



ABB SERVICE UK

NEPIC – Industrial Asset Management Event

Maintaining Ageing Plant in a Digital World

Kev Senior, Principal Consultant, ABB – 21 November 2018



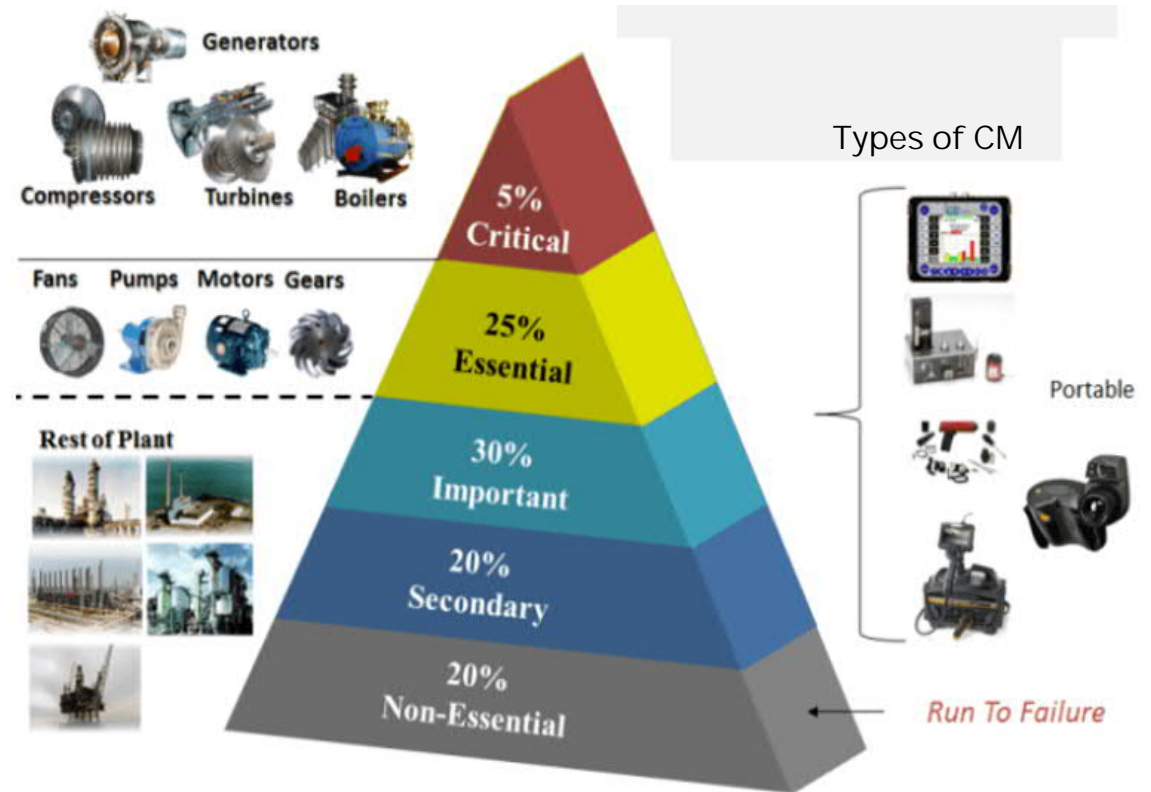
Maintaining Ageing Plant in a Digital World

The Problem Statement

The Problem Statement

Rotating Equipment Inventory

- Typically a broad range of rotating equipment, of varying ages and in dispersed site locations, including:
 - LV motors
 - Centrifugal pumps
 - Fans
 - Generators
 - Anti-surge systems
- Grouped into criticality categories based on their importance regarding:
 - Safety
 - Production
 - Reliability



The Problem Statement

Demography and shortage of technical competency

- The high-hazard process industries continue to suffer from a shortage of qualified engineers
- The demography of the workforce is heavily leveraged in favour of middle-aged professionals
- More and more companies are experiencing difficulties with recruiting and retaining good engineers
- Companies are suffering from a loss of corporate knowledge and dilution of experience
- The competition to attract good graduates to work in engineering is becoming fiercer
- Outsourcing certain areas of expertise, once seen as a short to medium-term palliative is rapidly becoming established as the norm

🏠 > Education > STEM Awards 2019 > Energy | Telegraph STEM Awards 2017

The great UK engineering shortage: 1.8 million are needed by 2025



1.74 jobs
supported by every
person employed
in engineering
(a multiplier effect of 2.74)



**Engineering
generated 23%**
(£1.23 trillion) of the
UK's total turnover



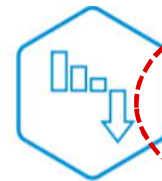
124,000
engineers and technicians
with core engineering
skills required per year



79,000
engineering-related
roles to arise per year



Altogether,
203,000 people
with Level 3+ engineering
skills will be needed every
year to meet demand
through to 2024



Annual shortfall of up to
59,000 engineering
graduates and technicians
to fill core engineering roles

The Problem Statement

Hidden Failure Modes

Poor motor health manifests itself as:

- Bearing condition – lubrication issues, worn rolling elements
- Cooling condition – dirty fan blades, blocked fan cover
- Rotor condition – cracked bars or short circuits
- Airgap condition – poor eccentricity, bent shaft



Affected motor performance exhibited by:

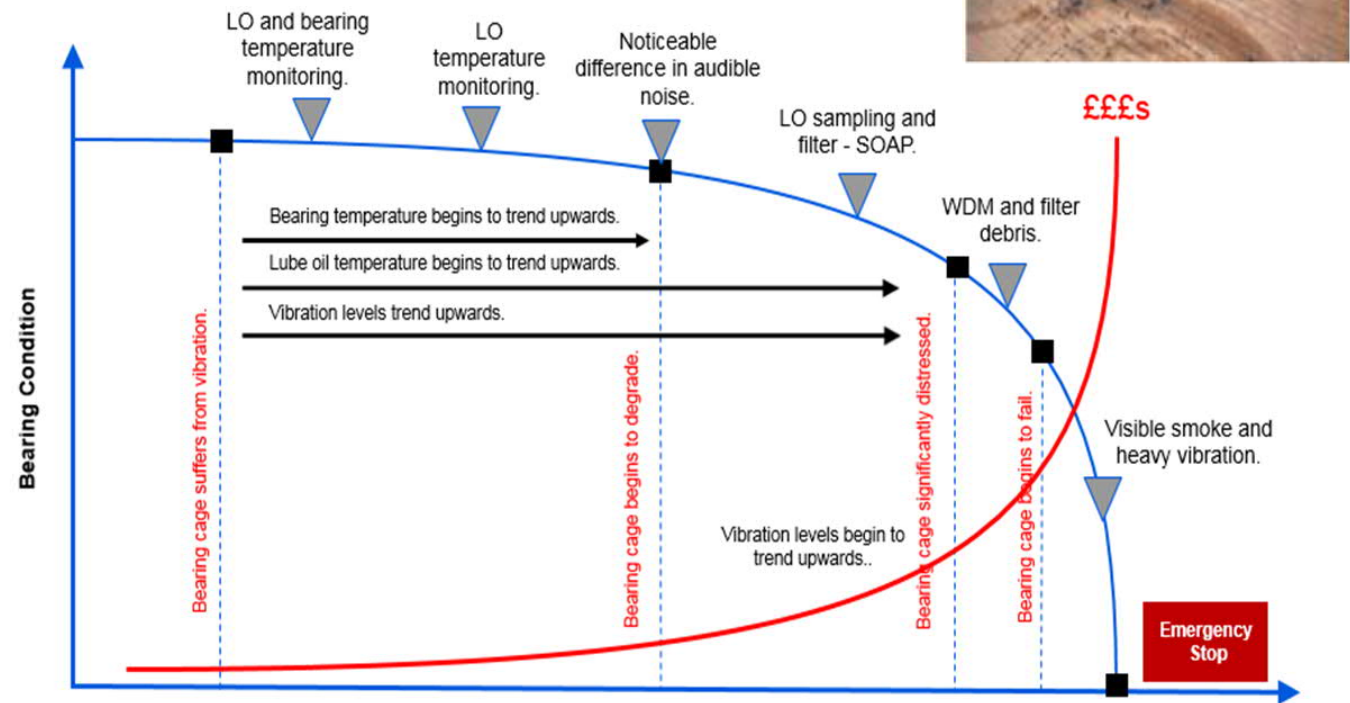
- Increased energy consumption
- Increased vibration levels
- Increased operating temperature
- Reduced operating time



The Problem Statement

Knowing when to maintain equipment

- Equipment operating in dangerous environments or hard-to-reach locations pose a workplace safety risk
- They are more likely to break down due to inadequate maintenance
- Poor reliability of rotating equipment directly impacts on productivity
 - 13% of the deferred gas production in the North Sea can be attributed to poor compressor reliability
 - 80% of premature motor bearing failures are lubrication related



The Problem Statement

Keeping pace with technological advances

- Technological advances have profoundly and irreversibly impacted industry and society.....



Easter Sunday 1900, 5th Avenue, New York
- Spot the car!

Easter Sunday 1913, 5th Avenue, New York
- Spot the horse!



The Problem Statement

Summary

- The amount of rotating equipment in use on major industrial plants is large, varied and dispersed
- The criticality of the equipment is not often fully understood
- The majority of major oil & gas, petrochemical and chemical sites in the UK began operations over thirty years ago
- There are fewer good engineers and technicians being recruited and retained
- The demography of the current workforce tends to be middle-aged and/or approaching retirement
- The pressure to carry out essential maintenance against a backdrop of dwindling resource and tight timescales is a concern for safety
- The need to maintain a healthy EBITDA ensures that reinstating production is always a priority
- Technology relentlessly marches on and the pace is accelerating

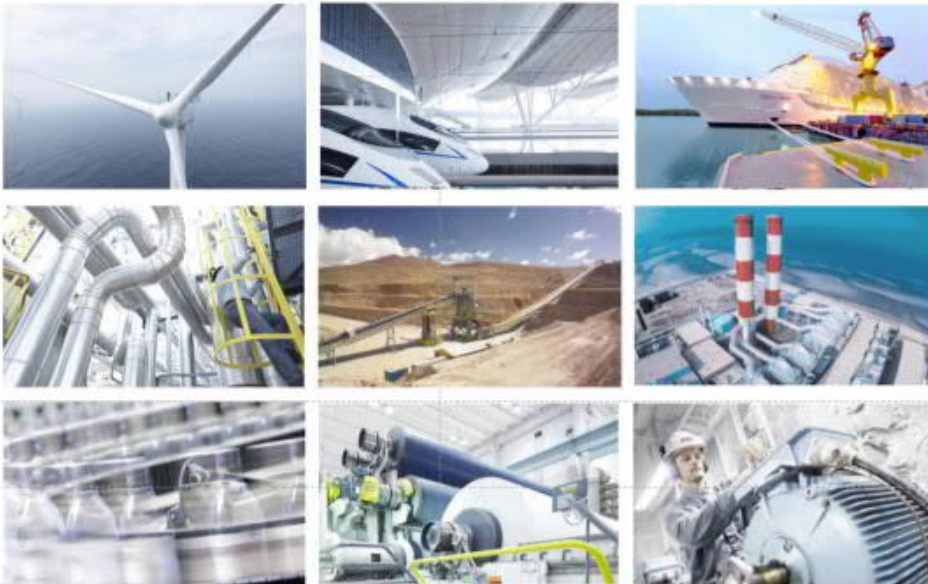


Maintaining Ageing Plant in a Digital World

The Theory

The Theory

Value Creation Vision



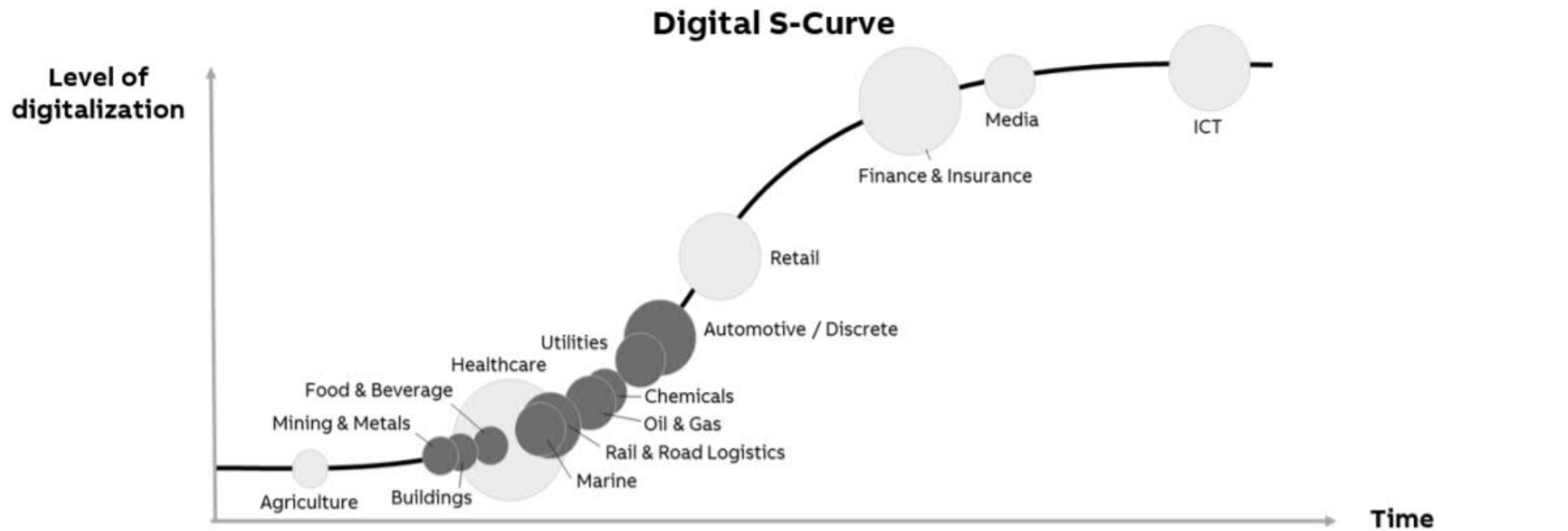
- **Safety** - Improve safety at work with maintenance inspections from a distance
- **Reliability** – Reduce downtime by up to 70% with a transition from reactive to proactive maintenance
- **Energy Savings** - Save up to 10% energy in a plant with data from all encompassing energy audits
- **Maintenance Savings** - Save time and effort of maintenance engineers with early warning systems
- **Net Working Capital** – Equipment can live up to 30% longer with less redundant plant and spare inventory
- **Risk Mitigation** – Minimise your liabilities, such as warranty, uptime guarantee, transportation damage, etc.

The Internet of Things is much more than condition monitoring

The Theory

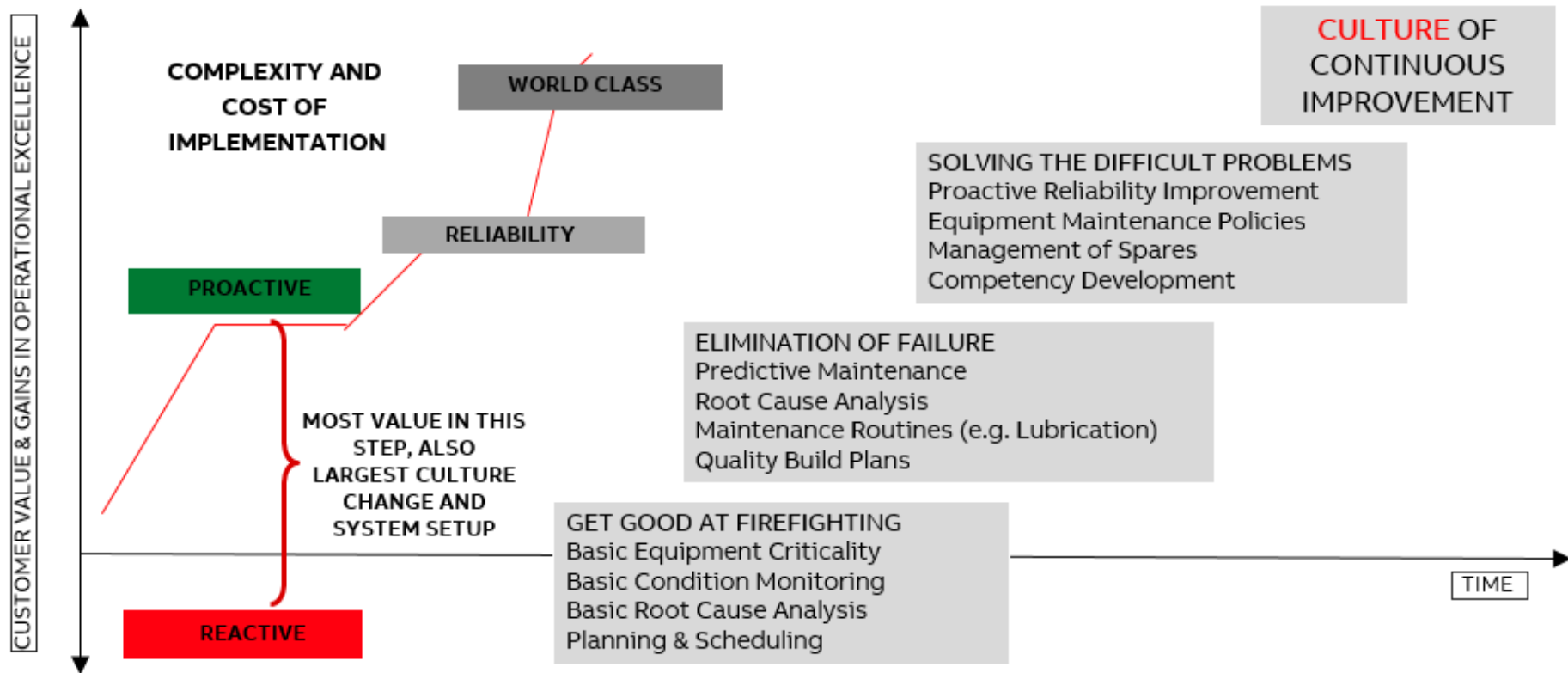
Digitally Enabled Industries

- ABB have identified those industries that are currently primed to adopt digital technologies in the form of mobile computing capability, internet connectivity, Cloud storage and predictive analytics



The Theory

The Reliability Challenge



The Theory

Prerequisites & Benefits

Prerequisites

A fault condition that is detectable (directly or indirectly)

Sufficient instrumentation to allow parameters to be observed

Data about fault progression, to assess equipment condition

Mature maintenance strategy and procedures

Benefits

- Predictive maintenance
- Longer asset life
- Improved energy efficiency
- Increased production



Connecting the unconnected

The Theory

The Improvements

Average Performer

- **Plant availability** between 80 and 90%
- **Large amounts** of process alarms due to **process variations** (exceeding EEMUA recommendations)
- **Low degree of autonomy** with a significant number of control loops in manual mode
- **Lacking visibility** into equipment conditions
- **No real-time insight** into true production potential

Top Performer

- **Plant availability** around 99%
- **Very few alarms**; operators are alerted only when action is required
- **High degree of autonomy** – the plant **"operates itself"**
- **Monitoring of critical equipment**
- Operators actively seeking to reach true production potential

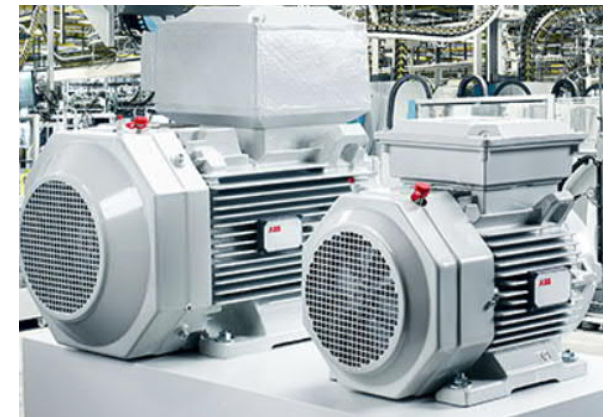
Maintaining Ageing Plant in a Digital World

The tools to do the job

The tools to do the job

Smart Sensors

- In order to harvest the condition data successfully:
 - The equipment must be adequately instrumented
 - For older equipment and, typically LV motors, this may require a smart sensor to be retro-fitted
 - Depending on the equipment, there are different types of sensor available, all suitable for retro-fitting and digital use
 - The sensors should be capable of being attached to the pump casing and/or motor frame without significant maintenance effort
 - They will need to be self-powered, Wi-Fi enabled in addition to having a Bluetooth capability
 - They must encrypt the data for cyber security reasons



The tools to do the job

Smart Sensors

- ABB's Smart Sensor can be retro-fitted by maintainers in about ten minutes
- The sensor monitors signals from the motor (or pump) accurately measuring key parameters at hourly intervals
- The data can be transferred using Bluetooth to a smartphone or exported to a cloud-based server using Wi-Fi
- The data is encrypted to ensure cyber security
- Algorithms are then used to analyse the data and measure the equipment's performance against agreed KPIs
- The server sends the KPI information to the operator's smartphone and a dedicated portal
- Data can be tracked over time for trend analysis purposes



The tools to do the job

Smart Sensors

