Future of Supply Chains & IoT / Sensor Data Use

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Sven Dharmani - EY

Introduction

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Supply Chain Leader for Advanced Manufacturing & Mobility / Automotive Sector

25+ years of global experience in supply chain transformation.

Focus on Implementing industry 4.0 capabilities such as predictive maintenance, advanced analytics, digital twins, machine learning, natural language processing and sensor data / IoT integration to solve complex SC & Operations challenges.

Extensive experience in driving large scale transformations in fortune 100 corporations globally

Discussion Topics

1. Future of Supply Chain

2. Digital Supply Chain – Case Studies
   - IoT/sensor data, natural language processing & predictive analytics in Supply Chain
   - GPS Tracking in Supply Chain – Marine Transportation

1. Top supply chain priorities to recovery and beyond

	1 Strategic architecture	2 **Transparency and resiliency**	3 Cost & cash reduction	4 **Sustainability**	5 Digitally networked supply chain
Key interventions	Rapidly redefine and integrate your supply chain strategy. Alter your global trade flows, global tax models, supply chain operating model and footprint.	Design and build agility into your supply chain footprint and supplier network. Improve your disruption response through real-time monitoring and scenario planning.	Drive a step change in your supply chain cost and working capital profile allowing you to fund the transformation.	Embrace the future of a circular economy by engaging suppliers and industry partners, aligned with available incentives to drive competitive advantage.	Move from doing digital to being digital. Implement supply chain technologies that open up new revenue streams rather than simplify efficiencies. Close the talent gap in digital fluency.

1. Resiliency and Sustainability - identify gaps and develop a path to short-term fixes and long-term value

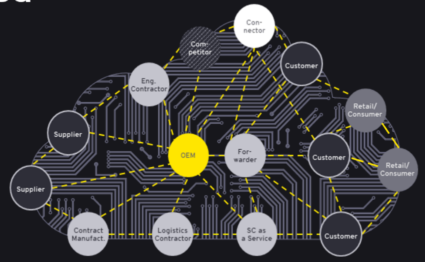
Resiliency = Visibility + Agility

- Embed end-to-end visibility, simulation and risk monitoring
- Design omni-capable agile networks.
- Secure alternative sources of supply.
- Develop a resilient operating model and workforce.
- Create a trusted and secure supply chain.

Future Vision of Supply Chain

Now.
Cost optimized, manual, rigid and linear

Next.
Agile, Networked Ecosystems



Beyond.
Autonomous

Cost take out & cash extraction

Industry 4.0 & Digital SC

Traditional Demands

Sustainability = Environmental + Social + Governance

- Establish sustainable and diverse sourcing.
- Enable traceability, visibility and disclosure.
- Decarbonize the value chain.
- Introduce circularity into your business model.
- Assess impact of new taxes and incentives for a sustainable supply chain.

Legend:
*Relevant topic for **today's** discussion
**Relevant topic for subsequent discussion

Discussion Topics

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2A. U.S. Public Sector Client – Case Study

Optimization of national maintenance activities through data-driven scheduling decisions and ML-driven reliability improvement

The Challenge

- Identify opportunities to reduce scheduled maintenance activities to drive cost savings
- Maintain or increase reliability of agency infrastructure to ensure national safety

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EY role

- ETL and Data Structuring: EY used natural language processing to structure textual log comments for predictive analysis
- Advanced Analytics/AI: EY developed predictive models incorporating log and IoT/sensor/telematics data, as well as a suite of visualizations for opportunity identification

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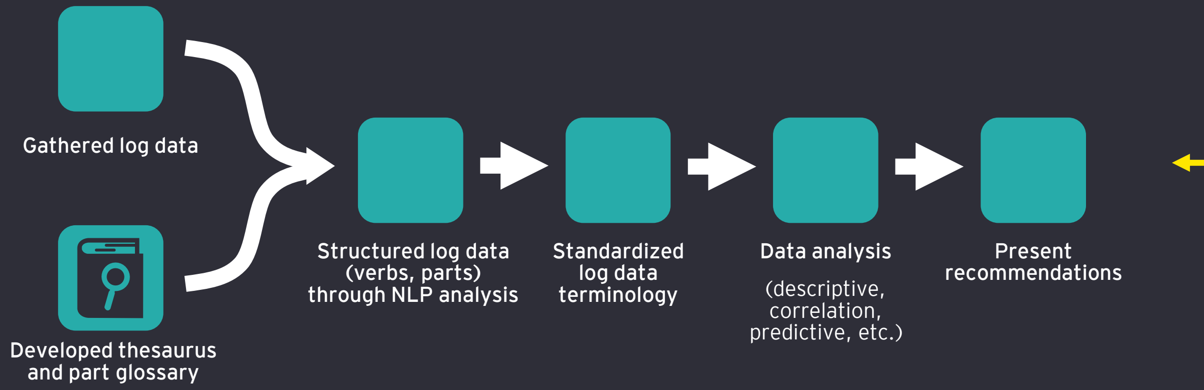
Value delivered

1. Predictive model: Developed analytical models on historical system health data to predict equipment failures and drive preemptive maintenance response to improve quality and reliability of service
2. Maintenance optimization analysis: Enabled exploratory analysis of current maintenance activities to identify areas for deep dive, and created models to understand optimal schedule for maintenance

Methodology



2A. Predictive Maintenance Modelling Approaches

We combine multiple AI modelling approaches to identify risks, predict failures, and minimize downtime

Data Mining

Natural Language Processing

Create dataset from unstructured text.

- Utilize maintenance log comments from field technicians and convert to a tabular format for modeling
- Data requirements maintenance log text

Predicting Failures

Failure Analysis
less complex

Estimate the probability of machine & parts failure based on maintenance logs

- Descriptive statistics about error occurrence, machine failure, and component lifetime
- Survival analysis using Kaplan-Meier model and parametric distribution fitting
- Data requirements: error alarm and maintenance log data

Time Series Forecast
moderately complex

Forecast IoT / sensor performance and detect anomalies given historical sensor data

- IoT / Sensor performance forecast using univariate time-series model, e.g. ARIMA
- Data requirements: historical and streaming telemetry data in time series

Machine Learning
most complex

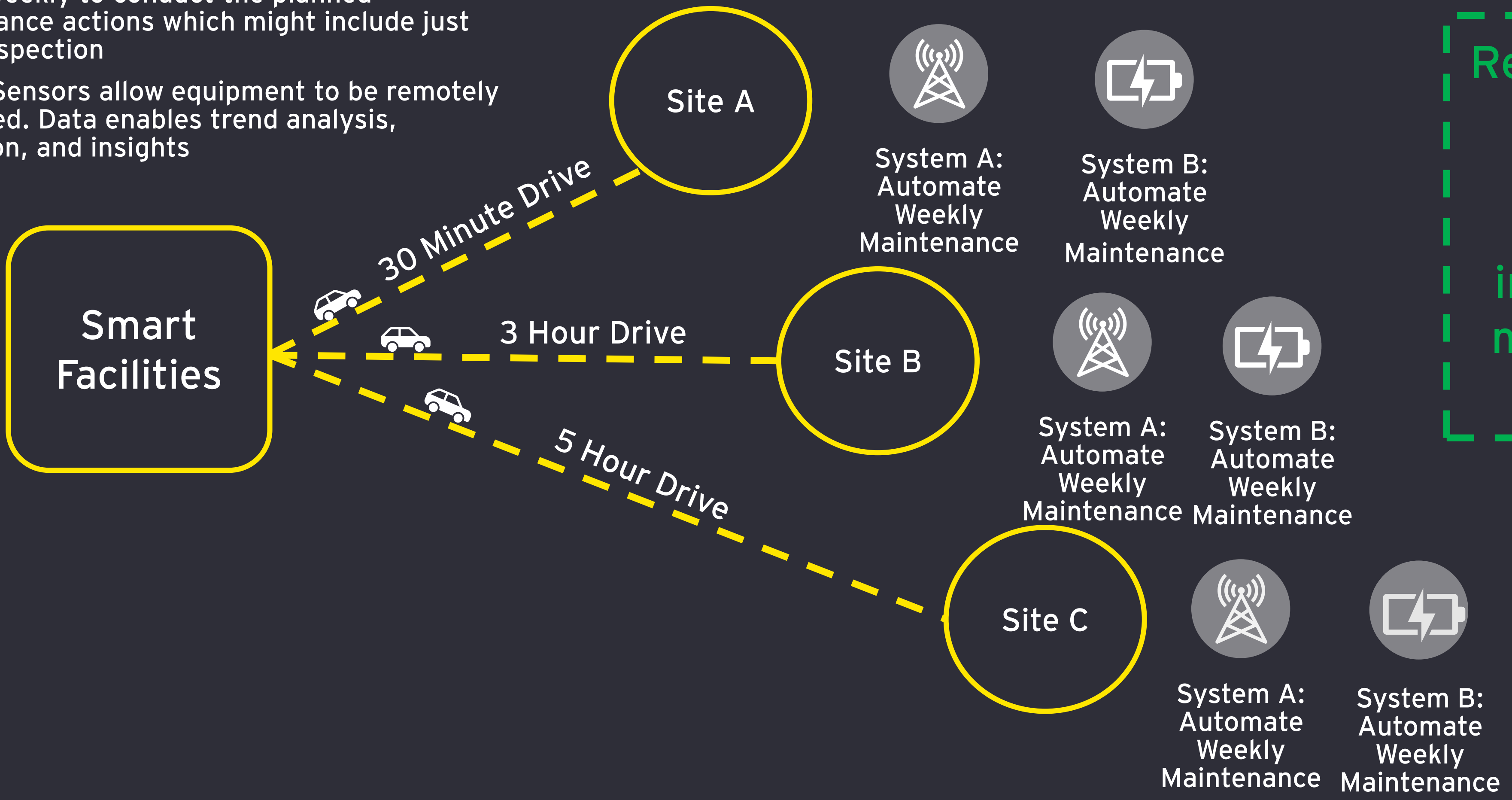
Predict the failure likelihood and remaining lifetime given machine conditions and maintenance data

- Error & failure prediction using classification model, e.g. ensemble learning, neural network
- Data requirements: machine specification, maintenance log, error alarm, and historical telemetry data

2A. One example of Smart Facility impacts

Remote Radar Facilities

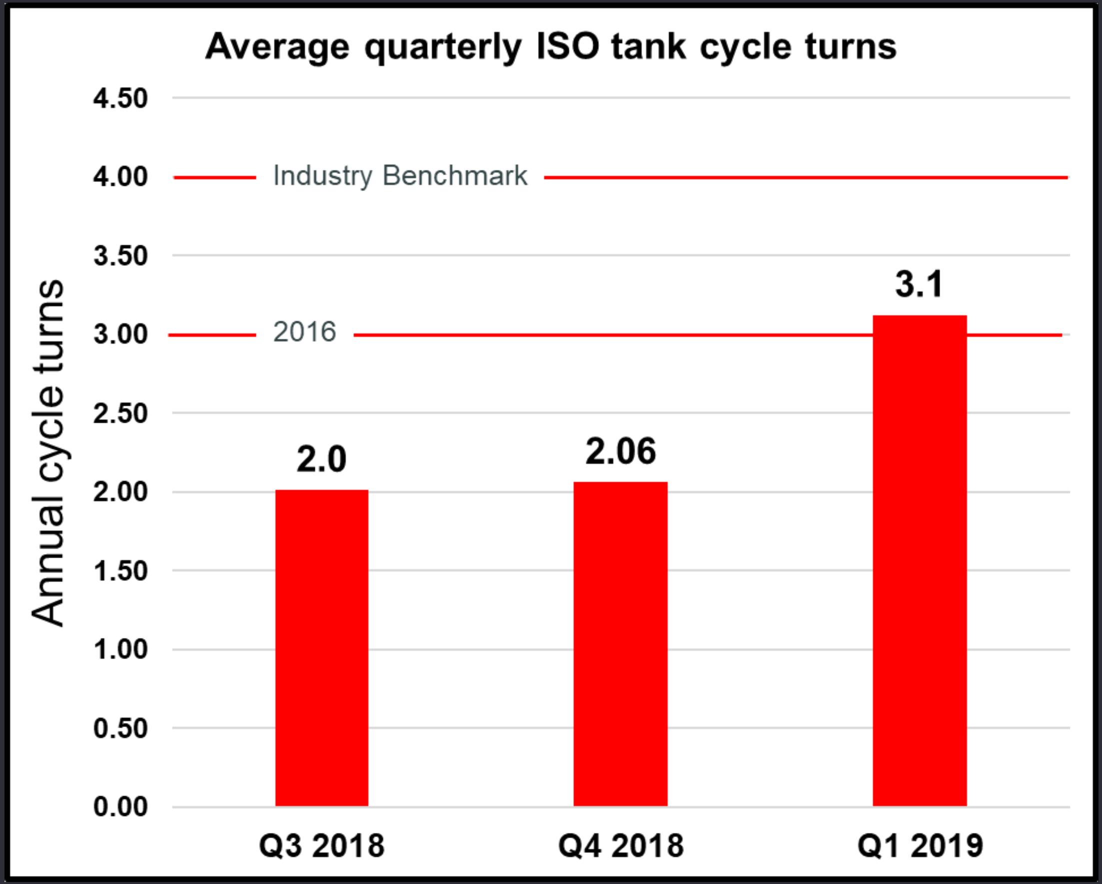
- Current: Maintenance Technician's drive to facility weekly to conduct the planned maintenance actions which might include just visual inspection
- Future: Sensors allow equipment to be remotely monitored. Data enables trend analysis, prediction, and insights

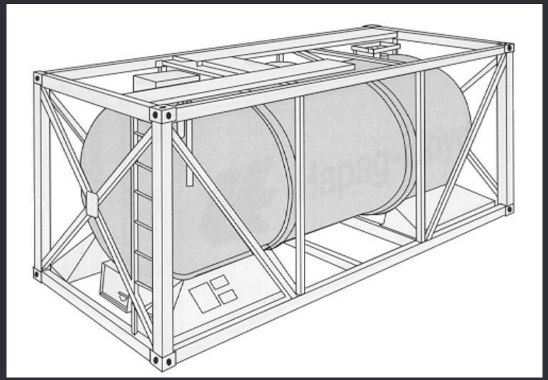


Reduced planned maintenance actions and travel time; increased real-monitoring and insights

2B. ISO Tank GPS Enablement – Logistics Visibility

GPS data on returnable containers – Improved turns leading to higher asset utilization, reduced inventory and stable supply





Cycle Time Improvement

2.0 Turns → **3.1 Turns**

Based on Q1 2019 data

2B. ISO Tank GPS Enablement – Logistics Visibility

Optimized vessel routing

Developed visibility of ISO tanks utilizing data from GPS tool to showcase the value of location and route mapping.

Findings

- Norfolk to Detroit via Canada took ~20 days not including stops
- Norfolk to Detroit direct takes ~7 days

Recommendation

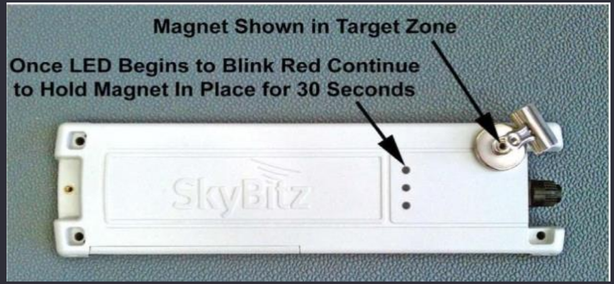
Review route optimization opportunities to optimize offload at Norfolk instead of Halifax to decrease transit time

Improved **ISO tank utilization** through newly developed visibility tools

Outbound Results as of Q4 2019

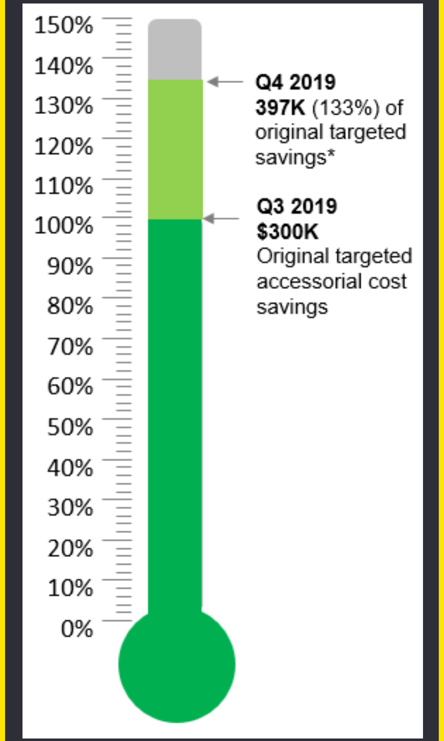
51 Days → **$xxM** → **39 Days**

Defined, **standardized** and **trained** key GPS deployment processes (installation → activation → registration) in multiple international sites.



Tracked **quarterly metrics** based on process design training and **improvements**

Process Improvement Savings Q3 2019



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2B. ISO Tank GPS Enablement – Logistics Visibility

Long cycle time for ISO Tank

Findings

- Complete Cycle (Full to Customer □ Empty to Barry) = 40 days
- 18 days spent at client in Leverkusen (45% of 40 day cycle time)
- Cycle 2 (next slide) on track to take ~40 days

Recommendation

- Evaluate process efficiencies
- Identify opportunities to replicate on other routes

No movement of ISO Tank

Findings

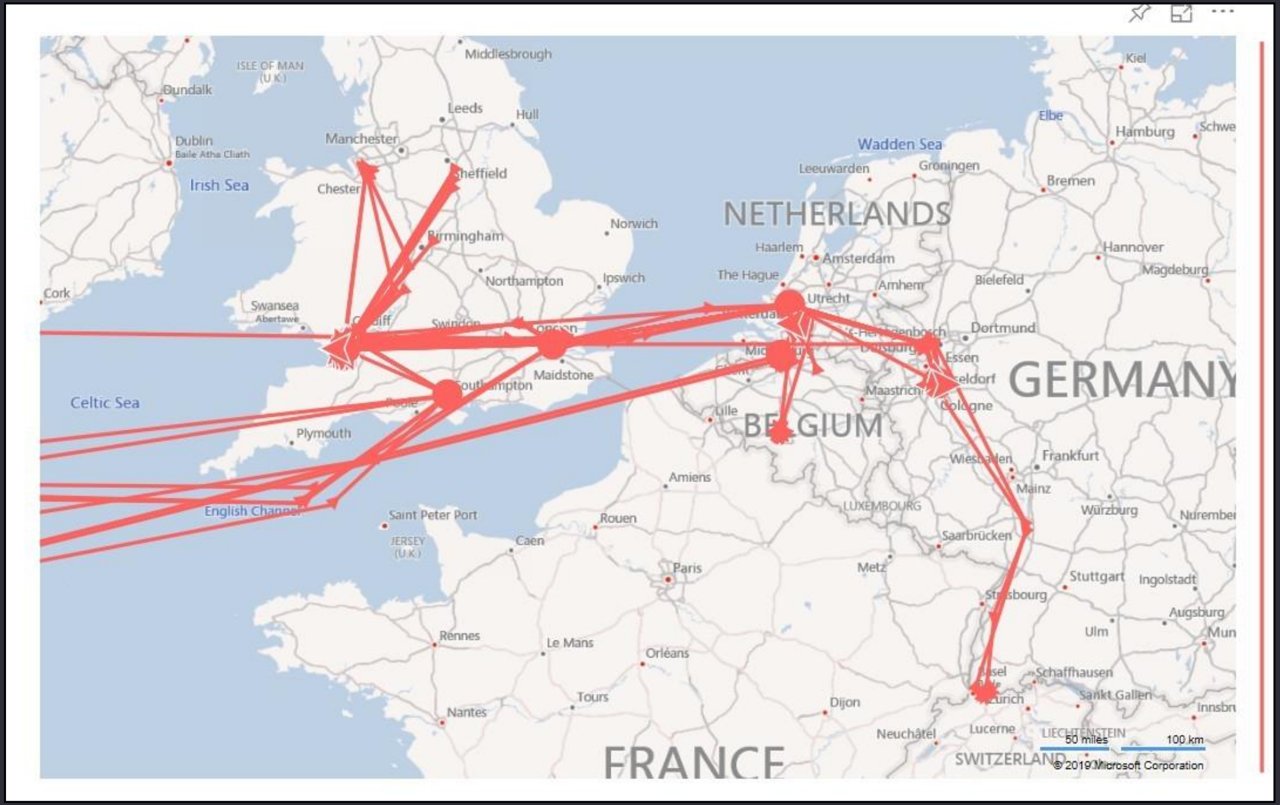
- Tank has not moved for almost 2 years
- Originally used for Phenyl TCS shipments thru Feb 2017
- Dow owned - using for storage

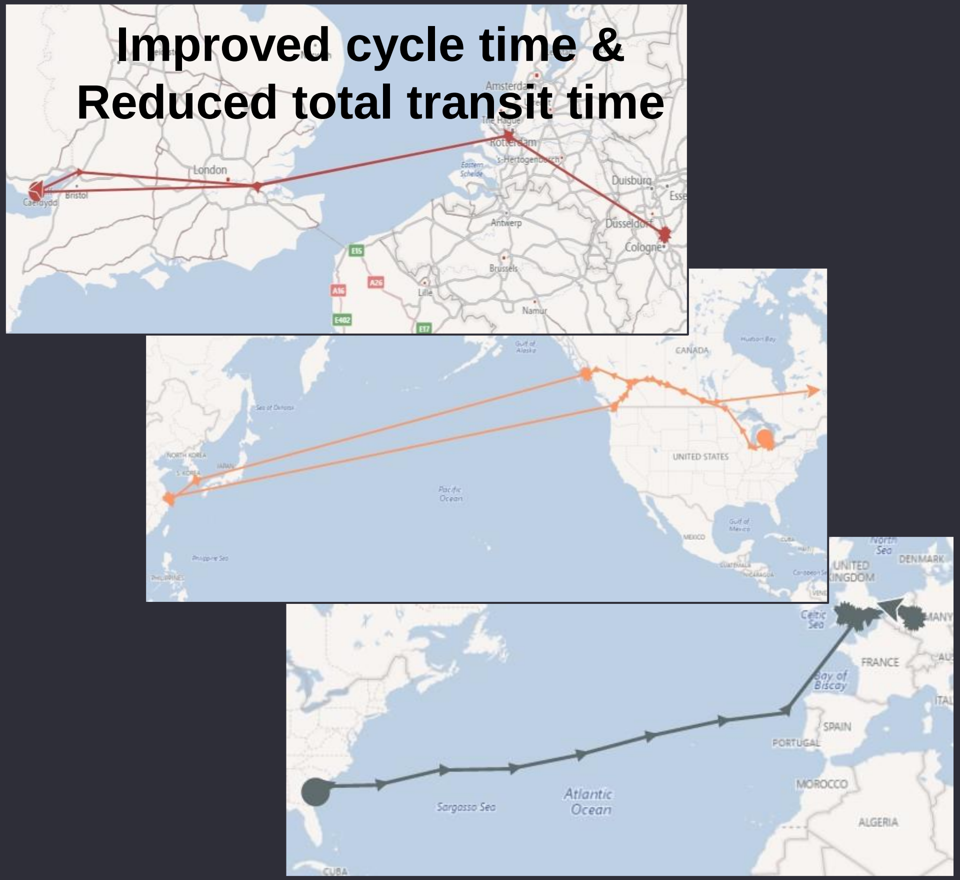
Recommendation

- Designate tank as storage only

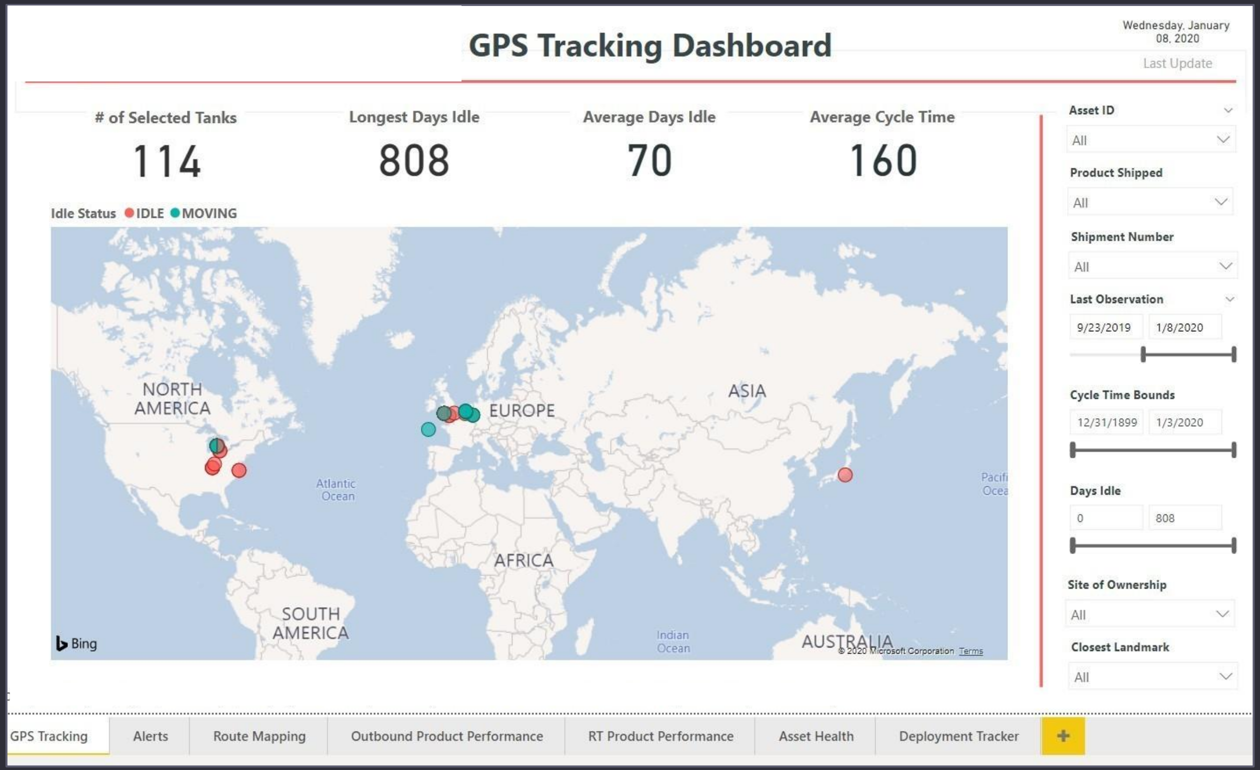
2B. ISO Tank GPS Enablement – Logistics Visibility

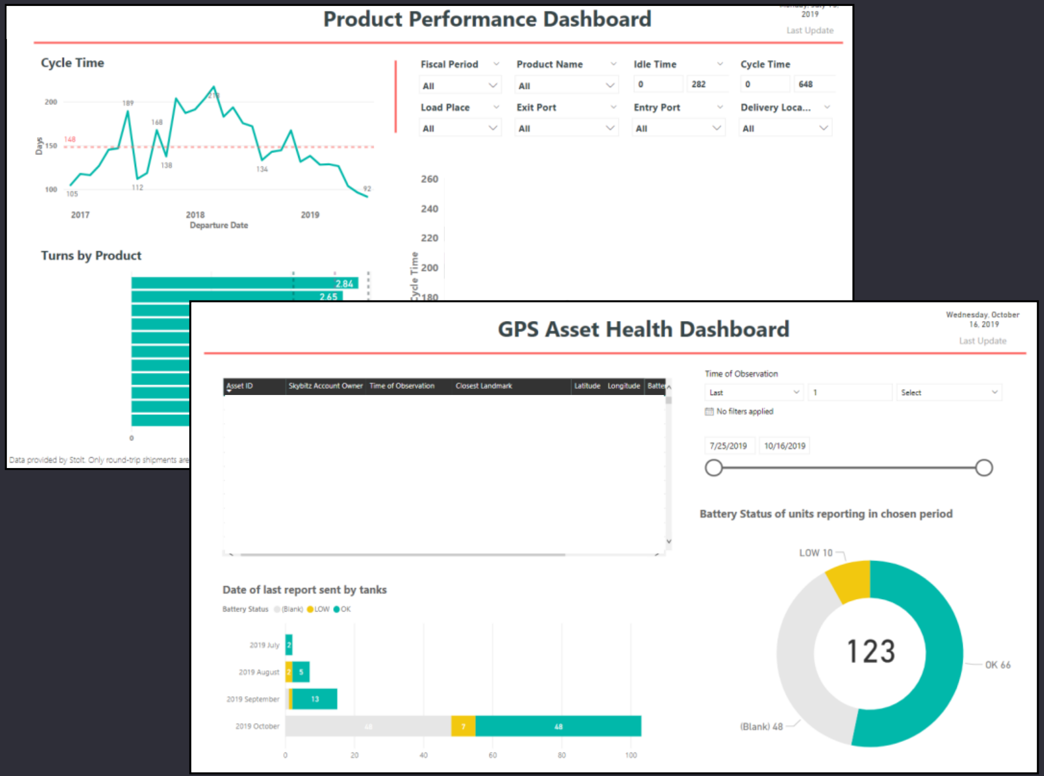
Improved supply chain and reliability driven by GPS tracking data





2B. ISO Tank GPS Enablement - PowerBI Dashboards





Developed analytics and dashboards from multiple sources (external GPS vendor and SAP) to monitor:

- Asset locations
- Alerts
- Routes
- F&I product performance
- Battery health
- Idle status

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Appendix

EY is ranked as a global leader in Supply Chain

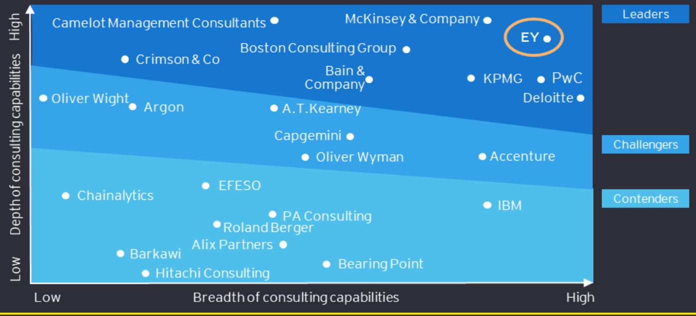
2021-2022

ALM Intelligence Pacesetter Research – Supply Chain 2021-2022

Consistently ranked in the Leaders' Quadrant by Industry Analysts 2021 Analyst Rankings

Leader on IDC MarketScape Worldwide Supply Chain Services (2021)

Leader on ALM Vanguard of Supply Chain Planning consulting providers



~4,000 Global Supply Chain Headcount

~1,000 Americas Supply Chain Headcount

2020 analyst reviews

- ALM Intelligence ranks EY a **Leader in Supply Chain Planning, 2020**
- ALM Intelligence ranks EY a Leader in Production Operations, 2020
- ALM Intelligence ranks EY a **Leader in Procurement Consulting, 2020**

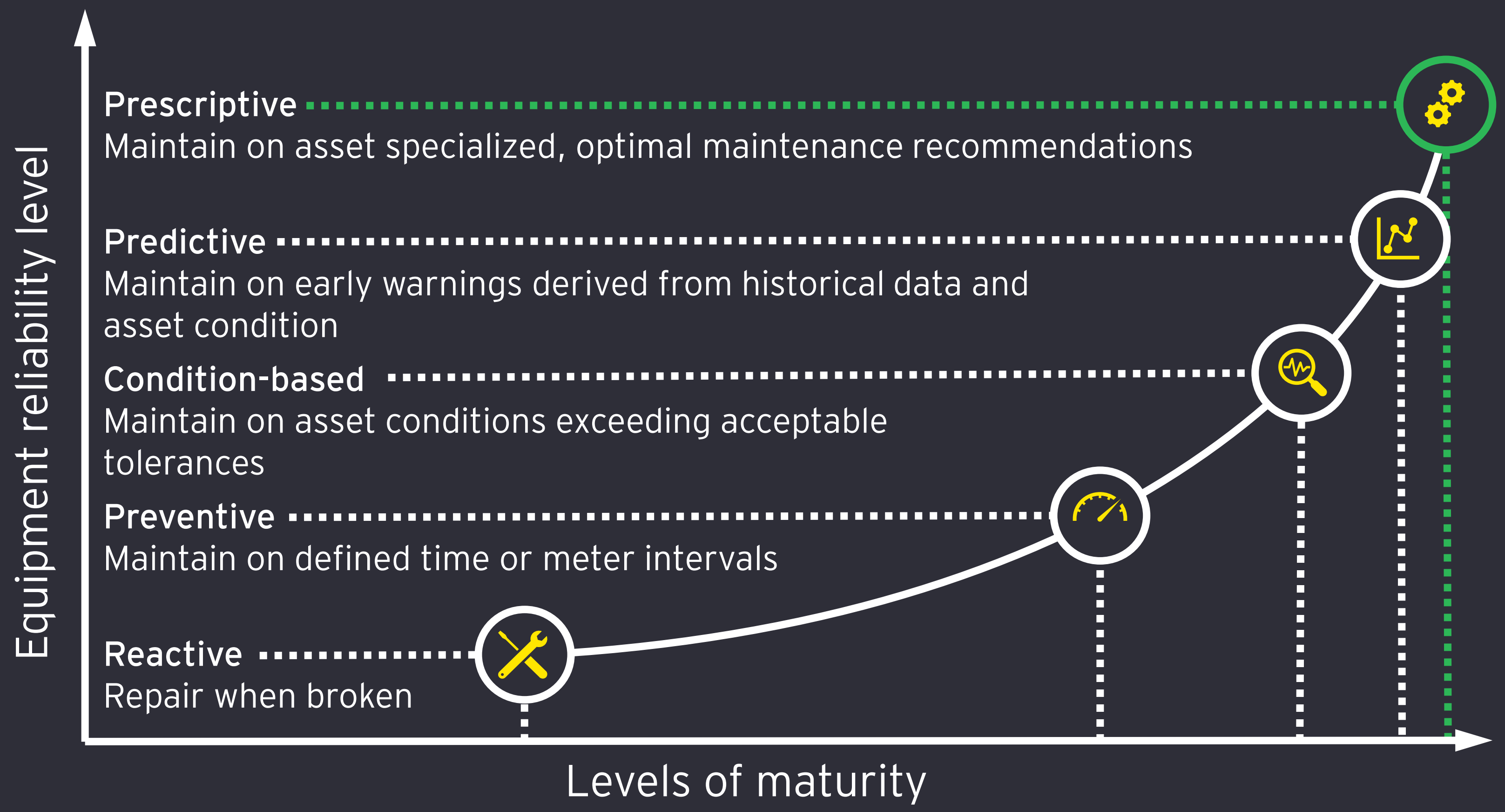
2019 analyst reviews

- ALM Intelligence ranks EY a Leader in Production Operations Consulting
- ALM Vanguard: Supply Chain Planning Consulting. ALM Intelligence, January 2019
- IDC MarketScape: Worldwide Business Consulting Services 2019

2A. Clients are beginning to tap into years of data logs and telematics data to enable AI-driven maintenance capabilities

Adding predictive and ultimately prescriptive capabilities to operational arsenal unlocks savings, drives quality, and enables accomplishment of the mission.

Maintenance Maturity Model



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