

GAMMA \ MANUFACTURING

Operations Analytics: Five key areas of focus

Manufacturing 4.0



Manufacturing Analytics

Use data and analytics for reliability and overall equipment effectiveness (OEE), quality improvement, energy efficiency, material consumption and flexibility



Advanced Asset Management

Ensure the predictive maintenance and value-based optimization of equipments use and throughput

Digital Supply Chain



Advanced Forecasting

Increase accuracy by integrating new signals and better algorithms for new product launches, inventory and pricing optimization, and workforce planning



Control Towers

Consolidate data from multiple systems in order to create end-to-end supply chain (SC) transparency and integrate predictive and prescriptive capabilities



Dynamic Networks Optimization

Create custom-made tools to optimize manufacturing and logistics networks

AI and analytics are reshaping manufacturing: BCG offers a unique approach to driving transformation



Quality optimization

5–10% increase in yield (technology)
60% reduction in non-conformity (aerospace)



Efficiency optimization

5–20% increase in OEE (packaging)
2–10% improvement in yield (pharma, petrochemicals)



Energy efficiency

8% reduction in energy consumption
(pulp & paper)



Predictive maintenance

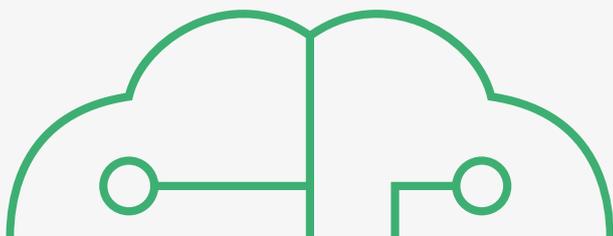
50% reduction of unplanned downtimes
(multiple industries)

Artificial intelligence (AI) and data science already deliver measurable outcomes in a wide range of functions and industries, including manufacturing.

Optimizing efficiency creates a competitive advantage by enhancing performance and enabling clients on their journey to achieving operational excellence.

BCG experts from various industries have developed a unique approach that will help you boost performance and reduce energy consumption.

Our end-to-end AI solutions are built around what we believe are the four key success factors in manufacturing analytics.



1

Driving a holistic transformation, not algorithms only

Manufacturing companies need more than algorithms and a successful proof of concept to boost business performance. Advanced technology and agile innovation also must be integrated into IT architectures and business operations to transform tools and processes at the same time. Our research shows that 10% of value comes from the algorithms, 20% from the technology, and 70% from the actual integration into business processes.

BCG Operations Centers & BCG GAMMA have joined forces to provide the best of Operations, Technology, and Data Science consulting. We design and implement integral solutions that can change the game for your operators and engineers – and create more value for your company.



CREATE TOOLS

BCG GAMMA:

- 12 offices around the world
- 500+ data scientists and data engineers
- 40% of activity in Operations



TRANSFORM PROCESSES

OPERATION CENTERS:

- 10 centers across the globe
- 400 Operations experts
- All trained in Operations Analytics

BCG INNOVATION CENTERS FOR OPERATIONS:

- 6 centers worldwide (France, Germany, Singapore, and the United States)
- Trial tools and new processes in real conditions to raise awareness and train people



2

Building customized solutions

Our experience shows that when companies use the same solution for every situation, important value is left on the table. Tackling the most complex or valuable use cases requires more than one piece of equipment – you need to address the whole process.

Customization doesn't mean re-inventing the wheel every time, however. With the right skills, technology, and expertise, you can design and implement your own solutions rapidly and at scale.

For each situation, it's important to find a customized solution that balances robustness with the speed of continuous improvement.

BCG GAMMA
Manufacturing helps you build your own customized solutions for production, and trains your people to expand upon these solutions.



COLLECT

the right data efficiently, whether it's from structured systems or individual equipment and programmable logic controllers (PLCs)



PROCESS

the data effectively, whether you're using unstructured text data and images or creating traceability along the process



BUILD

the right predictive models and decision-making support tools



CREATE

a Graphical User Interface (GUI) that's easy to adopt and improves employee satisfaction with your site

GAMMA\ Manufacturing Platform

To build these end-to-end solutions, you need the right tools – including a platform that will help cross-functional teams develop and industrialize solutions faster – and the right user experience.

BCG GAMMA has developed one of the most flexible and versatile data science platforms focused on manufacturing applications.



Applications & models



Proprietary algorithms and models library tailored to different kinds of situations: linear and non-linear regressions, tree-based, random forest, gradient boosting, support vector machines (SVM), Bayesian networks, and various deep learning-based models, including two that are patented



Proprietary UI library



Effective code-based access



Containerization

Data processing



Scalable storage and computing solution



Effective data pipeline creation



Most rigorous access control, data encryption, and cybersecurity protocols

Connectivity

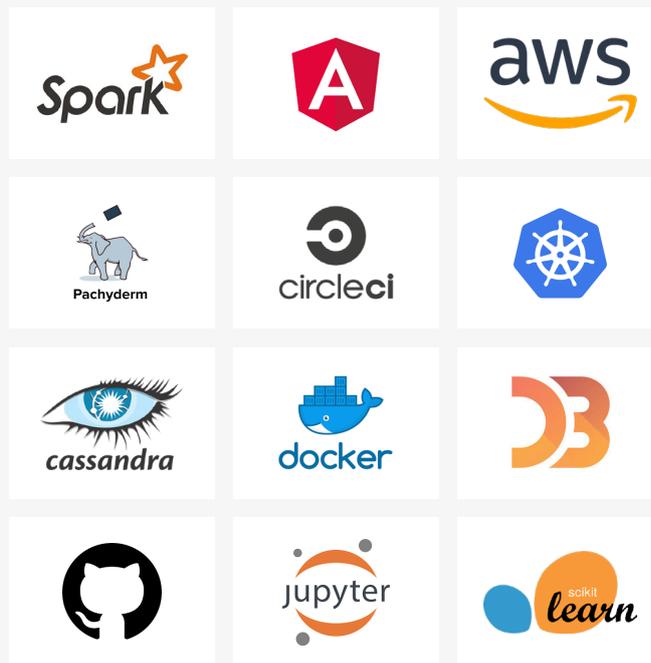


Connectivity and data ingestion toolbox that adapts to any situation:

- Connectors to main enterprise resource planning (ERP) tools and operational systems
- Exclusive partners to establish connectivity to PLCs, machines, industrial equipment, and edge computing
- Your own connected device for dedicated smart sensor implementation

\ Some of the tools we use

The platform builds on recognized open source solutions.



It can be combined with our proprietary scripts and UI library.



It partners for rapid connectivity implementation on your shop floor.



Edge devices and smart sensors



BCG GAMMA's platform encompasses the full stack required for effective data processing and tool design. It can help you quickly deliver the most advanced use cases and create the tailored manufacturing solutions you need.

3

Progressive industrialization yields results along the way



TECHNOLOGY

Enable parallel ramp-up of the technology platform and data analytics for use cases without sequencing

Deliver rapid results to fund the journey and build momentum across the organization



PEOPLE

Focus deeply on adoption at the operating level of the shop floor

Work alongside operators and engineers to define custom UI and detailed integration of tools in operating processes and standard operating procedures (SOPs)



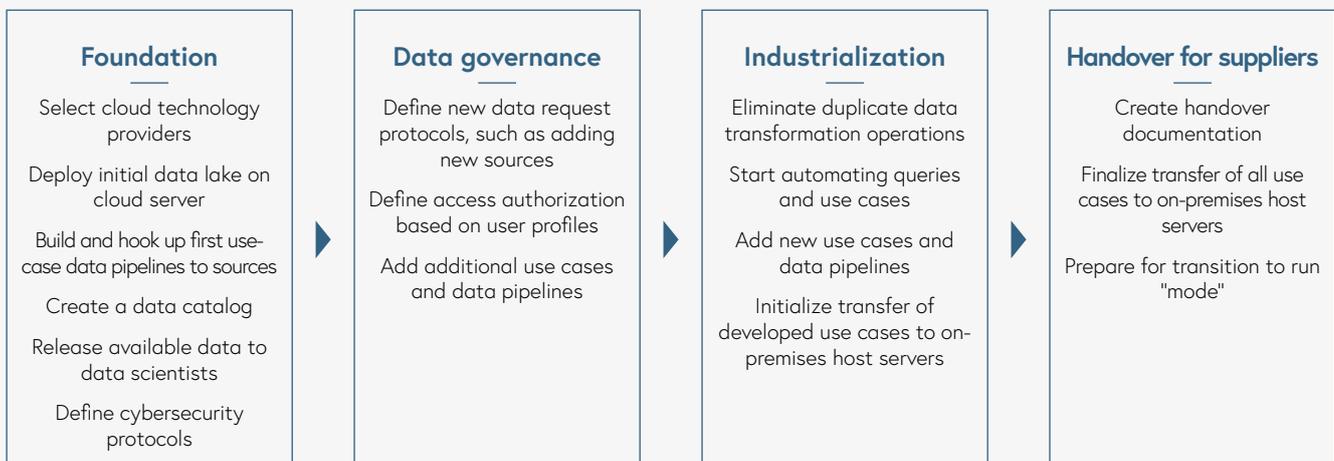
PROCESSES

Enable upskilling and competency building along the way

- › For build: several models including single projects, digital factories, and build-operate-transfer (BOT)
- › For run: digital centers, site level, and edge computing

Technology ramp-up can be progressive

One example of many possible paths



A recent case example: Quality optimization in technology equipment production

Testing benches are commonly used in technology equipment manufacturing to enable the testing of products after production. Test protocols include thousands of electrical tests.

Based on the test results being in acceptable ranges, products are released and shipped to customers.

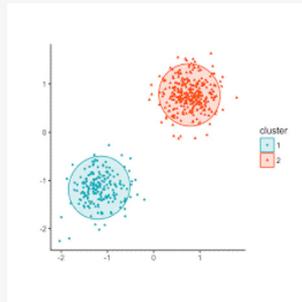
Despite these stringent protocols, a significant number of defects still appear at customers.

To predict the future probability of failure, we looked at the specific values of test results – as well as process, supplier, and environmental data. This had never been attempted.

It yielded spectacular results, enabling us to identify with great precision a small number of products with very high probability of failure (representing >60% of all failures) and those with zero probability of failure (representing >40% of products).

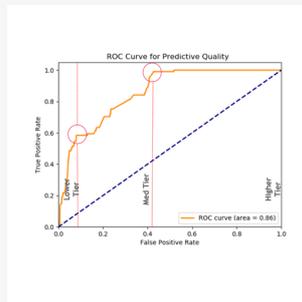
This resulted in better quality control of the systems delivered and a sharp reduction in non-quality costs.

Data engineering



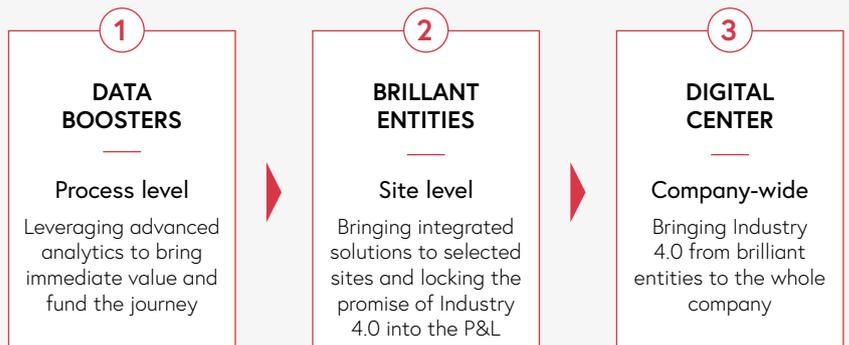
- › Feature engineering was not an easy task in this case
- › Structuring the data: test results were thousands of semi-structured text files
- › Classifying of input data necessary: high level of overlaps and lack of consistency in test naming and definition
- › Applying the usual feature engineering on process, environmental, and supplier data

Predictive model



- › Creating an ensemble model by using combinations of machine learning algorithms (mostly non-linear tree-based algorithms, gradient boosting, and random forest)
- › Generating high predictive power, with area under the curve (AUC) close to 0.9
- › Enabling the defining of a new quality checking and rework protocol

Company-wide rollout



Other examples



Quality optimization for an automotive tier 1 supplier

Challenge	Unexplained geometry quality defects in automotive subassemblies.
Solution	Classification of defects patterns for each product: <ul style="list-style-type: none">• >1,000 input parameters collected, processed, and analyzed (furnace settings, environment, cutting and grinding parameters, material characteristics)• Predictive solution leveraging machine learning built to anticipate and avoid a large number of defects
KPI	>50% defects avoidance Integration into company's technology roadmap (incl. data platform and edge computing)



Energy optimization for a building materials producer

Challenge	High energy consumption in large building materials dryers.
Solution	Analysis of gas consumption patterns for various products and operating conditions (steady and transient states): <ul style="list-style-type: none">• Processing and analysis of >300 input parameters• Definition of predictive models based on combination of machine learning algorithms to simulate energy consumption and recommend optimal settings for reduced energy consumption while maintaining other KPIs (throughput, quality, flexibility, etc.)
KPI	>3% reduction in energy costs



Predictive maintenance for a production equipment manufacturer

Challenge	Reduce equipment downtime and optimize maintenance costs.
Solution	Collection of equipment data including historical settings, operating conditions, environment, maintenance logs, failure descriptions by engineers and operators, etc. (>400 parameters): <ul style="list-style-type: none">• Natural language processing on failure descriptions• Feature engineering• Definition of ensemble predictive model (combination of different regression/machine learning algorithms)• Definition of maintenance protocol optimization tool for several pieces of equipment
KPI	50% downtime reduction while reducing maintenance costs

Meet our team

Some of our Data Scientists specialize in manufacturing analytics



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A worldwide network connecting 500 data scientists, data engineers, and developers.



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