

A photograph of two industrial workers on a construction site. They are wearing yellow hard hats and high-visibility yellow safety vests over light-colored work clothes. The worker on the left is pointing upwards with his right hand, while the worker on the right holds a black clipboard and looks in the same direction. They are standing on a metal structure, possibly a scaffolding or part of a large machine. The background shows more of the industrial environment with metal beams and a bright sky.

# THE KEY STEPS TO REDUCING DOWNTIME:

Designing and Implementing an  
Effective Reliability Strategy to Improve  
Asset Performance

12th July 2018

# Session Objectives

- Understand why asset reliability is critical in meeting production and plant efficiency targets

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- Learn what steps need to be taken to implement an effective reliability strategy and asset management program
- Learn how data driven asset management will reduce maintenance costs and increase workforce effectiveness

# Speaker Introductions



## **John Morrison, Managing Director John Crane Asset Management Solutions**

- John has over 37 years' experience in the Oil and Gas Industry in Senior Enterprise Asset Management positions.
- His experience ranges from being an operator in BP Exploration (29 years) and as a service provider with Petrofac (6 years) as the European Business Manager for their maintenance consultancy business.
- John is a member of the *Institute of Asset Management (IAM)*



## **Jason Gondron, Business Development Manager, PERFORMANCE PLUS®, Americas**

- Jason has 22 years' experience devoted to reliability and its economic impact to process industries.
- Background in sales, reliability engineering staffing and reliability software directional leadership.
- Jason received his Bachelors of Science in Mechanical Engineering and Master of Business Administration (MBA) from Louisiana State University.



## **Victoria Williamson, Contracts Support Manager, PERFORMANCE PLUS®**

- Victoria has 10 years' experience within the Pulp & Paper Industry and is currently contracts support manager for EMEA, within John Crane's PERFORMANCE PLUS® team
- She works with customers to enable them to implement clear improvement strategies and training development programs for maintenance teams.
- Victoria has a HNC in Mechanical Engineering.

# Definition of Reliability

“The ability of equipment, machine, or system to consistently perform its intended or required function or mission, on demand and without degradation or failure.”

## **Maintenance Engineering:**

Focused on efficient  
maintenance and repair

**REACTIVE**

Repair it  
after it breaks

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**REACTIVE**

Repair it  
after it breaks

**Reliability Engineering:**  
Focused on  
eliminating failures

**PROACTIVE**

**Planned**  
Repair it  
before it  
breaks

**Defect  
Elimination**  
Don't repair  
it — eliminate  
the root cause

**World  
Class**  
Asset  
optimization

# Value of Getting Reliability Correct

**40–50%**

of operational budgets are often  
spent on maintenance management

Source: <https://raconteur.uberflip.com/i/959349-asset-management-special-report-2018>



# Value of Getting Reliability Correct

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On average, an unplanned maintenance activity takes **eight times longer** than a planned maintenance activity using a Computerised Maintenance Management System (CMMS) functionality and data set, resulting in significant time saving for the customer.



**UNPLANNED**  
maintenance activity

— VS —



**PLANNED**  
maintenance activity  
utilizing a CMMS functionality  
and data set

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# Value of Getting Reliability Correct

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**7-9 times**

reduction in maintenance costs by implementing a preventive maintenance strategy with a CMMS

**44%**



of unscheduled downtime in plants/factories is a result of aging equipment

**1/3**



of plants/factories spend more than 10% of their operating budget on maintenance

On average, an unplanned maintenance activity takes **eight times longer** than a planned maintenance activity using a Computerised Maintenance Management System (CMMS) functionality and data set, resulting in significant time saving for the customer.



**UNPLANNED**  
maintenance activity

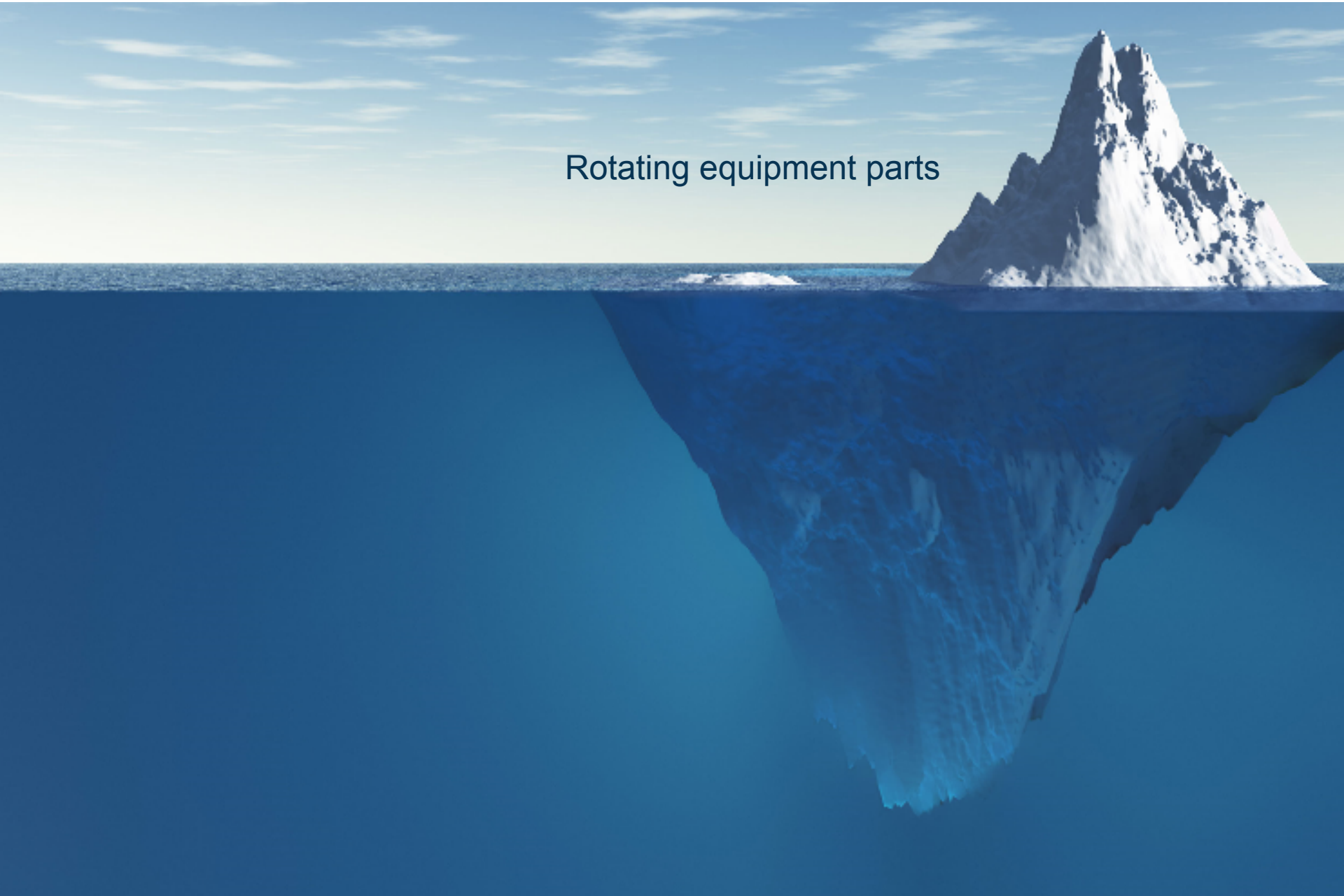
— VS —



**PLANNED**  
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Rotating equipment parts



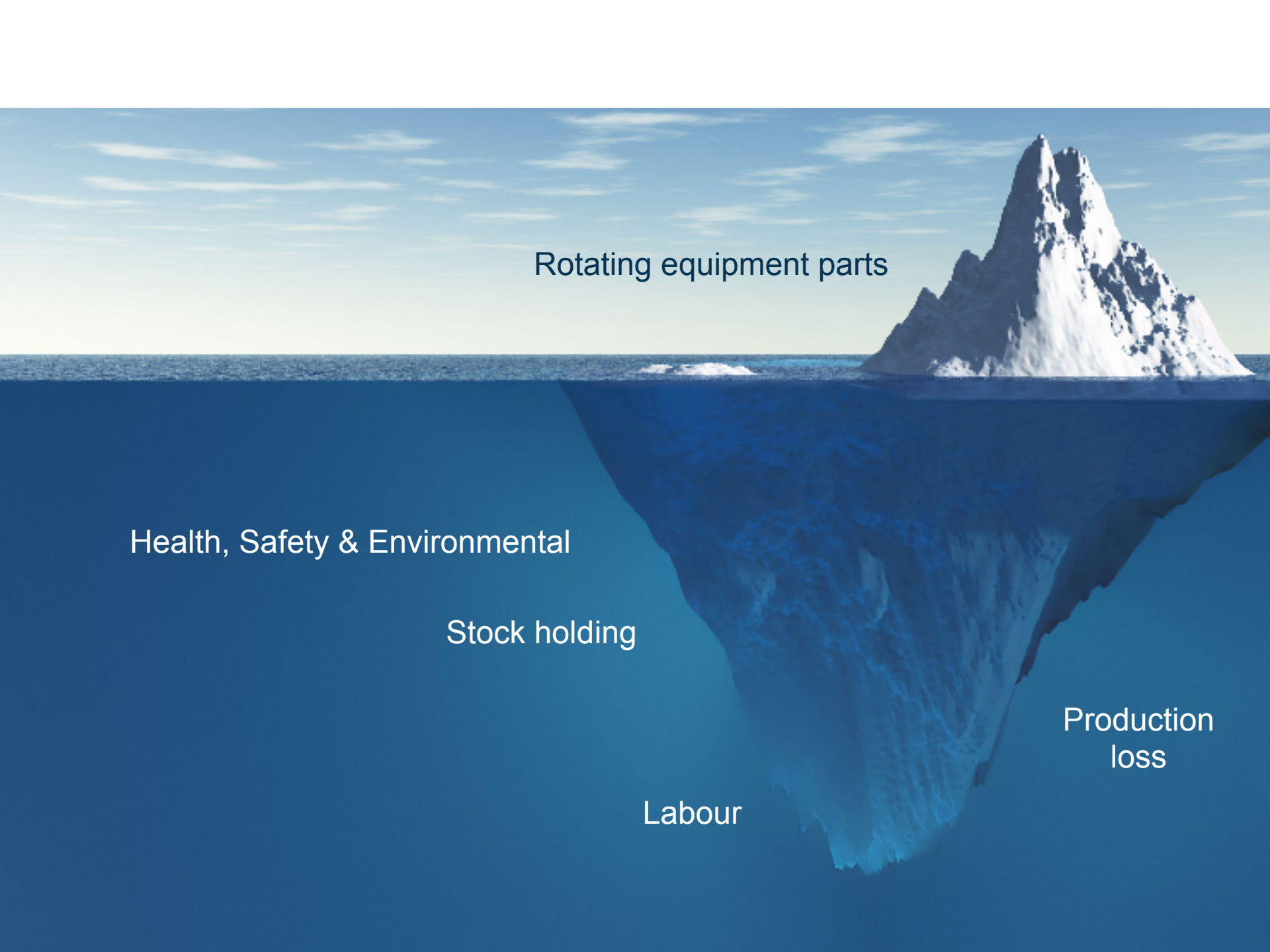
An iceberg floating in the ocean. The tip of the iceberg is above the water surface, and the much larger base is submerged below. The sky is blue with light clouds, and the water is a deep blue. The text 'Rotating equipment parts' is positioned above the water line, while 'Health, Safety & Environmental' and 'Stock holding' are positioned below the water line.

Rotating equipment parts

Health, Safety & Environmental

Stock holding





Rotating equipment parts

Health, Safety & Environmental

Stock holding

Production  
loss

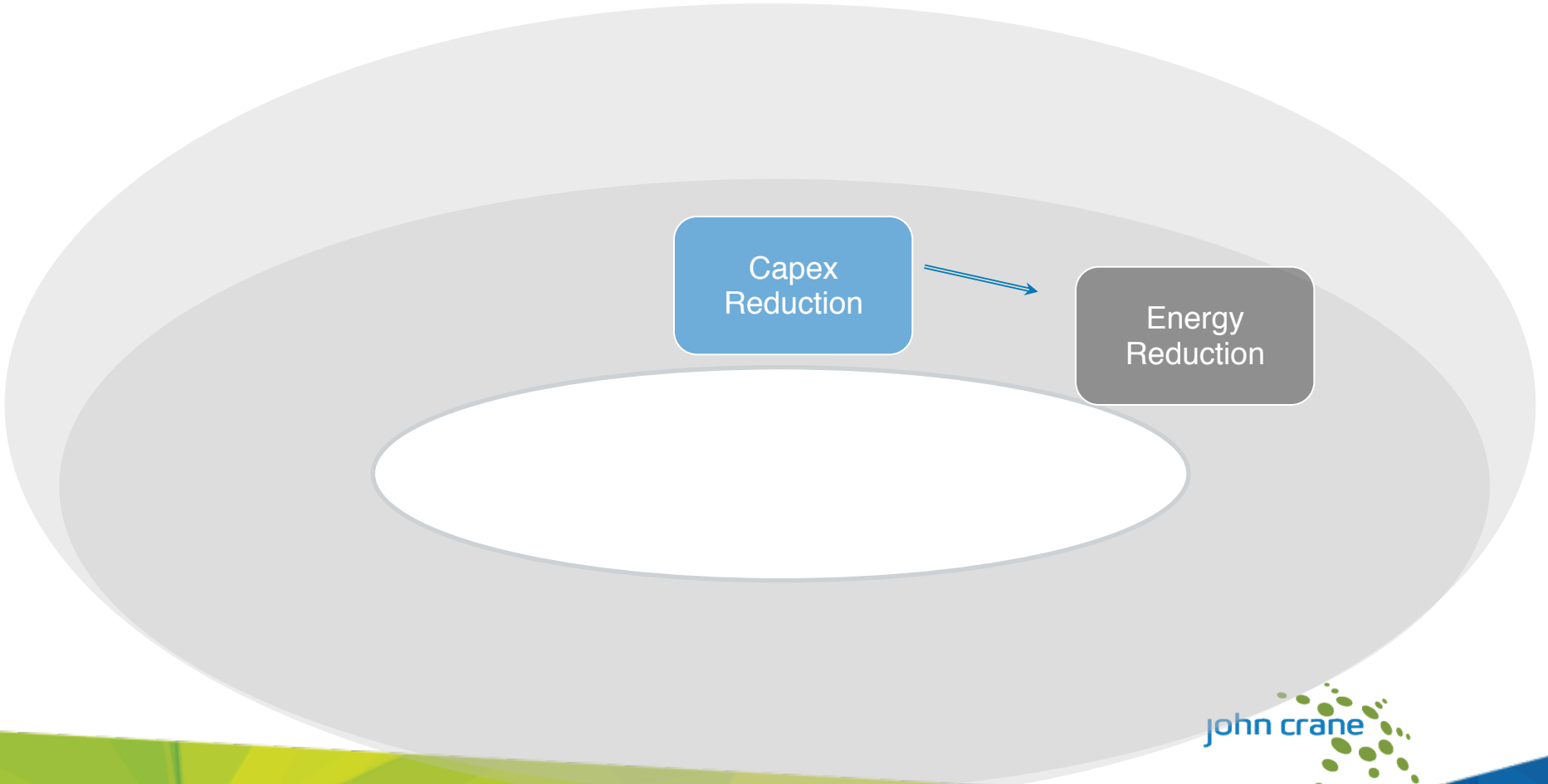
Labour



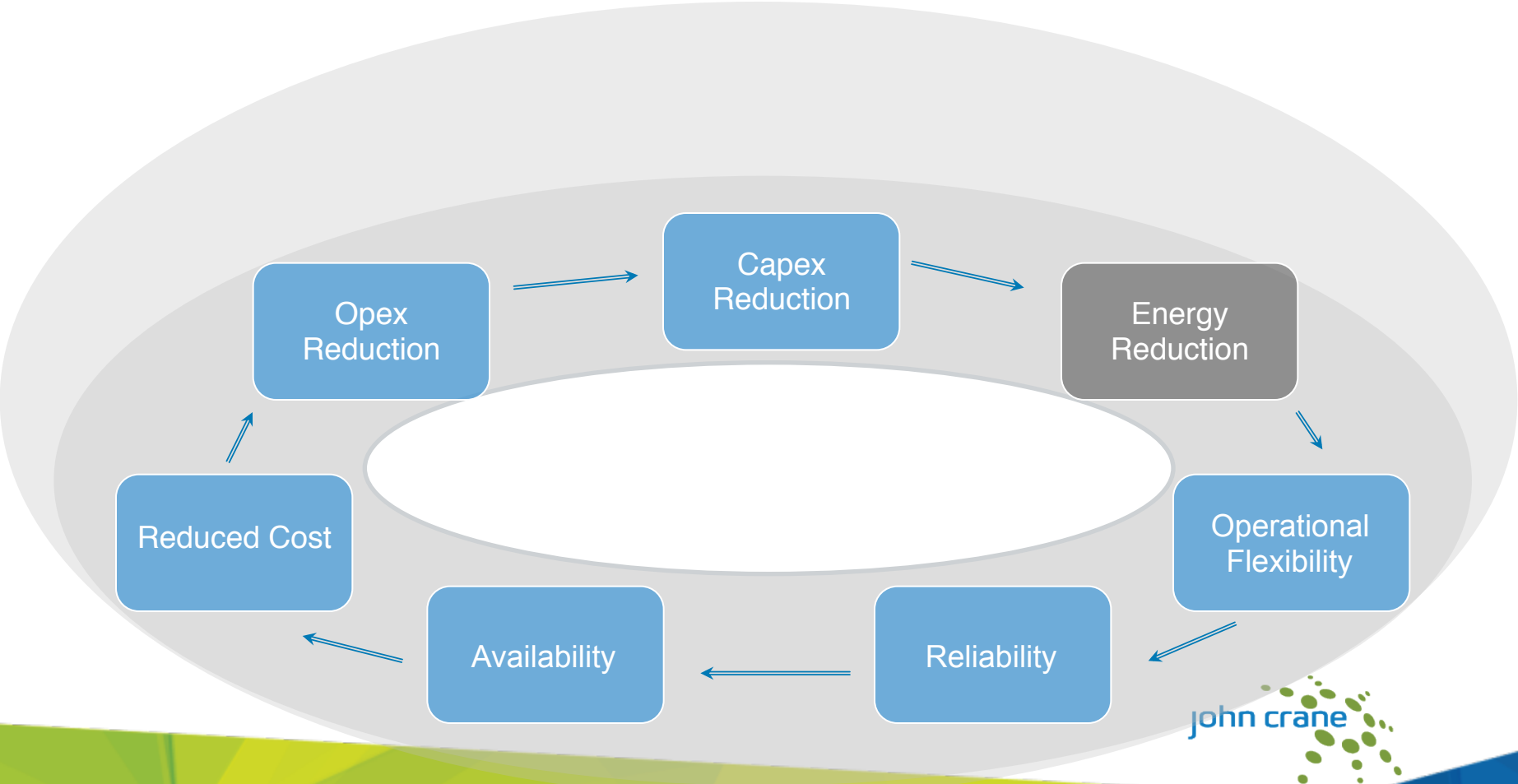
# Total Cost of Ownership



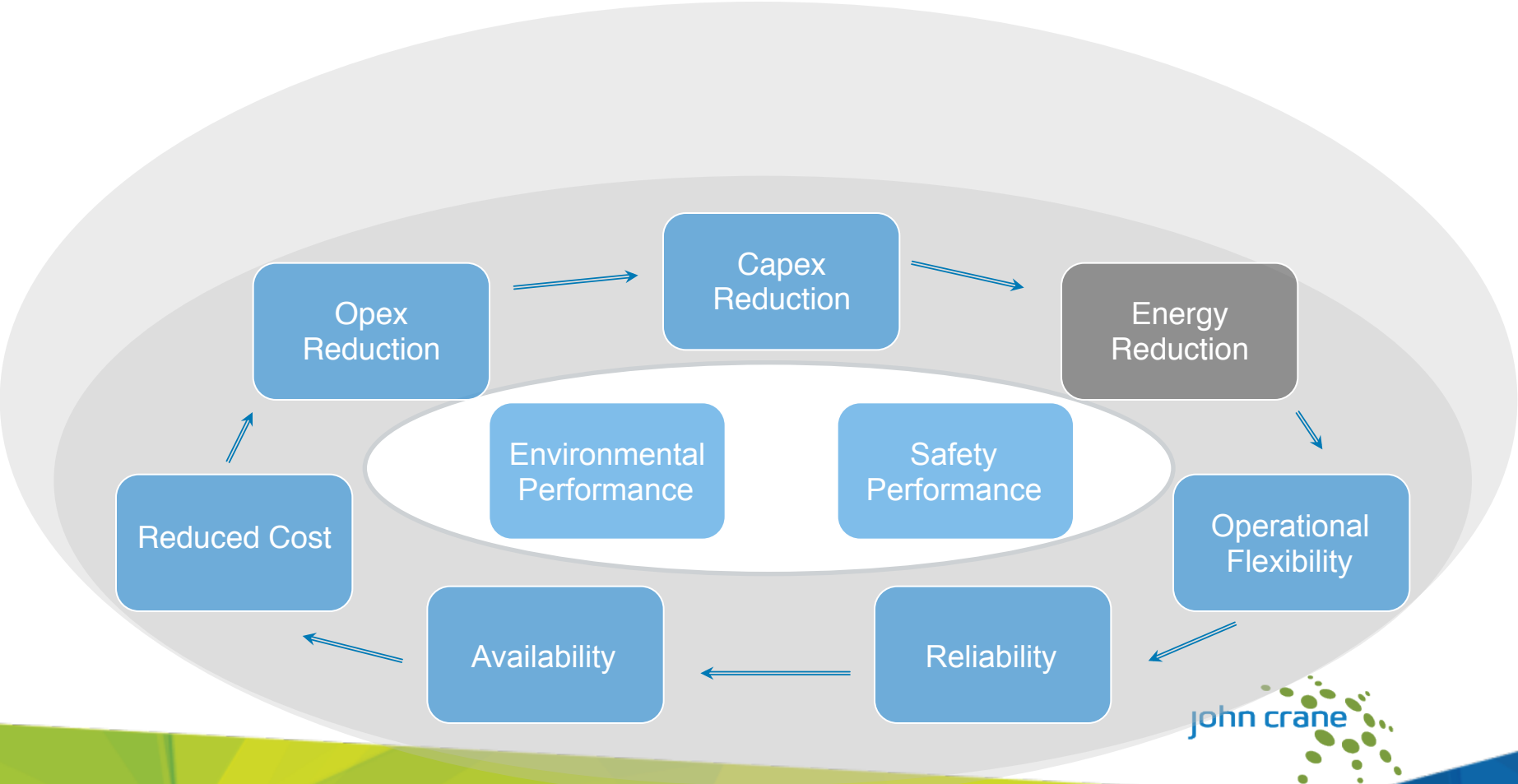
# Business Drivers



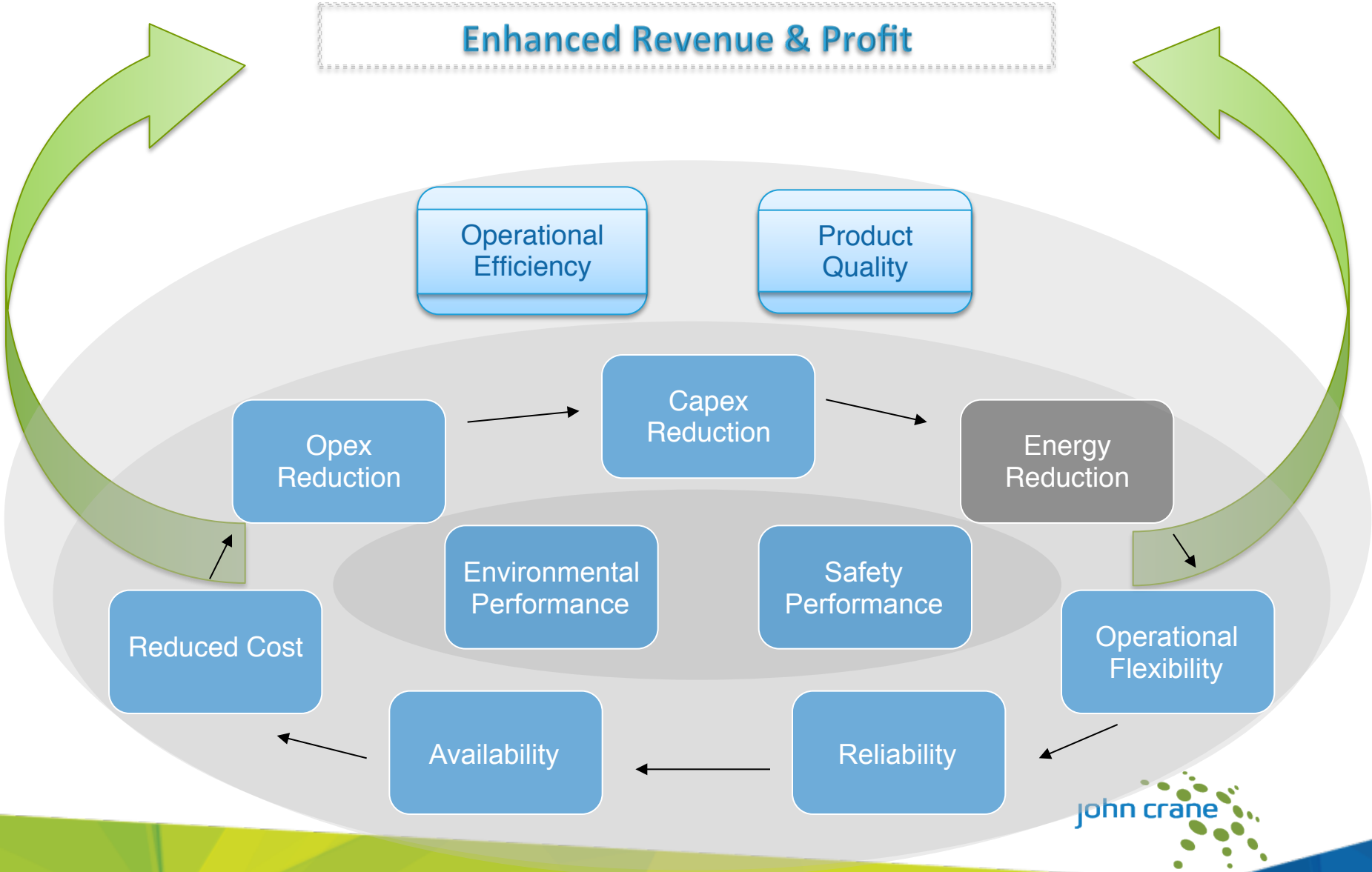
# Business Drivers



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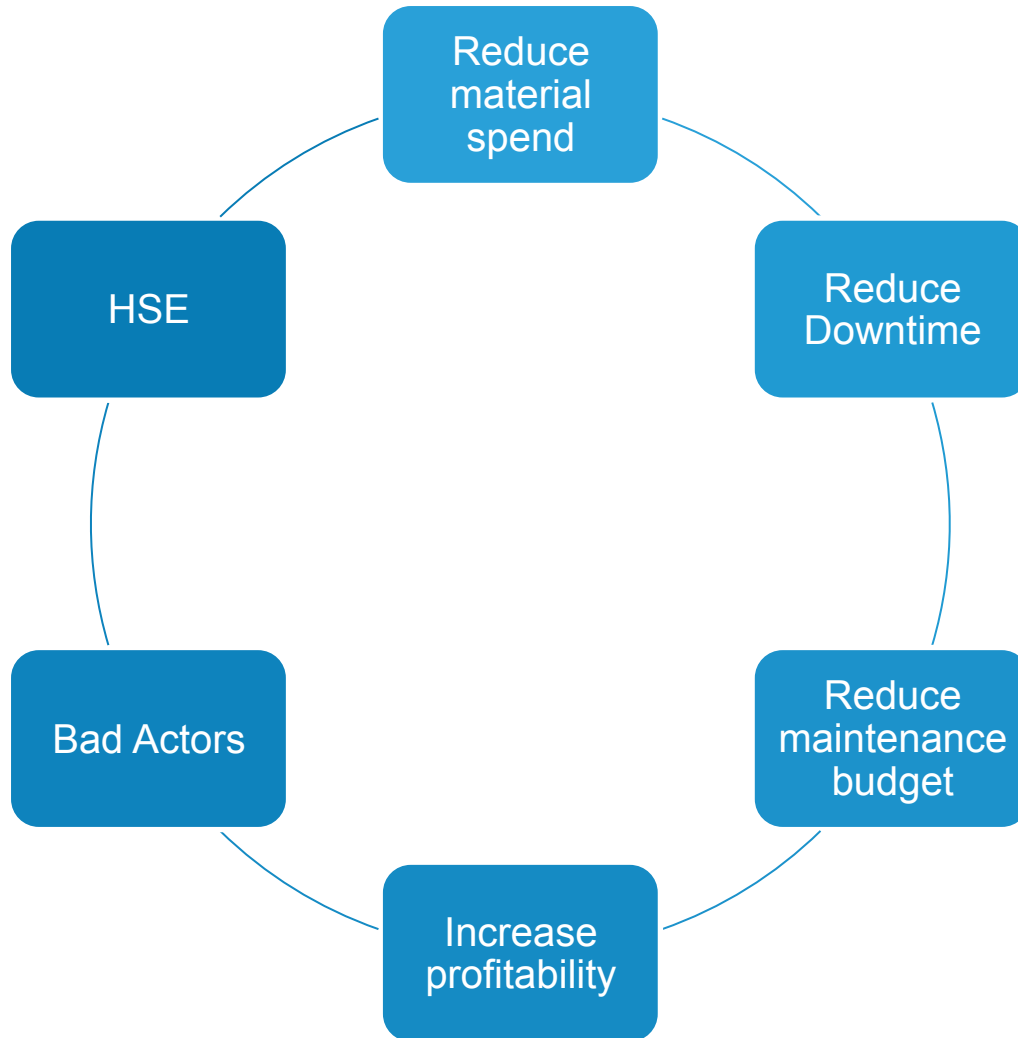


Great ...  
We know this already

In summary

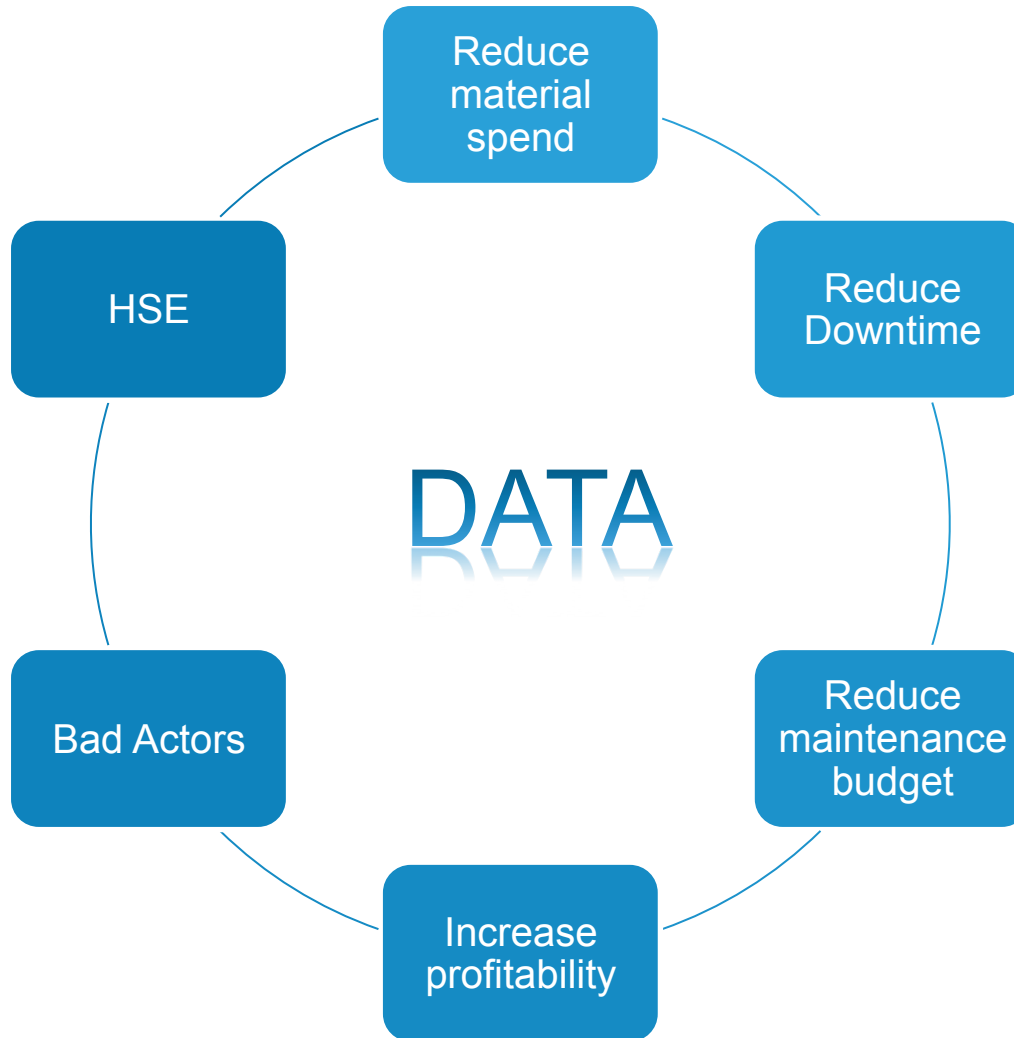


# Where Should The Focus Be?





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# Data vs. Information

# Data vs. Information

## Complete

Ensures  
**all assets**  
are known and  
considered

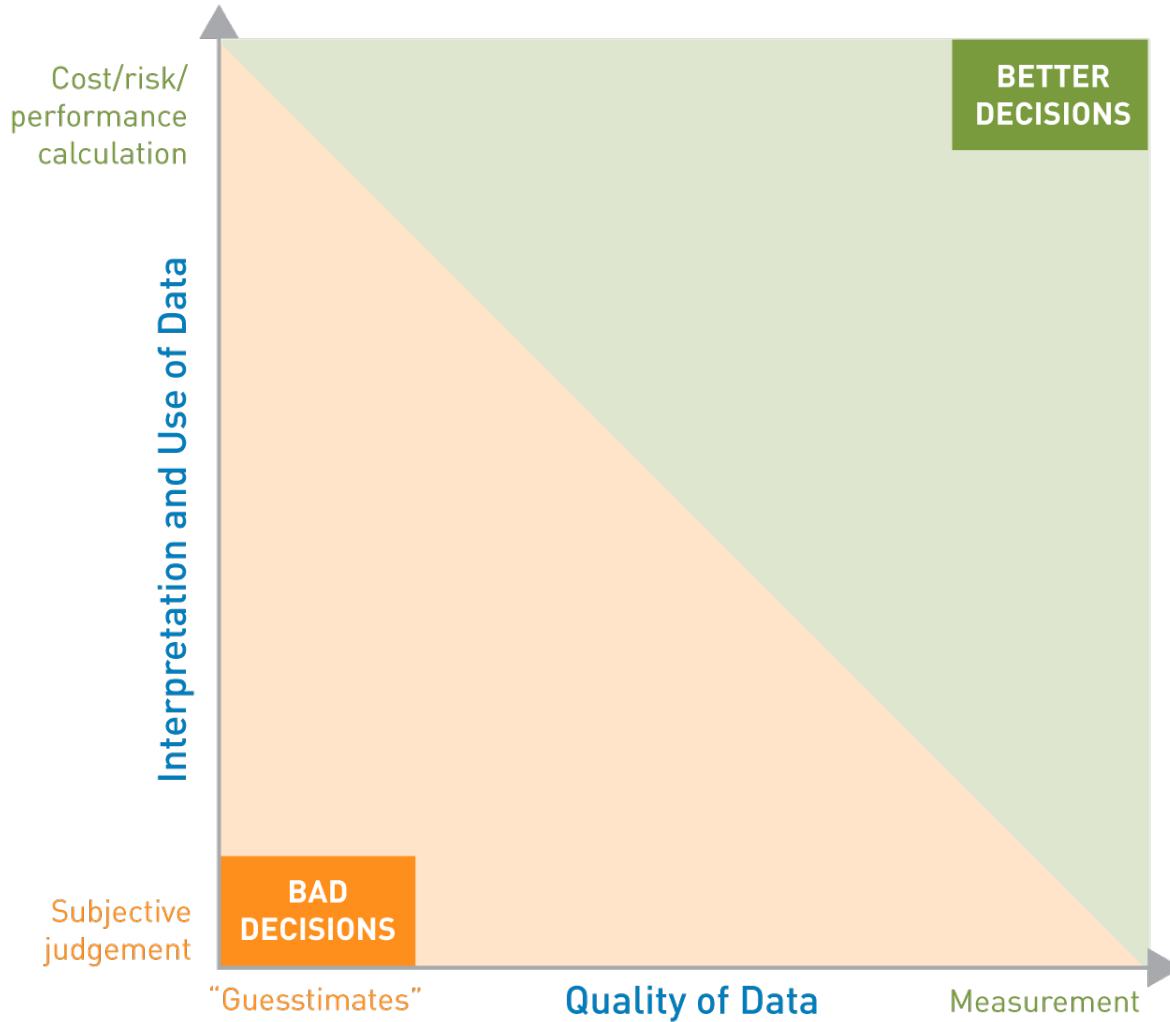
## Accurate

Ensures **all**  
**requirements** are  
considered

## Drive Actions

The ability to  
assign **correct**  
**maintenance**  
**strategy**

# Poor Data = Poor Decision Making



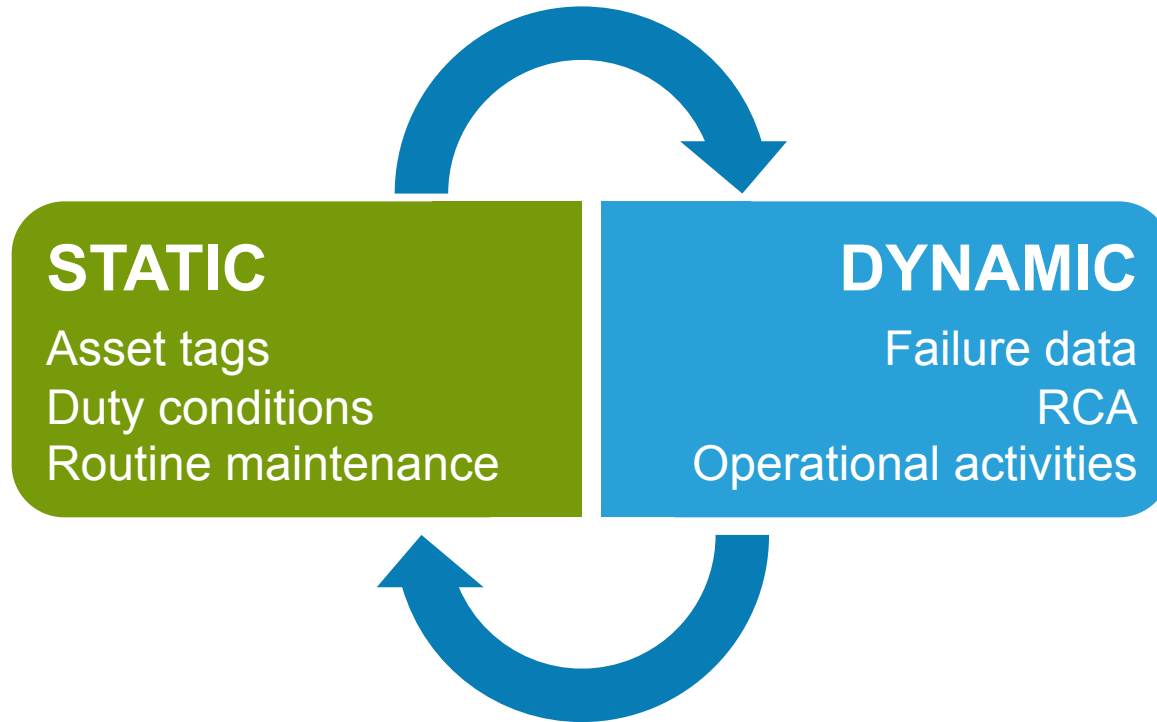
# What Data Affects

**Data** affects  
accuracy of  
**maintenance**  
routines

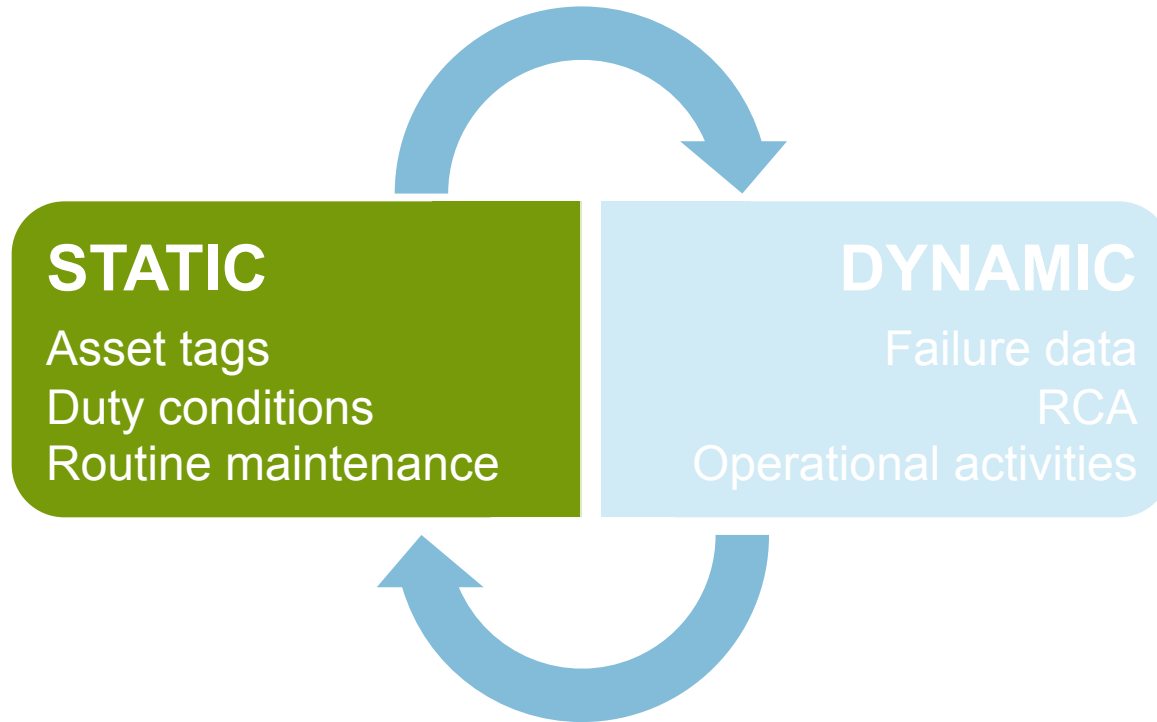
which affects  
**reliability**  
performance

which affects  
**Total Cost of**  
**Ownership**

# Data



# Data



## STATIC

Asset tags  
Duty conditions  
Routine maintenance

All assets recorded

Records accurate and up-to-date

Failure modes assigned to  
equipment categories

Planned maintenance activities  
assigned to failure modes



# Is Your Static Data Working For You?

- Can you measure MTBR for your critical assets?

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- How efficient are your maintenance routes and how would you review this?

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- How well does your CMMS record your maintenance processes?
- Are you carrying out your maintenance process but still experiencing unexpected breakdowns?
- How easy is it to update your maintenance strategies?
- How does your maintenance process consider criticality?
- How easy is it to find maintenance processes within your CMMS?
- How efficient are your maintenance routes and how would you review this?
- Do you know why maintenance is assigned?



# Is Your Static Data Working For You?

## **Poll Question:**

Are all of your maintainable assets recorded in your CMMS?



# Case Study

## Upstream Oil and Gas

### BACKGROUND

Industry: Upstream oil & gas

Location: North Sea

End Product: Crude oil

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“Data within the customer’s current CMMS was incomplete, duplicated or missing. They needed to bridge this data gap to increase operational efficiency and reduce safety and environmental risks.”

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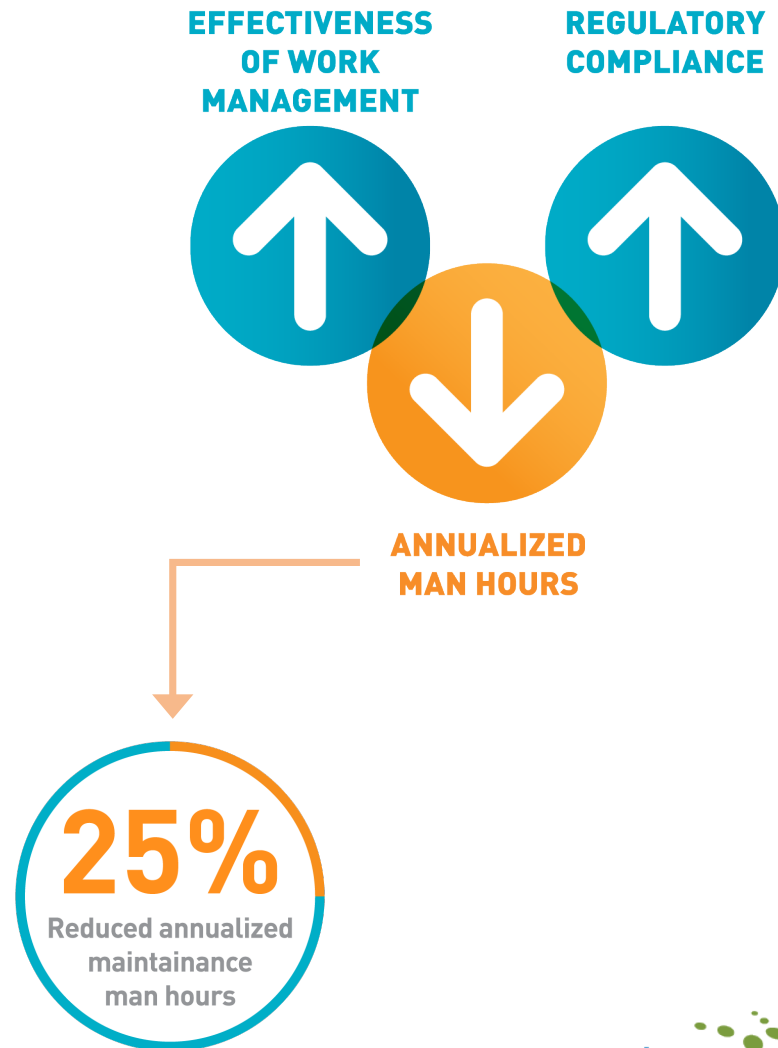
### SOLUTION

- The customer chose us to support them. Our team understood the customer’s practices and operations, as well as the data.
- The team undertook a structured process to cleanse the data within the customer’s system, using proprietary CMMS data builder and optimization software.
- Data cleansing identified:
  - Deficiencies in existing records
  - Key business critical data items
  - Safety backlog, justifying changes/reductions via quality data
  - Out of service equipment, which does not need maintenance assigning

# Case Study

## RESULTS

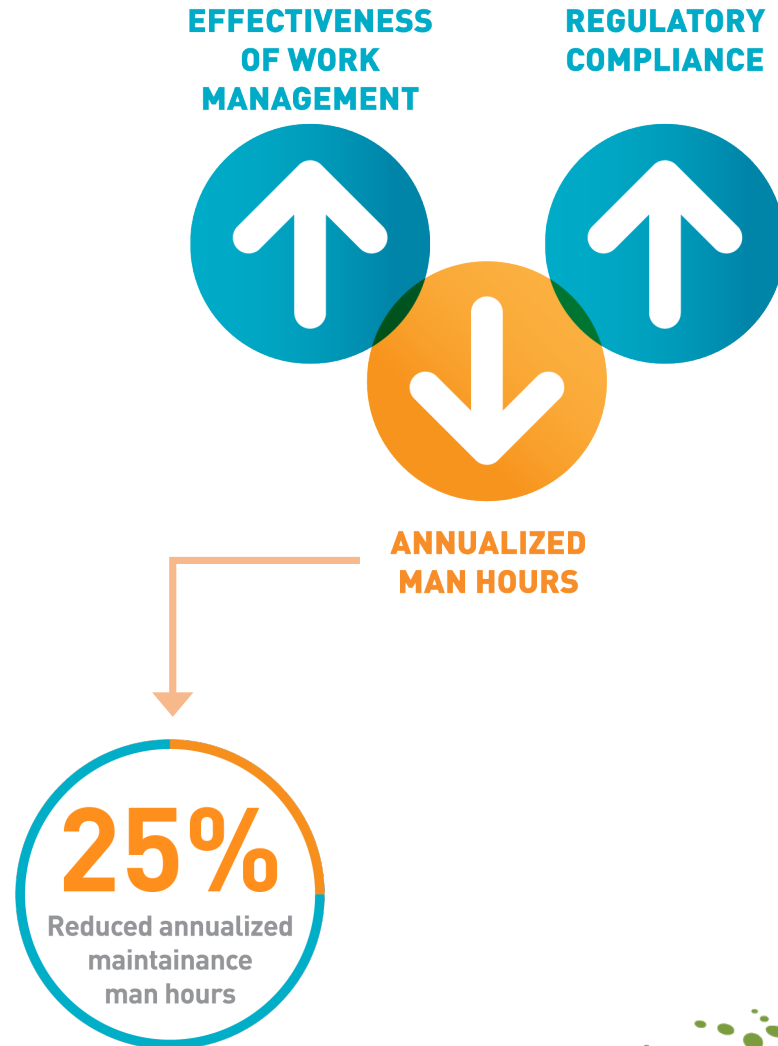
- After the data cleanse, the customer achieved regulatory compliance.
- The CMMS held a correct asset population, and updated maintenance schedules and activities were aligned within the system, significantly reducing the risk of future health, safety and environmental issues.



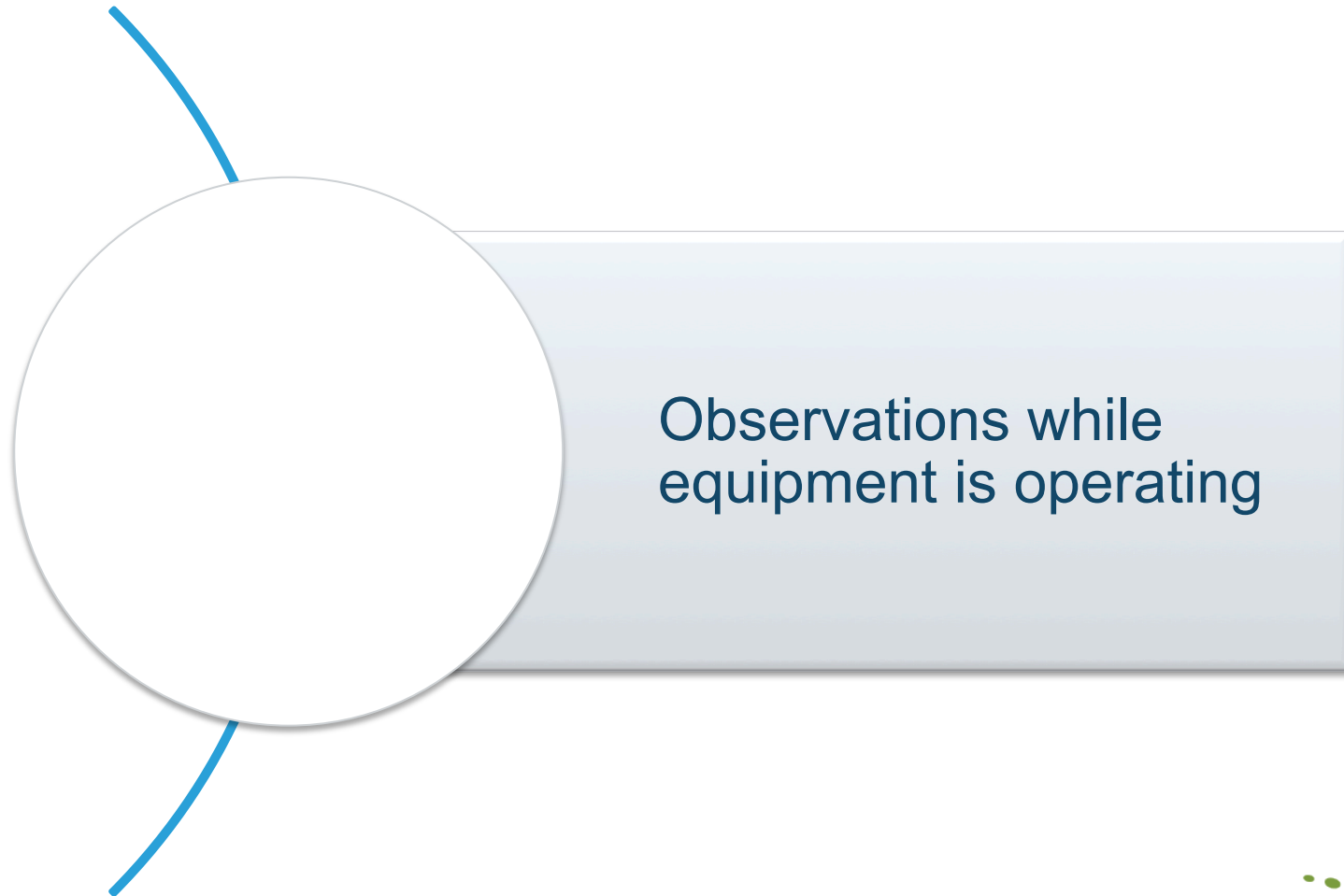
# Case Study

## RESULTS

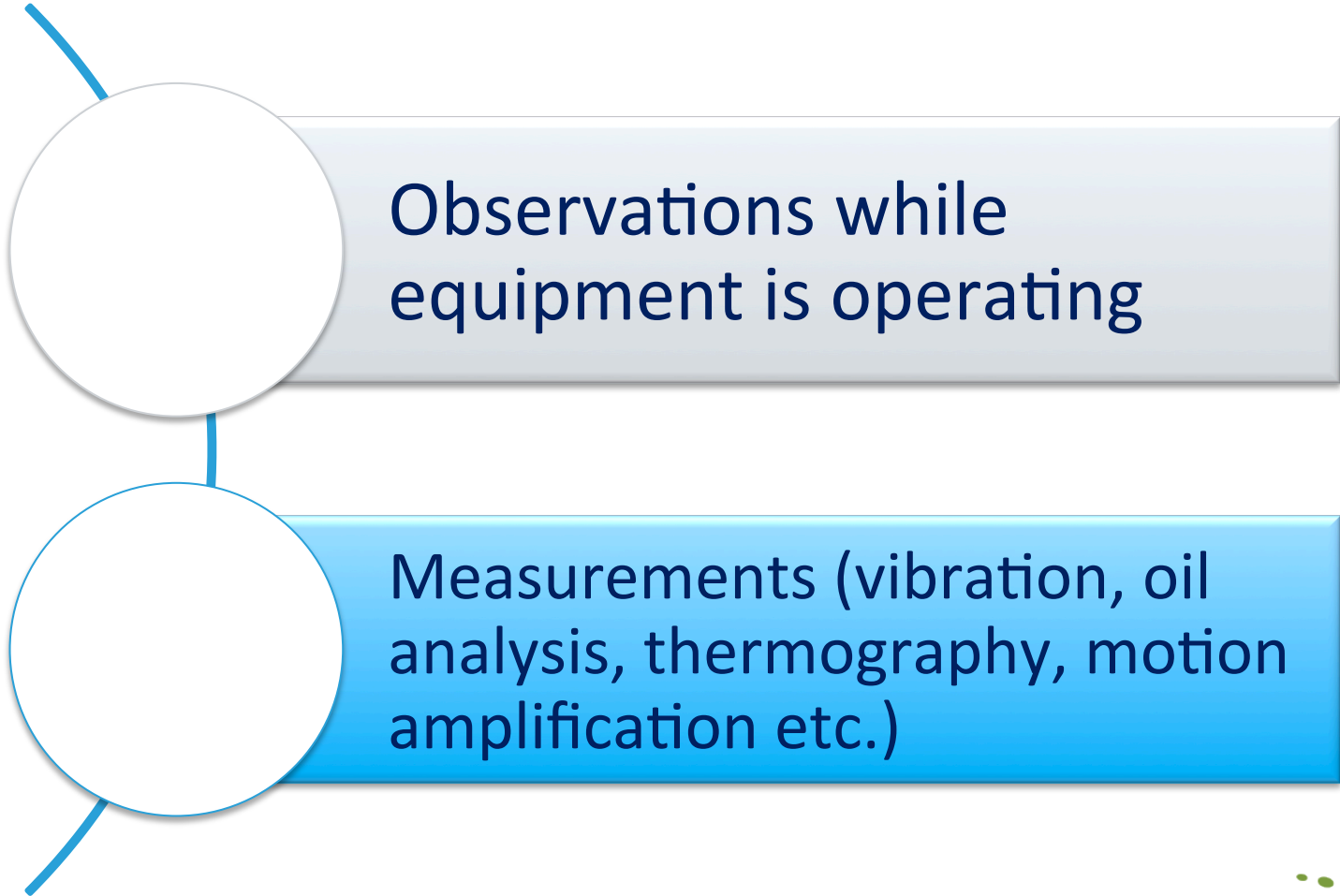
- After the data cleanse, the customer achieved regulatory compliance.
- The CMMS held a correct asset population, and updated maintenance schedules and activities were aligned within the system, significantly reducing the risk of future health, safety and environmental issues.
- The customer saw a **reduction of 14,000 annualized man hours**, equating to approximately **\$1.6M USD (£1.2M GBP)** in cost savings on maintenance and operations costs.



# Dynamic Data



# Dynamic Data



Observations while  
equipment is operating

Measurements (vibration, oil  
analysis, thermography, motion  
amplification etc.)



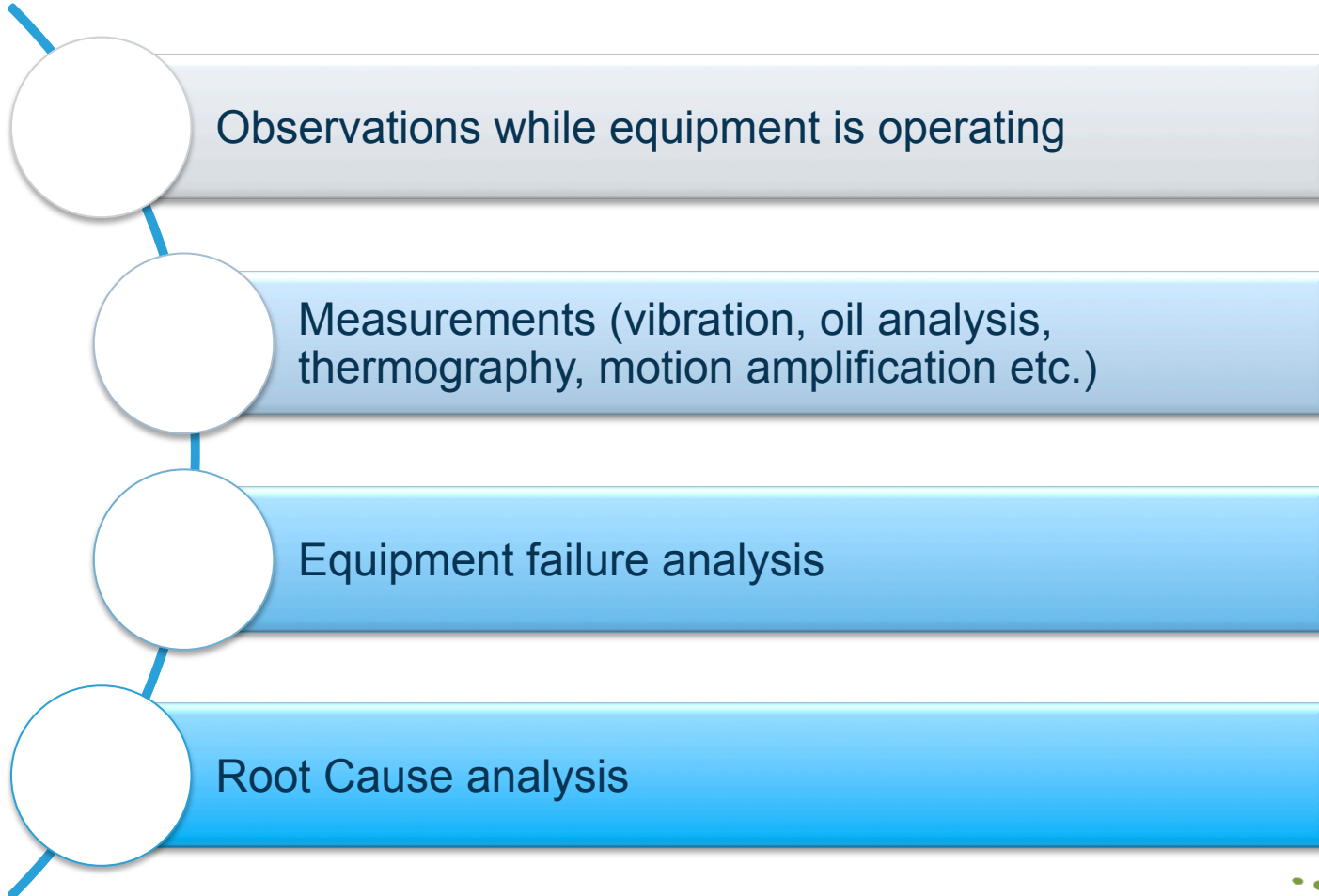
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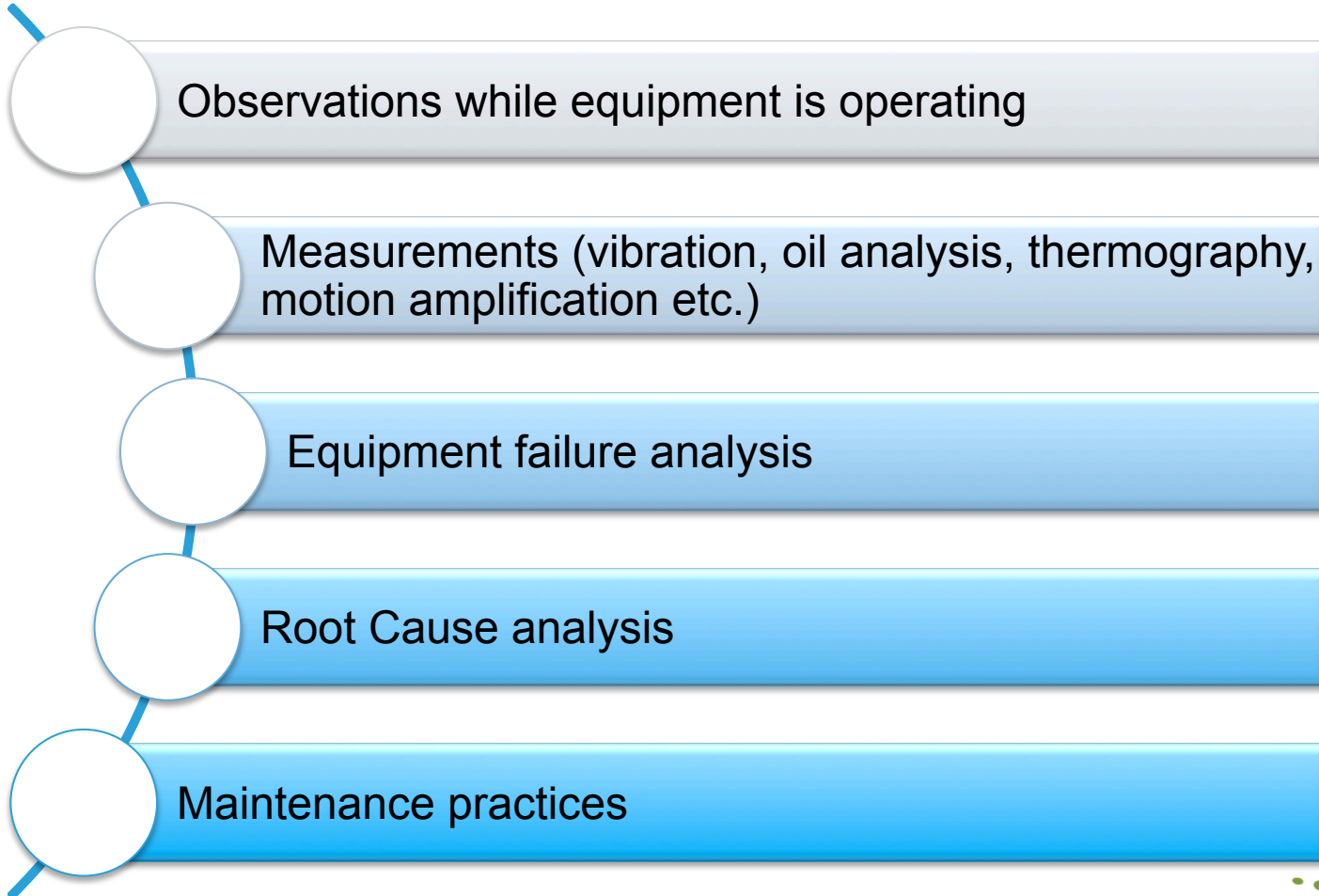
Measurements (vibration, oil analysis, thermography, motion amplification etc.)

Equipment failure analysis

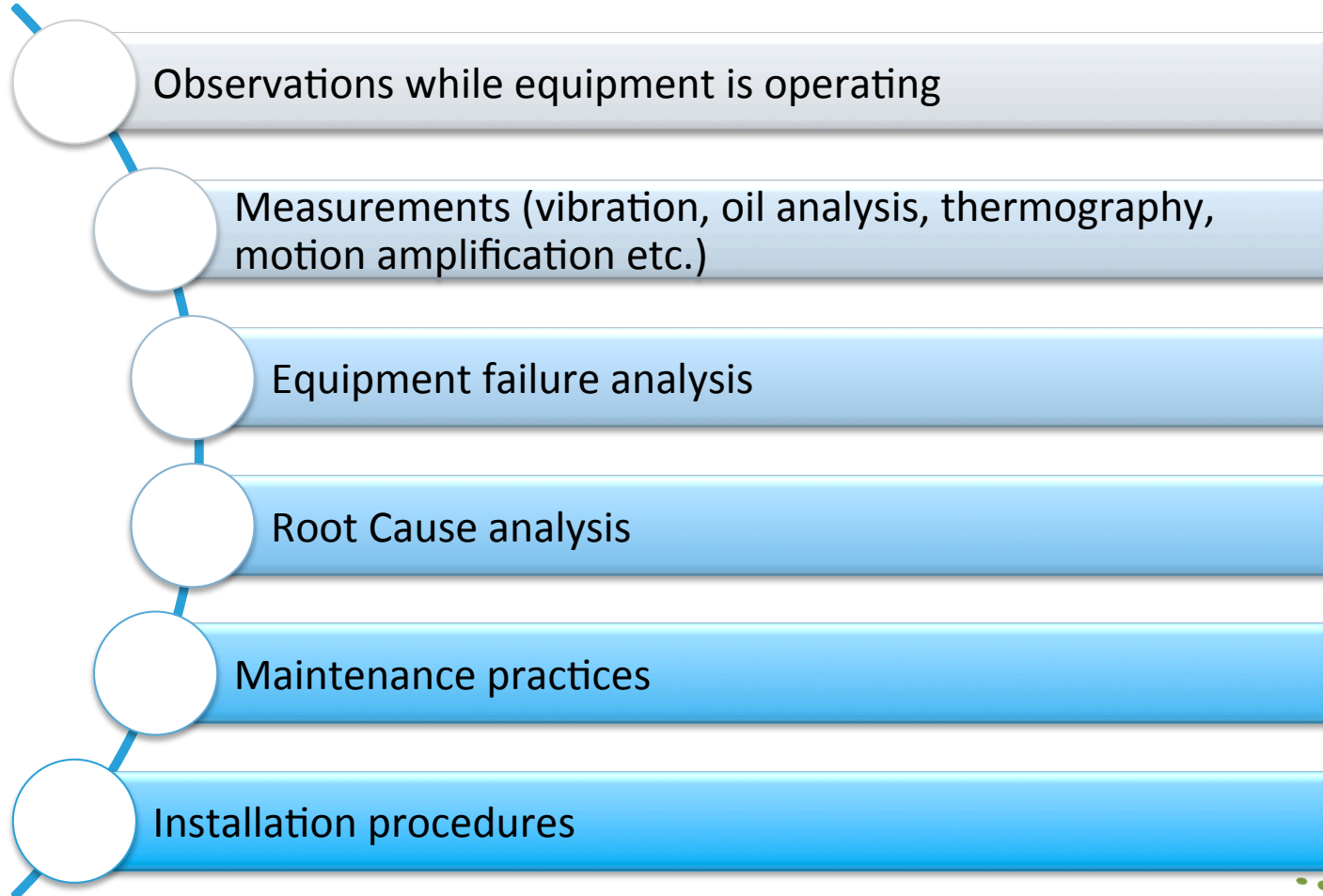
# Dynamic Data



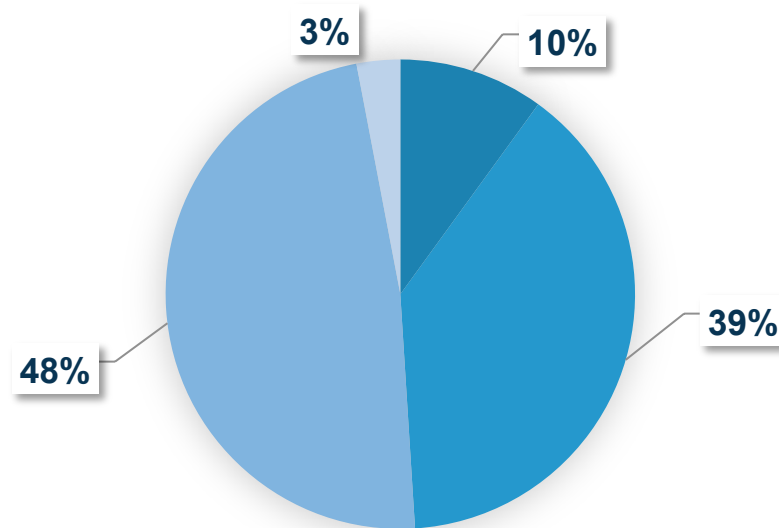
# Dynamic Data



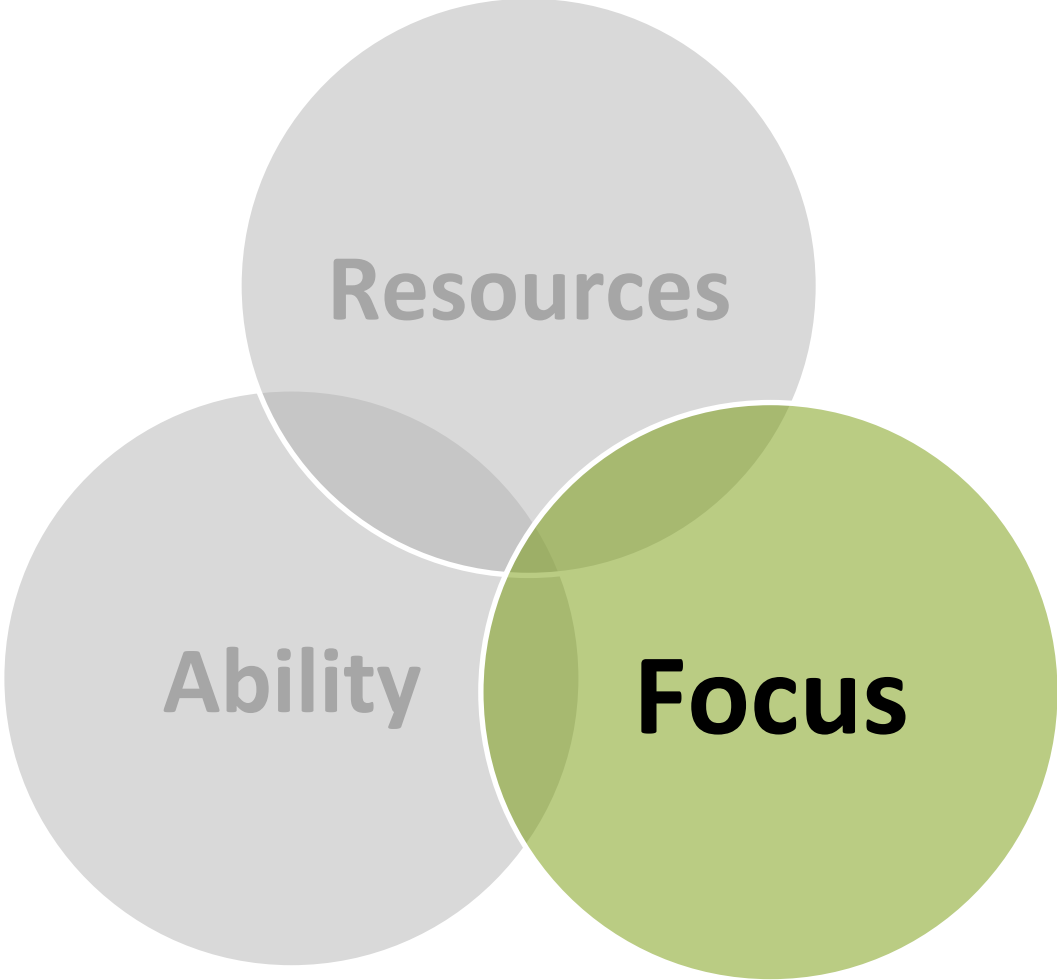
# Dynamic Data



# Using Dynamic Data to Find Causes of Failure



- **10% outages result from bearing failures.....and**
- **39% of outages resulting from off-specification operation**  
**Process goes out of tolerance**  
**Changes in pump use**  
**Incorrect selection.....and**
- **48% of outages result from direct operational / maintenance handling**



# What Information a Performance Program Should Give You..

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Training



# What Information a Performance Program Should Give You...



Training



Reporting

# What Information a Performance Program Should Give You...



Training



Reporting



Recommendations

# Case Study: Example 1

## Oil Refinery

### BACKGROUND

Industry: Oil Refinery

Location: Texas, US

End Product: Transportation fuels & solvents

### SOLUTION

- An in depth analysis was undertaken, calling on opinions from a range of specialists.
- The site accepted the analysis that there was no indication that this vibration behaviour would lead to a catastrophic failure.
- Monitoring was increased to weekly to manage the risk, and the **maintenance was deferred with confidence** until after the turnaround.



“ Soon after the commencement of the John Crane CBM Service contract the site highlighted a concern they had with this un-spared blower. The site were preparing to pull the blower for repair ahead of the turnaround, but the product cost was very high, so this was not an opportune moment for this.”

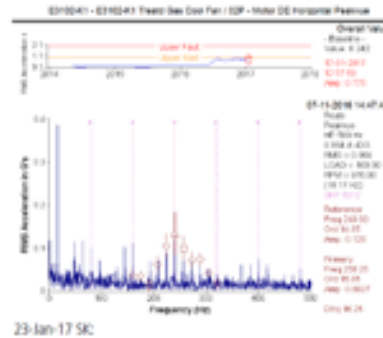
# Case Study: Example 1

## RESULTS

- John Crane analysis has given the client confidence to delay the repair work and **extend the life of this equipment.**
- The blower has run without deterioration for this duration and maintenance is scheduled for a **more opportune time.**
- This has resulted in significant production savings, estimated by the site at **\$4 million**

### Analysis:

24-Jan-17 SAC: Recent analysis of the motor vibration shows an increase in the overall velocity levels at the motor DE, more notable at the horizontal measurement point, having increased from 4.4 mm/s rms to 5.0 mm/s rms. PeakVue acceleration levels are elevated against the historical trend data at an amplitude of 0.37 g's rms, with the presence of inner race defect frequencies, accompanied by the multiple 1x rpm sidebands, which are also a characteristic of an inner race bearing defect, these can also be seen in the velocity spectrum.



Will advise accordingly when these tests have been carried out/reviewed.

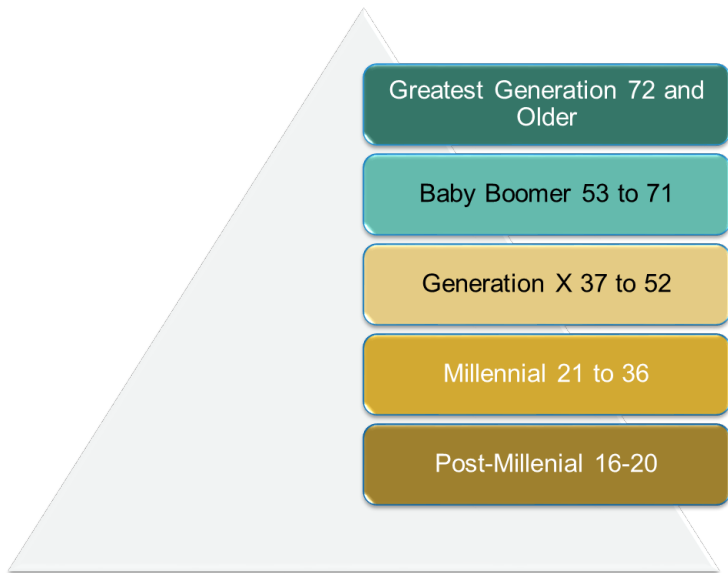
### ACTION BY: Mechanical Technician

1246-R01 H5501B-K1 Boiler	Action	25-Oct-16	25-Oct-16	wo N	1341345 10351109	<b>Increase in unit vibration at 1x rpm</b> It is recommended to inspect the fan for build up on blades or damage, and rectify if possible.
1261-R01 G3104B Rich Amine Pump	Warning	09-Dec-16	09-Dec-16	wo N		<b>Possible developing Defect or Skidding - Motor DE</b> Frequency of monitoring to be increased to two weekly on a temporary basis to develop a better trend and to see if there are any increases in the overall velocity levels.  If no change is noted in a couple of months then the frequency will return to nor
1259-R01 G3106A Amine Transfer Pump	Information	24-Nov-16	24-Nov-16	wo N	1349349 10359791	<b>Water in Oil</b> Drain flush and replenish the sump oil. Ensure the Denco Oiler is seated correctly to prevent water ingress.

# Workforce Generations

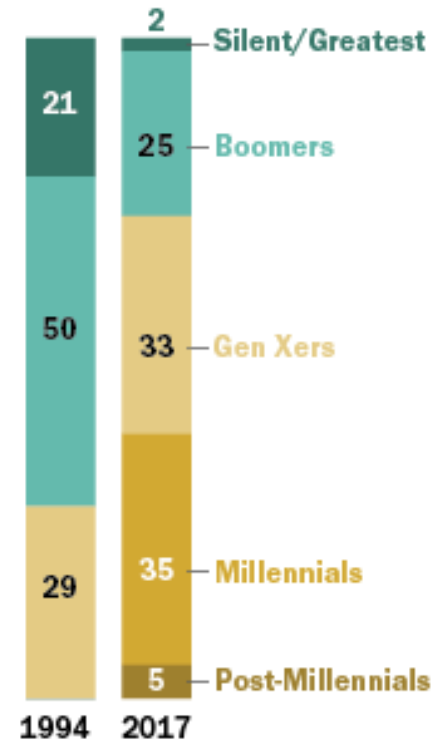
# Workforce Generations

**ABILITY :**  
According to Pew Research  
Millennials now makeup  
1/3 of the total US  
Workforce



## More than a third of the workforce are Millennials

*% of the U.S. labor force*




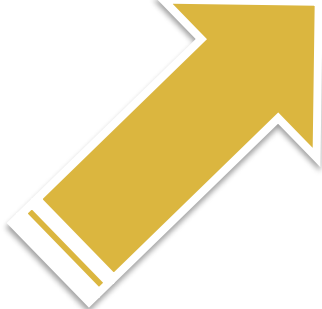
Note: Labor force includes those ages 16 and older who are working or looking for work. Annual averages shown.  
Source: Pew Research Center analysis of monthly 1994 and 2017 Current Population Survey (IPUMS).

**PEW RESEARCH CENTER**



# More importantly “The Great Crew Change” has begun

Industry	Millennial 21 to 36	Generation X 37 to 52	Baby Boom 53 to 71
Paper manufacturing and printing	229	398	266
Petroleum refining	45	89	37
Chemicals manufacturing	329	685	301
Plastics / rubber manufacturing	155	242	125
<b>Totals</b>	<b>758K</b>	<b>1,414K</b>	<b>729K</b>



Source : <https://www.bls.gov/cps/cpsaat18b.htm>

Assuming the working age in these industries began at 22:

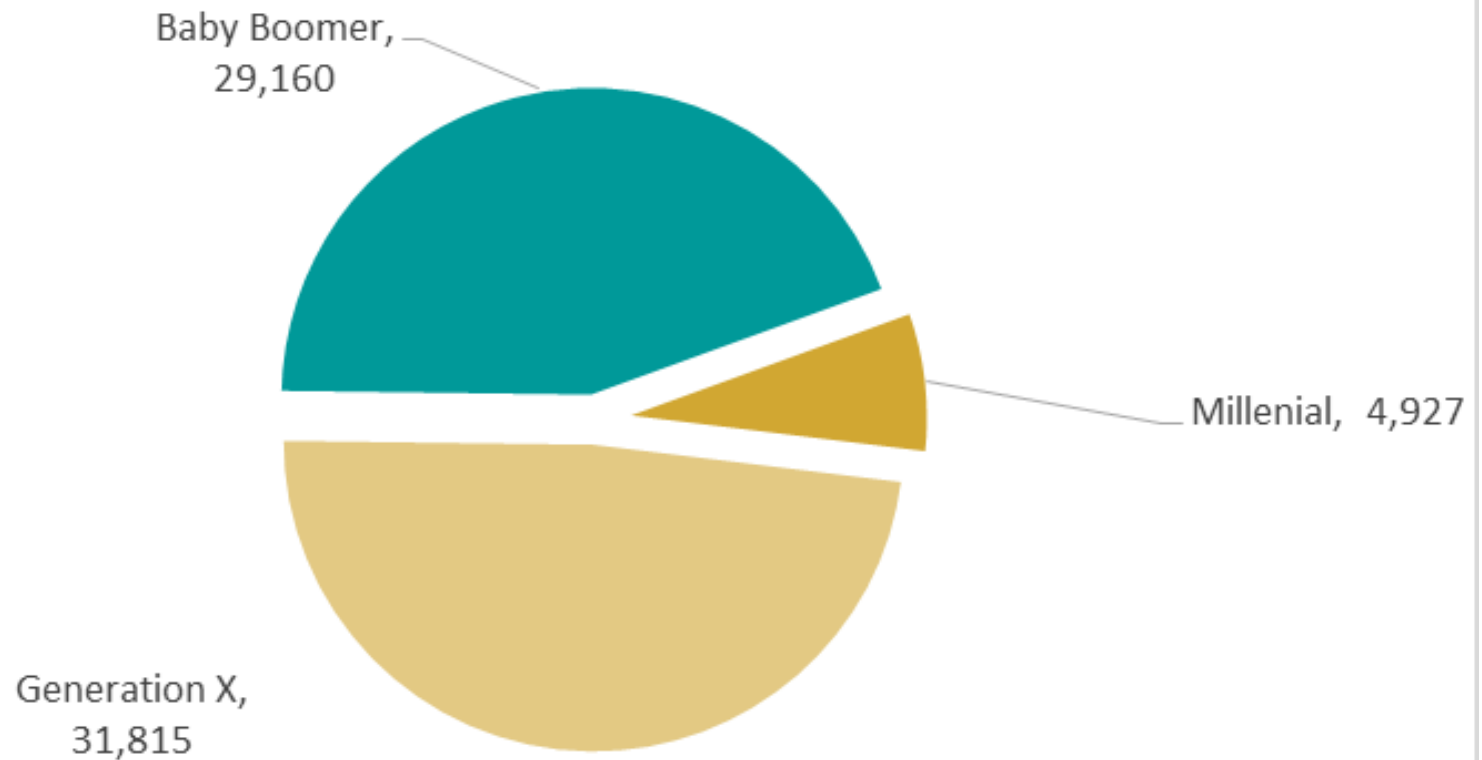
**Avg**  
**Generation**  
**Age**

**Work Experience:**  
Assuming  
Professional  
Working age Begins  
at 22

<b>29</b>	<b>7</b>	<b>Millennial</b>
<b>45</b>	<b>23</b>	<b>Generation X</b>
<b>62</b>	<b>40</b>	<b>Baby Boomer</b>



## Accumulated Wisdom (Working Years in Thousands)



# Case Study: Example 2

## Oil & Gas

### BACKGROUND

**Industry:** Oil & Gas

**Location:** Scandinavia

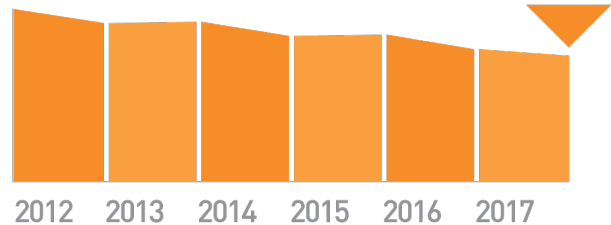
**End Product:** Chemicals, fossil fuels, lubricants and renewable fuels

“Due to an aging workforce and the upcoming retirement of knowledgeable oil & gas engineers, local expertise and knowledge of the plant’s operations was decreasing.”

### HIGHLIGHTS

- Customer needed to secure and increase equipment reliability through outsourcing seal expertise due to retiring workforce and lack of local engineering expertise.
- In 2012 John Crane supported the customer’s two sites to improve their reliability through a five-year PERFORMANACE PLUS® Managed Reliability program (MRP) which included training of the customer’s workforce to increase local knowledge and expertise.
- **By the end of the contract, MTBR has increased by 5% each year and total cost of ownership (TCO) reduced by 23%.**

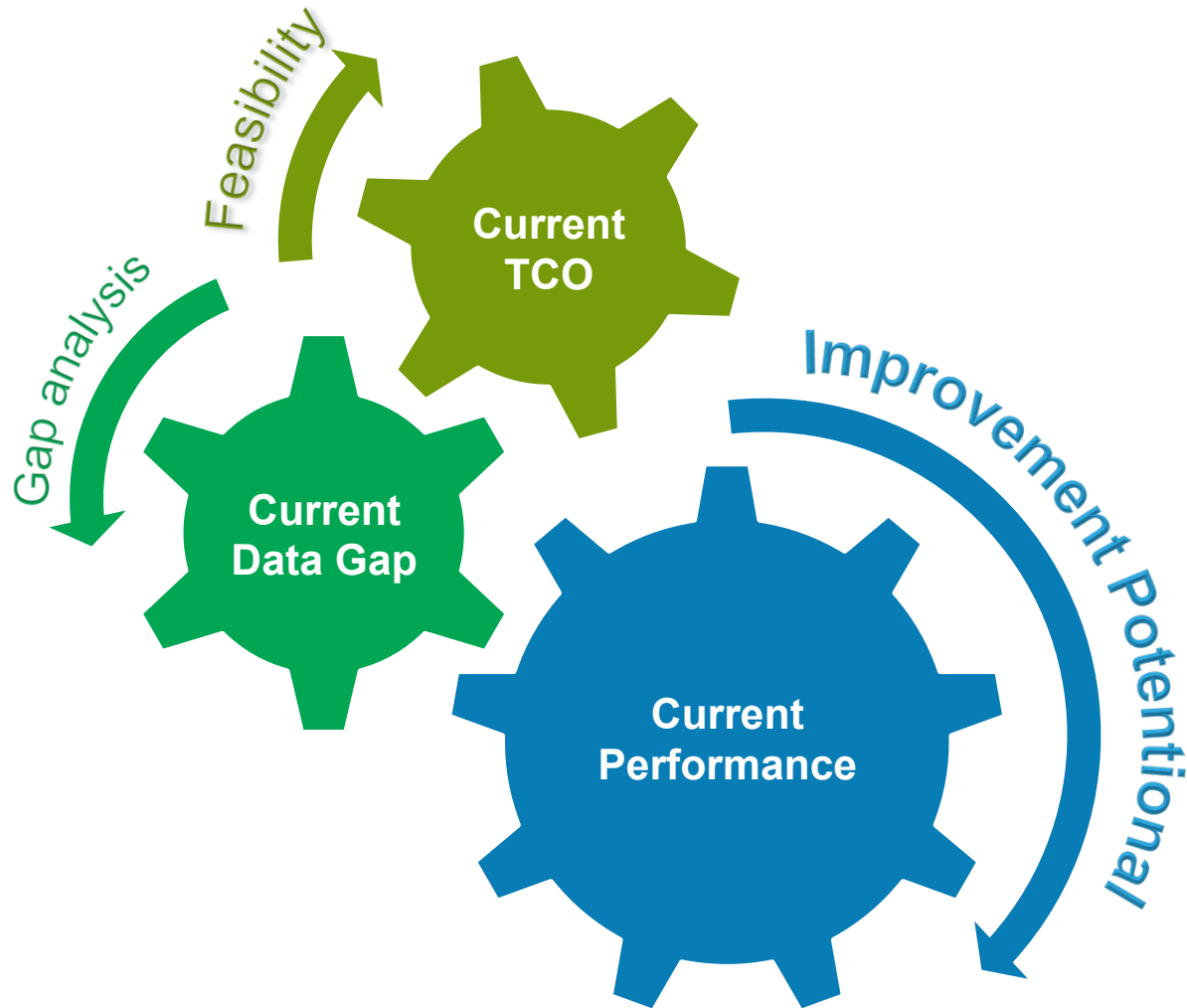
Total cost of ownership



# In Summary

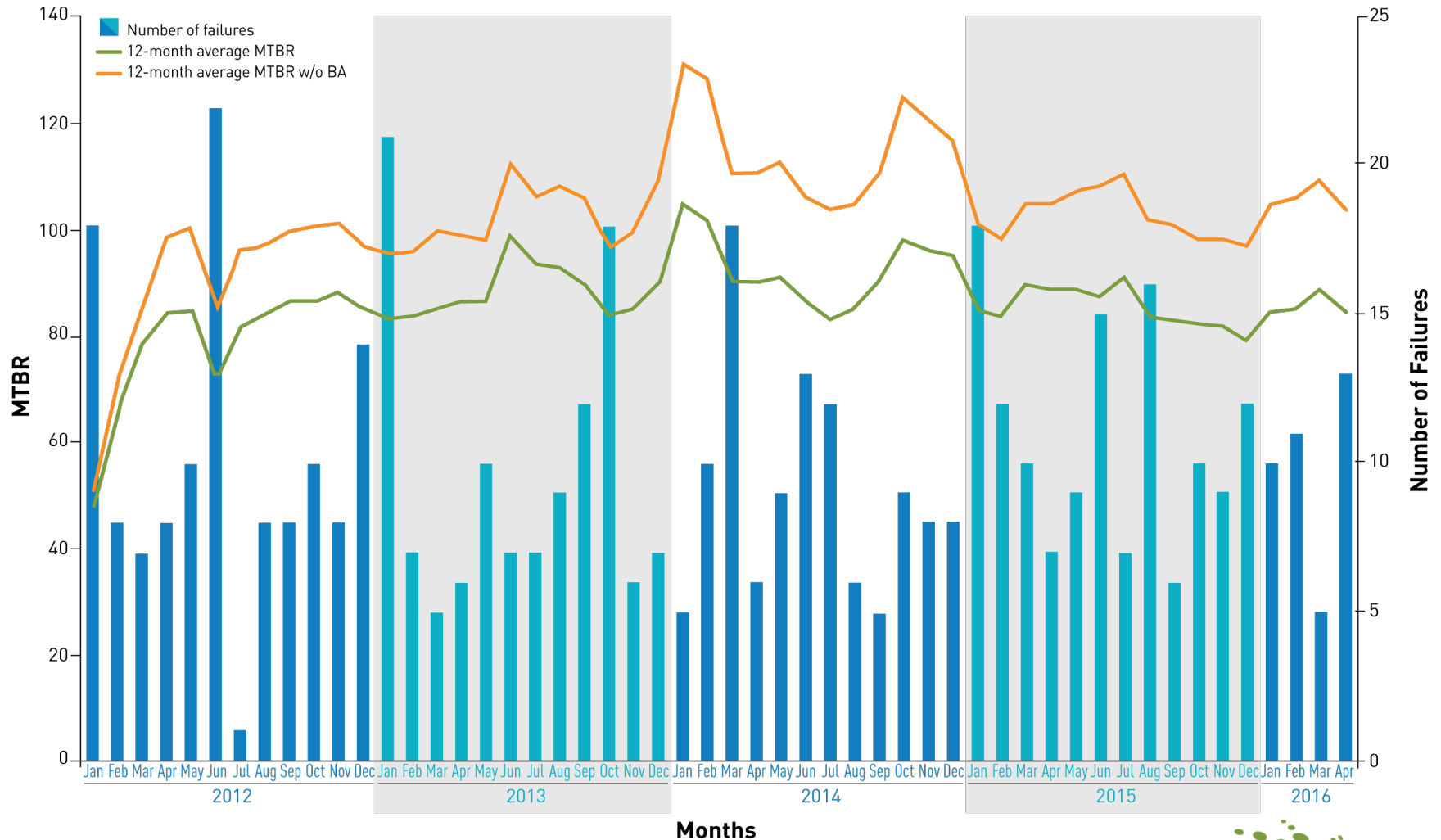


# What's the Starting Point?

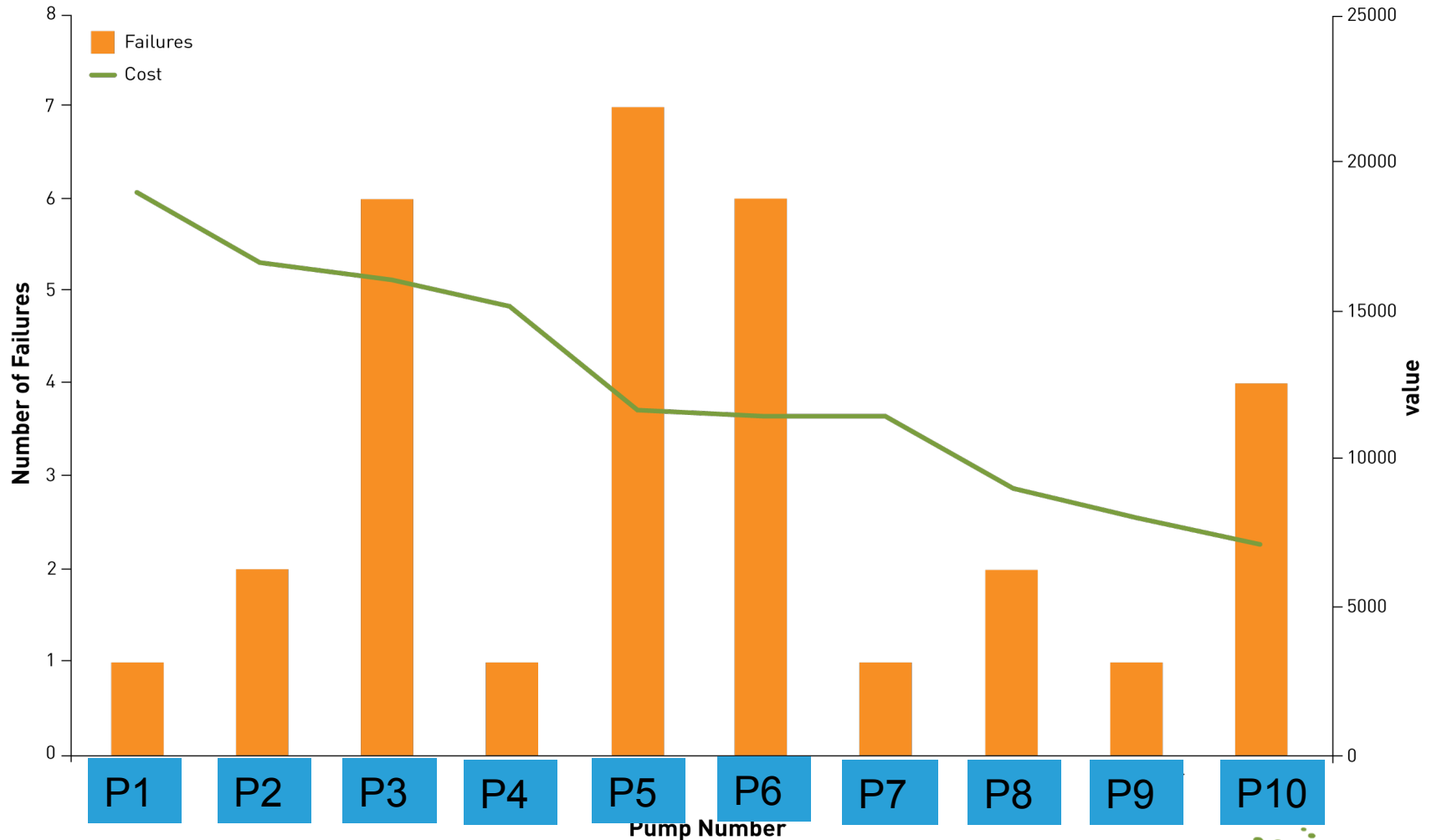


# Reliability Performance

## MTBR vs. Actual Monthly Repairs



# Reliability Performance



# Quantified Data Gaps

## Master Equipment Listing

- % Parent Locations do not exist
- % Descriptions are not populated
- % Locations are “live route stops” that have been marked as “Scrapped”
- % Failure Codes are not populated
- % Locations “Scrapped” with an active PM
- % Locations where Parent is “Scrapped” but children have an Operating Status
- % Location where Parent is “scrapped” or “Red.In.Situ”

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## Preventative Maintenance

- % Descriptions are not populated
- % Worktype not populated
- % PM have invalid Frequency
- % PM are on a “Scrapped” Location and not suspended
- % PM list a route that does not exist
- % PM list a Location that does not exist
- % PM’s use a JobPlan that does not exist in the PMSEQUENCE table
- % PM do not have a JPNUM populated in PM Table



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## JOBPLAN

- % PM’s that have no tasks associated
- % JPM’s that have no trades associated

## JOBOP

- % PM Tasks that have no associate manhours

## JOBLABOR

- % crafts that have no associated manhours

## ROUTES

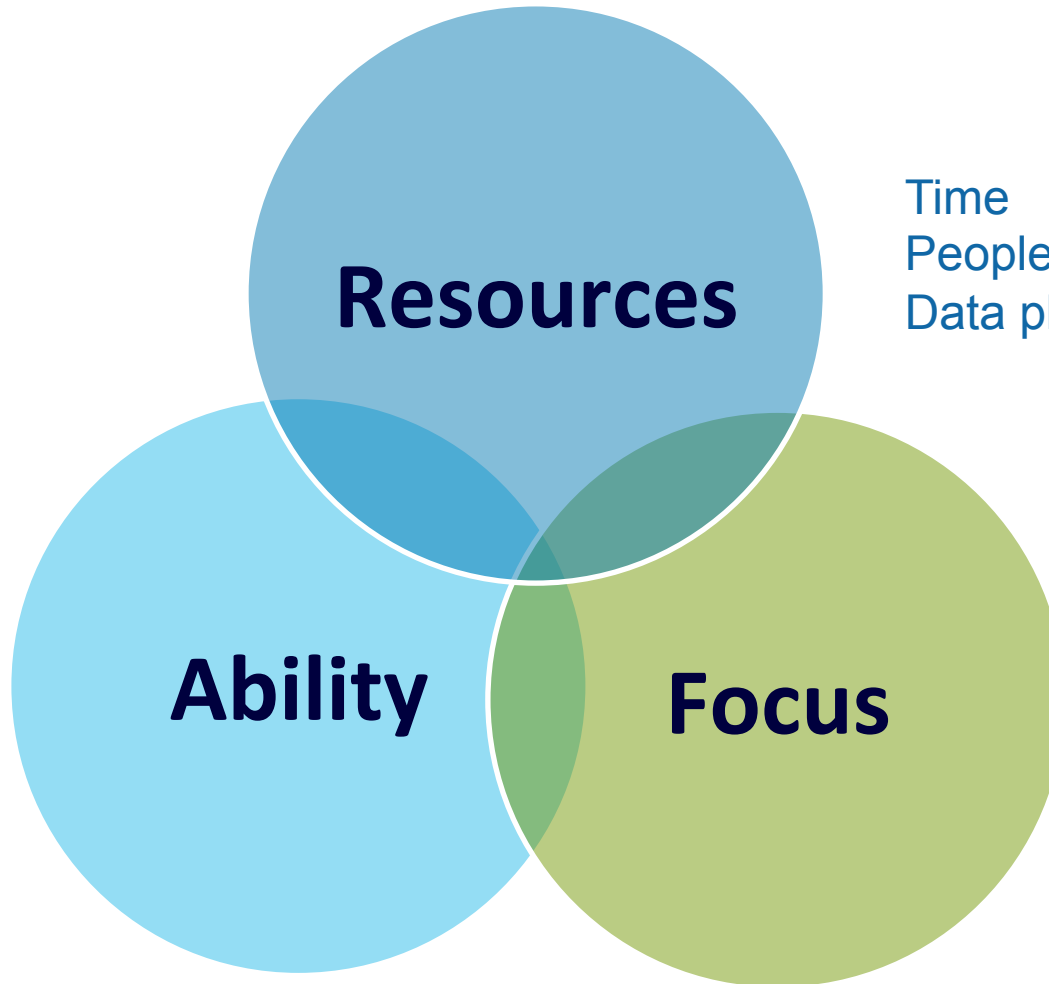
- % Routes do not have associated equipment
- % Routes do not have associated PM’s
- % Route stops belong to a route that does not exist in CMMS
- % Route stops do not have associated locations
- % Route stops list a JobPlan that does not exist in CMMS
- % Route stops have duplicate Routes/Locations
- % Route stops are on a “Scrapped” Location

# Starting With a Feasibility Study

## Just some of the benefits

- ✓ Understanding what data you have available
- ✓ Identifying any gaps
- ✓ Ruling out human bias through proper statistical treatment
- ✓ Acquiring meaningful insights into your business
- ✓ Breaking a macro picture into a micro one

# In Summary



Time  
People  
Data platforms

Knowledge and skills  
Experience  
Accessibility to data platforms

Data must be acknowledged, recorded and valued by everyone

# Latest Thinking in Achieving World Class Reliability



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**PREDICTIVE ANALYTICS** is the branch of the advanced **analytics** which is used to make predictions about unknown future events. **Predictive analytics** uses many techniques from **data** mining, statistics, modelling, machine learning, and artificial intelligence to analyze current **data** to make predictions about future

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**BIM** (*Building Information Modeling*) is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage assets and infrastructure

# How many of you believe you have a reliability strategy in place?

## **Poll Question:**

How many of you believe you have a reliability strategy in place?

Yes, I have a reliability strategy in place

No, I don't have a reliability strategy in place

I don't know



# Thank You!

Please join us on our next webinar with Pumps and Systems:  
**Strategies to Save 2 Million Gallons of Water Annually**

*Thursday July 26<sup>th</sup>, 10 am Eastern (15 pm BST)*

<https://www.pumpsandsystems.com/webinar/strategies-save-2-million-gallons-water-annually>

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# QUESTIONS AND ANSWERS