

EVIDEN

Smart Factory

How to establish, scale and
operate smarter factories

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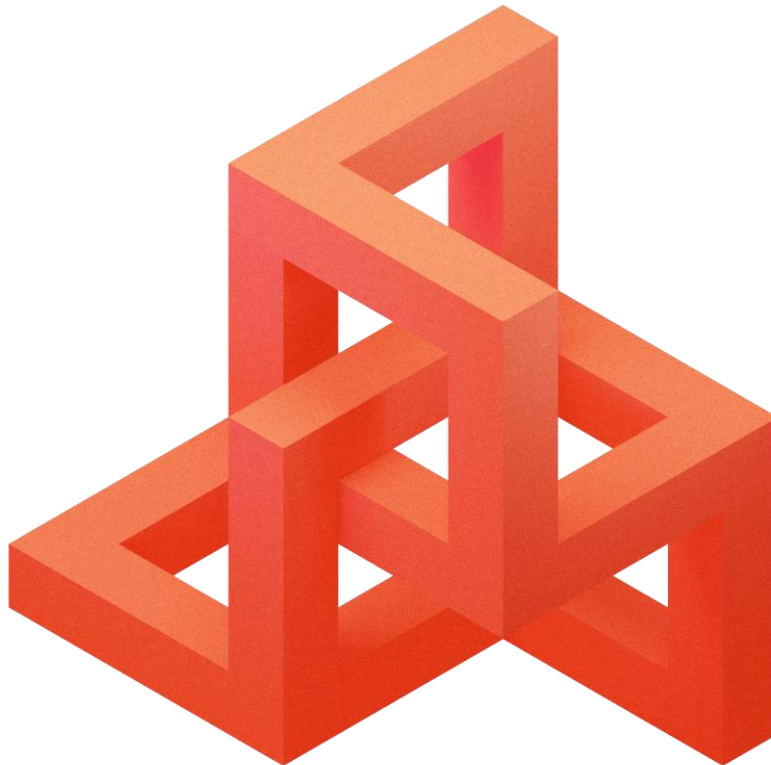
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Introduction

In times of accelerated market changes everywhere, manufacturers need to deploy highly adaptive business strategies and models.

Evolving towards smart factories is a strategic priority for manufacturers today.

By establishing data-driven operations and consolidating and processing massive amounts of operational and enterprise data from sensors, devices, machines and business systems, manufacturers can dramatically improve agility, efficiency, flexibility and sustainability, with the capability to produce more compliant, higher quality individualized goods at lower cost.



Why should I make smart factory a top investment priority?

Many companies have identified smart factory as a key driver to achieve a competitive edge, and forecasts estimate that investments in smart factories will grow at a rate of approximately 10%, to reach around \$244.8 billion US by 2024.⁰¹ A recent survey from Eviden and Forrester revealed that the most critical drivers for investment in smart factories and IoT are the pursuit of cost reduction, efficiency and sustainability in production.⁰²

Yet, despite the high potential of a smart factory, many companies still operate conventional factories. A recent survey of the German manufacturing industry showed that:

- 20% of companies still control and coordinate their production processes and associated production and operating facilities via classical IT systems
- In about half of all companies surveyed, the establishment of a smart factory is in planning, while another fifth is considering addressing the topic⁰³

COVID-19 has put factories digitalization on top of manufacturers priorities. During the pandemic, many organizations have experienced struggles in quickly reconfiguring their production and supply chain networks and have identified obvious shortcomings in the digital maturity of their operations. In fact, in a McKinsey survey from the second quarter of 2020, 85% admitted to this lack of maturity.⁰⁴

At the dawn of the new normal digital era, deploying smart factory technologies appears more than ever to be a strategic imperative for manufacturers to meet tomorrow's challenges. In our increasingly volatile and uncertain world, the key is to be able to adapt rapidly to the increasing pace of change in demand or supply, reduce costs, optimize quality of service, improve user experience, increase resilience, compliance, sustainability, and differentiate from the competition.⁰⁵



What distinguishes a smart factory?

According to the Fraunhofer Institute, a smart factory can be defined as:

- “A fully connected and flexible system that is characterized by autonomous decision-making processes and simultaneously control of production processes in real or near-real-time.”
- “[The] objective is the synchronization of production processes through an accelerated communication of integrated ‘things’ within smart domains production, logistics and maintenance.”⁰⁶

To gain the full benefits of a smart factory journey, it is essential to have a holistic view on the relevant ecosystem and distinguish three key elements.

1 Core manufacturing processes

The focal point of the smart factory is obviously the make process. The consistent digitalization of the shop floor with an integrated, flexible and scalable IT/OT industrial data platform unleashes significant business benefits and can pave the way for end-to-end business process optimization.

2 Horizontal end-to-end process optimization

To overcome functional silos and fragmented processes, smart factory initiatives should not be seen as isolated, but should be embedded into the broader horizontal ecosystem. Leading companies strive to achieve end-to-end process automation including R&D, supply chain, sales and customer service processes. Standardized data interfaced with the make process provide data seamlessly and facilitate additional improvement measures within the smart factory, while simultaneously reducing implementation efforts.

3 Vertical shop-floor-to-top-floor integration

A vertical shop-floor-to-top-floor integration from connected machines and workers up to enterprise planning processes allows advanced controls, decision making and integrated KPI dashboards from production line to enterprise level. While the IoT and industrial equipment connectivity on the shop floor is the foundation for any smart factory initiative, integration with ERP, MES and MOM systems is necessary for any integrated business planning processes and end-to-end KPI dashboards

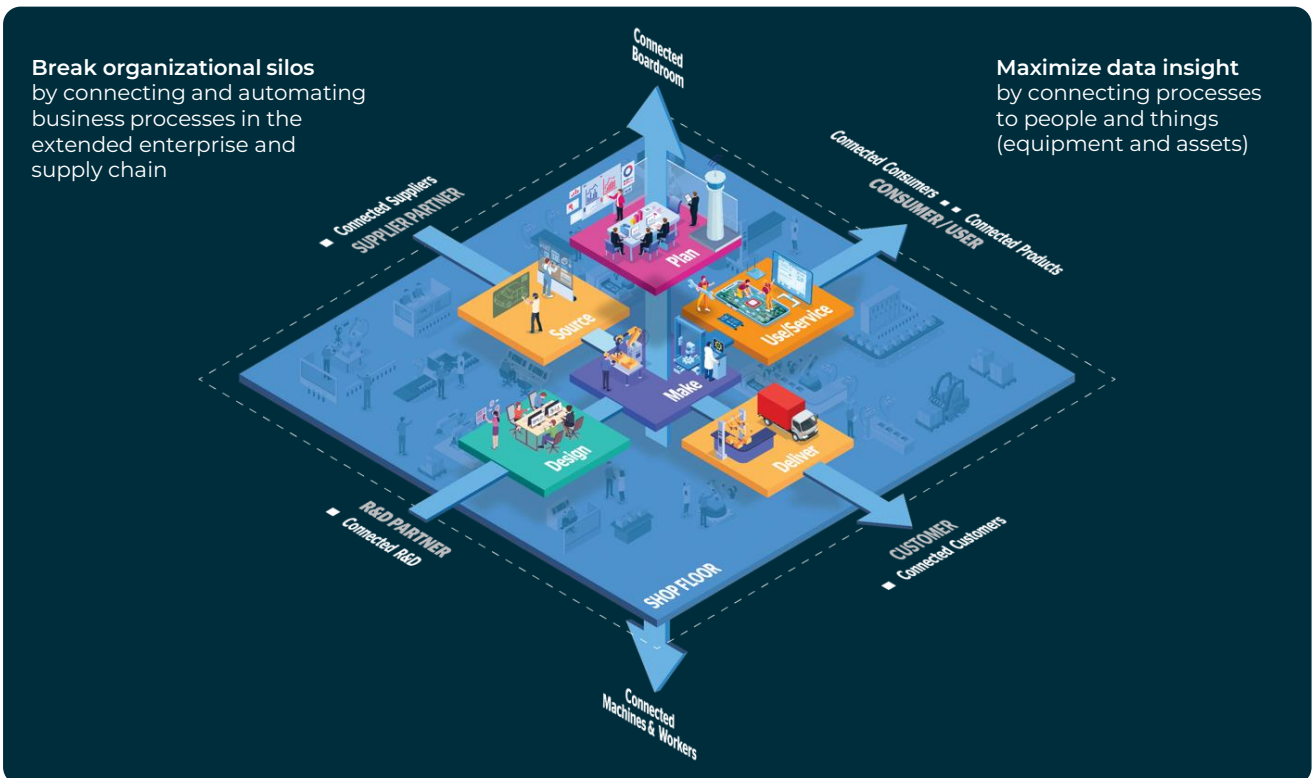


Figure 1 – Fully integrated smart factory

What are the benefits?

At Eviden, our experience with multiple smart factory initiatives shows that key benefits of investments into smart factories can be clustered into eight domains:

1 Increasing production efficiency

A recent survey from Eviden, in partnership with Forrester in 2020, where 524 decision makers at manufacturing firms participated, revealed, that 51% see the highest priority to invest in smart factory technologies such as IoT is driven by the need to drive cost reduction and efficiency in production processes.⁰² The detection of unleashed potentials and resources within the shop floor or nearby domains such as inventory stocks, planned maintenance cycles or high utilization of equipment is a decisive competitive factor. A high level of connectivity and intelligent automation among the production value chain enables the location of any product in real-time and raises the level of transparency and traceability

2 Improving traceability

For many manufacturers, traceability of events and tracking of physical items has become the top ranked topic to trigger highly connected smart factory initiatives. End-to-end digital continuity, increasing needs for real-time visibility and transparency require advanced capabilities. Smart factories are then able to catch production execution details such as actual characteristics of products and processes, material flows, assets settings and comprehensive genealogy of products. At any time, authorities or clients can get the answers to questions such as: What has been produced? When and by whom? On which machine? Maintained by whom? With which tool, that has been calibrated by whom? Consuming what components that have been stored where, for how long and transported by whom?

3 Driving production agility

Reorganizing traditional production systems and the use of intelligent automation in production processes delivers higher flexibility in facilities and the capability to react agilely to demand. Reliable information exchange – secured from digital threats - leads to shorter innovation cycles, shorter time to market and better design for manufacturing and assembling.

4 Enhancing supply chain resilience

A recent survey of manufacturing and supply chain professionals by McKinsey found that 93% plan to focus on the resilience of their supply chain.⁰⁴ To remain competitive, there is a critical need to adapt and disrupt by using predictive intelligence, analytics and real-time visibility, ensuring your supply chain and last-mile delivery initiatives deliver their full benefits. This is a strategic benefit from smart factories.

5 Fostering superior quality

In 2019, BCG conducted an online survey to assess the status and future impact of so-called “Quality 4.0” initiatives. In this survey, participants considered predictive quality, machine vision quality control and digital standard operating procedures to be the use cases with the most crucial impact in manufacturing.⁰⁷ A smart factory provides a boost to Quality 4.0 initiatives through digital plant structures and processes.

6 Boosting user experience

New capabilities boost usability, and active interaction on operating interfaces and between human-to-machine plays a decisive role along the digital journey. Smart factories enable conventional training models to be reinvented and physical interactions adjusted ergonomically, as the recent past (and COVID-19) have demonstrated.

7 Ensuring compliance

Leveraging digital technologies is essential to tackle the growing array of manufacturing regulations. Regulatory compliance is becoming more challenging due to the increasing role of governmental regulatory bodies in many industry sectors, along with the emergence of global manufacturing compliance standards. In addition, IT is becoming a crucial component of the product in many industries, such as autonomous cars, with legal implications. Smart factories provide a major contribution there.

8 Improving sustainability

Resource and energy efficiency enabled by digital technologies in the factory is a key lever to reduce the carbon footprint on a company's journey towards net-zero emissions.

What does a best practice approach look like?

According to a recent study by McKinsey, only 30% of smart factory initiatives have been able to scale in recent years.⁰⁴ The main challenge is to deploy digital solutions across the production network to achieve the expected large-scale business benefits. Together with several of our clients, Eviden has developed a best practice approach for successfully initiating and scaling a corporate-wide smart factory transformation. It consists of three key elements:

- 1 Set-up a scalable industrial digital foundation platform**, to easily plug-in multiple use cases and support large-scale operational deployments
- 2 Deploy smart factory blueprints and an agile solution center**, to enhance production KPIs holistically across value chains and plants.
- 3 Drive a global transformation and deployment management plan**, to ensure optimal roll-out and fully capture business benefits and ROI.

The recipe for success: Think big, start small, scale fast

From a business perspective, Eviden's field experience working with key clients shows that there are three stages required to pave the way for smart factory initiatives:

1. Set the foundation
2. Scale up the solutions
3. Go big globally

To establish a reliable foundation for any smart factory initiative, it is essential to have an unbiased view of the current situation and capabilities. This analysis can be used as a baseline to define the strategic goals and action fields of a smart factory initiative.

Besides having this structured and holistic approach, it can be beneficial to start with one or two lighthouse use cases within a small number of factories to prove the benefits of your initiative and create positive

momentum within the organization. Make sure to check the scalability of the lighthouse use cases by testing the ability to repeat and deploy in different contexts (such as different plants, different products, different processes, different production assets) and at a reasonable cost. While the use cases for this lighthouse phase differ from company to company, in many cases it is important to start with use cases that can be broadly reused and that can provide a solid bootstrap for the smart factory journey.

But experience shows that successful smart factories initiatives start first with a solid industrial data management foundation, that can consistently scale across multiple use cases. In Eviden's experience, the first solid step in smart factory initiatives starts with the set-up of an industrial data management platform.

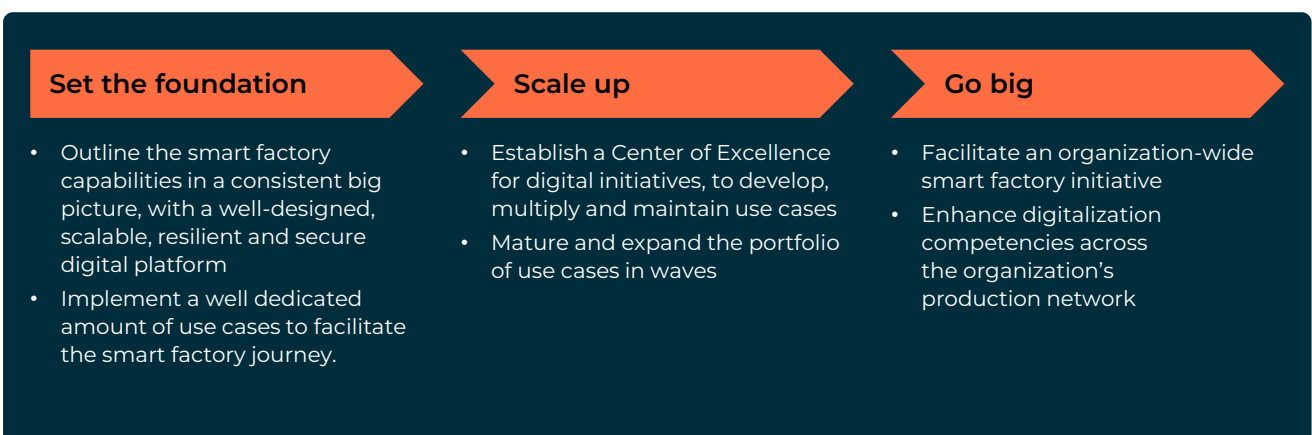


Figure 2 – The Eviden approach: Think big, start small, scale fast

1

Set up a scalable industrial digital foundation platform

The purpose of the industrial data management platform is to provide capabilities to efficiently scale and roll-out the digital solutions to multiple plants. It must rely on a powerful standard, elastic reference platform architecture, mapping functional building blocks and data flows to technical building blocks, instantiated with technologies adapted to the specific IT environment of each manufacturer.

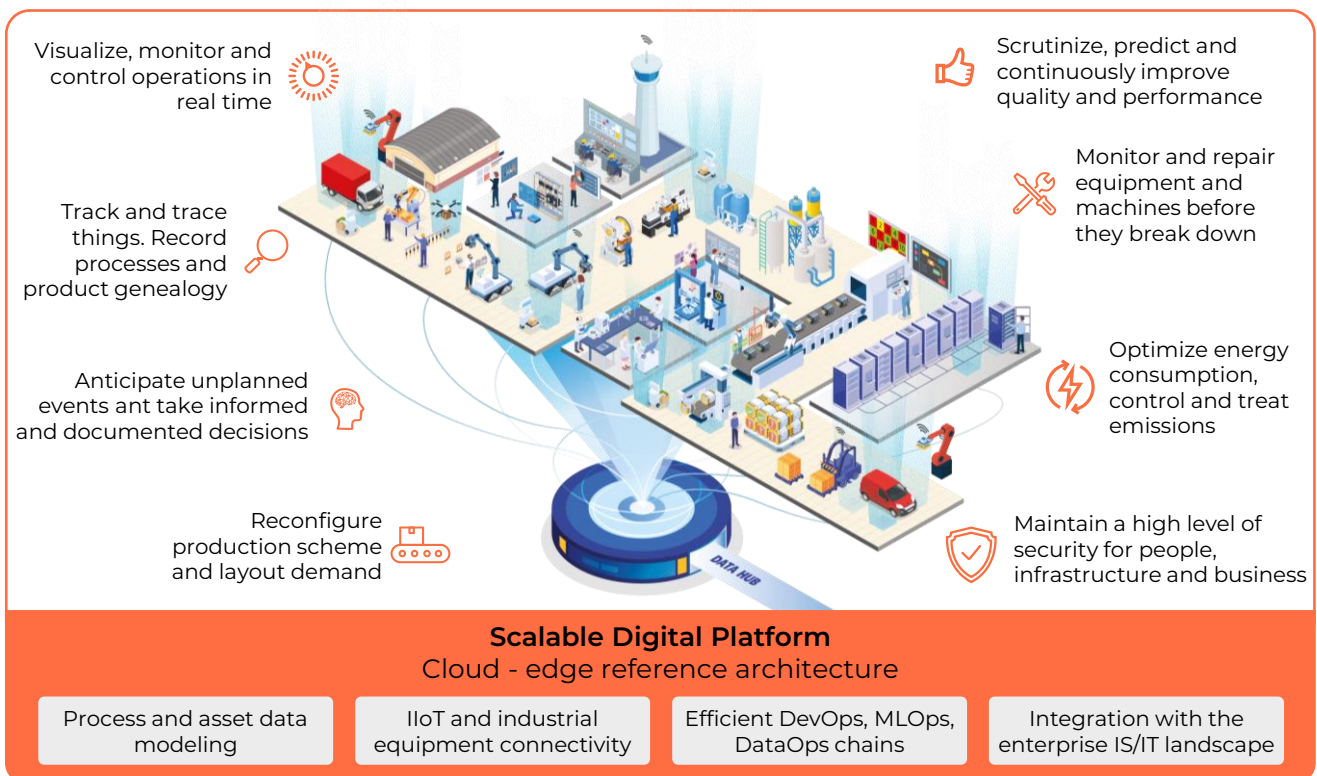
This foundation is essential because the technological circumstances are heterogeneous from plant to plant. The three main components of the framework are:

- **IoT and industrial equipment connectivity** – This layer provides adaptable functionality to efficiently connect multiple plant source systems, as relevant data can be provided by many different types of sources — including historians, programmable logic controllers (PLC), distributed control systems (DCS), lab instruments and manual data entry.
- **Data modeling and integration with the IS/IT landscape** – This enables manufacturers to establish a data repository fueled by the plant connectivity layer and other sources like ERP to make the data available securely and efficiently. This repository is the key source of data for the digital solutions. A data lake scrum team is responsible for fulfilling the various data demands from the digital solutions.

- **DevSecOps** – This favors highly automated application development and operations for the continuous development and maintenance of the digital solution portfolio, including global support aligned with the company's guidelines — especially regarding security. This is usually done by designated teams in the digital factory or in collaboration with corporate IT. A standardized, modular application architecture is essential to adapt and roll-out the applications to multiple plants and to reuse functionality across multiple applications. In addition, it is beneficial to establish a repository of best practice software components that can be reused by all teams and communities (such as the scrum master community and front-end developer community) to foster best practice exchange.

While maintaining maximum flexibility and ownership within digital solution development teams, it is essential to establish with this platform foundation standards and guidelines aligned with corporate IT policies (for example, regarding security, code quality, UX/UI design and CI/CD pipelines) and to rely on services from the corporate IT organization (like applications and IT infrastructure).

The value of this platform can be then easily demonstrated with a few first lighthouse use cases that will also facilitate the extension to the subsequent steps of the smart factory journey



2

Deploy smart factory blueprints and an agile solution center

After proving the value of the first smart factory use cases, the use case portfolio should then be expanded with additional use cases, and the initial use cases can be rolled out to additional factories in the production network.

From an Eviden perspective, use cases must be based on a thorough analysis of business-driven key performance indicators (KPIs) to enhance production holistically, defined through a four-step process:

- Identify meaningful production KPIs derived from the production strategy
- Structure and group KPIs and relate them to each production domain
- Define and set objectives for each production domain
- Ideate and develop digital solutions to fulfill targets and measure impact on KPIs

Examples of digital solutions in a smart factory are:

- **Factory Control Tower:** A digital performance cockpit with an end-to-end view of the production flow. This includes real-time alerts and supports data-driven decisions. The purpose is to reduce plant cycle times, reduce inventory levels and improve customer service.
- **OEE Reporting:** A digital index that puts availability, performance and quality of the production line in relationship. The focus is to enhance production performance through improved responsiveness, drill-down problem solving, enhanced data accuracy and real-time reaction.
- Other solutions include Energy Monitoring, Remote Assistance and Instruction, Digital Quality, Data Knowledge and Learning, Asset Management, Equipment Condition Monitoring, Predictive Maintenance, etc.



A structured way to manage a use-case portfolio in an agile and efficient manner is to establish a smart factory Center of Excellence. The Center of Excellence bundles the necessary capabilities to drive the smart factory initiative forward and is responsible for use case development and operations, as well as global rollout support.

The set-up of a smart factory Center of Excellence is a central pillar to structure and foster a company-wide smart factory initiative. Its main tasks are to develop, maintain and operate an evolving portfolio and provide the digital foundation for the factories. It ensures the consistent delivery of digital products within the factory network.

The building blocks of a smart factory Center of Excellence include three main elements:

- Innovation and development process
- Enterprise transformation
- Agile organization

Innovation and development process

The core process of developing and operating digital solutions consists of five steps:

- **Ideation** – A design-thinking-based workshop to identify and prioritize the most promising use cases within only a few hours.
- **Design sprint** – An excellent method to create and validate a business idea and sketch a customer-centered digital solution in only three days.
- **Prototype** – Create a near-final impression of the solution within two weeks. The graphical theme will match the UI/UX of the final solution by 90% or more, with some clickable features but without the full business logic.
- **Minimum viable product (MVP)** – An MVP is the first usable version of a digital solution that provides only key functionality to the users in a pilot plant to limit investment risks. If the MVP is successful, additional features are added and the solutions will be rolled out to multiple plants.
- **Rollout playbook** – The usage of a standardized rollout playbook helps deploy the solutions into multiple plants. The rollout team, local ambassadors and key users work together closely to ensure that the digital solution is adapted to the local requirements where needed.

Enterprise transformation

Aside from the capabilities mentioned above, another key success factor for a successful enterprise transformation is to enable the workforce with:

- **Digital training and certifications** – This capability enables employees in the factories to train on digital skills like analytics and rapid software development. A holistic training approach offers programs for beginners as well as experts, to broaden and deepen digital skills across your company's production network.

- **Agile coaching** is of major importance for anyone working in the smart factory Center of Excellence, because all digital products are developed in an agile way. Agile coaching for scrum masters and teams fosters best practice exchange and a mature, consistent agile approach across the scrum teams.
- **Marketing and communication** – A smart factory Center of Excellence is like a start-up that offers a portfolio of digital products to the factories within the same company. Typically, the factories should not be forced to use the products. Instead, appropriate in-house marketing creates knowledge about the benefits as well as demand in the factories to use the digital solutions.

Agile organization

The solution center organization is divided into four agile tribes with different roles and responsibilities:

- **Leadership team** – Responsible for the overall strategy of the Center of Excellence and the digital solution portfolio. It includes digital advisors and agile coaches to facilitate corporate-wide scaling.
- **Development teams** – Responsible for the development of digital solutions in a user centric and agile way.
- **Enablement teams** – Consists of subject matter experts from domains such as production, compliance, security and architects that act in an advisory function to support the respective site. Their also include a rollout team with responsibility for the adoption and integration of new digital solutions in factory operations.
- **DevOps, CloudOps and scaling platform teams** – Includes experienced IT professionals to manage code releases and operate the applications and the underlying cloud infrastructure. They define system communication standards, ensure and maintain the data lake and IoT connection, create reusable assets and orchestrate the application development.



3

Drive a global transformation and deployment project management plan

After successfully establishing a Center of Excellence, the team can act as a nucleus to foster the corporate-wide factory digitalization. While the central team remains the core of the smart factory transformation program, to achieve the next maturity level of smart factory digitalization, it's essential to also have decentralized digitalization competencies and skilled staff as well. This can be supported by a smart factory training and certification curriculum provided by the Center of Excellence.

This methodology has been developed and proven based on the experience of Eviden, our clients and partners with large scale implementations that resulted in billions of business savings, increased agility, efficiency, flexibility and sustainability, with the capability to produce more compliant, higher quality individualized goods at lower cost.



How can these best practices apply to your own smart factory projects?

Eviden has developed an ideation workshop based on design thinking to provide a business value centric starting point for your smart factory journey. Along the way, Eviden can accelerate your smart factory program with consulting, digital solutions, technology and data management, as well as security services.

Based on design thinking methods, initial use cases (including estimated business value) and a high-level roadmap will be developed jointly within only a few hours.



Empathize

- Workshop roadmap and overview
- Understand the context
- Illustrate challenges and pain points



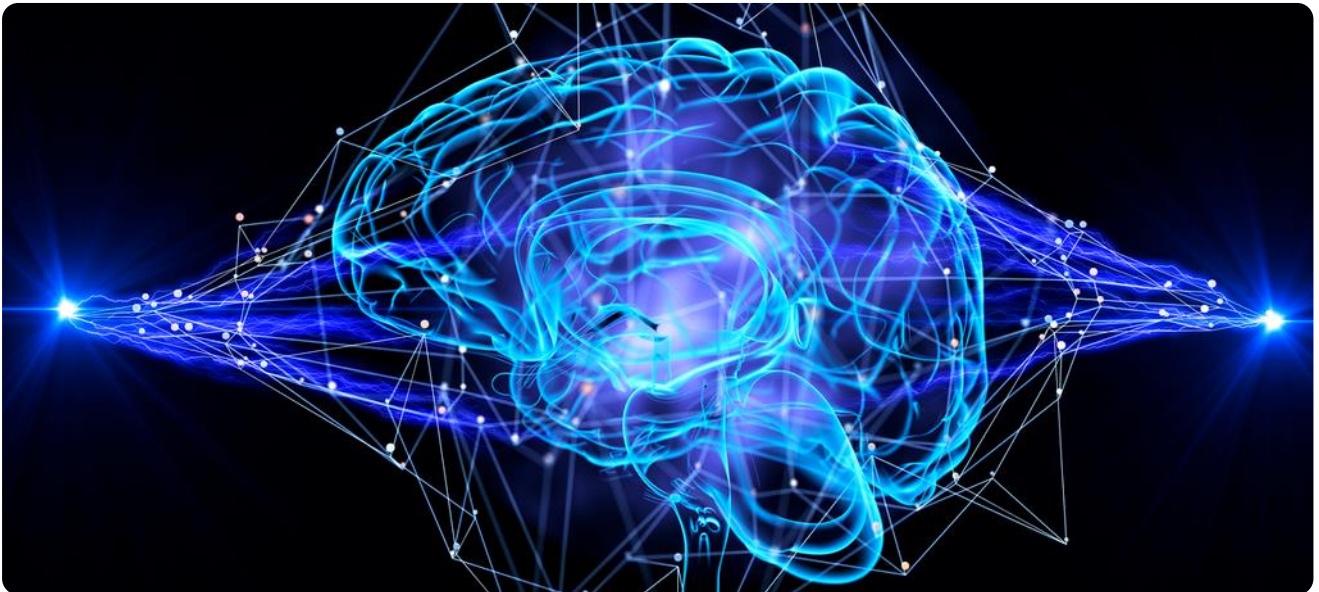
Define

- Learn from other industries
- Identify and scope use cases
- Prioritize and select use cases



Ideate

- Sketch solution draft of first use case
- Define business metrics
- Derive roadmap and next steps



Request a workshop online at our Smart Manufacturing Studio, or through your Eviden Client Executive Partner

<https://atos.net/en/manufacturing/smartmanufacturingstudio>



About Eviden Manufacturing

In the field of Industry 4.0 and IOT, Servitization Intelligence is the essence of modern manufacturing. Leveraging its long-term industry expertise, Eviden helps clients drive their strategic transformation towards smart industry and build the sustainable manufacturing of the future.

From consulting to integration and operation, Eviden helps manufacturers:

- Move to sustainable manufacturing
- Accelerate product innovation and time to market
- Deploy smart factories and intelligent supply chains
- Develop customer and service innovation

All while building an intelligent manufacturing platform, cloud, security and managed services foundations.

To support you all along the way, Eviden has developed as full set of smart factory solutions & services. Together with a large partner ecosystem, we are able to leverage the experience of multiple implementations for manufacturers worldwide. Eviden' **Smart Factory @ Scale** offering brings together best practices and technologies to ensure the success of your smart factory programs along a three-step journey:

- Provide a scalable digital platform
- Set up a replicable use case solutions center
- Drive a global Industry 4.0 roll-out



Consulting services

- Maturity assessment
- Discovery and use case assessment
- Roadmap/blueprint development
- POC/POV services
- Program acceleration and roll-out services



Technology and data management services and solutions

- Architecture
- Asset data modeling
- Industrial equipment & machines connectivity
- Data pipeline management
- ML model development/lifecycle management
- Application development/lifecycle management
- IIoT platform development/lifecycle management
- Integration services
- Service management
- Edge computing solutions
- High-performance computing



Solutions

- | | |
|-----------------------|-------------------------------|
| Enterprise solutions: | Solutional use cases: |
| • CAX services | • Smart control room |
| • PLM services | • Predictive maintenance |
| • MES services | • Advanced quality control |
| • EAM services | • Digital twin |
| • SAP services | • Additive manufacturing |
| | • AR/VR/remote expert support |



Security services and solutions

- Security consulting
- IT/OT security operations center
- Threat detection and response
- Penetration testing
- Red teaming
- Incident management

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EVIDEN

About Eviden¹

[Eviden](#) is a next-gen technology leader in data-driven, trusted and sustainable digital transformation with a strong portfolio of patented technologies. With worldwide leading positions in advanced computing, security, AI, cloud and digital platforms, it provides deep expertise for all industries in more than 47 countries. Bringing together 55,000 world-class talents, Eviden expands the possibilities of data and technology across the digital continuum, now and for generations to come. Eviden is an Atos Group company with an annual revenue of c. € 5 billion.

¹ Eviden business is operated through the following brands: Alia Consulting, AppCentrica, ATHEA, Atos Syntel, Bull, Cloudamize, Cloudeach, Cryptovision, DataSantics, digital.security, Eagle Creek, EcoAct, Edifixio, Energy4U, Engage ESM, Evidian, Forensik, IDEAL GRP, IDnomic, In Fidem, Ipsotek, Maven Wave, Miner & Kasch, Motiv, Nimbix, Processia, Profit4SF, science+computing, SEC Consult, Visual BI, Worldgrid, X-Perion, zData.

About Atos

Atos is a global leader in digital transformation with 107,000 employees and annual revenue of c. € 11 billion. European number one in cybersecurity, cloud and high-performance computing, the Group provides tailored end-to-end solutions for all industries in 69 countries. A pioneer in decarbonization services and products, Atos is committed to a secure and decarbonized digital for its clients. Atos is a SE (Societas Europaea) and listed on Euronext Paris.

The [purpose of Atos](#) is to help design the future of the information space. Its expertise and services support the development of knowledge, education and research in a multicultural approach and contribute to the development of scientific and technological excellence. Across the world, the Group enables its customers and employees, and members of societies at large to live, work and develop sustainably, in a safe and secure information space.

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