Sustentabilidade e Digitalização: Inteligência Artificial para Aumento de Eficiência
Sostenibilidad y Digitalización: Inteligencia Artificial para el aumento de la eficiencia

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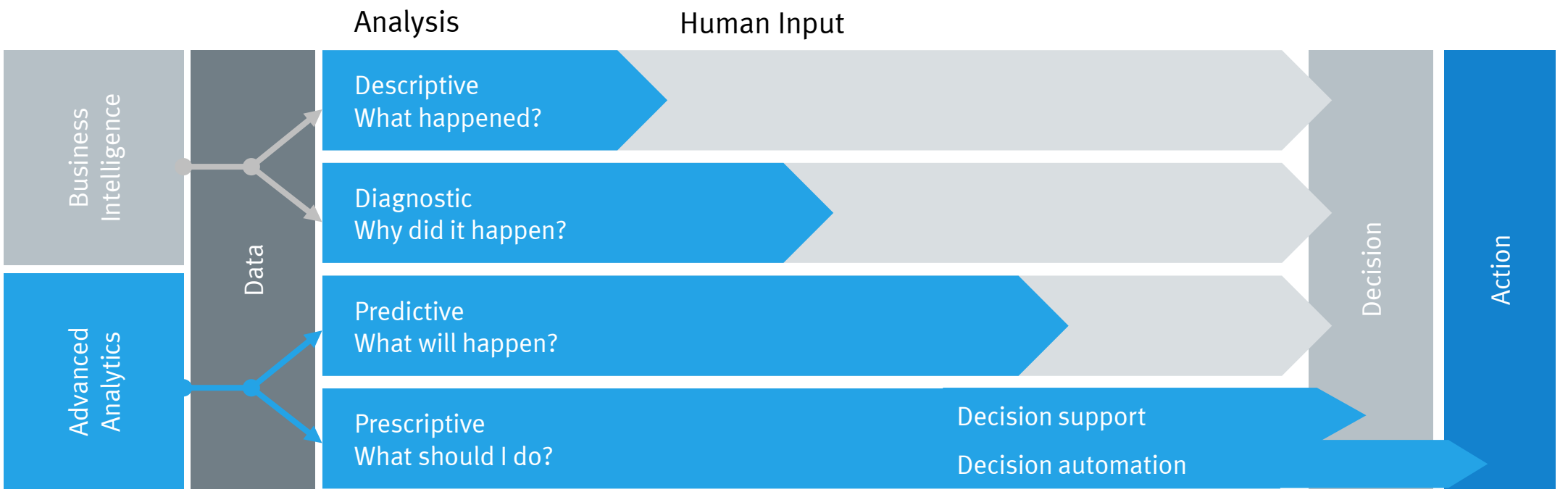
The nature of Data Analytics

.... and where it takes us



What is Machine Learning?

Example: Anomaly Detection and Classification

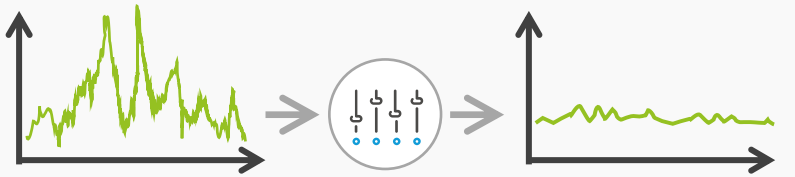
1. Training

Raw Data → Model

The model is adjusted to data with a learning/training algorithm

2. Evaluation

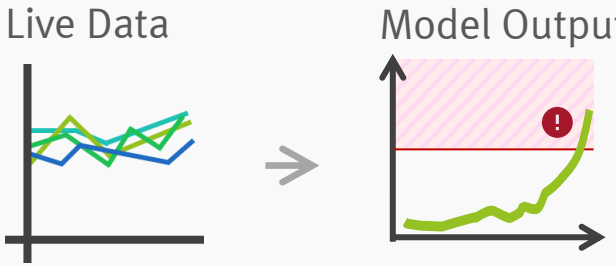
Model Evaluation → Optimized Model



Optimization of model quality by adjusting meta parameters

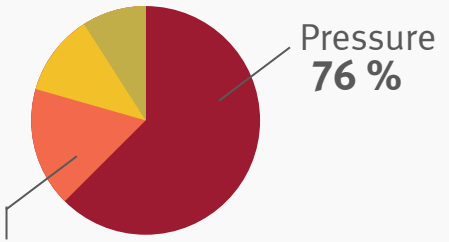
3. Anomaly Detection

Live Data → Model Output

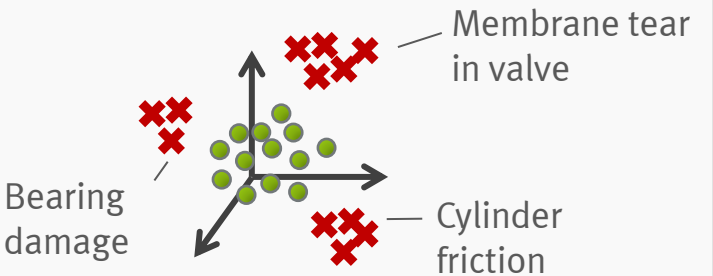


Analysis on Real Time Data

4. Anomaly Localization

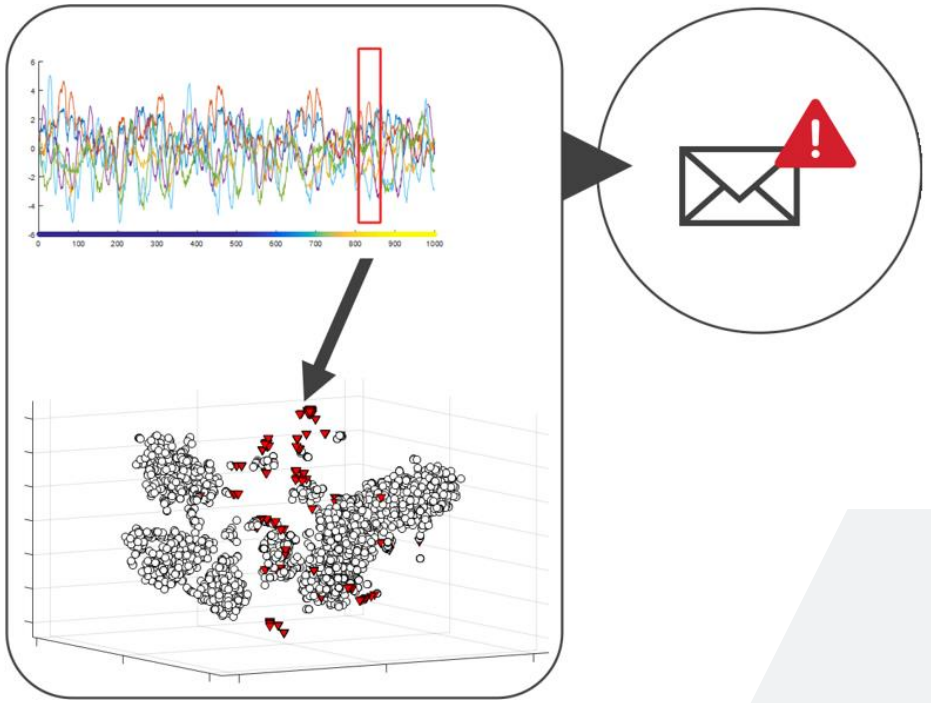


5. Anomaly Classification



The Machine Learning approach

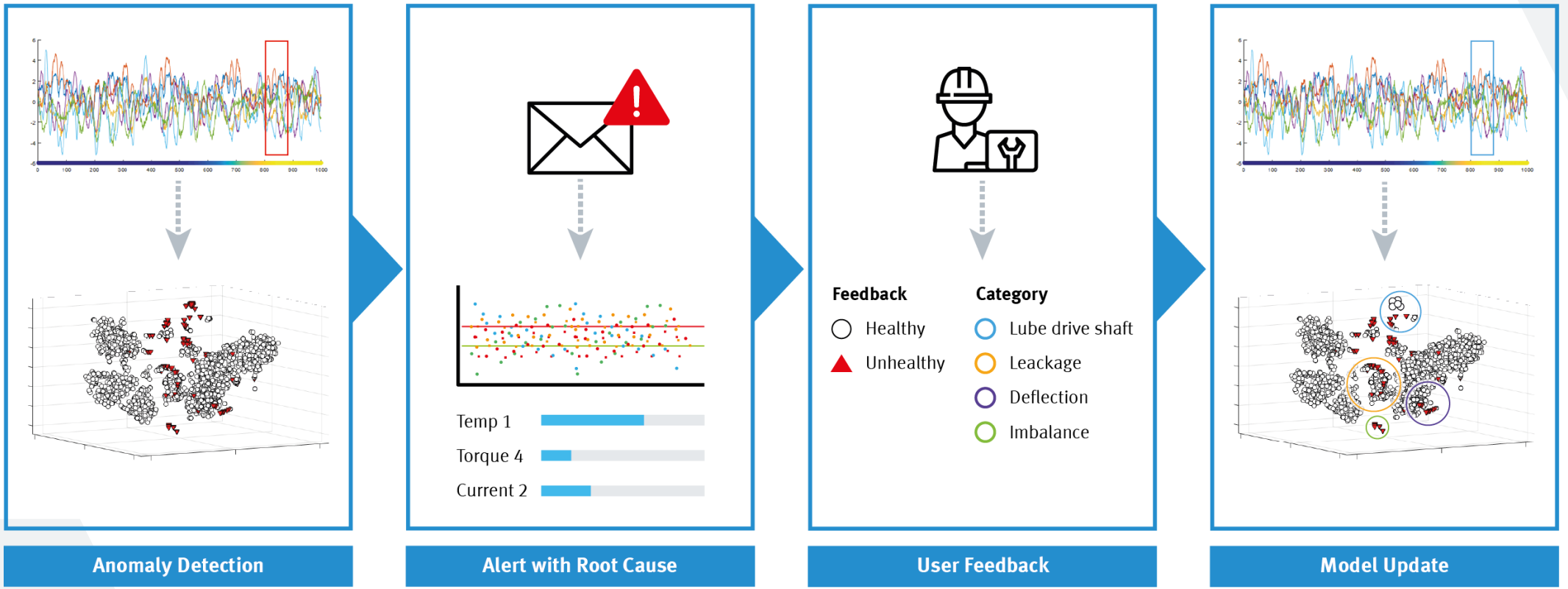
From Data to Anomaly



What happens when an anomaly is detected:

- A notification that an anomaly has occurred, is sent for example:
  - by e-mail or
  - into an existing maintenance system/tool or
  - directly to your smartphone or
  - into an existing dashboard

The “Human-in-the-loop”-Principle



What can AI achieve on the shop floor?

1. **Anomaly warning**
   Reduces downtime - Maintenance measures can be planned directly

2. **Direct anomaly localisation**
   saves up to 20% of the time needed to locate the anomaly

3. **Cycle time monitoring and optimisation**
   More parts produced per day

4. **Process transparency, quality and traceability**
   Reduction of possible follow-up costs

5. **Cause classification**
   Identify the problem, not the symptom

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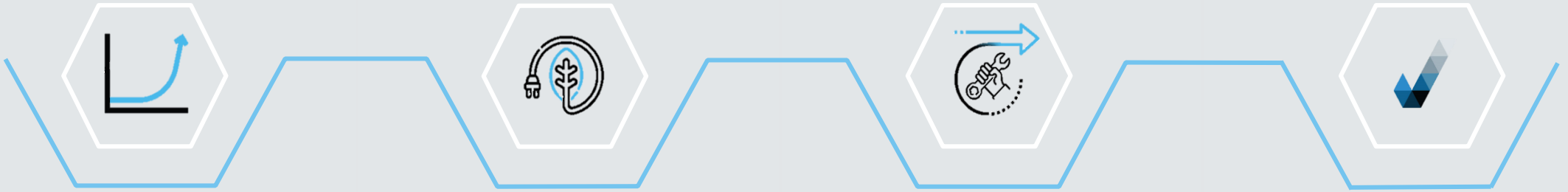
Festo Innovation Summit

Festo AX – The automation industry needs AI

#higherproductivity by leveraging AI, IoT and Edge Computing

Solutions for improving OEE



Predictive quality
Improves overall production quality by continuously monitoring and analysing production data and detecting quality issues

Predictive energy
Optimises energy usage by continuously monitoring and analysing energy consumption as well as detecting anomalies

Predictive maintenance
Predicts failures and reduces unplanned downtime by continuously monitoring and analysing asset data

Smartenance
Supports all maintenance activities in a cloud-based application. Offers an API for seamless connectivity and a mobile app for the shop floor communication

Operations processes

Maintenance processes

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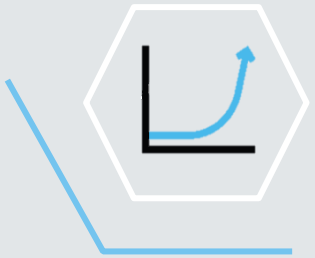
Predictive quality

Solutions for improving OEE



Predictive quality

To **ensure the quality of the products is consistent** throughout the entire production, it is necessary to permanently monitor and analyse all of the relevant parameters and data (via algorithms based on artificial intelligence and machine learning) – technology independent, from component level up to complete machines and production lines.
Business Case: Increase yield by reducing number of rejected parts

Operations processes

Maintenance processes

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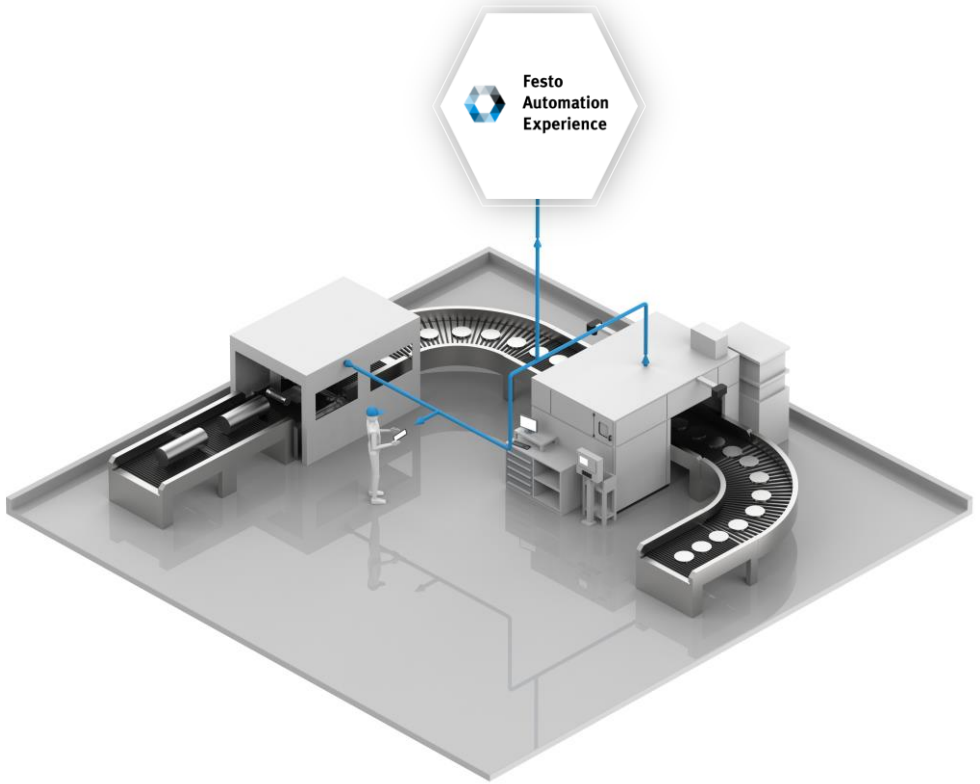
Predictive quality – Continuous production monitoring and detection of quality issues to improve overall production quality



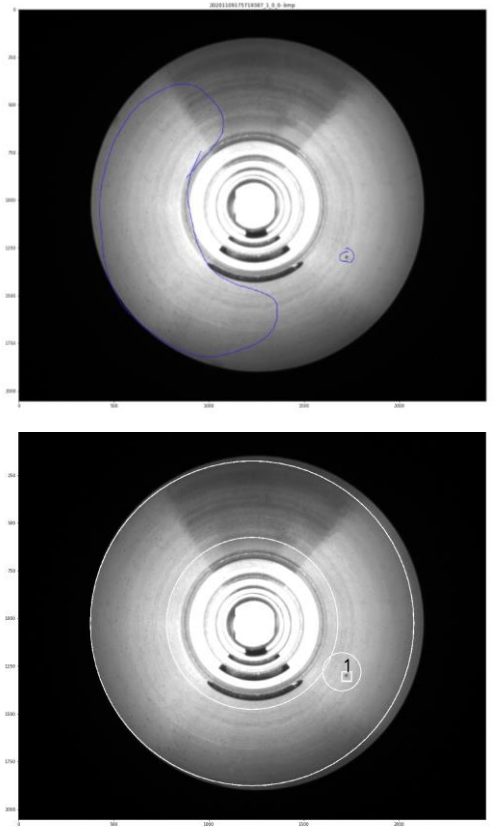
Customer case: Wafer production, Semiconductor Industry

Classic IO/NIO checks
Only detects NIOs wich random checks, but does not prevent them

Automate quality checks
e.g. by image detection with AI

Correlate with production data
Get information about possible root causes for poor quality

Predictive Quality
For every workpiece with early detection of quality loss



Detecting blowholes in Scharnhausen (Festo)

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Predictive Quality in discrete manufacturing

Industry:
Semiconductor Industry

Project description:

Predictive maintenance to ensure product quality in discrete manufacturing processes through intelligent data analysis

Challenges:

- Automatic recognition of quality losses in the sawing process and determination of influencing factors
- Aim: OEE improvement by reducing maintenance efforts and quality losses

Solution:

- Data analysis based on the inventory data of the machines
- Extension of the sensors and increase of the data sampling frequency on brownfield machines
- Learning the process data of good cuts based on historical data
- Real-time monitoring and evaluation of cut quality by SCRAITEC to identify early process deviations and quality losses
- Automatic calculation of factors that influence the quality

Result: Poor quality costs approx. 10,000 € per machine per month

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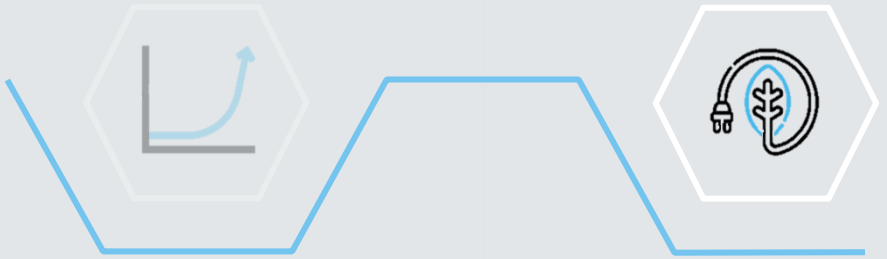
Predictive energy

Solutions for improving OEE



Predictive energy

In order to ensure the **lowest possible energy consumption** on the shop floor as well as the entire factory, it is necessary to permanently monitor and analyse all of the relevant parameters and data (via algorithms based on artificial intelligence and machine learning) – technology independent, from component level up to complete machines and production lines.
Business Case: Cut costs by reducing energy consumption

Operations processes

Maintenance processes

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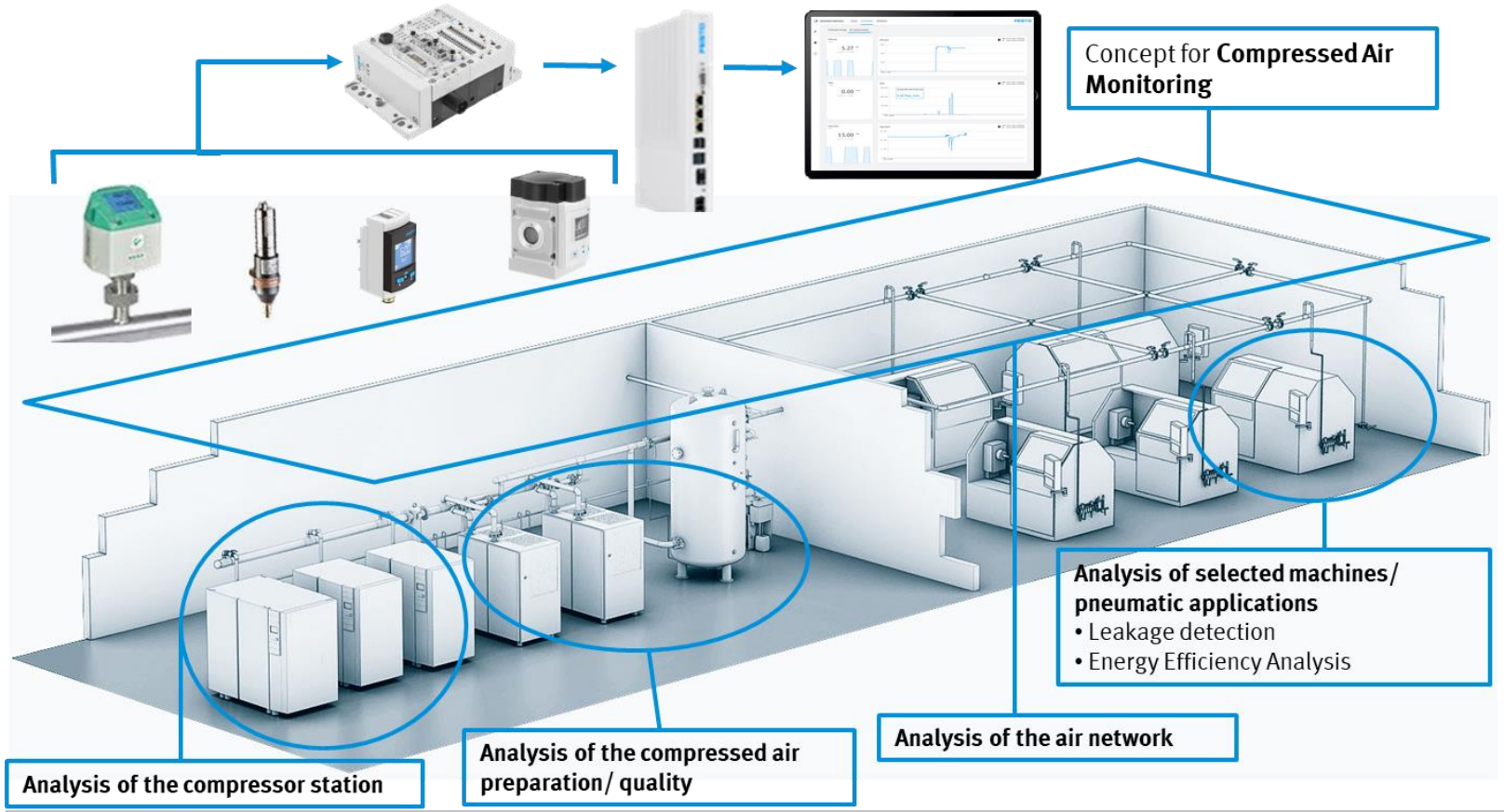
Predictive energy – Continuous energy consumption monitoring and anomaly detection to optimise energy usage



Energy efficiency audit

Implementation

Predictive energy monitoring

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Predictive maintenance

Solutions for improving OEE

Predictive maintenance

To ensure the **constant performance of components** during production, it is necessary to permanently monitor and analyse all of the relevant parameters and data (via algorithms based on artificial intelligence and machine learning) – technology independent, from component level up to complete machines and production lines.

Business Case: Increase machine uptime by reducing unplanned downtime

Operations processes

Maintenance processes

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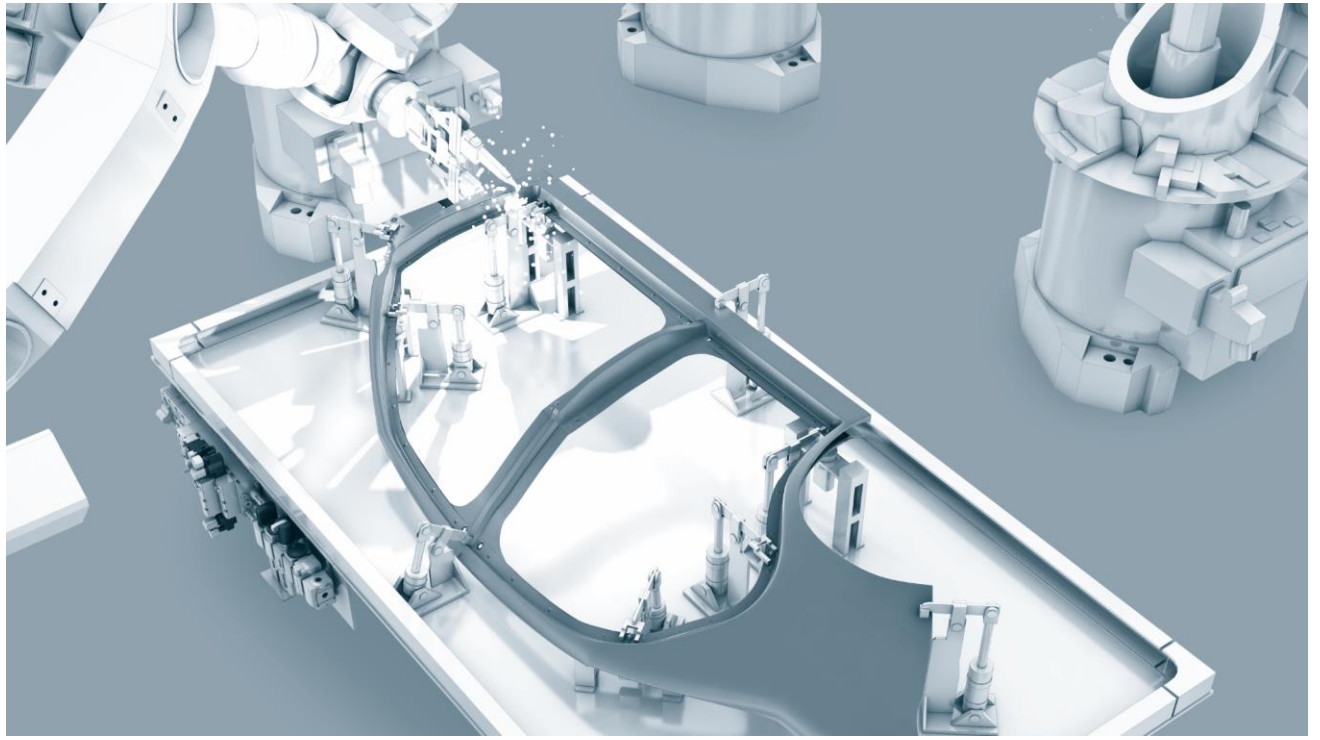
Predictive maintenance – Continuous monitoring and analysis of assets to predict failures and avoid unplanned downtime



Customer case: welding guns, Automotive Production

Rotary transfer machine in Scharnhausen (Festo)

High Pressure Deburring Machine in Scharnhausen (Festo)

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Predictive Maintenance and Predictive Energy in a high-pressure degassing system

Company:
Festo SE & Co. KG

Industry:
Engineering

Project description:

Predictive Maintenance to reduce unplanned downtime

Challenges:

- Reduction of unplanned downtime through early detection of problems (each downtime costs approx. 600 €)
- Goal: OEE improvement by reducing maintenance efforts and quality losses

Solution:

- Predictive Maintenance via high-frequency data acquisition using CPX-VTSA / FB44
- Monitoring of Festo cylinders and flow sensors
- Data basis: travel and reaction times from FB44, information on compressed air supply (pressure, flow)

Result: Approx. 1,200 € per year/machine through leakage detection
Approx. 2,400 € per year/machine through Predictive Maintenance

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Predictive Maintenance on packaging machines

Industry:
Packaging machines

Project description:

Early detection of wear in packaging machines

Challenges:

- Detection of process disturbances in cardboard production
- Training a generalisable model that detects faults independent of the cardboard formats

Solution:

- Installation of SCRAI**FIELD** to record and analyse process data (analogue and digital) of the packaging machine
- Training a generalisable model that knows the normal operating condition independent of the cardboard format
- Early detection through real-time data analysis of anomalies such as the contamination of cardboard suckers

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Your benefits in a nutshell

- **Reduced downtime on the shopfloor**
  no unplanned stand stills, no production delays
- **Reduced energy costs**
  due to optimal energy consumption
- **Reduced rejected goods**
  no quality loss, less waste, more efficient production due to consistent product quality
- **Reduced production costs**
  due to the optimal setup of adjustable control parameters
- **Increased daily output**
  by monitoring and and identifying bottlenecks and optimising cycle times
- **All the information you need at your fingertips**
  customised to your needs, with Festo AX Visualisation

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