AI IN ACTION:
MANUFACTURING
FROM PROMISES TO PROOF, REAL-WORLD CASE STUDIES

(expleo)

FOREWORD

Manufacturing has always been about balance: delivering uncompromising quality at the pace and cost the market demands, while keeping people safe and operations sustainable. But today's factories face pressures their predecessors never imagined — global supply volatility, ever-shorter product cycles, and rising expectations for traceability and customisation.

AI is helping manufacturing leaders tip that balance in their favour. Not by replacing the human skills that make production possible, but by expanding their reach — enabling faster inspections, sharper process control, and smarter decisions on the shop floor.

The projects in this playbook illustrate that shift.

We've chosen these examples because they show AI working where manufacturing is at its most demanding, in real production environments, under real constraints and still delivering measurable gains in quality, speed, and resilience.

At Expleo, our role is to help manufacturers harness these capabilities with confidence, so they can focus on what they do best: building the products the world relies on.

With Expleo, maximise production efficiency, to the power of AI.

Bruno Piranda

Vice President, Manufacturing Engineering, Expleo

TABLE OF CONTENTS

AI IN MANUFACTURING

HOW AI WILL CHANGE MANUFACTURING PROCESSES FROM DESIGN TO PRODUCTION (AI)

AI is reshaping manufacturing into a connected, adaptive, and self-optimising system, from early design to shop-floor operations. By combining hyperautomation, predictive insights, and next-generation robotics, it helps teams boost agility, cut emissions, and scale sustainable production across every phase.

HOW AI WILL CHANGE MANUFACTURING (AI)

1. Process & industrial design

- Generative Computer Aided Design (CAD) & process modelling: design production lines or cells by prompt, propose alternative layouts and workflows.
- Product–process integration: automatic adaptation of manufacturing processes when product designs change, synchronised with PLM systems.

Reduce the time of design phases and the risks of reworks.

2. Process prototyping

- Predictive analytics to identify the most impactful manufacturing process parameters for the product quality and predict how product quality changes with parameter adjustments.

Require fewer costly physical prototypes and accelerate the design-manufacturing convergence.

3. Work preparation & knowledge transfer

- Automatic generation (video-to-text) of assembly sequences and work instructions from operator videos.
- AI-driven creation of training curricula and maintenance documentation.
- Augmented Reality (AR) to support operator guidance and learning.

Accelerate efficiency and reduce the time to market.

4. Procurement, construction & installation

- Analysis of historical Factory Acceptance Test (FAT) datato predict recurrent non-conformities.
- AI-generated corrective action recommendations and assistance of FMEA process.

Shorter commissioning cycles with fewer costly late-stage defects.

5. Commissioning, qualification & ramp-up

- Natural Language Processing (NLP) to auto-generate PLC, HMI, and robot code.
- AI-powered visual inspection (with AR) to automate defect validation and support PPAP requirements.
- Digital twins for accelerated line balancing and ramp-up optimisation.

Faster transition from pilot to commercial operations.

6. Operations & continuous improvement

- Predictive maintenance to reduce downtime and optimise asset life cycle.
- AI-enabled MES/BMS for stock optimisation, energy management, and OTD prediction.
- Advanced robotics (collaborative & humanoid) to automate more complex workflows.
- NLP-driven root cause analysis of recurring non-conformities and automated corrective action planning.
- Digital twin–driven SCADA for real-time decision making and autonomous interventions (e.g. purchasing parts in shortage).

Improve production efficiency and cost, prevent production shutdown, reduce carbon impact and scraps, track non-quality.

QUALITY INSPECTION

AUTOMATING VISUAL INSPECTION IN CAR FACTORIES, WITH AI

(expleo)

In high-speed automotive manufacturing, every second counts and every detail matters. For one global carmaker producing nearly two million vehicles a year across Europe, the way to deliver consistent quality under pressure was AI.

Before AI: the challenge behind the project

In large-scale automotive production, visual inspection is an essential step. Each vehicle must meet dozens, if not hundreds, of visual criteria to ensure it aligns with specifications for its model, market, and client. That includes verifying colours, surface conditions, wheel configurations and more.

But for this leading automotive group, one of the world's top manufacturers with 14 brands and almost 30 new models released annually, the process was carried out by human eyes. This took time and introduced a margin of subjectivity, an inefficient solution at odds with an industry moving toward smart factories and leaner operations.

Initial attempts to automate the process with vision systems delivered mixed results. The main issue wasn't the concept, but the scale: it was nearly impossible to replicate the solution across dozens of plants, each with different configurations, production speeds, and inspection priorities. In some plants, a car came off the line every two minutes. The existing system simply couldn't keep up.

How AI was applied: the turning point

The shift came when the manufacturer partnered with Expleo. With a dual understanding of data and engineering, Expleo helped design and deploy a **deep learning-powered image recognition system capable of handling 2D visual inspection tasks with precision and agility.**

The Expleo teams, comprising data scientists and engineers, tackled the problem. First, they standardised how datasets were built and labelled across factories. For example, when inspecting wheel rims, the system needed thousands of annotated images covering every variation and angle. Expleo introduced pixel-area templates to streamline labelling and trained the model to undertake image classification tasks.

Then came deployment. The key innovation came with edge computing: latencies were slashed by allowing each camera-based inspection system to process data locally. The result: **checks dropped from 120 to 20 seconds. Accuracy now consistently exceeds 90% as the model continuously learns from new inputs.**

What changed: measurable outcomes & business impact

Critically, this solution helps inspectors in lieu of replacing them. They now receive instant reports, which reduces their subjectivity and enables faster, more consistent decision-making. Today, the solution runs in over 30 factories across 10 countries.

AI can be deployed quickly, tailored precisely, and deliver ROI at scale. Visual inspection, for both compliance and quality matters, is a cornerstone of most manufacturing processes. Its pertinence spans from electronics to pharmaceuticals, from aerospace to fast-moving consumer goods. This combination of deep tech and real-world practicality gives any manufacturer a great competitive edge.

HOW AI-POWERED DRONES ARE TRANSFORMING AIRCRAFT QUALITY INSPECTIONS

When safety is non-negotiable, even the smallest oversight can lead to major consequences. Expleo explored how autonomous drone swarms, through its AI innovation ExpleoCassie, can reimagine the quality inspection process in aerospace manufacturing.

Before AI: the challenge behind the project

In the Final Assembly Line (FAL) of aircraft manufacturing, quality inspections are essential but arduous. Inspectors must verify the tightness of thousands of bolts, check cable fastenings, and hunt down any Foreign Object Debris (FODs) left behind, such as tools and screws. Many of these tasks require crawling into confined spaces or under fuselage floors, exposing workers to serious Musculoskeletal Disorders (MSDs). With 473,000 UK workers affected by MSDs annually, and 6.6 million working days lost, the stakes are both human and technical.

The process is time-consuming, physically demanding, and prone to blind spots, creating a strong case for intelligent automation. The burden was twofold. First, it slowed down time-to-market, a critical challenge in a sector where digital-first competitors move fast. Second, it introduced inconsistencies and room for human error, especially when large teams interpreted user stories differently or under pressure. Add to that the cost of regression testing and the struggle to maintain quality across updates, and the traditional approach began to show its limits.

How AI was applied: the turning point

To address this challenge, Expleo is co-developing ExpleoCassie, an AI-powered autonomous drone swarm designed specifically for high-complexity assembly environments. Informed by deep operational insight from over 500 quality inspectors, the system aims to automate the riskiest and most repetitive inspection tasks. The drones operate without manual piloting, navigating tight aircraft interiors, scanning large surfaces, and using AI to detect anomalies that may require expert review. The concept behind ExpleoCassie is not to replace inspectors, but to extend their reach, reducing physical strain while increasing inspection coverage and consistency.

What changed: measurable outcomes & business impact

With this innovation, the goal is to significantly improve inspection efficiency, traceability and safety. AI-equipped drones like ExpleoCassie could automate the early detection of FODs and record every inspection pass, providing a clear digital audit trail. Most importantly, they would help reduce MSD-related risks by limiting the time inspectors spend in confined or awkward positions.

In a sector where precision and safety are paramount, solutions like ExpleoCassie have the potential to set new standards for quality assurance, where human expertise is augmented by autonomous intelligence. With solutions like ExpleoCassie, Expleo is shaping the future of quality inspection, bringing safety, speed and intelligence to the factory floor.

CLEARER AND BETTER-QUALITY CONTROLS: HOW AI CAN TRANSFORM OPTICAL LENS INSPECTION

In a high-precision industry where microscopic flaws matter, AI proved to be the difference-maker. With Expleo's deep learning solution, the world's largest lens manufacturer accelerated its quality control process without compromising accuracy.

Before AI: the challenge behind the project

For one of the world's largest producers of ophthalmic lenses, quality control is critical. The company manufactures over 400 million lenses every year, a product so refined that even the slightest defect is unacceptable. But traditional inspection methods had reached their limits. Defective lenses were so rare, around 300 out of millions, that it was nearly impossible to train a conventional AI system on what 'defects' looked like. This scarcity of faulty examples made automation tricky, leaving expert Quality Control (QC) operators to shoulder an increasingly heavy workload. The company needed a way to scale inspection without sacrificing the precision it's known for.

How AI was applied: the turning point

Expleo's healthcare and life sciences engineers took a different route. Rather than teaching the system to recognise defects, they taught it to recognise perfect products. Using an AI model called an autoencoder (a type of neural network that is trained to copy its input to its output) the system learned the visual patterns of flawless lenses. It analysed three ultra-high-resolution images of each lens: a back view, a frequency-mapped view using Fourier Transform, and a UV light exposure. Trained entirely on compliant products, the AI could then flag anything that deviated from the expected pattern. Backed by Microsoft Azure's cloud computing power, Expleo validated this innovative method with hundreds of gigabytes of image data.

What changed: measurable outcomes & business impact

The results were sharp and conclusive. The system achieved an 87% defect detection rate, even without access to defective samples. This enabled faster inspections, reduced the burden on senior Quality Control (QC) operators, and brought the company a step closer to a data-driven factory model. Expleo's smart inspection system elevated their QC process: now, quality checks are faster, smarter, and more scalable, allowing manufacturing leaders to redirect skilled staff towards higher-value tasks, while maintaining the exceptional standards the company is known for.

PROCESS OPTIMISATION

AI BRINGS PRECISION AND HELPS A HIGH-TECH MANUFACTURER CUT SCRAP RATES

In the world of manufacturing medical supplies even the slightest defect can lead to total product rejection. By applying AI-powered root cause analysis, a specialist manufacturer dramatically improved its quality yield and safeguarded its most strategic customer relationship.

Before AI: the challenge behind the project

An independent French manufacturer with over 500 employees produces ultra-precise metallic tubular components for the world's most demanding industries, especially medical technology. One of its most valuable products is a cold-drawn tube made from a proprietary high-tech alloy, manufactured exclusively for a major medical device company. But the manufacturer was facing a costly problem, non-concentricity, a subtle but critical defect where the inner and outer tube walls are not perfectly aligned. In the medical sector, this kind of non-compliance makes the product unusable. The consequences: a rising scrap rate, the percentage of tubes discarded during production, and a growing risk to quality, profitability, and client trust.

How AI was applied: the turning point

To address the issue, Expleo deployed a structured, two-phase response combining its expertise in precision manufacturing, data engineering and digital transformation. First, Expleo's consultants worked alongside the client to map the full production process, identify available data sources, and prioritise optimisation opportunities. This business transformation groundwork created the foundation for AI-enablement.

In the second phase, Expleo's team applied a robust data analytics pipeline using Structured Query Language (SQL), Python and Power BI. The team cleaned and adapted the client's data, identified correlations between process variables and the concentricity defect, and created dynamic, reusable dashboards that made the analysis accessible, actionable and continuous.

What changed: measurable outcomes & business impact

With Expleo's support, the manufacturer gained clear visibility into the root causes of product non-compliance. It now operates with a structured catalogue of critical data and a formalised production model that can be reused and refined. More importantly, AI-driven insights led to targeted recommendations, such as tooling adjustments, that helped significantly reduce the scrap rate, cutting waste and enhancing overall product quality. This data-informed transformation not only improved production yield but also strengthened the manufacturer's position as a reliable strategic supplier in the global health market.

HOW A BATTERY MANUFACTURER KICKED OFF ITS AI INDUSTRIAL JOURNEY WITH AN INVESTIGATIVE DATA ANALYSIS

One of Europe's most promising Electric Vehicle (EV) battery manufacturers used agnostic data analysis to understand its processes in new ways. With support from Expleo's data, manufacturing, and AI experts, it laid the foundations of a truly smart, data-driven factory.

Before AI: the challenge behind the project

A leading European manufacturer of lithium batteries for electric vehicles had a clear vision: to produce one million battery cells annually by 2030, but reaching this scale required better control over production quality.

When pushing for higher energy density in their batteries, the company saw scrap rates rise significantly, sometimes reaching up to 75% of a batch. These inefficiencies were costly and difficult to resolve without a clearer view of the manufacturing process end-to-end. Although the company had access to large volumes of production data, it lacked the tools and methods to use this information effectively.quality across updates, and the traditional approach began to show its limits.

How AI was applied: the turning point

Expleo's expert team, combining data scientists and EV manufacturing engineers, performed a full agnostic data analysis, reviewing production data without assumptions about the expected outcomes. This approach allowed the team to surface unexpected correlations and insights across both chemical and electrical phases of battery production. Using real-time data collected from connected industrial machines, the team mapped out the key process parameters influencing the quality of the EV batteries. The analysis was powered by Python and visualised using Power BI, enabling clear communication across all teams. This initiative supported the client's ambition to become a smart manufacturer, laying essential groundwork for the deployment of industrial AI, connected sensors and a scalable data infrastructure.

What changed: measurable outcomes & business impact

The company now operates with a complete view of its production data: a data inventory programme which tracks, organises and centralises data across machines and processes. Real-time insights are now possible thanks to connected sensors and a centralised big data platform. This has led to a much deeper understanding of which process parameters affect battery performance and which inefficiencies can be tackled. Scrap rates have dropped significantly, helping to reduce waste and manufacturing costs. More importantly, the company is now firmly on the path to realising its AI-driven smart factory ambition, one where data actively supports product innovation, process control and strategic growth.

TRAINING AND WORK INSTRUCTIONS

EXPLEO HARNESSED THE POWER OF GENAI TO TRAIN NEW QUALITY INSPECTORS IN RECORD TIME

A leading aerospace manufacturer revolutionised the way it trains its quality inspectors, using an AI coach powered by GenAI and Retrieval-Augmented Generation (RAG). The results: faster onboarding, sharper skills, and job-ready inspectors in record time.

Before AI: the challenge behind the project

In high-stakes manufacturing environments like aerospace, quality control matters more than anything else. For one of Expleo's clients, a global aerospace manufacturer, training quality inspectors was a lengthy, high-cost process. It could take over six months before a new hire was certified to inspect parts on the line. Most of this training happened in classrooms, far from real-world production conditions. The steep learning curve, combined with documentation overload and limited access to mentors, slowed down productivity and created resource bottlenecks across operations.

How AI was applied: the turning point

To solve this, Expleo deployed an AI-powered training assistant using GenAI and Retrieval-Augmented Generation (RAG). Built and optimised by Expleo's team of Large Language Models (LLM) engineers, the assistant provides 24/7 support to trainees through a chat interface. It ingests thousands of pages of technical manuals, diagrams, and training videos, to give real-time, contextual answers to conformity-related questions as inspectors work on live components.

Trainees receive suggested follow-up questions, plus direct links to source documents for further exploration. The system is secure with an intuitive user interface. In short, it acts as a digital mentor that's always available and perfectly reliable.

What changed: measurable outcomes & business impact

With the AI assistant in place, trainee inspectors were able to shift from passive classroom learning to active, on-the-job training, without sacrificing rigour or compliance. The result: training times were reduced by up to 40%, and quality inspectors were operational up to two months earlier than before. The assistant drastically reduced the mentoring workload for senior staff, improving knowledge transfer consistency.

Moreover, operational efficiency improved by up to 60%, while the organisation gained the ability to cross-skill engineers into quality roles faster and at scale. Although the AI assistant was built for Quality Control (QC), its potential applies across multiple functions, opening doors to a broader transformation of onboarding processes across all manufacturing roles and all sectors.

AI THAT TALKS BACK: HOW AIRBUS IS REVOLUTIONISING WORK INSTRUCTIONS WITH GENAI

Airbus is scaling AI across every layer of its industrial operations, from assembly lines to after-sales support. With its experimental app that functions like a chatbot, GenAIR, even the most complex manufacturing processes are becoming accessible to all its workers, regardless of skill level.

Before AI: the challenge behind the project

Aircraft manufacturing is a high-stakes discipline with zero margin for error. Operators rely on thousands of pages of technical documentation to perform standard procedures, whether fitting components, applying torque, or validating inspections. For Airbus, ensuring each worker could access the right information at the right moment became a growing challenge, especially as processes evolved and workforce diversity increased. Traditional tablets and manuals slowed execution and created knowledge gaps, particularly for less experienced operators. Meanwhile, maintaining the highest quality standards remained a non-negotiable priority.

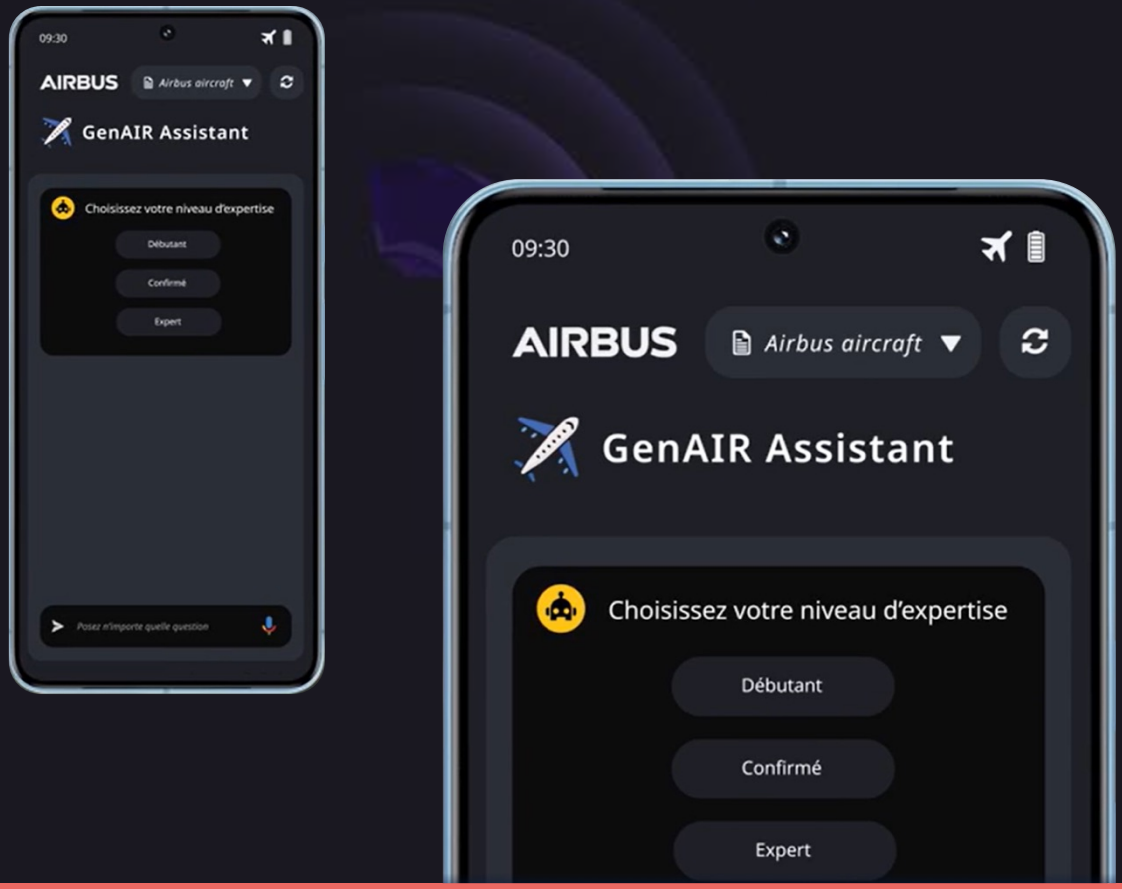
AI THAT TALKS BACK: HOW AIRBUS IS REVOLUTIONISING WORK INSTRUCTIONS WITH GENAI

How AI was applied: the turning point

In response, Airbus doubled down on AI, embedding it as a core pillar of its every operation. The company had already used AI since 2016 - for satellite image processing, predictive maintenance, and engineering support.

But with the arrival of GenAI, the group saw an opportunity to scale AI beyond data scientists and into the hands of frontline workers. In 2023, Airbus launched a global working group to responsibly deploy GenAI.

Among them: GenAIR, a conversational assistant that creates a natural dialogue between frontline workers that can ask it any questions about complex operating procedures, skipping the part where they had to research through heavy documentation. Built to support workers of all experience levels, GenAIR delivers tailored, real-time instructions on smartphones, whether guiding a novice through the steps of hole-drilling or advising a seasoned technician on torque settings. This AI doesn't just fetch data as it understands context, adapts, and learns.



What changed: measurable outcomes & business impact

With GenAIR, Airbus has redefined how operators interact with knowledge on the factory floor. The assistant dramatically reduces the time it takes to access standard operating instructions, enabling teams to work with fewer interruptions. Instructions are personalised by skill level, helping accelerate onboarding and reduce dependency on supervisors.

Such initiatives improve flow, raise first-time-right rates, and build resilience into Airbus's manufacturing systems. What began as experiments are now being scaled, paving the way for a GenAI-enabled workforce.

ABOUT EXPLEO

At Expleo, we cut through the AI noise to focus on one thing: **helping you build what matters most to you, to the power of AI.**

We bring decades of engineering, manufacturing, IT and data expertise, combined with hands-on AI know-how, to deliver customised solutions that solve real-world challenges.

But above all, we bring people who listen, understand, adapt, and roll up their sleeves. Our experts work side by side with your teams, making AI practical, usable, and above all, valuable. Whether you're just starting or scaling AI across your organisation, we help you making AI work — for your business, your people, and your goals.

With Expleo, build what matters most, to the power of AI.

Let's talk

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