TRIOVEGA
SECURELY SHAPING YOUR FUTURE

Factory 4.0

Data-driven excellence in manufacturing

Case studies

From predictive maintenance to real-time quality control – How data science increases industrial efficiency

How we put data science to work in an industrial setting

In an era of abundant data, data science methods are opening up entirely new opportunities for optimizing industrial processes. Many companies are facing growing challenges, such as rising energy costs, unplanned downtimes, and inefficient lines. At the same time, they have extensive valuable data, but make little use of its potential.

TRIOVEGA's **service.factoryINSIGHTS** delivers a solution for exactly this challenge.

The scalable service supports manufacturing companies in moving beyond identifying operational issues to data-driven process control. Our approach follows a four-stage knowledge pyramid – from data description to automated process control.

Our data scientists excel across all levels of this pyramid – and apply their knowledge on the shop floor, where it delivers real value.

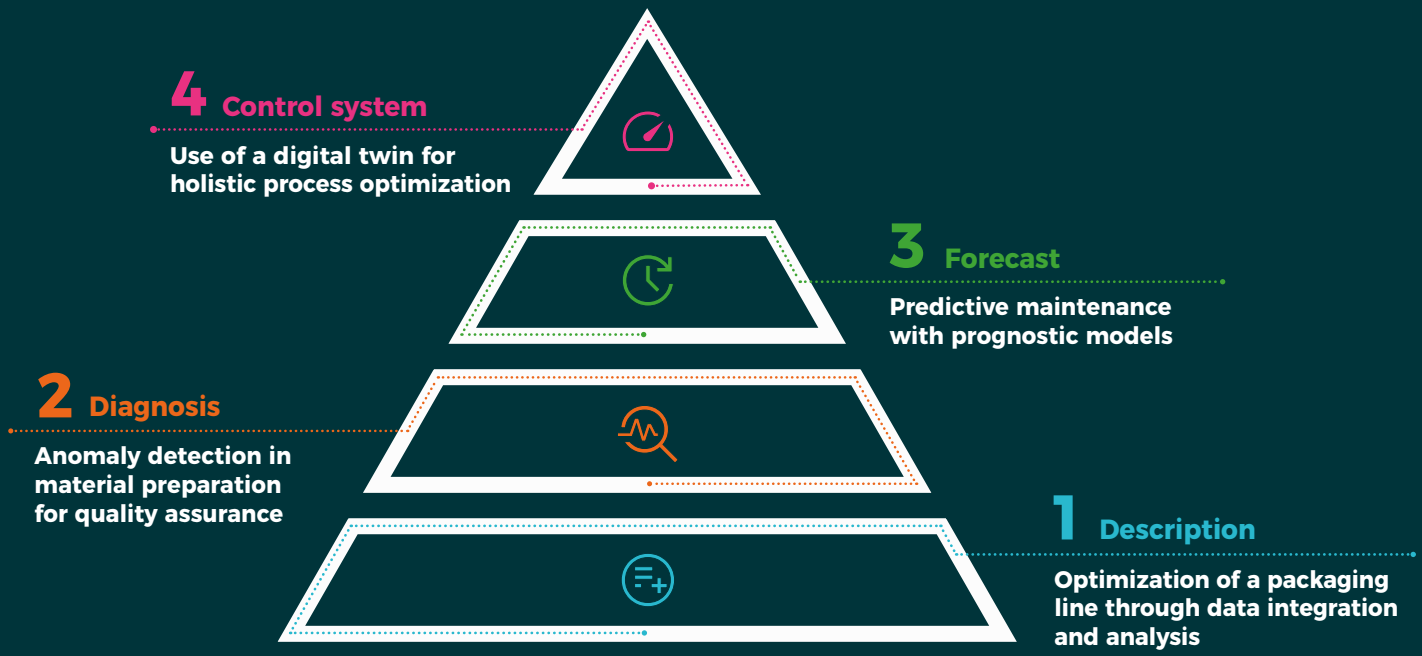

Fig.: Four-stage pyramid of knowledge

service.factoryINSIGHTS unlocks potential in production by applying data science in a targeted and practical way, as shown in the following four case studies.

They also demonstrate how data-driven approaches can develop along the knowledge pyramid and across different maturity levels.

Case study 1

Two million additional product units per quarter – without new machinery

▶ Challenge

A food manufacturer was unable to accept new customer orders because the packaging line was experiencing long downtimes due to malfunctions.

▶ Solution

Instead of investing in new machines, product and system-specific information was merged for the first time. This enabled the identification of failure patterns according to packaging type and line.

Data science in action:
Packaging line in the food industry

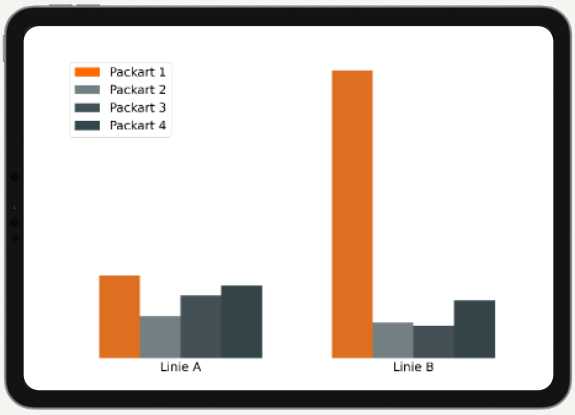

Fig. 1: Incidents per packaging type and per line
Specific patterns were identified through the holistic analysis of disparate data from production machines and quality assurance. It was found that certain types of packaging (see packaging type 1) could be processed more efficiently on a specific line (line A) than on the other (line B). By assigning products to the optimal packing line, production was increased by 2 million units per quarter.

▶ Result

One type of packaging caused a disproportionately high number of disruptions on a specific line. Through targeted redistribution, output was increased by 2 million product units per quarter – without additional investment in machinery. In subsequent projects, the analyses were automated and displayed on a live dashboard.

Case study 2

Abort rates halved through intelligent error detection

▶ Challenge

After a process changeover, the abort rate in raw material processing increased significantly. The company performed a manual review, but was unable to identify the cause.

▶ Solution

A neural network was used to compare successful and faulty production runs, and identified which production parameter was the first to deviate from the normal course.

Data science in action:
Raw material preparation in the process industry

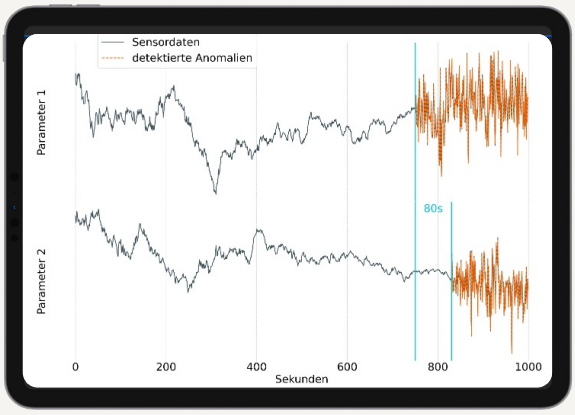

Fig. 2: Sensor data from two different production parameters with anomalies
Instead of time-consuming manual troubleshooting, an AI model was used to compare faulty production runs with successful ones, to detect anomalies at an early stage in the process before an abort occurs. Parameter 1 shows abnormal behavior 80 seconds before parameter 2. By adjusting parameter 1, future aborts can be averted.

▶ Result

The data analysis identified deviations 80 seconds before the resulting event. The cause was quickly identified, and the abort rate returned to normal.

Case study 3
30-day advance warning before machine failure

▸ Challenge
A critical component in the production process caused unexpected downtime – with high follow-up costs due to production losses.

▸ Solution
A neural network was trained with historical data to identify recognizable patterns at an early stage. Predictable pressure drops were flagged, allowing the network to be trained specifically for their detection.

Data science in action:
Ongoing operation of a critical production plant

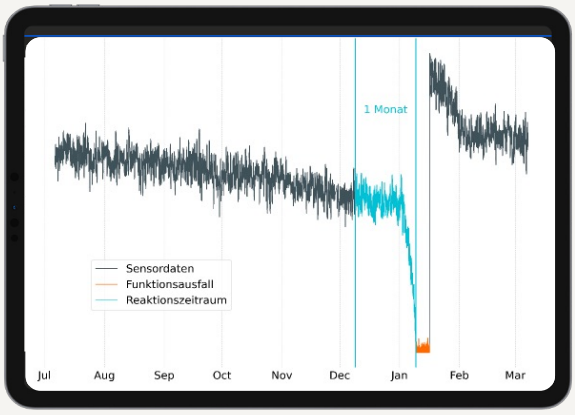

Fig. 3: Device sensor data with the downtime period marked
A neural network is used to analyze real-time sensor data (grey lines). The wear shown by the drop in pressure (blue lines) can now be identified up to four weeks in advance of the failure (orange lines). This prevents failures, and allows the replacement of machine components to be scheduled during routine maintenance.

▸ Result
Continuous measurements and a forecasting system enable the detection of failures up to 30 days in advance, allowing maintenance to be scheduled proactively, reducing downtime, and avoiding significant costs.

Case study 4
Test virtually, improve in reality – with a digital twin

▸ Challenge
Complex processes led to errors that were difficult to understand and trace.

▸ Solution
Using a digital twin, the production process can be virtually mapped and modified before changes are actually implemented. This enables risk-free scenario testing and comprehensive evaluation.

Data science in action:
Optimization of a production plant

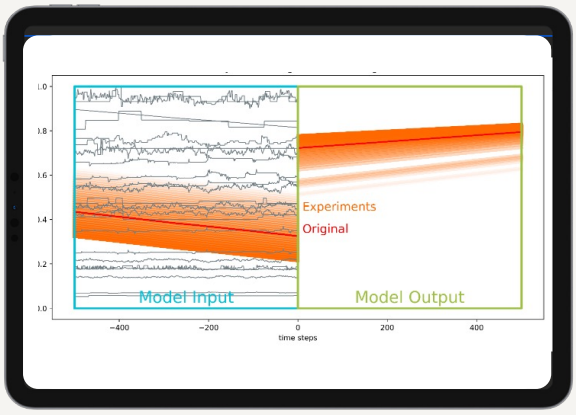

Fig. 4: Sensitivity experiments with a digital twin
This sensitivity experiment illustrates how a parameter on the left (model input, red line) is varied around its original value, and how this affects the digital twin on the right (model output), as well as the resulting impact of this change on overall equipment effectiveness (OEE).

Watch this video to explore more.

▸ Result
The optimization of process parameters can now be tested virtually. This made it possible to simulate and assess the impact of minor deviations in a critical value – without any risk to actual batches. At the same time, knowledge is systematically built and made accessible to everyone, without affecting ongoing production.

At a glance – how data science benefits you

Golden Batch
Achieve and sustainably reproduce excellent production results

Scrap reduction
Adjust plant configuration by identifying critical production parameters

Minimize downtime
Detect wear through predictive maintenance to reduce stoppages

Increase energy efficiency
Adapt your manufacturing processes based on consumption data analysis.

Increase production efficiency
Identify and optimize critical process parameters

Whether you are just starting your data science journey, or are ready to scale existing analyses, we support you from initial concept through to productive deployment. Secure, practical, and quantifiably effective.

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Explore the untapped potential in your data with us.

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Securely shaping your future
TRIOVEGA, part of the Viega Group, has been supporting global industrial companies to unlock the potential of digitalization for over 25 years – securely and sustainably. The company, based in Hamburg and Lübeck in northern Germany, boasts a portfolio that includes ready-to-use products and services designed to increase production security and efficiency. In addition, it offers customized software solutions that can be integrated seamlessly in the customers' value chain.

With award-winning innovations and patented cybersecurity expertise, TRIOVEGA stands for true partnerships on an equal footing – from technical consulting and implementation to after-sales service.

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