

# Predictive Asset Optimisation for Maximo

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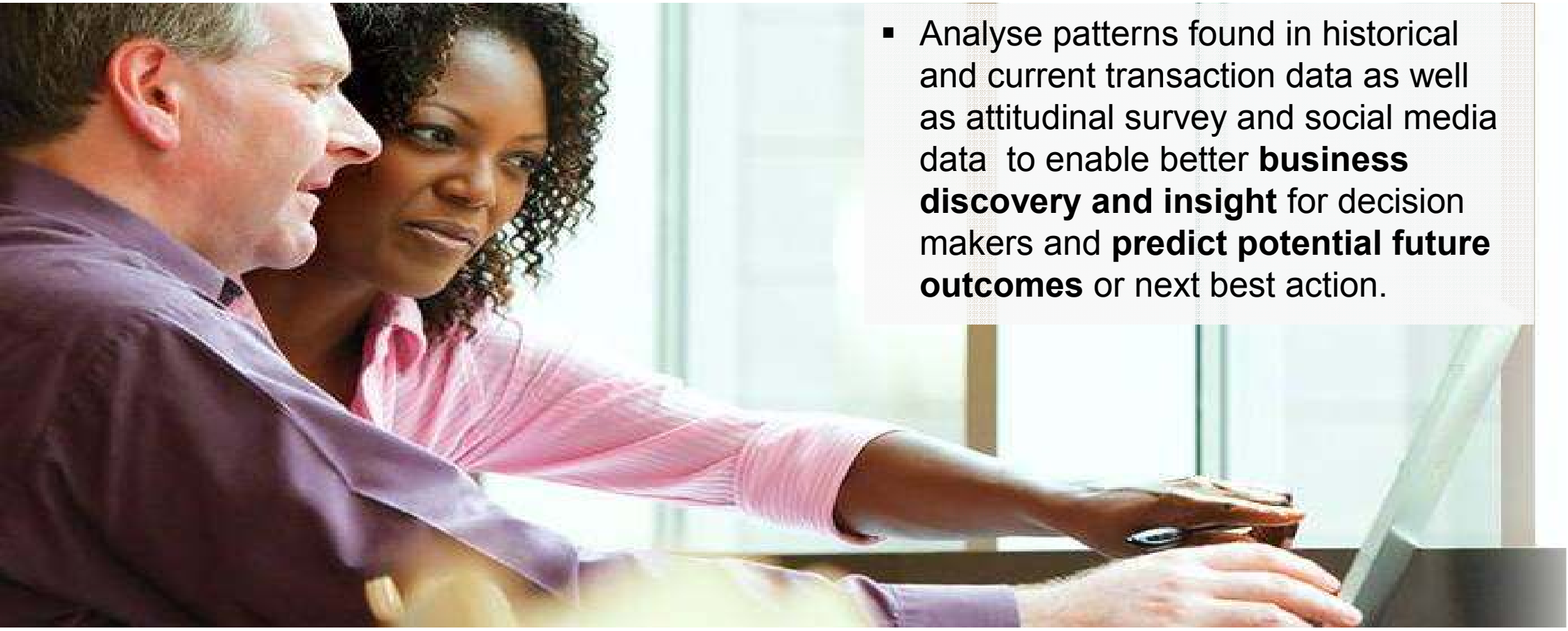
*June 2013*

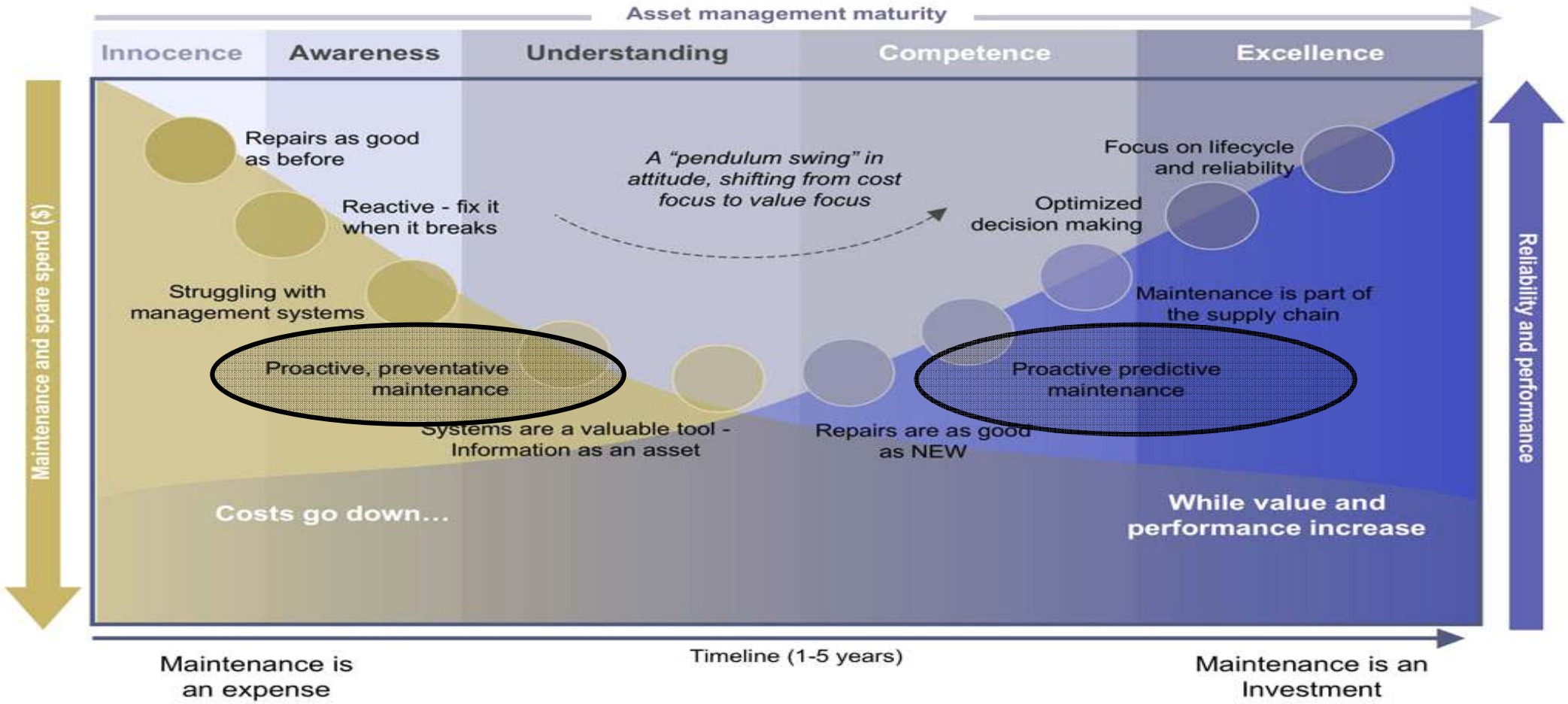
IBM

# Gaining Insight from Data

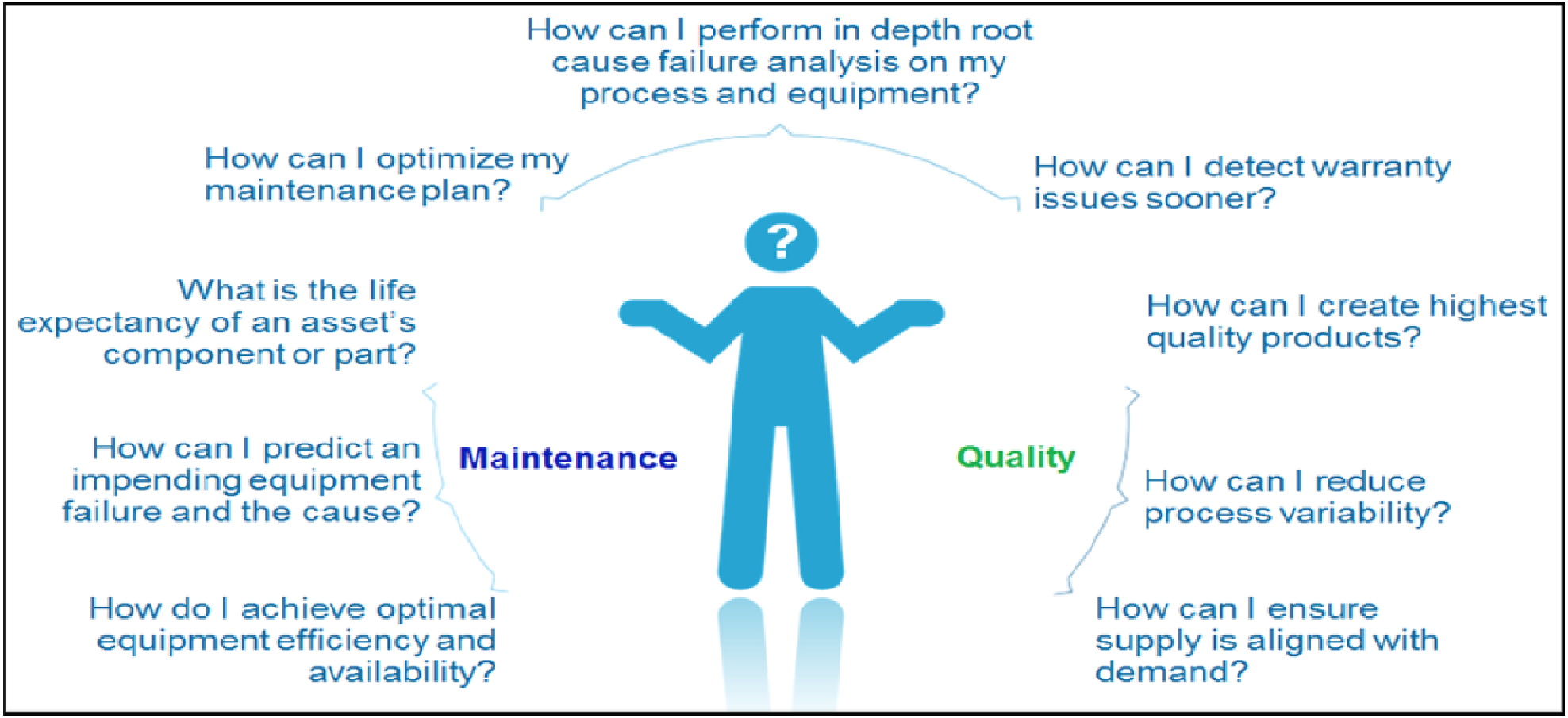


- Analyse patterns found in historical and current transaction data as well as attitudinal survey and social media data to enable better **business discovery and insight** for decision makers and **predict potential future outcomes** or next best action.

# Asset Management Maturity



# How do we answer these Questions…



# IBM Predictive Maintenance

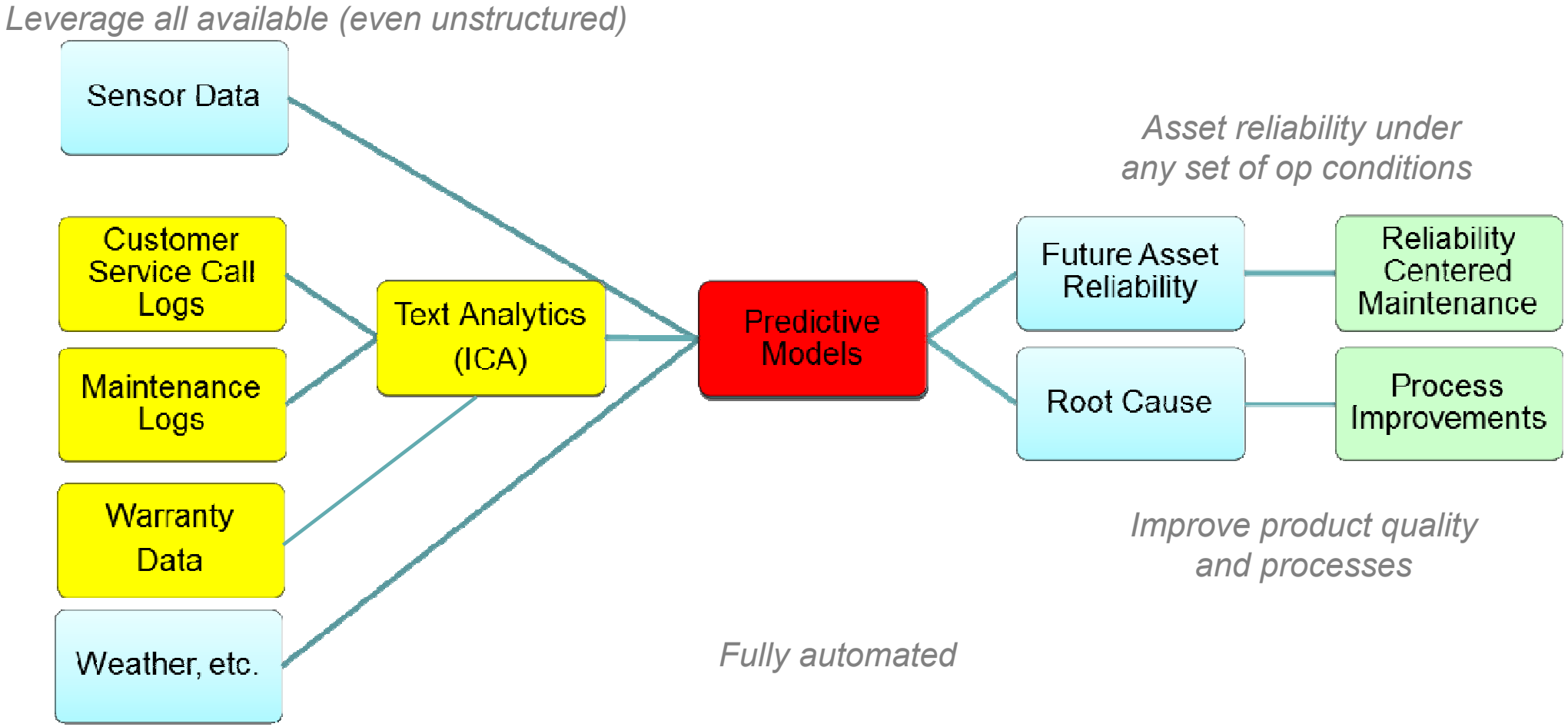
"A proactive analysis process using equipment and application data from multiple sources to make informed operational, maintenance, repair or component replacement decisions."

- Forward visibility into equipment, process and quality performance
- Understand, monitor, predict and control process variability
- Enhance equipment and process diagnostics capabilities
- Optimize maintenance intervals
- Minimize unscheduled maintenance
- Enable in depth root cause failure analysis
- Determine optimum corrective action procedures

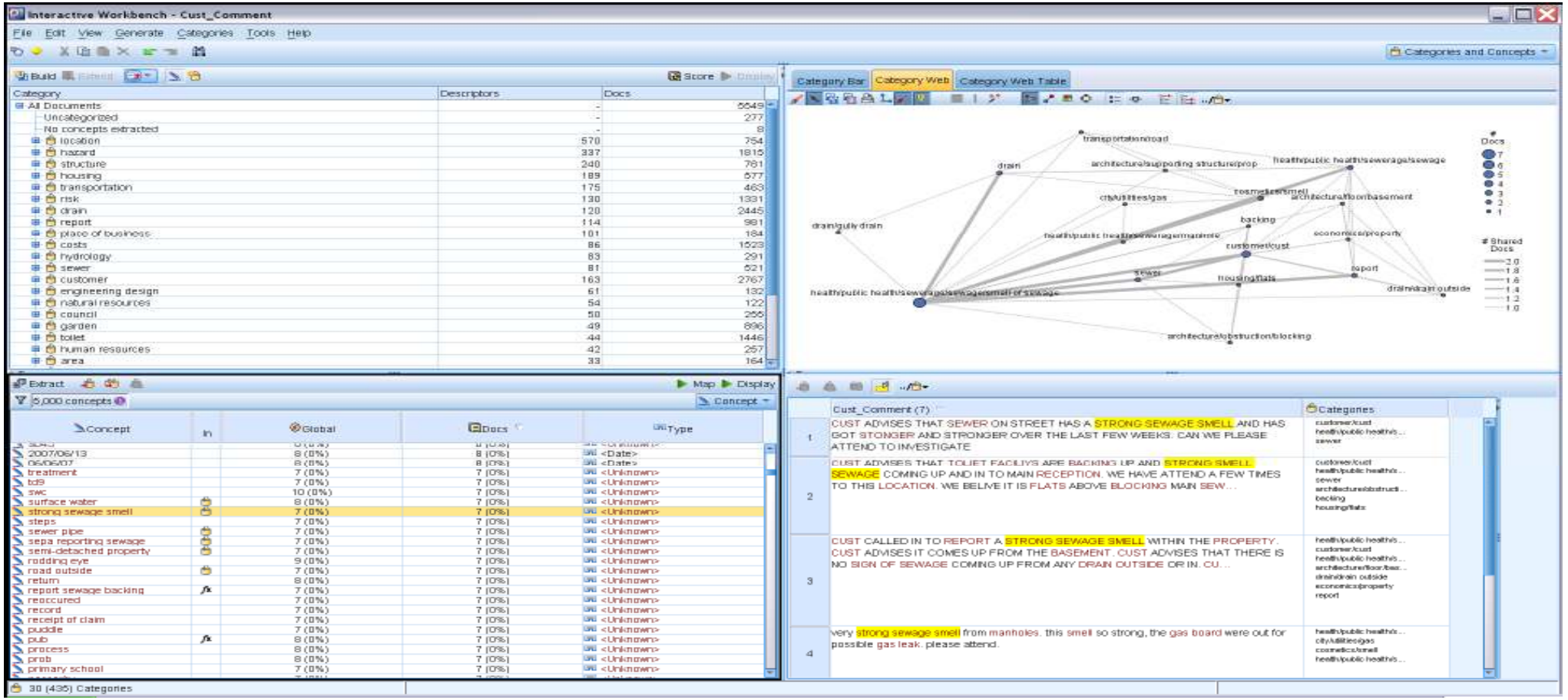
**Deliver High Operational Efficiency**

by leveraging multiple (near) real-time and historic data-sources with advanced analytics

# Smarter Processes driven by Insight



# Text Mining of Maintenance Reports

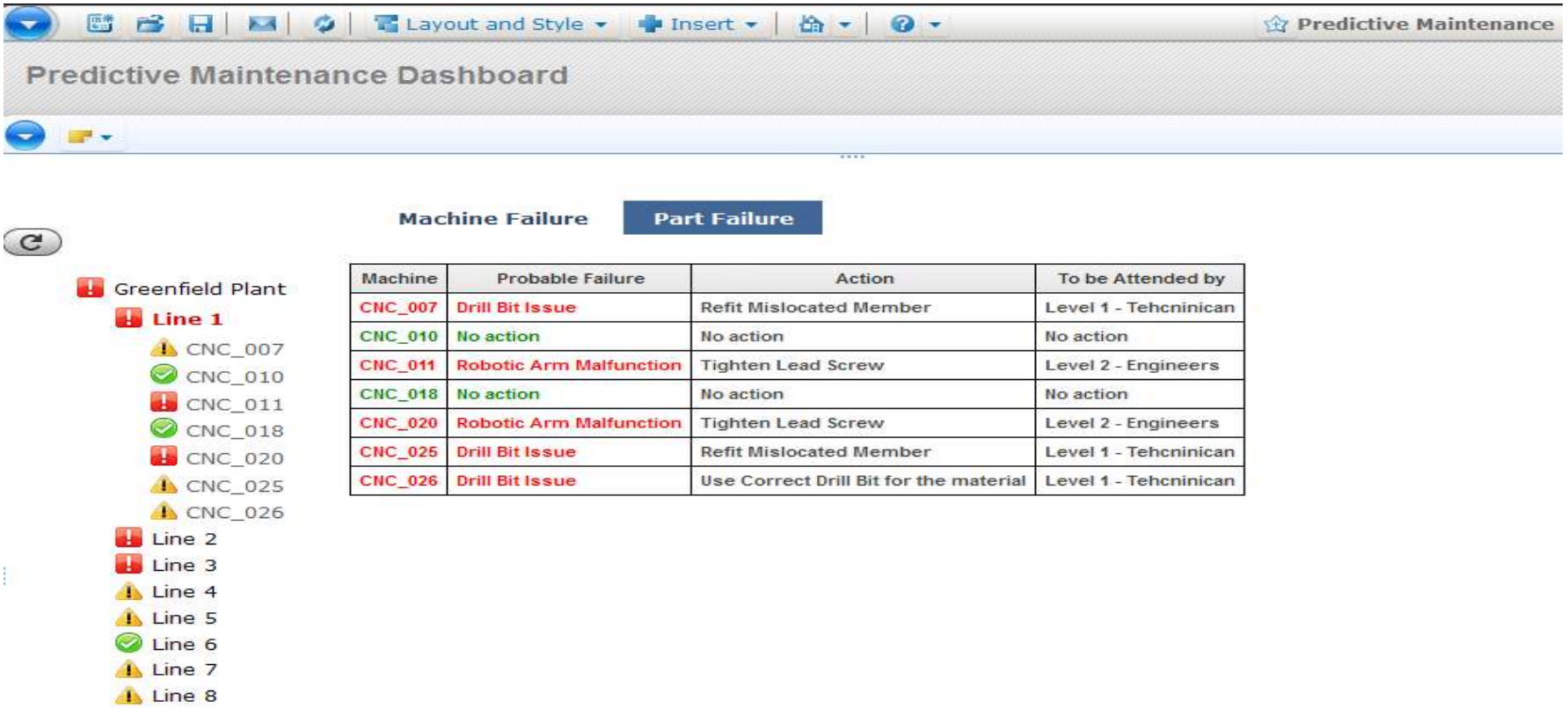



- Text mining produces *structured data*

# GIS Mapping overlay

# Scenario 1: Operations manager

# Alert Management

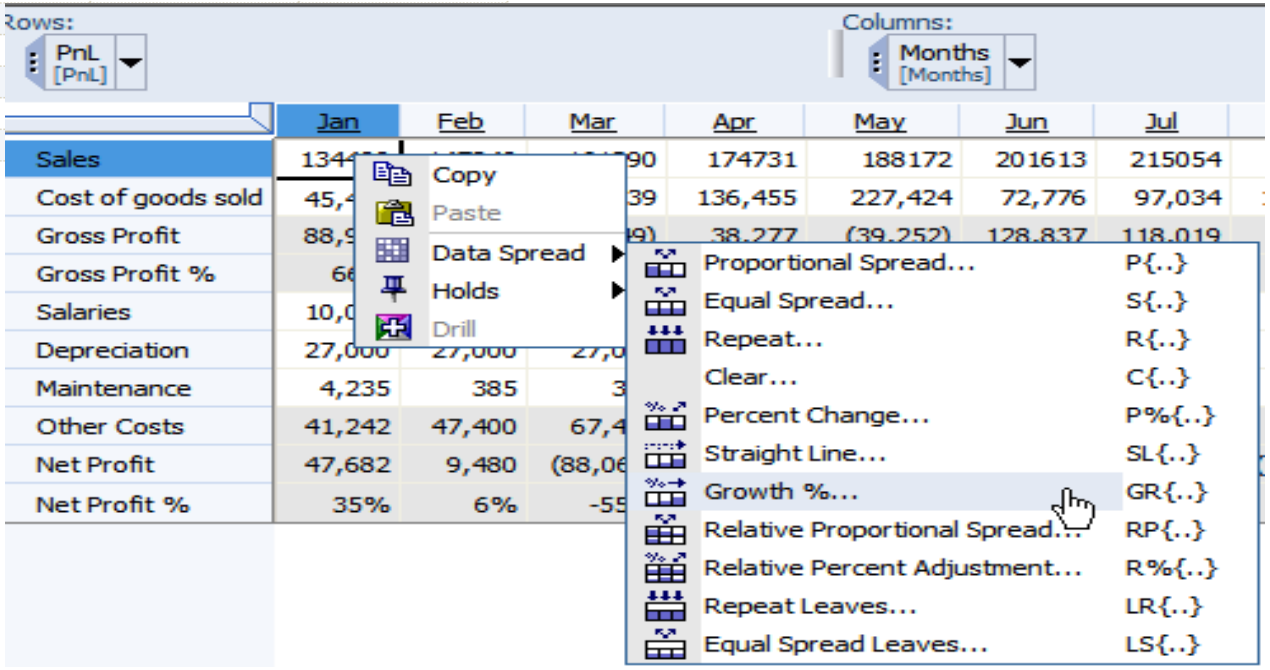



| Machine | Probable Failure | Action | To be Attended by |
|---|---|---|---|
| CNC_007 | Drill Bit Issue | Refit Mislocated Member | Level 1 - Tehcnician |
| CNC_010 | No action | No action | No action |
| CNC_011 | Robotic Arm Malfunction | Tighten Lead Screw | Level 2 - Engineers |
| CNC_018 | No action | No action | No action |
| CNC_020 | Robotic Arm Malfunction | Tighten Lead Screw | Level 2 - Engineers |
| CNC_025 | Drill Bit Issue | Refit Mislocated Member | Level 1 - Tehcnician |
| CNC_026 | Drill Bit Issue | Use Correct Drill Bit for the material | Level 1 - Tehcnician |

# Predictive Maintenance Dashboard

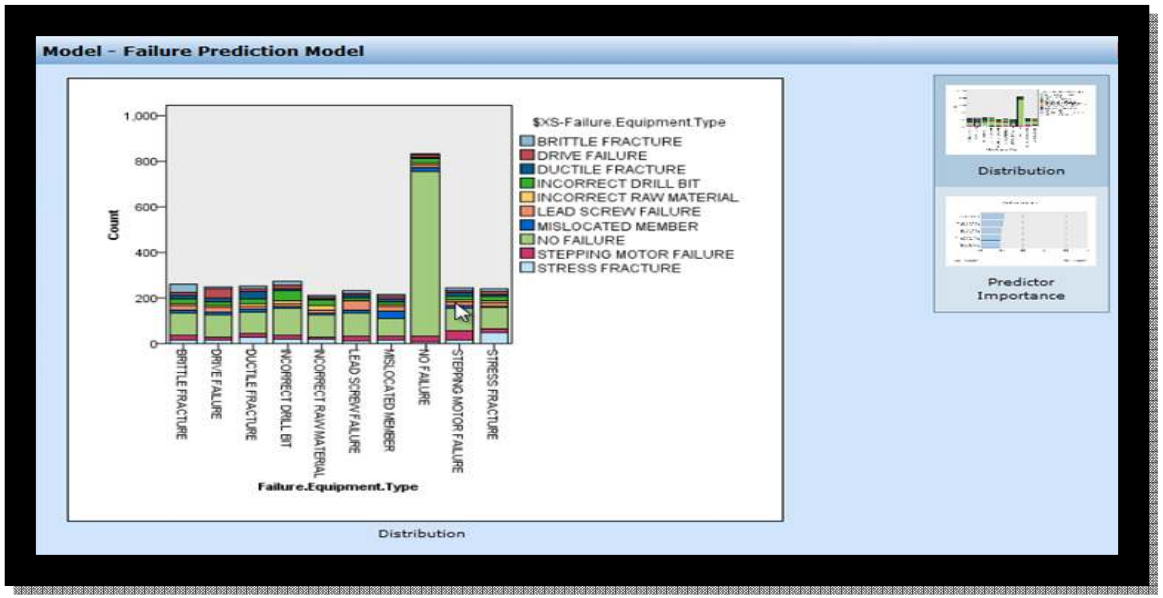
# Scenario Modeling

| Name | State | Ownership | Reviewer | Last Data Commit |
|---|---|---|---|---|
| Central Store | Not Started | None | ADMIN | Never committed |
| Needham | Work In Progress | Admin | ADMIN | Never committed |
| Information Srevices | Not Started | None | ADMIN | Never committed |
| Packaging | Not Started | None | | |
| Garage Store | Not Started | None | | |
| Research and Development | Not Started | None | | |
| Human Resources | Not Started | None | | |
| Sales and Marketing | Not Started | None | | |

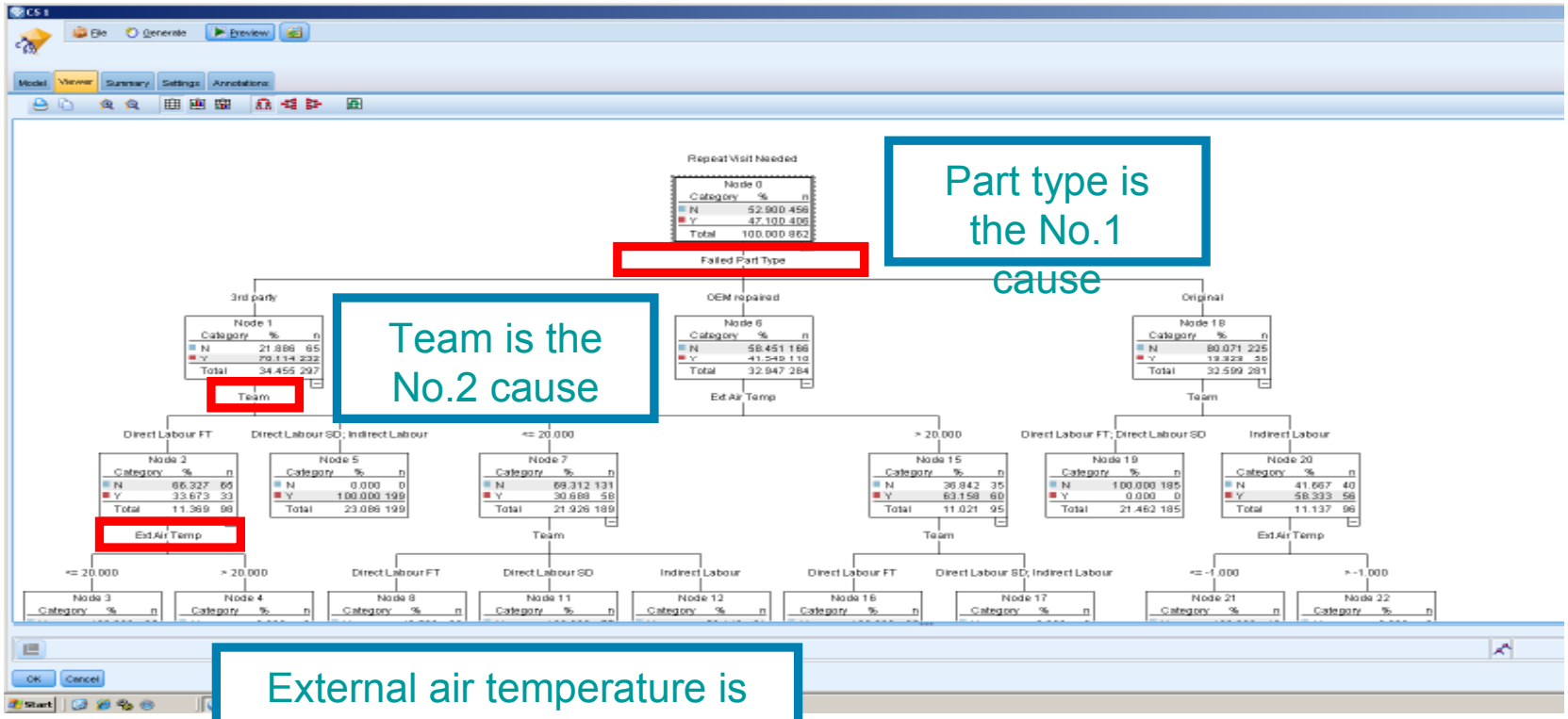



- What if analysis
- Workflow
- Security
- Collaborative
- Contribution model

# Scenario 2: Production Manager



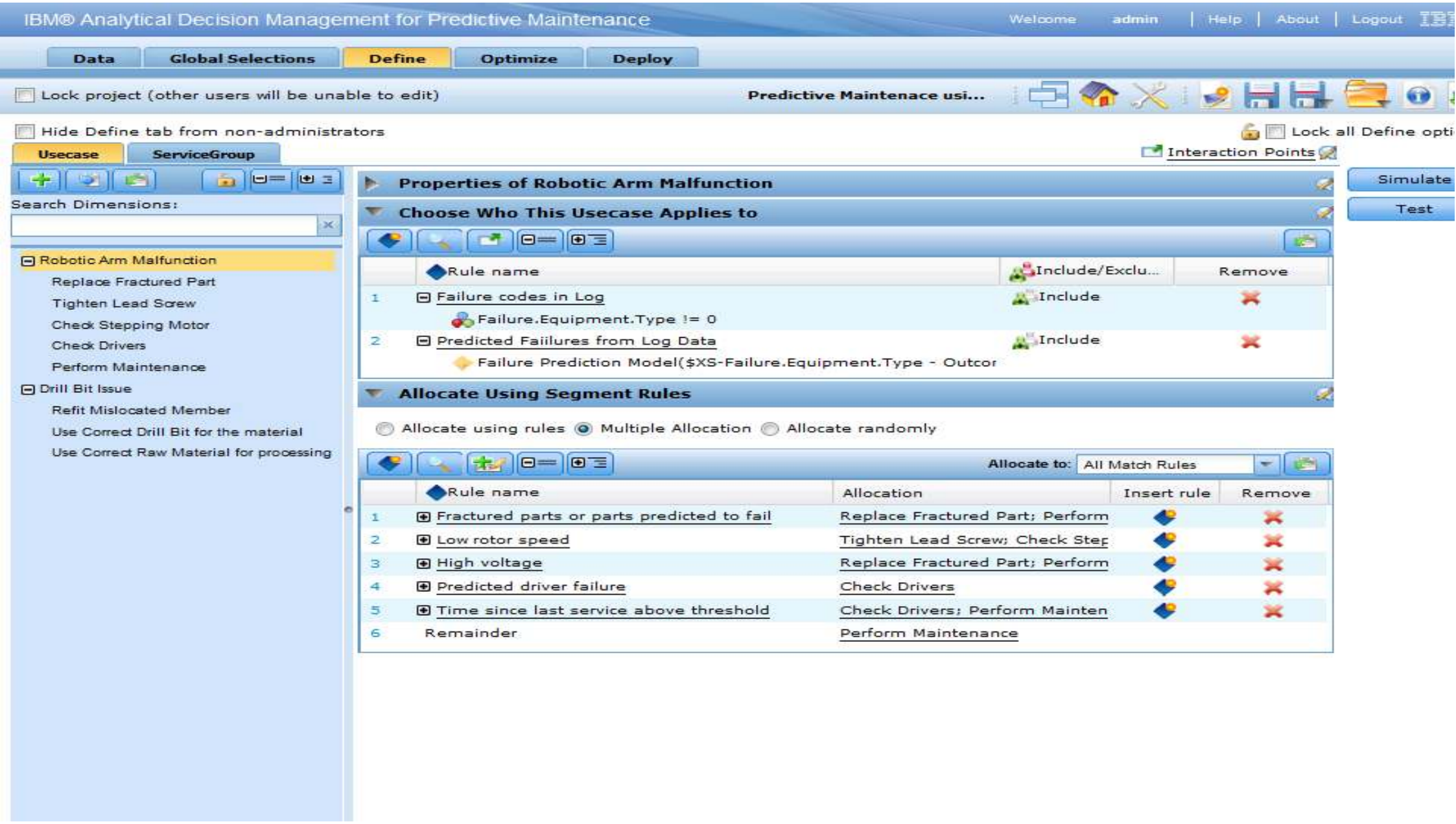
# Root Cause Analysis




Part type is the No.1 cause

Team is the No.2 cause

External air temperature is the No.3 cause – this data came from an external system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Welcome admin | Help | About | Logout
Data
Global Selections
Define
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Deploy
Lock project (other users will be unable to edit)
Predictive Maintenace usi...
Hide Define tab from non-administrators
Lock all Define opti
Usecase
ServiceGroup
Interaction Points
Search Dimensions:
Robotic Arm Malfunction
Replace Fractured Part
Tighten Lead Screw
Check Stepping Motor
Check Drivers
Perform Maintenance
Drill Bit Issue
Refit Mislocated Member
Use Correct Drill Bit for the material
Use Correct Raw Material for processing
Properties of Robotic Arm Malfunction
Choose Who This Usecase Applies to
Rule name
Include/Exclu...
Remove
1 Failure codes in Log
Include
Failure.Equipment.Type != 0
2 Predicted Faiilures from Log Data
Include
Failure Prediction Model($XS-Failure.Equipment.Type - Outcor
Allocate Using Segment Rules
Allocate using rules
Multiple Allocation
Allocate randomly
Allocate to: All Match Rules
Rule name
Allocation
Insert rule
Remove
1 Fractured parts or parts predicted to fail
Replace Fractured Part; Perform
2 Low rotor speed
Tighten Lead Screw; Check Step
3 High voltage
Replace Fractured Part; Perform
4 Predicted driver failure
Check Drivers
5 Time since last service above threshold
Check Drivers; Perform Mainten
6 Remainder
Perform Maintenance
Simulate
Test

Firefox

9.122.123.35:9080/DM/?mid=8c2ff931f0afd398#T_2

IBM® Analytical Decision Management

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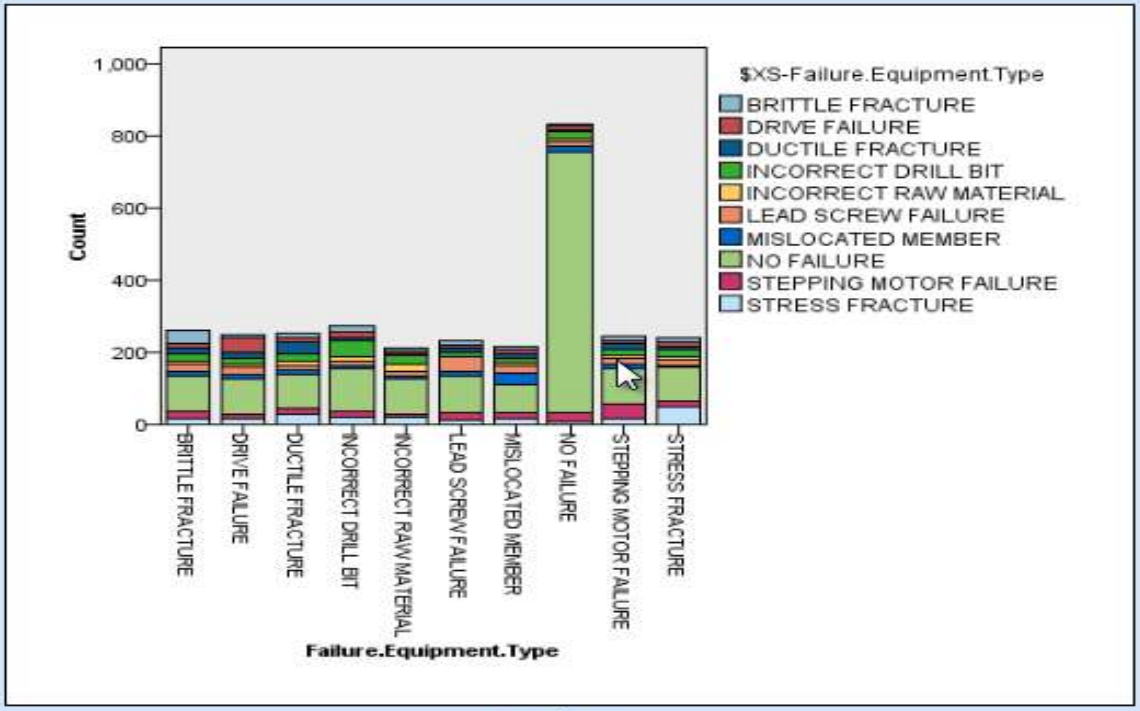
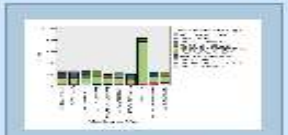
Simulate

Test

## Model – Failure Prediction Model



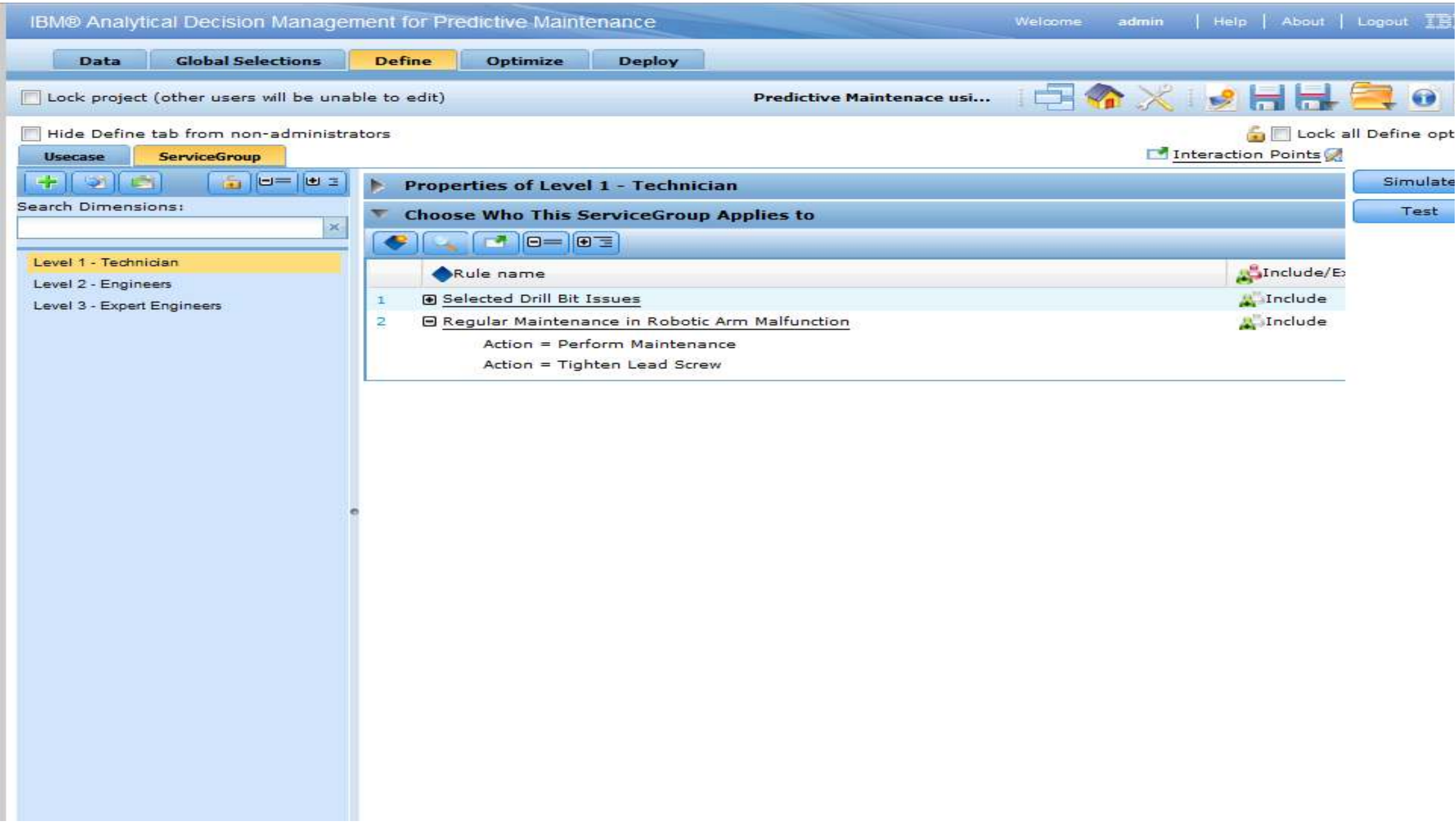

Distribution



Distribution

Predictor Importance

Use Model | Exit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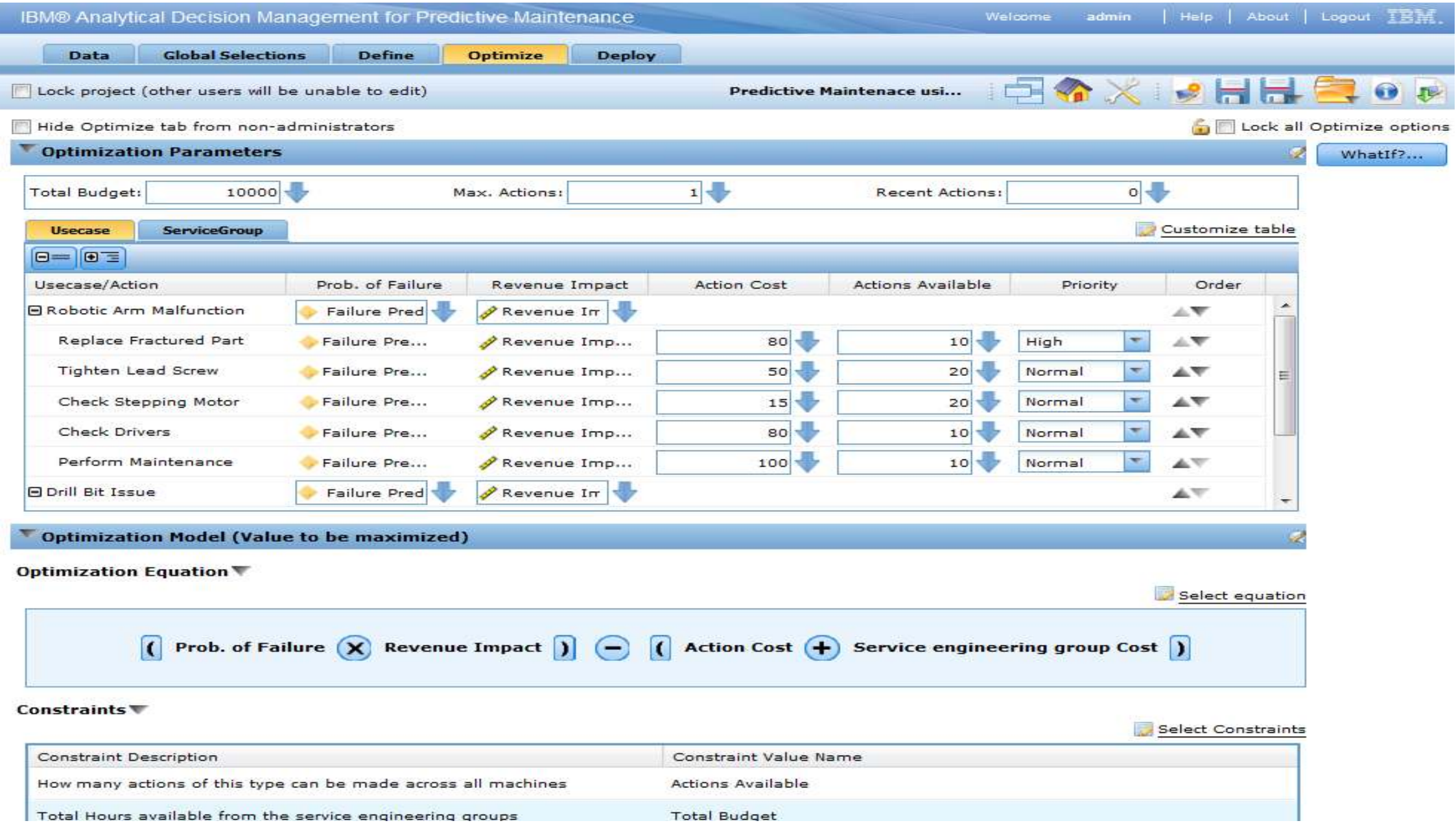
Usecase
ServiceGroup
Interaction Points
Search Dimensions:
Level 1 - Technician
Level 2 - Engineers
Level 3 - Expert Engineers
Properties of Level 1 - Technician
Choose Who This ServiceGroup Applies to
Simulate
Test
Rule name
Include/Ex
1 Selected Drill Bit Issues
Include
2 Regular Maintenance in Robotic Arm Malfunction
Include
Action = Perform Maintenance
Action = Tighten Lead Screw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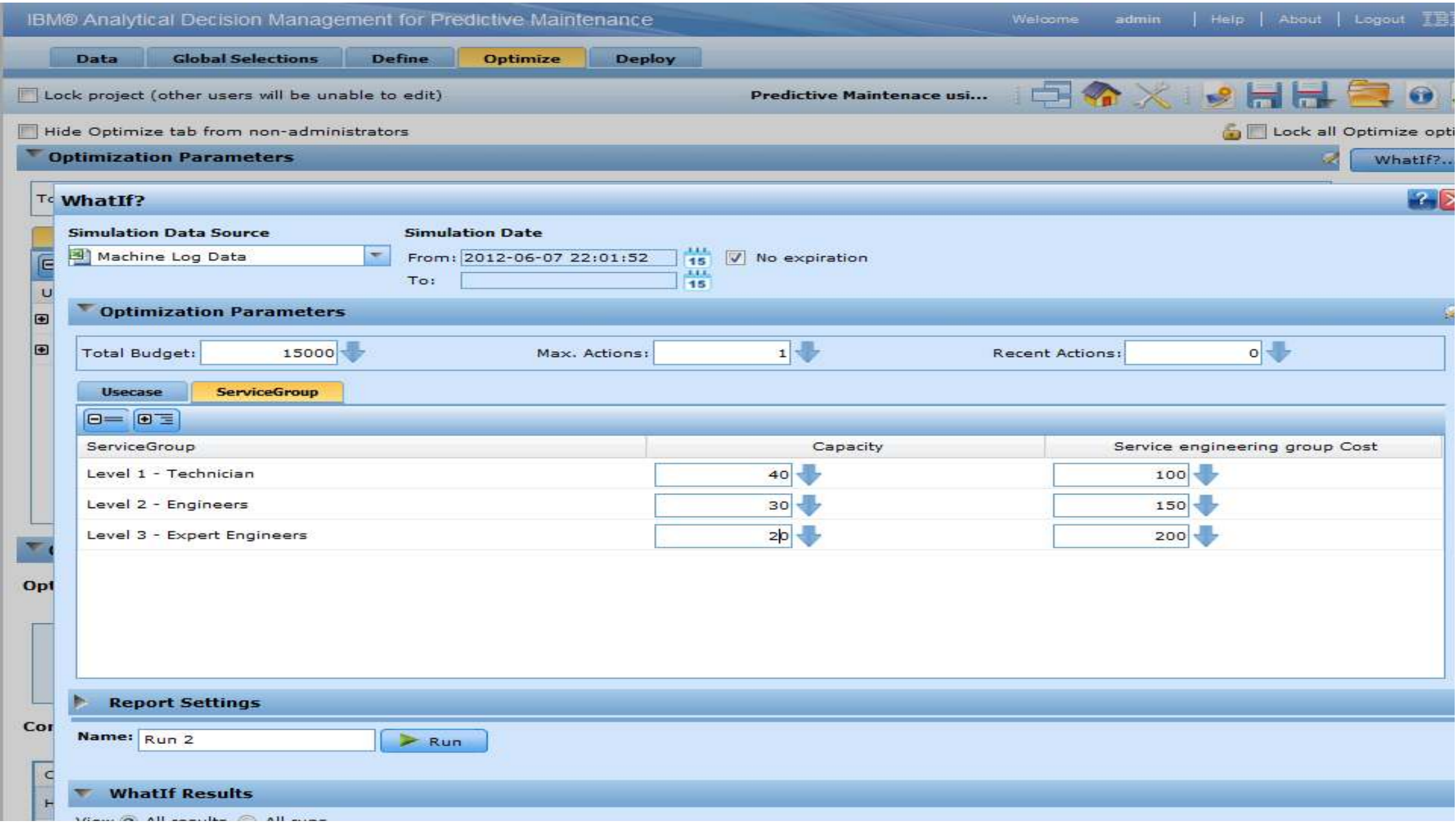
Hide Optimize tab from non-administrators
Lock all Optimize options
Optimization Parameters
WhatIf?...
Total Budget: 10000
Max. Actions: 1
Recent Actions: 0
Usecase
ServiceGroup
Customize table
Usecase/Action
Prob. of Failure
Revenue Impact
Action Cost
Actions Available
Priority
Order
Robotic Arm Malfunction
Failure Pred
Revenue Im
Replace Fractured Part
Failure Pre...
Revenue Imp...
80
10
High
Tighten Lead Screw
50
20
Normal
Check Stepping Motor
15
20
Normal
Check Drivers
80
10
Normal
Perform Maintenance
100
10
Normal
Drill Bit Issue
Optimization Model (Value to be maximized)
Optimization Equation
Select equation
( Prob. of Failure × Revenue Impact ) − ( Action Cost + Service engineering group Cost )
Constraints
Select Constraints
Constraint Description
Constraint Value Name
How many actions of this type can be made across all machines
Actions Available
Total Hours available from the service engineering groups
Total Budget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Lock all Optimize opti
Optimization Parameters
WhatIf?..
WhatIf?
Simulation Data Source
Machine Log Data
Simulation Date
From: 2012-06-07 22:01:52
No expiration
To:
Optimization Parameters
Total Budget: 15000
Max. Actions: 1
Recent Actions: 0
Usecase
ServiceGroup
ServiceGroup
Capacity
Service engineering group Cost
Level 1 - Technician
40
100
Level 2 - Engineers
30
150
Level 3 - Expert Engineers
20
200
Report Settings
Name: Run 2
Run
WhatIf Results

| | | |
|---|---|---|
| Robotic Arm Malfunction | Failure Pred | Revenue Im |
| Drill Bit Issue | Failure Pred | Revenue Im |

## Report Settings

**Name:** Run 3 Run

## WhatIf Results

View All results All runs

Usecase ServiceGroup

Display Run 2 Number of runs retained: 2

| Action | Count | Budget Spent | Expected profit |
|---|---|---|---|
| Drill Bit Issue | 26 | 4260 | 50106.8 |
| Refit Mislocated Member | 6 | 1560 | 7305.4 |
| Use Correct Drill Bit for the material | 10 | 1300 | 24090.9 |
| Use Correct Raw Material for processing | 10 | 1400 | 18710.6 |
| Robotic Arm Malfunction | 50 | 10680 | 103270.2 |
| Replace Fractured Part | 10 | 2800 | 21643.8 |
| Tighten Lead Screw | 18 | 3900 | 34149.2 |
| Check Stepping Motor | 20 | 3500 | 44465.1 |
| Check Drivers | 1 | 230 | 1966 |
| Total | 76 | 14940 | 153377.1 |

Total Records: 100

Update Settings Close


## Report Settings

**Name:** Run 3 Run

## WhatIf Results

View All results All runs

Usecase | ServiceGroup

Display Count

Number of runs retained: 2

| Action | Run1 | Run 2 |
|---|---|---|
| Level 1 - Technician | 23 | **26** |
| Level 2 - Engineers | 20 | **30** |
| Level 3 - Expert Engineers | 10 | **20** |
| Count | 53 | 76 |
| Budget Spent | 9885 | 14940 |
| Total Channel Cost | 7300 | 11100 |
| Expected profit | 142795.4 | 153377.1 |

Total Records: 100

Update Settings Close

# Summary

- **Objective**
  - Maximize cost savings
- **Things you know (rules)**
  - Equipment history and repair schedule
  - What failures have happened in past
  - Cost of repairs / down time
- **Things that are uncertain (models)**
  - What will break next
  - Changes in demand
  - Business environment, physical environment
- **Constraints**
  - Budget
  - Available of technicians, equipment

# The balance between risk & financial saving

What if I push back the maintenance by 1 month?

How much will we save?

How will the risk of failure increase?

When do we predict the asset will fail?

Let’s push back by only 2 weeks to get the saving but not risk failure…

# Early Equipment Anomaly Detection

## Komatsu

Exponential growth of the machine population year on year with limited resources to maintain and support existing fleets.

Results

- 18% decrease in problem identifications to solution
- Implemented proactive monitoring system using multiple parameters from various sources
- Repair procedures incorporated before failure
- ROI 12-14 times in first 4months

**$1 Million**
In the first 2 weeks

# Reduction in Unscheduled Aircraft Downtime (UAD)

## Major US Domestic Airline

craft shortages resulting from unscheduled downtime
impact customer arrival times,
tronage, revenue and brand reputation

sults

Pinpoint subsystems which are more important drivers of UAD that warrant special attention.

Provide context and evidence based investment decisions in improvements

A quantifiable improvement in reliability against the additional investment

**Predicting Downtime**

Keeps flights on time

# Reduction in direct maintenance costs

## Sikorsky - Helicopters

ability to analyze various data types and formats, including structured and unstructured, historical and current to determine the relationship to how the aircraft is being operated and maintained and the consumption of parts

ults

Embed a just-in-time inventory prediction into supply management systems for real-time monitoring and decision making

Identify and predict equipment maintenance for helicopter customers

Intelligently price extended warranty contracts based on up predicted costs and repairs by aircraft.

**Lowest FH Cost**
**Highest Availability**
Increased Customer loyalty

# Questions?