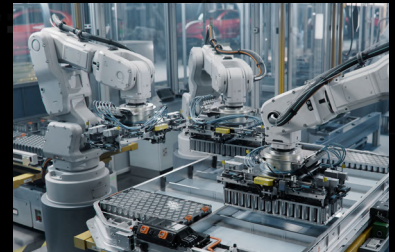# The data-driven Factory

Insights gained from operational data can transform manufacturing performance

Accelerating the data-driven factory journey

Operational managers in factories and their CIOs are under continuous pressure to optimize production and improve productivity.

In sports, performance coaches track metrics like distance covered, speed, and exertion levels to optimize training loads and prevent injuries. Orange Business helps its customers apply the same approach to manufacturing performance by making full use of their operational data to streamline operations and minimize downtime.

Estimates suggest that manufacturers only use 40% of their potential through spending too much time on manual tasks –and many struggle to keep the lights on as a result. This is where data can make a significant difference. While its use in manufacturing is not new, the arrival of digital technologies means data can be used to understand operations down to a granular level of detail.

However, this comes with a caveat. You will not get the answers you want without having the right operational data in the proper format. Providing the meaningful insights that will drive the business forward depends on knowing what data to capture and how to structure and analyze it.

Keeping everyone match-fit

Performance coaches rely on data analytics to identify the risk factors that might cause an athlete to break down during a game. The same applies to manufacturing environments. Data harvested from OT (Operational Technology) machines can help predict maintenance schedules and raw material inventories to keep production lines running at their optimum levels. Automated monitoring can enhance quality control and identify patterns in specific manufacturing processes that may be causing issues.

With real-time data generated from machinery and other assets, manufacturers can predict the likelihood of failure, ensuring parts and labor are on hand to minimize downtime and avoid significant operational disruption.

However, to use the data, you first must harvest it. According to IDC, getting this operational data out of outdated and legacy systems is one of the challenges most frequently cited by manufacturers in their transformation. A 2024 study by the Manufacturing Leadership Council revealed that 70% of manufacturers still collect data manually[1].
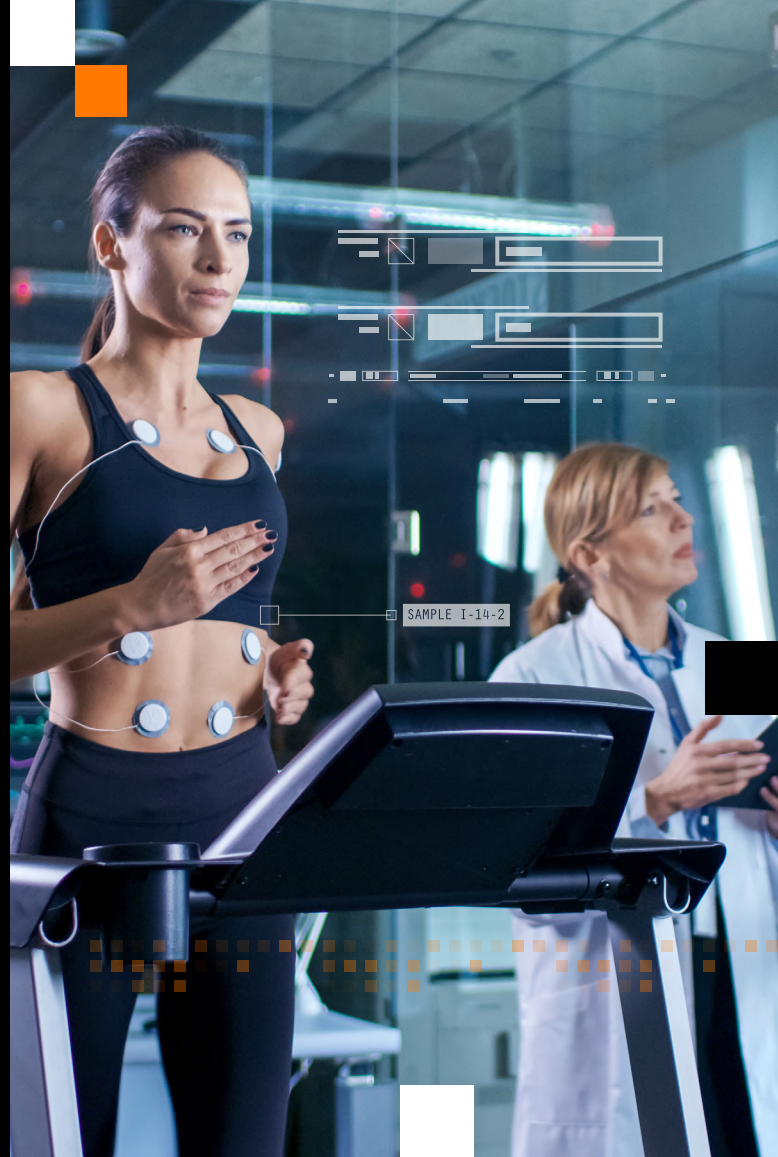
Creating a playbook for the long term

Data is transforming the worlds of sport and manufacturing alike. Data gathered from training grounds and sporting areas is transforming how athletes train, how coaches strategize, and how fans engage.

Equally, data collected and stored from inside and outside the factory is helping manufacturers to solidify their competitive edge and build resilience in a dynamic global marketplace. Manufacturers must shift to a data-driven factory model without compromising safety, product quality, or customer service.

Trailblazers are already making changes to become more data-driven and intelligent. Deloitte's 2025 Smart Manufacturing and Operations Survey found that investment priorities remain data-focused, with 40% investing in data analytics, 29% in cloud computing, 29% in AI, and 27% in IIoT[2].

Operational excellence gives manufacturers the best foundation for adapting quickly to changing markets now and in the future. But it requires commitment and comes with many challenges.

Here, we highlight how applying data-driven techniques to manufacturing via a robust transformation strategy can significantly enhance your overall productivity, minimize risk, and reduce waste in a safe and secure environment.

Why success is data-driven

Data is a critical asset. In sport, it informs decisions at all levels, from player recruitment and training to in-game strategies. In manufacturing, it provides visibility and insight into operations, from asset performance and predictive maintenance to inventory planning. For example, the data from the sensors that monitor telemetry, humidity, noise, and motion for real-time asset tracking and predictive analytics can be analyzed to address operational issues and make improvements. All of this can contribute to decreasing downtime and higher productivity.

Data also offers external visibility into supply chains, maintaining an agile inventory that can rapidly adapt to unforeseen demand.

If used correctly, data can help achieve operational excellence by helping to raise efficiencies, reduce expenses, and ensure that managers have the information necessary to drive continuous improvement in the workforce.

Here are seven ways that a data-driven approach can utilize operational data to meet business outcomes.

Predictive maintenance
Data sourced from machines and Industrial IoT (IIoT) can be used to continuously analyze the health of machines and predict, with the highest accuracy, when breakdowns will occur and the time to failure if not serviced. This can also help to improve worker safety, as unexpected breakdowns can lead to hazardous working conditions.

Preventative maintenance
Preventive maintenance analysis is used alongside the machine's lifecycle data to maintain health and ensure no issues arise that may cause production disruption.

Various indicators such as speed, vibration, temperature, and abnormalities can be monitored and flagged up if safe parameters are exceeded. This can be used in conjunction with maintenance strategies to decrease the costs associated with unplanned downtime.

Improving productivity and quality control
Manual quality control processes are time-consuming and prone to human error. By analyzing data from sensors on machines, manufacturers can identify the source of defects and take corrective actions. Data can also be used to map quality control to identify patterns that may indicate process issues.

Integrating quality control as an automated function in all manufacturing processes will greatly simplify the creation of a proactive end-to-end quality check. It will also free up human resources for critical thinking and complex decision-making.

Achieving workforce excellence
With the correct information provided to the right people, informed decision-making can happen throughout the factory floor, improving productivity, safety, and worker engagement.

Enhancing sustainability
Data analytics, AI, and ML can help reduce waste through enhanced prediction capabilities, better observability, and greater control.

Real-time data analytics can help manufacturers identify where they can improve their production processes and drive sustainability goals. For example, KPIs can be established and tracked on energy usage to help achieve energy savings and reduce carbon footprints.

Consistent rules lead to better business outcomes
Data governance supports business goals by ensuring data is compliant, consistent, accurate, and up-to-date. A secure data management foundation allows the organization to make decisions based on a unified version of the truth and is critical in ensuring trust and reliability in data insights.

Data governance is central to any smart factory's overarching data management strategy and is critical in any heavily regulated industry. For example, pharmaceutical companies must ensure that the right security and tracking are in place for any drug they wish to take to market.

Demand forecasting and inventory management
Demand forecasting is essential for manufacturers to manage resources and efficiently run production lines, allowing them to scale up and down as required.

Supply chain data and real-time shop floor data can be used to identify trends and monitor throughput and demand to better manage production resources and enhance inventory control.

Recognizing what you are up against

While many manufacturers have started their data-driven journey, some struggle to get the expected insight.

AI is revolutionizing recruitment strategies in recruitment at English Premier League clubs and is at the heart of the recently introduced Semi-Automated Offside Technology. In industrial product manufacturing, a 2024 Deloitte survey found that 55% of those surveyed are already leveraging GenAI tools in their operations, and over 40% plan to increase investment in AI and machine learning over the next three years. However, nearly 70% of manufacturers indicated that problems with data, including data quality, contextualization, and validation, are the most significant obstacles to AI implementation[3].

Many still depend on manual updates to firmware. Updates are time-consuming, slowing down data capture, which means it cannot be capitalized on fast enough for optimum results. A fundamental shift in thinking is required. As Gartner points out, a data-driven approach must embrace treating data as an asset, not a by-product[5].

With data from diverse sources and multiple system levels, there are hurdles to overcome to get the full value from factory data. These sources include product lifecycle management (PLM)

systems, IIoT devices, SCADA systems, PLCs, and others. It is a complex scenario that requires integrating technologies efficiently to share seamlessly mapped data.

A poorly defined digital transformation strategy results in high effort but low outcomes due to a misalignment with corporate objectives. A transition roadmap is critical in determining the capabilities, business cases, and pilot projects necessary to assess return on investment.

These are the main pitfalls
manufacturers need to watch out for in their transformation:

Connecting the unconnected

Many manufacturers are unaware of all of the assets in their estate, and which of them are – or are not - networked. An asset inventory is essential to determine digital maturity levels and align the overall vision. Next is a plan for secure connectivity, bringing systems together in a unified environment. These fundamental steps are necessary to ensure your transformation will succeed.

Data locked in silos

Operational data is often trapped in disparate or legacy systems that are not integrated and are manually maintained. This makes it impossible to share data or gain visibility and control. Manufacturers must look for ways to integrate and centralize their data securely.

Poor data quality

Inconsistent and poor data quality results in a lack of trust in the presented information and related decisions – and, at worst, bad decision-making. Increasingly, manufacturers are making use of data contextualization, which transforms raw data into meaningful insights and helps them to understand not only what happened but also how and why. By understanding the context surrounding data, manufacturers can identify root causes of problems, predict potential issues, and improve quality control, leading to reduced downtime and increased competitiveness.

Barriers to OT/IT convergence

Getting data out of older manufacturing equipment isn't an easy task. Legacy systems are not designed to exchange data. Integrating legacy OT systems with IT can be difficult, as some systems may have been created in-house and lack standardized interfaces. Restructuring or modernizing may be necessary.

Keeping distributed systems secure

Distributed systems connected to the internet give manufacturers greater agility. But they also potentially create a threat vector for unauthorized access. Manufacturers must understand what needs to be protected and what the risks are. Strong authentication and authorization are paramount.

To mitigate risk, manufacturers should implement robust data protection policies, including secure storage, regular data backups, and regularly revisit disaster recovery plans.

The global skills shortage

A lack of in-house skills is a growing problem. According to Gartner, organizational complexity, integration, and process reengineering are the most prevalent obstacles to executing data-driven manufacturing initiatives[6].

Furthermore, a data-driven factory is founded on a data-driven culture, and many manufacturers embark upon their transformation without assessing the in-house resources and budgets for upskilling and digital training.

Failing to turn data into intelligence

Operational data is only useful if it has context. However, data management and governance are often seen as add-ons that will subsequently cause issues with data protection and industry compliance. As a result, many manufacturers fail to put together a data management strategy for managing and storing data in a usable and contextualized format.

Scaling too fast

Some manufacturers make the mistake of rushing to scale up without putting proper transitional steps in place. This inevitably creates excessive downtime, as necessary actions may have been missed. Scale at a pace the business can manage, putting the right training in place and avoiding unnecessary disruption. This means choosing business cases that will bring the most value first.

The four essential pillars
in constructing a smart
data-driven environment

Four pillars of data analytics are re-shaping the world of sports – performance analysis, personalized training programs, talent identification and scouting, and real-time insights that enable immediate adjustments to in-game tactics and strategies. In the data-driven factory, there are also four pillars, but these relate to the connected assets and digitization that enable people, processes, and data to work harmoniously together: these are infrastructure, OT/IT integration, security, and smart insights.

1. Infrastructure

Connectivity is the backbone of the data-driven factory. Networks must be fast, secure, and reliable while being scalable and flexible enough to cope with changing bandwidth demands.

Change does not mean ripping out legacy systems. It is about tiny steps – integrating the old with the new and connecting them efficiently. Networking options include Industrial

Ethernet, Bluetooth Low Energy (BLE), Wi-Fi[6], LoRaWAN, and 4G/5G, together with Flexible SD-WAN for enterprise-wide communication, to provide secure access to the cloud.

5G brings the ability to handle more significant volumes of data and offers lower latency than connectivity solutions we have seen before.
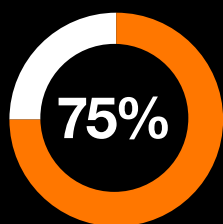
75% **Of industrial organizations expect budget allocations for smart manufacturing initiatives to increase:** areas such as active sensors, IoT platforms, AI-driven vision systems, edge computing, and factory automation hardware were described as key parts of their strategic focus.[7]

2. IT/OT convergence

Integrating IT and OT can provide a 360-degree view of operations through data analytics. Thus, manufacturers' drive to optimize operations and costs has become one of the prime drivers of the manufacturing data analytics market[8].

IT/OT integration makes drilling, managing, securing, and exploiting data sources easier to feed to analytics solutions. Integration can also cut overall costs by reducing duplication amongst people, assets, and processes[9]. It is little surprise, therefore, that Gartner expects that 75% of G2000 manufacturers will implement IT-OT integration strategies to accelerate product cycles and strengthen resilience[10].

The transformation required should not be underestimated, however. Restructuring – including cultural change and governance initiatives – may be necessary to align IT and OT integration alongside investment in new tools and modernizing legacy systems.

Data from OT systems must be available in a usable format for IT systems to analyze and gain insight. To achieve this, IT and OT teams must collaborate to enable operational efficiencies and maintain a secure environment for devices and data traffic in transit and at rest.

3. Security

IT/OT convergence has expanded the attack surface considerably. Thus, security must be baked in and not an afterthought.

Manufacturers must prepare for threats by securing internal data flows, ensuring compliance with regulatory requirements, and securing the entire digital supply chain.

Utilizing asset discovery and management tools, network security monitoring solutions, and vulnerability scanners will empower manufacturers to accurately map asset connections and proactively detect anomalies through continuous monitoring.

A multi-layered approach is vital to ensure the security of the digital infrastructure. This includes services for threat detection, monitoring, and analytics, strong identity authentication, secure remote access controls, encryption, and incident response capabilities. Cybersecurity awareness training is also a crucial component.

A robust cybersecurity program should include regular risk assessments, governance security policies, incident response plans, and continuous monitoring.

4. Smart insights

The rise to prominence of IIoT, AI, and ML technologies is enabling manufacturers to exploit data analytics for more granular insights. AI can be trained to automatically find and eliminate bottlenecks or alert operators when machines show signs of fatigue. ML can use tailored algorithms to identify issues that may impact quality control automatically. These can be flagged up to process managers to prevent product losses.

In addition, APIs that allow for the easy integration of application software can make data available quickly to provide visibility into supply chains. Dashboards built with these APIs track KPIs, such as throughput, in real time to ensure client deadlines are being met.

Finding the best-fitting and most scalable architecture and technology will depend on the company's unique requirements and needs the right balance between best practice and innovation.

"Investments in data readiness and connectivity are setting the stage for increased automation."

Deloitte, 2025 Smart Manufacturing and Operations Survey: Navigating challenges to implementation[13]

The practical steps to building a data-driven factory strategy

Whether you are a sports franchise or a manufacturing company, creating a data-driven strategy is a systematic process that gathers and analyzes data to provide a 360-degree view of operations that promotes competitive advantage and business growth. These insights can pinpoint potential opportunities, highlight areas where improvements can be made, and improve efficiencies. To achieve this, you must:

Define objectives and vision

Firstly, identify development priorities and business cases. Run a data maturity analytics assessment to identify all data assets and their current use. This will help to spot any weaknesses and determine development priorities.

Look at how data can be harvested from legacy systems - IoT devices with the right connections, protocols, and firmware can aid this process.

Next, develop business cases by looking at control, efficiencies, and savings gained alongside the availability of consistent quality data. Consider prioritizing cases that will address urgent business issues and stimulate overall growth. It is imperative to create metrics that track the progress of your chosen data-driven projects.

Address the IT/OT stack for successful integration

Several challenges come with integrating the OT stack with IT. These include connecting existing legacy assets, which can be many years old. There are also inconsistencies in technical standards and cybersecurity policies, which can also create difficulties.

Transitioning from siloed IT and OT architectures to a highly integrated data platform requires a multidimensional approach – aligning technology with processes and business goals.

IT/OT integration is complex and needs a strategic and holistic integration plan to link both environments successfully. This includes assessing the legacy estate, securely extending OT data to the cloud, and choosing the scalable use cases that will generate the most immediate benefits from integration. Every factory is at a different stage in its transformation, so be prepared to execute gradually.

To break down data silos, you must know precisely where all your data sits, how it is harvested, and how relevant it is to your needs. Once the data is audited, you can map it to ensure it is discoverable, used, and shared across the organization.

You also need to decide which platform you want to use as a single source of truth. For example, this may be via a Unified Name Space (UNS) that exchanges real-time data in a central location. Developing technological and human capabilities to gather, merge, manage, and analyze data is also essential.

It is essential to draw up a strong data governance and management plan. Data governance provides policies and procedures to utilize and protect your data. In addition, data management ensures that stored data is reliable, easily accessible, and current. This ensures that the correct data is used in dashboards for analytics, reporting, and decision-making.
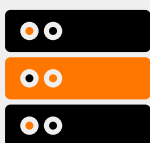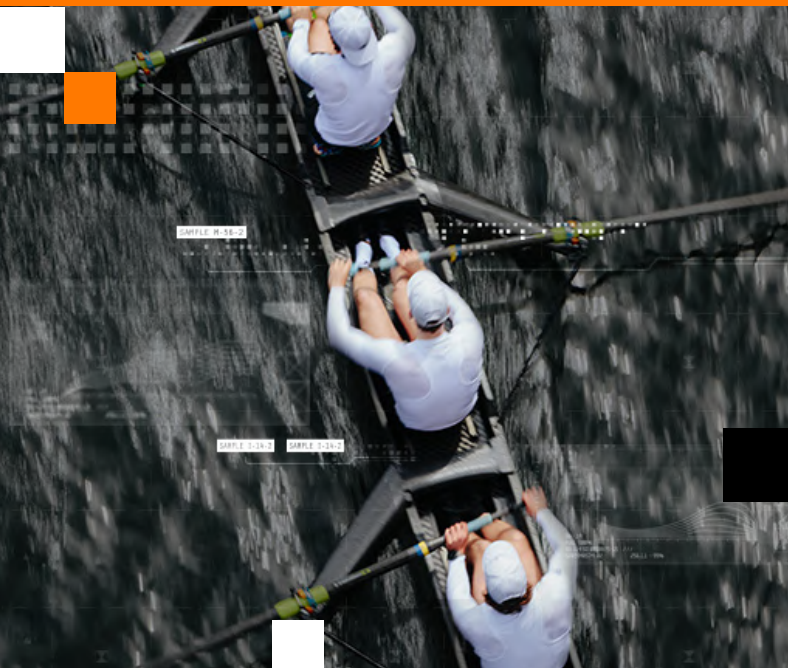
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# Develop a data-driven mindset across the enterprise

For sports coaches and factory managers alike, getting maximum value from a data-driven culture means everyone on the team must have the skills to share and understand the collected data. All too often, manufacturers overestimate the digital literacy of their workforce, so ensure yours is trained to get the maximum benefit from the technology they use and can see why data insight benefits their roles.

Enable faster time-to-value by being more agile

Agile methodologies and team structures are effective tools to ensure tangible and value-adding results. The more important aspect of this structure is setting the focus on clear business outcomes, starting small and iteratively past a working Proof-of-Concept (PoC), and delivering the initially anticipated benefits. As Gartner points out, every factory is unique, and even when carefully scoped out, transformation may be more challenging than initially thought[14].

What is a Unified Name Space and why do I need one?

A UNS is a concept of distributed data that uses a hierarchical structure to provide standardization and a single source of truth for an enterprise's production data. It connects all systems, including edge devices and other platforms, and serves as a central hub or repository for data interoperability. This means every machine and software application across the organization accesses the same information as all data passes through the hub.
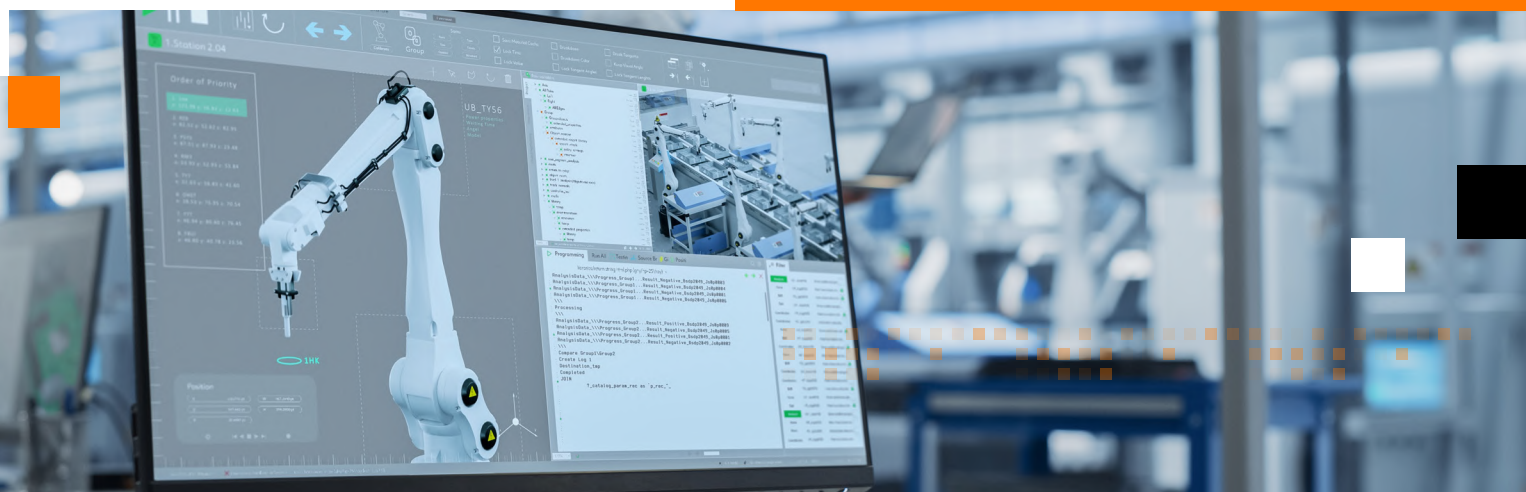
Future-proofing your game plan

It is very easy to underestimate the challenges entailed in successfully transitioning to a data-driven factory. In the world of sports, coaches' resistance to data analytics stems from such factors as concerns about preserving traditional methods and potential threats to coaching authority.

To learn more about the stumbling blocks in implementing a digital solution in the OT environment, Orange Business commissioned a survey by GlobalData which identified the biggest hurdles as: Difficulty in integrating the new solution with legacy infrastructure (43%); Poor performance of an external professional services vendor (38%); Digital solution not correctly configured for the actual production environment (34%); And, lack of staff with appropriate skills (32%).

To navigate this journey effectively, collaboration and partnerships play a pivotal role. Partnering with trusted technology providers and industry leaders allows manufacturers to tap into diverse expertise and best-in-class solutions

– reducing complexity, mitigating risks, and speeding up transformation. However, it is critical that your chosen partner can demonstrate expertise and experience across both IT and OT environments if your data-driven strategy is to deliver the outcomes you seek.

Improvements in manufacturing performance will be achieved through greater automation, better insights, and real-time decision-making – and data is fundamental to the realization of all of these ambitions. However, this is not a tick-box exercise. It is a continuous journey. Regular reviews and strategic updates of the data-driven manufacturing roadmap are essential for achieving data excellence.

A teammate
you can trust

Orange Business is your go-to global transformation partner for the data-driven factory. We provide enterprises with state-of-the-art Industry 4.0 solutions to increase their agility, scalability, and resilience while increasing productivity and opening opportunities to explore new connected products and digital business models.

- Our approach is designed to make your business outcomes a reality. Our consultants have extensive industry experience and vertical expertise supported by best-in-class partner ecosystems.

- Our consultants can answer your transformation challenges at every stage of the data journey using a secure, scalable, flexible approach.

- With our business insights, methodology, and skills, we will work closely with you to outline business goals, organize efficient and secure data sharing, and accelerate innovation.

1. Manufacturing Leadership Council https://manufacturingleadershipcouncil.com/seventy-percent-of-manufacturers-still-enter-data-manually-2-37141/?stream=all-news-insights**, 2.** 2025 Smart Manufacturing and Operations Survey https://www2.deloitte.com/us/en/insights/industry/manufacturing/2025-smart-manufacturing-survey.html, **3.** 2025 Manufacturing Industry Outlook https://www2.deloitte.com/us/en/insights/industry/manufacturing/manufacturing-industry-outlook.html, **4.** Source: https://www.prnewswire.com/news-releases/survey-finds-manufacturers-lag-in-modernization-despite-surge-of-pandemic-driven-investments-301546053.html, **5.** Gartner data-driven cultural change https://www.gartner.com/smarterwithgartner/create-a-data-driven-culture-by-influencing-3-areas, **6.** Gartner 6 key actions for smart manufacturing strategy https://www.gartner.com/smarterwithgartner/6-key-actions-for-a-successful-smart-manufacturing-strategy, **7.** 2025 Smart Manufacturing and Operations Survey: https://www2.deloitte.com/us/en/insights/industry/manufacturing/2025-smart-manufacturing-survey.html, **8.** Transparency market research manufacturing analytics market 2023 https://www.globenewswire.com/en/news-release/2023/06/02/2681331/0/en/Manufacturing- Analytics-Market-Size-to-Exceed-US-22-3-Bil, **9.** Gartner IT/OT alignment. IT/OT integration March 2022, **10.** The Power of IT-OT Convergence in Driving Manufacturing Innovation https://blog.3ds.com/brands/delmia/the-power-of-it-ot-convergence-in-driving-manufacturing-innovation/, **11.** IDC Futurescape worldwide manufacturing 2023 predictions https://idcdocserv.com/US48630122, **12.** IDC Futurescape top 10 predictions operations https://www.idc.com/getdoc.jsp?containerId=prUS49960122, **13.** 2025 Smart Manufacturing and Operations Survey https://www2.deloitte.com/us/en/insights/industry/manufacturing/2025-smart-manufacturing-survey.html, **14.** GlobalData Seizing the opportunities of industrial digitalization: Governance, innovation and excellence