SmarterAnalytics

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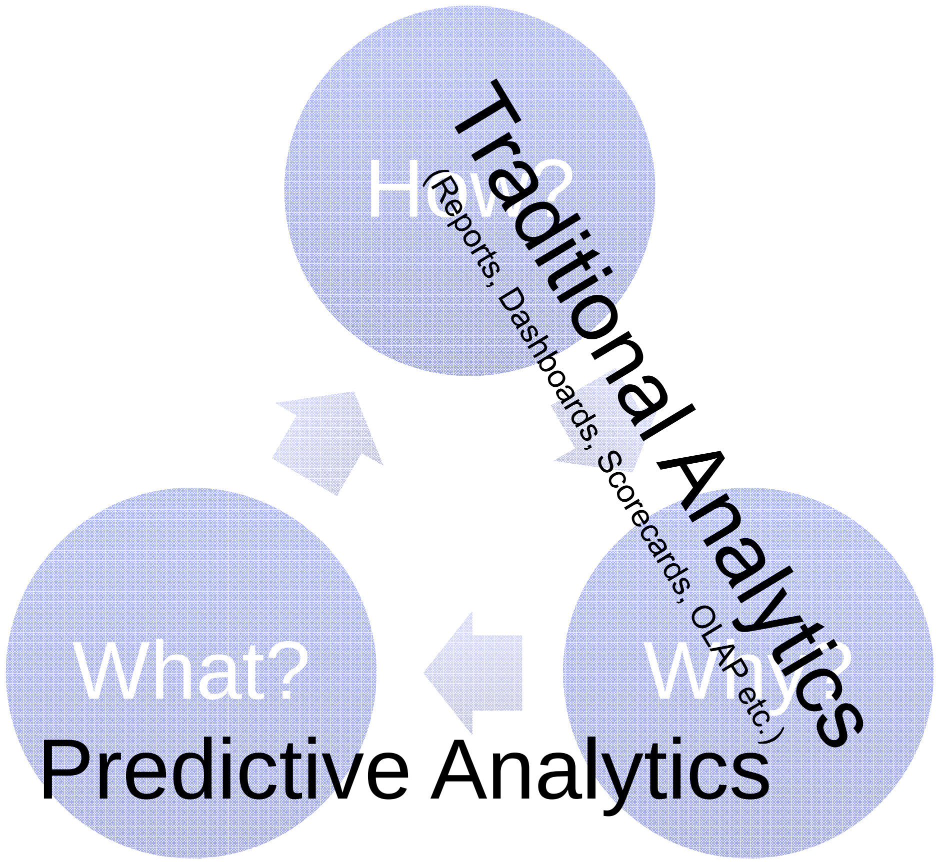
Predictive Analytics
Going from reactive to proactive

Niels Bohr
“the father of quantum physics”
Nobel Prize in Physics 1922

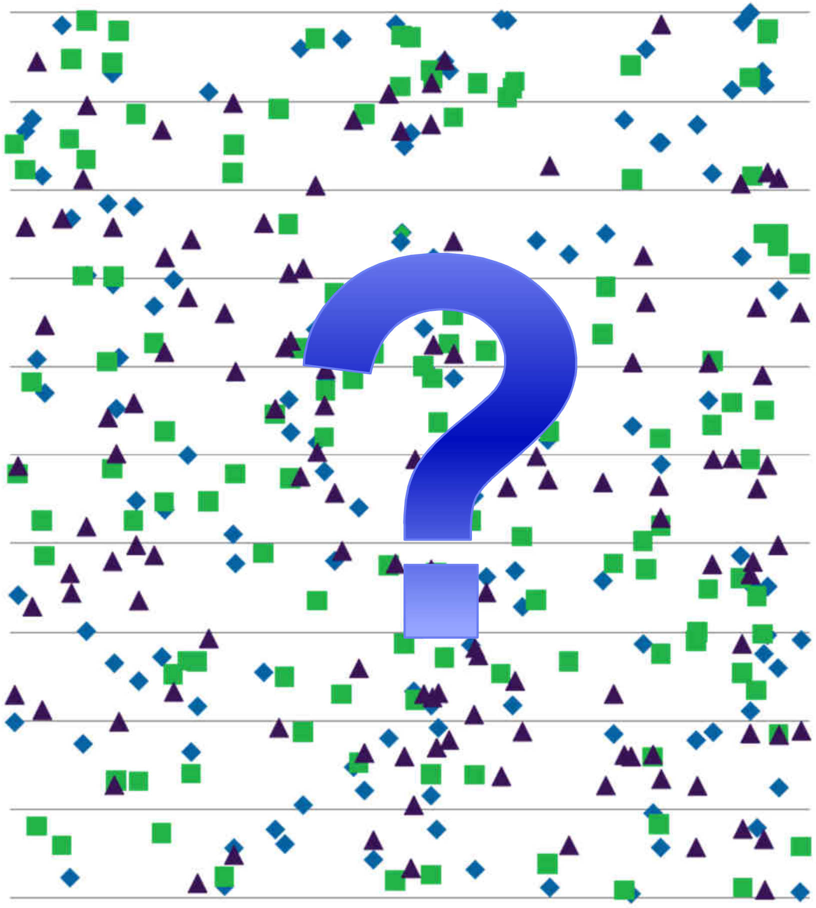
“Nothing exists until it is measured”

Setting the stage

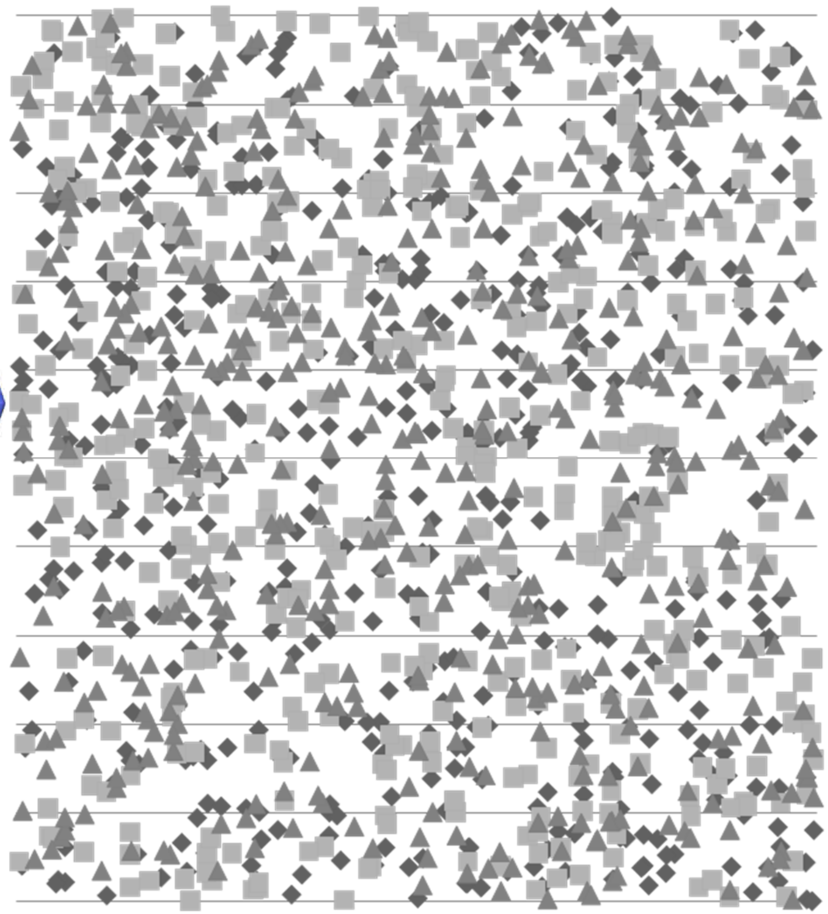


SO WHAT IS IT?

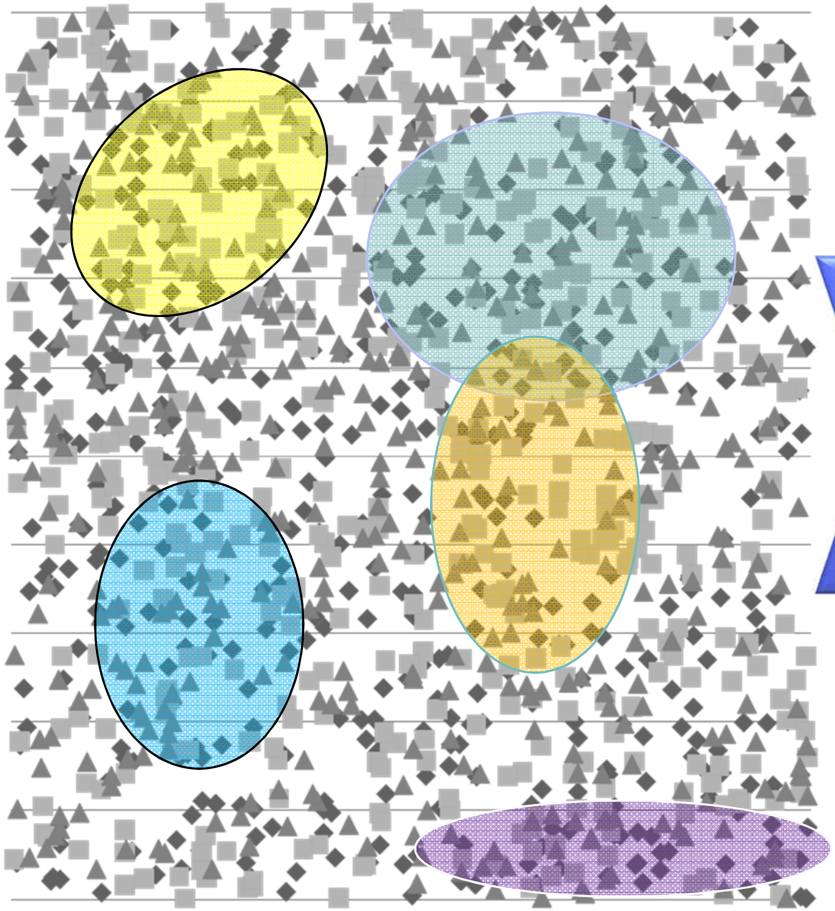
A Sample of Data



A Universe of Things That Generate Data



A Universe of Data



A Predictive Model

Attributes:
•Married, 2 kids
•Lives in a apartment in Stockholm
•Owns a car
•Works in IT
•38 years old
•Enjoys Whisky

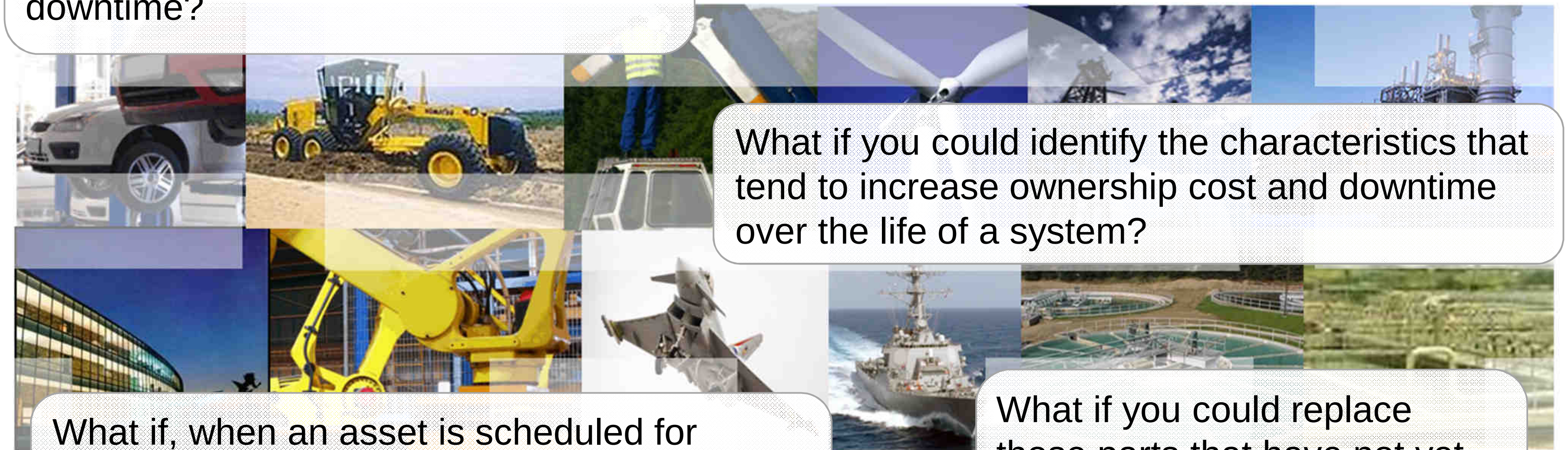
Predicted Attributes
•Likes Guns n Roses
•Likes Lagavulin
•Works long hours
•Commutes
•Middle Income

Predicted Behavior
•Wants to Buy a House!
•Buys Ecological Food
•Family vacations

... and how can Predictive Analytics help?...

What if you could predict the failure of an asset to prevent costly unexpected downtime?

What if you could unearth patterns in maintenance operations over time that could point to opportunities for improvements?



What if you could identify the characteristics that tend to increase ownership cost and downtime over the life of a system?

What if, when an asset is scheduled for maintenance, you could predict what parts are likely to fail in the near future?

What if you could replace those parts that have not yet failed and avoid further unscheduled downtime?

What if you could quickly mine the thousands of logs that describe the maintenance performed on systems and determine what important observations are being logged by the maintenance team?

A Major UK Water Supplier

Business goals

- Needed to reduce the number of DG5 incidents (sewerage floods caused by blocked sewers) by 30% over 2 years to achieve additional OPA points
- Double the detection rate of network blockages
- More effectively target existing maintenance spend
- Justify additional maintenance spend
- Increase customer satisfaction via fewer complaints

Solution

- Leverage data and text mining to predict future part failures and preventive maintenance, analyze warranty claims, and increase profitability by more accurately pricing warranty contracts.

- Major supplier of water and sewerage services in England, regulated by OFWAT (Government Agency)

Results

- Pro-Active blockage detection rate increased by 25-30%
- 41% reduction in DG5 'other causes' incidents
- Consolidated position at the top of the Overall Performance Assessment (OPA)
- Jumped 7 places to number 3 in the DG5 measure over a two year period.

Sikorsky

Business goals

- Proactively increase customer loyalty by providing the lowest flight-hour cost and highest aircraft availability
- Determine the relationships between how the aircraft is being operated and maintained and the consumption of parts
- Predict repairs and associated costs for each aircraft to anticipate customer needs in helicopter fleets
- Identify and predict equipment maintenance for helicopter customers

Solution

- Leverage data and text mining to predict future part failures and preventive maintenance, analyze warranty claims, and increase profitability by more accurately pricing warranty contracts.

- A world leader in the design, manufacture and service of commercial and military rotary wing and fixed-wing aircraft

Results

- Proactive prediction of what types of repairs will be needed
- Replace parts before their projected failure points
- Embed a just-in-time inventory prediction into supply management systems for real-time monitoring and decision making
- Forecast demand by analyzing historical data

BMW

Business goals

- Identify anomalies in production
- Improve overall quality
- Reduce warranty claims

Solution

- Performed automated root cause analysis to quickly pin-point exact cause of production line quality issues
- Identified specific combinations of vehicle options that led to excessive warranty claims
- Identified operational issues that lead to premature part failures

- Manufacture and sale of luxury and performance vehicles
- Also owns and produces the Mini brand, is the parent company of Rolls-Royce Motor Cars.

Results

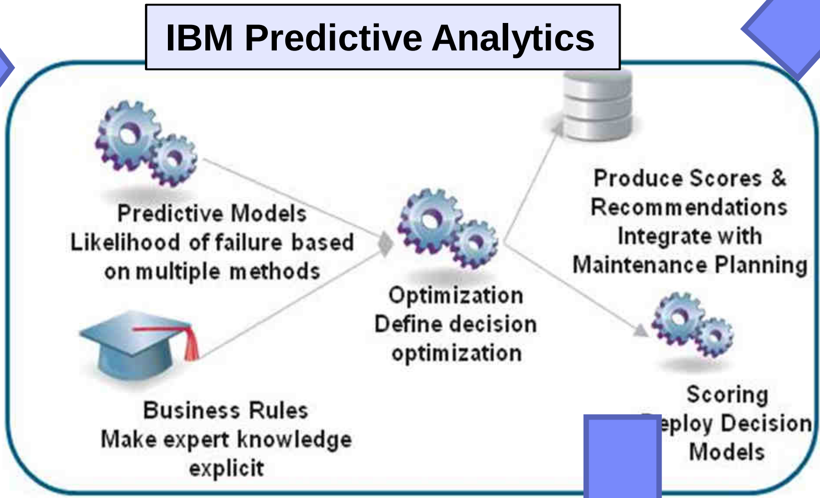
- Identified root cause of quality issues quickly
- Reduced warranty claims from 1.1 to 0.85 per vehicle

So what's different about our approach?....Capture, Predict and Act.

Predictive Analytics System

Analytics for 'through the windscreen' view . Predictive insights improve Management and refine business rules

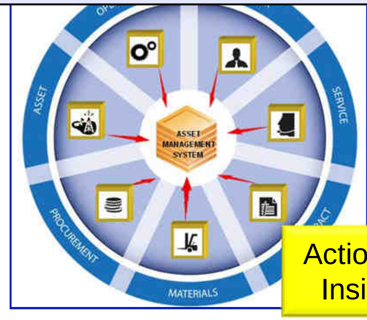
Collect data from a wide array of devices.



Actionable Insights

Discover design flaws and supplier issues via root cause analysis.

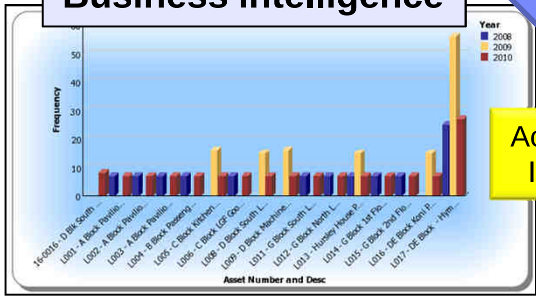
Asset Management System



Actionable Insights

Preventive maintenance workflow triggered via SPSS real-time equipment analytics.

Business Intelligence



Actionable Insights

Real-time dashboard signals an impending failure and sends alerts to pre-specified users.

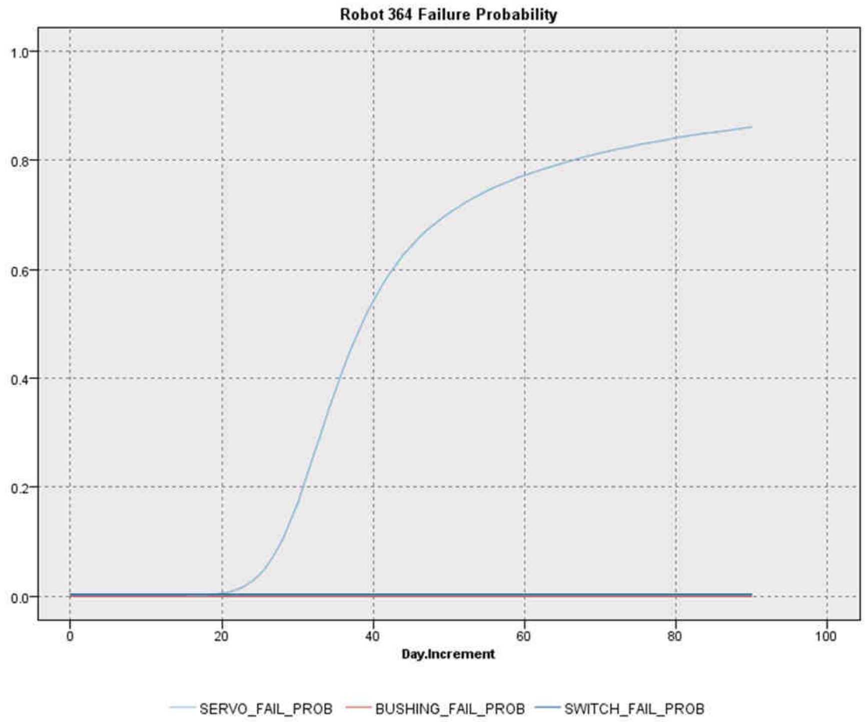
HOW DOES IT LOOK LIKE?

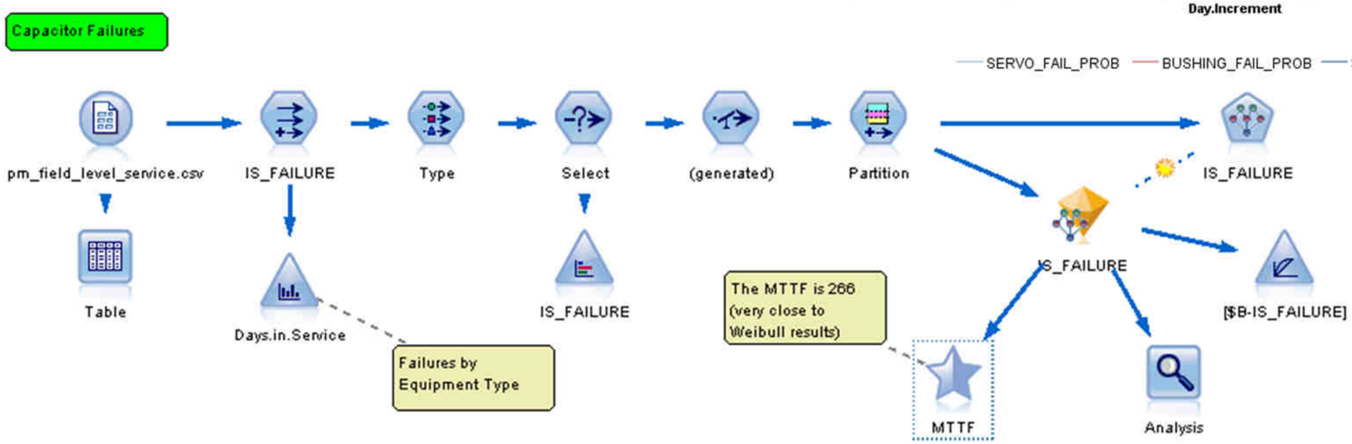
How Likely Is a Failure at Time X?

- Leverage **all available data** such as sensor logs, maintenance logs (including unstructured text), condition monitoring data, etc.

- Build predictive models to estimate the failure likelihood at any point in the future for every piece of equipment

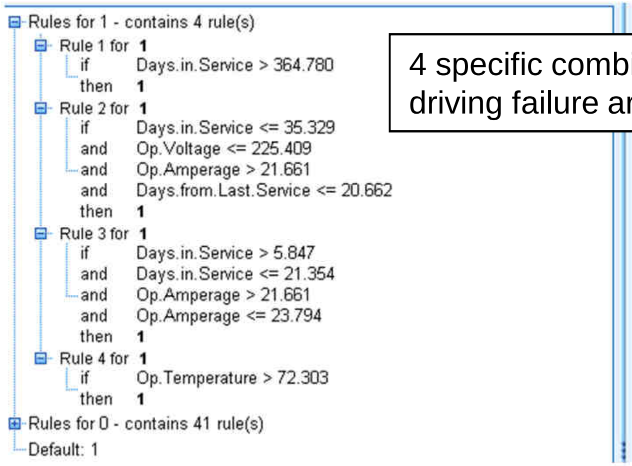
- As new data becomes available leverage these models to generate updated failure likelihood values



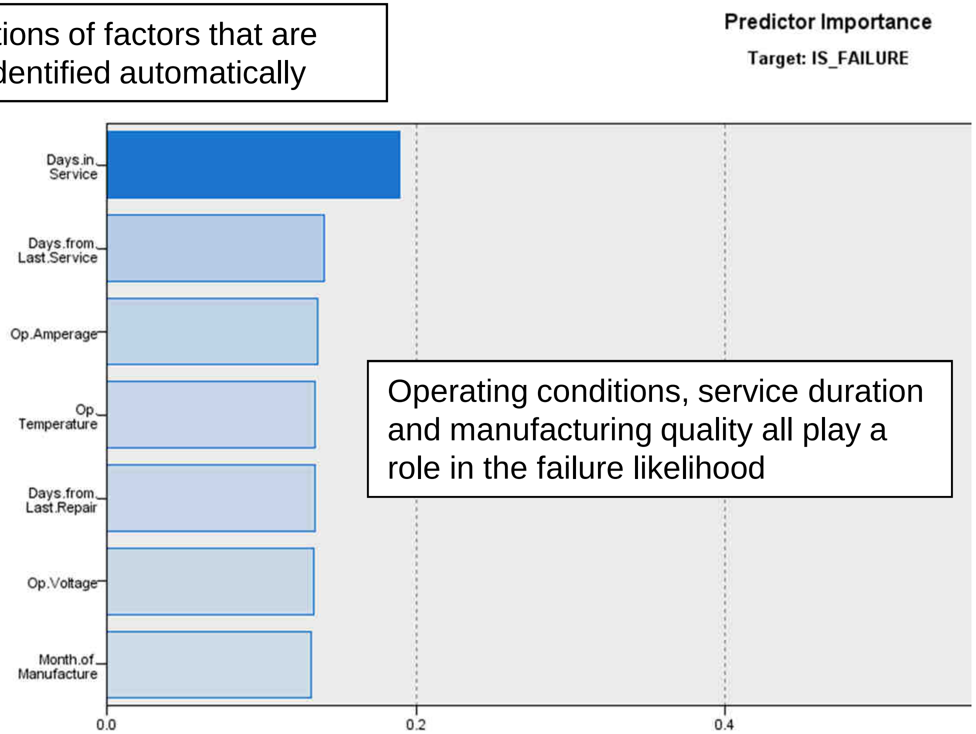


Root Cause Analysis of Failures

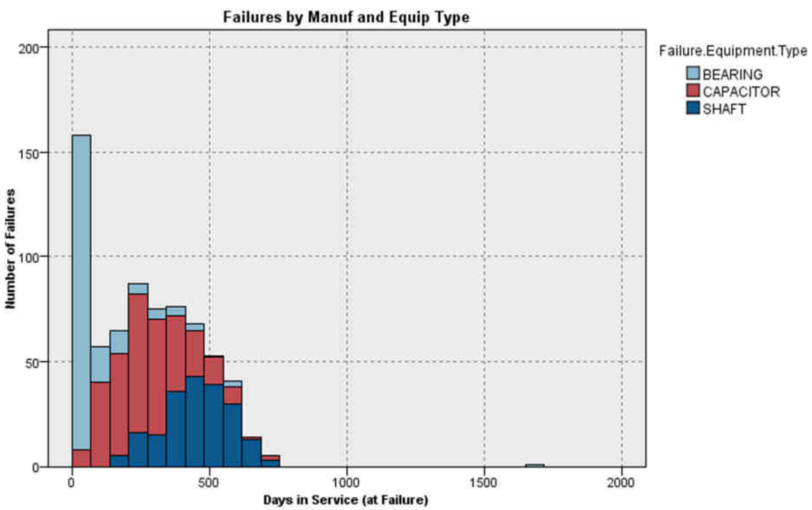
What is parts are failing? What is driving the failure?



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

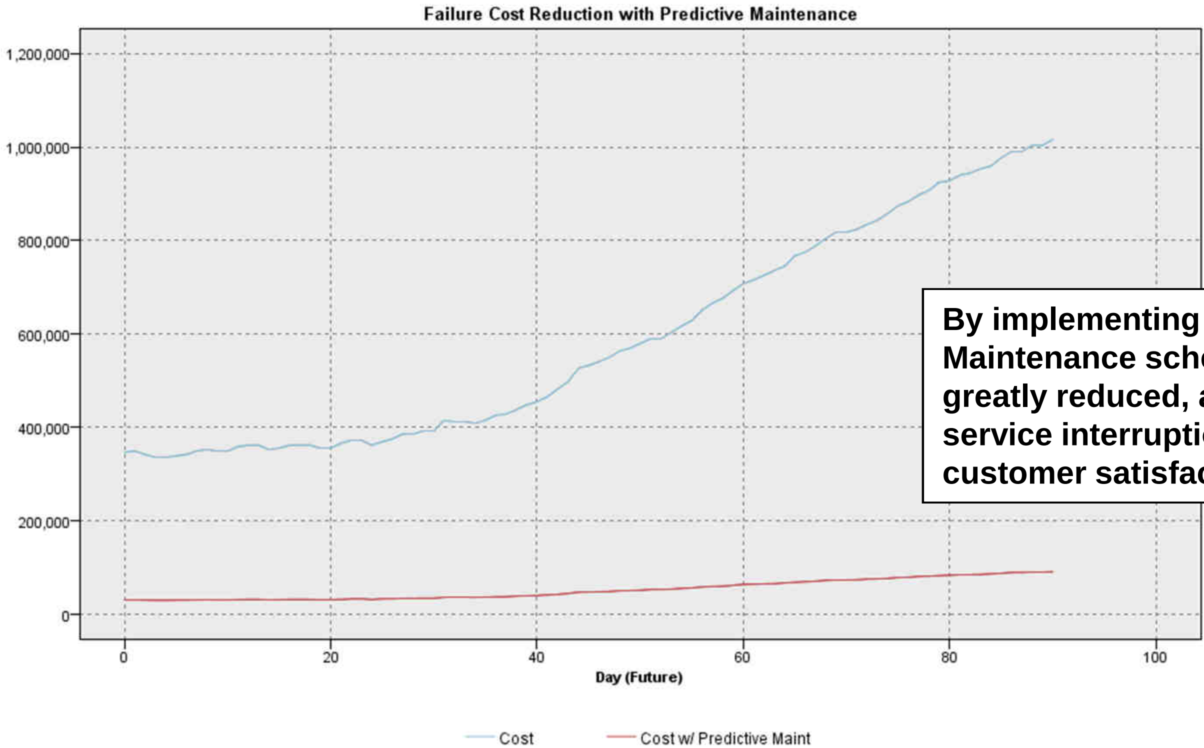


Operating conditions, service duration and manufacturing quality all play a role in the failure likelihood



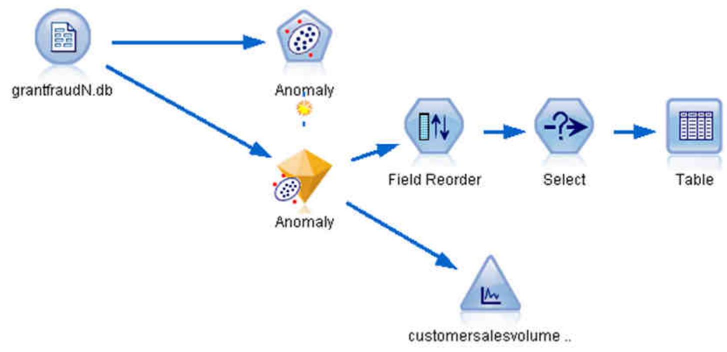
What is the Cost of Maintenance, Failures and Claims?

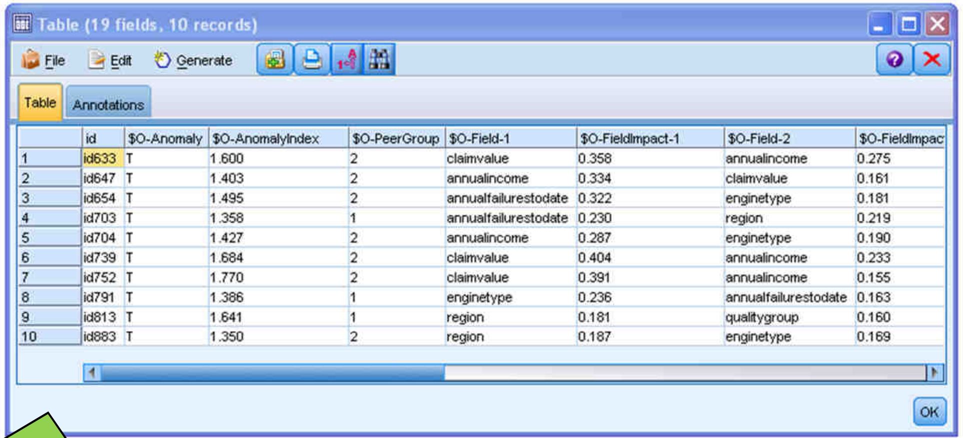
- How do costs vary by region? Why do they vary?
- What is the total cost of ownership of each piece of equipment?
- What will repairs and/or claims cost me next year?



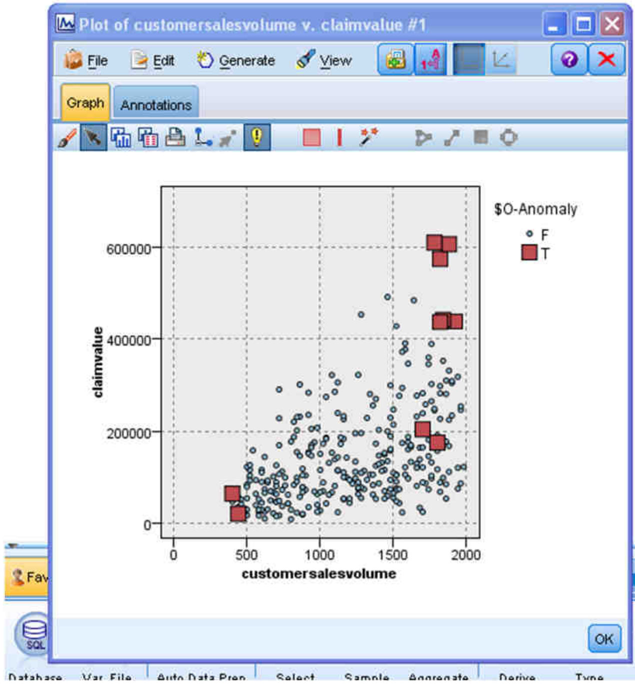
By implementing a Predictive Maintenance schedule costs are greatly reduced, as well as, net less service interruption and increased customer satisfaction

Anomaly Detection – Finding Small Problems Before They Grow…



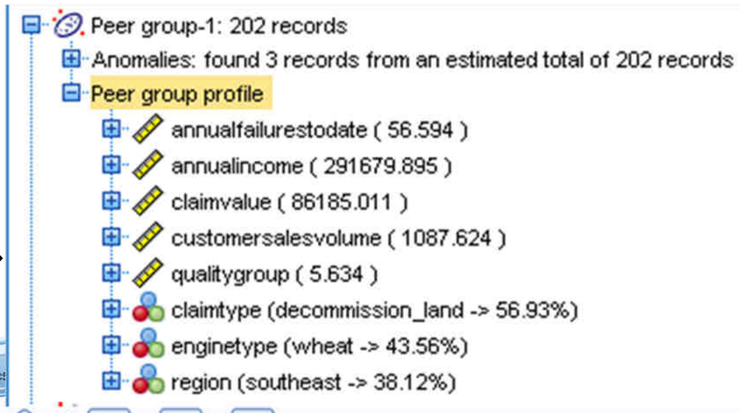


	id	\$O-Anomaly	\$O-AnomalyIndex	\$O-PeerGroup	\$O-Field-1	\$O-FieldImpact-1	\$O-Field-2	\$O-FieldImpac
1	id633	T	1.600	2	claimvalue	0.358	annualincome	0.275
2	id647	T	1.403	2	annualincome	0.334	claimvalue	0.161
3	id654	T	1.495	2	annualfailurestodate	0.322	enginetype	0.181
4	id703	T	1.358	1	annualfailurestodate	0.230	region	0.219
5	id704	T	1.427	2	annualincome	0.287	enginetype	0.190
6	id739	T	1.684	2	claimvalue	0.404	annualincome	0.233
7	id752	T	1.770	2	claimvalue	0.391	annualincome	0.155
8	id791	T	1.386	1	enginetype	0.236	annualfailurestodate	0.163
9	id813	T	1.641	1	region	0.181	qualitygroup	0.160
10	id883	T	1.350	2	region	0.187	enginetype	0.169



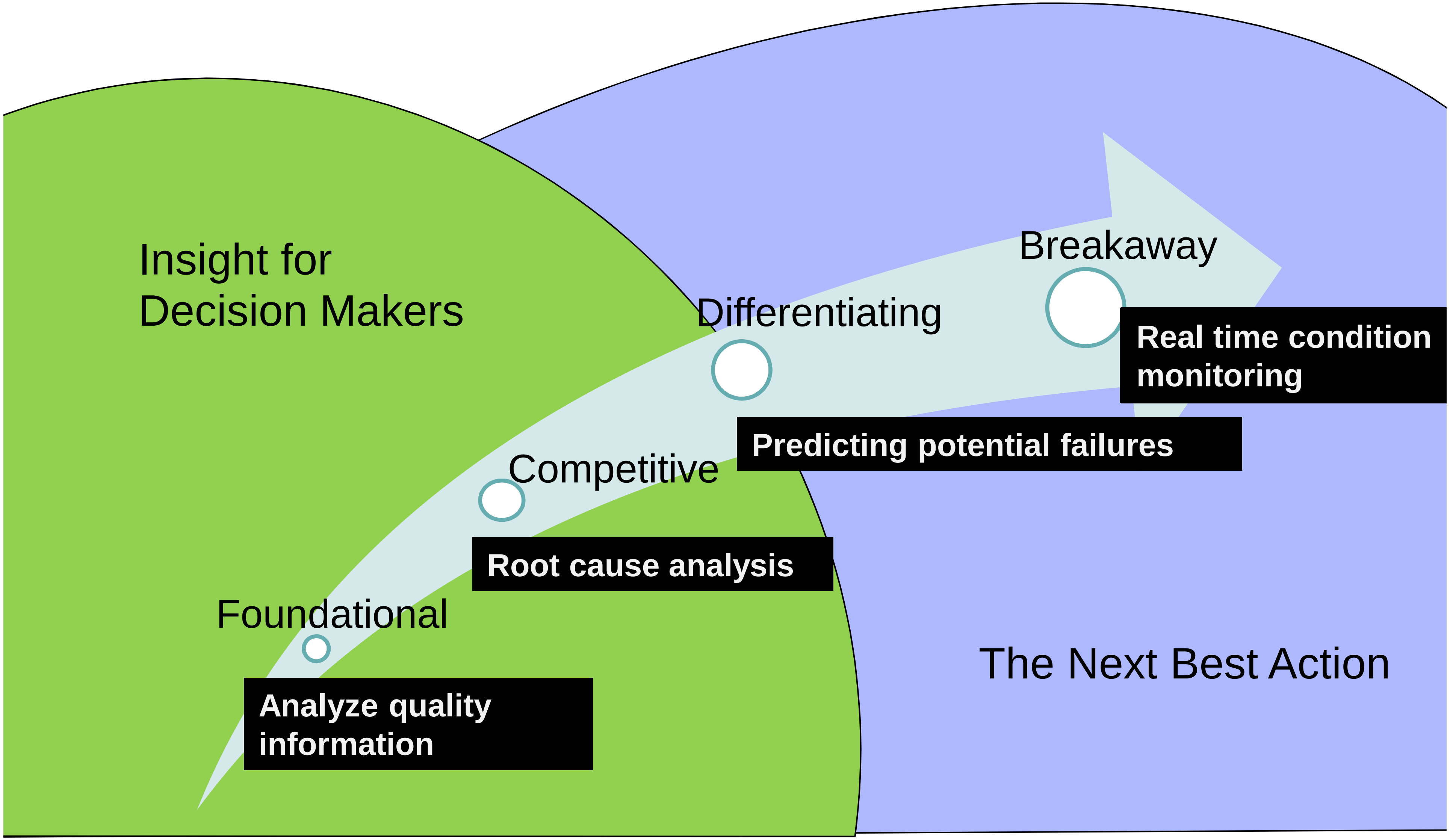
Identify anomalous production data and show the specific data that is out of tolerance

Peer group profile compared to anomalous runs



HOW DO I BEGIN?

Evolutionary solutions for operational excellence



THANKS!

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ADDITIONAL EXAMPLES

A semiconductor wafer manufacturer

What if you knew exactly which variables to adjust in a complex manufacturing process to achieve optimal yields and cycle times?
A semiconductor wafer manufacturer uses sophisticated statistical analysis and predictive modeling to determine production outcomes in real time and find the right balance of quality and speed.

The Opportunity

This manufacturer produces more than 50,000 semiconductor wafers every month, working to incredibly precise specifications on the scale of 0.25 microns to 0.14 microns. Production must be carefully monitored and continually adjusted to achieve sufficiently high line yields and low defect density. But the company manually compiled data from many sources, which provided inaccurate information, slowed production and left expensive machinery idle. It needed real-time monitoring and sophisticated analytics for a better understanding of the complex variables involved in producing higher-quality wafers, faster.

What Makes it Smarter

The semiconductor wafer manufacturing process is as delicate and complex as the thin silicon components it produces. The cycle can involve hundreds of steps—etching layer upon layer of circuits, exposing them to ultraviolet light and baking them with chemicals. You can't simply press a "start" button and hope for the best. This wafer manufacturer relies on a comprehensive, high-performance analytics platform to model production outcomes and make adjustments on the fly for the best combination of quality, speed and profitability. The solution captures real-time data from 600 equipment sensors on the production line as well as the ERP, sales and manufacturing execution systems, creating an accurate and dynamic view of production capacity. Using modeling techniques such as classification and regression trees and neural networks, the company can predict possible outcomes for any given batch of wafers and find the optimal balance of variables, including wafer yield, cycle times, defect rates, equipment usage and costs.

Real Business Results

- Expected to generate USD27 million over a period of three years for an ROI of 344 percent
- Increased wafer fabrication yields and minimized defects by providing near real-time information on wafer fabrication and testing
- Optimized use of valuable manufacturing equipment by removing expensive, inefficient delays that leave machines idle

Lower defect rates and faster cycle times have a direct impact on the bottom line. In the past, it was difficult to improve these key performance indicators. Now we have the visibility and power to model different scenarios and choose the best course of action.

Canadian energy company

What if a utility company could optimize the operation of its power grid to avoid outages or power surges resulting from supply and demand fluctuations?

This Canadian energy company uses advanced analytics, and the creation of more accurate predictions of demand, to enable it, for the first time, to fully capture and optimize the energy generated by its own and external distributed generation sources

The Opportunity

Ontario's Green Energy Act (GEA) requires that power companies embrace Smart Grid technologies and transform Ontario's electricity distribution network. This energy company must accommodate the expansion of distributed generation (DG) external power sources, which are expanding rapidly, driven by the GEA. The company recognizes that it must also leverage new smart grid technologies for modernizing its distribution system to improve reliability, responsiveness, planning and overall customer satisfaction. The company's strategic objective was to increase support of renewable energy, improve grid efficiencies and operations by improving business processes, leveraging smarter power systems devices and integrating operating communications and IT systems technologies.

What Makes it Smarter

Adding renewable energy sources to an existing electrical grid creates forecasting challenges for any utility, since these sources are not part of the company's own power generation processes, and because the ability to predict and manage both supply and demand accurately and consistently has thus far eluded power companies. This major North American utility can now create highly accurate demand forecasts by analyzing historical, demographic and other data, allowing it to manage its own power generation more precisely. An advanced distribution grid, coupled with the ability to predict demand, helps reduce the probability of outages caused by spikes in demand, and ensures that the right amount of power is generated during lower demand times, improving the efficiency of power production, and lowering costs for the utility. In addition, by creating improved business processes, and by leveraging real-time analytics for key elements of the power grid, The energy company will be able to improve its monitoring, control and protection of distributed energy resources, while optimizing its outage restoration and distribution network asset planning and management.

Real Business Results

- Analytics helps the operator allow up to 100% more DG into the grid
- By taming the unpredictability of the DG forecasting model data, the operator can now automate its demand forecasting and gain a competitive edge
- In the future, sensors will report outages automatically, and crews can be dispatched more accurately, perhaps even before the outage is reported by a customer

By modernizing the distribution system, and applying advanced analytics to demand forecasting and power systems monitoring, this power company will be positioned as a leader in the electricity marketplace well into the future.

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