**eng**

WHITE PAPER

# Digital Industry
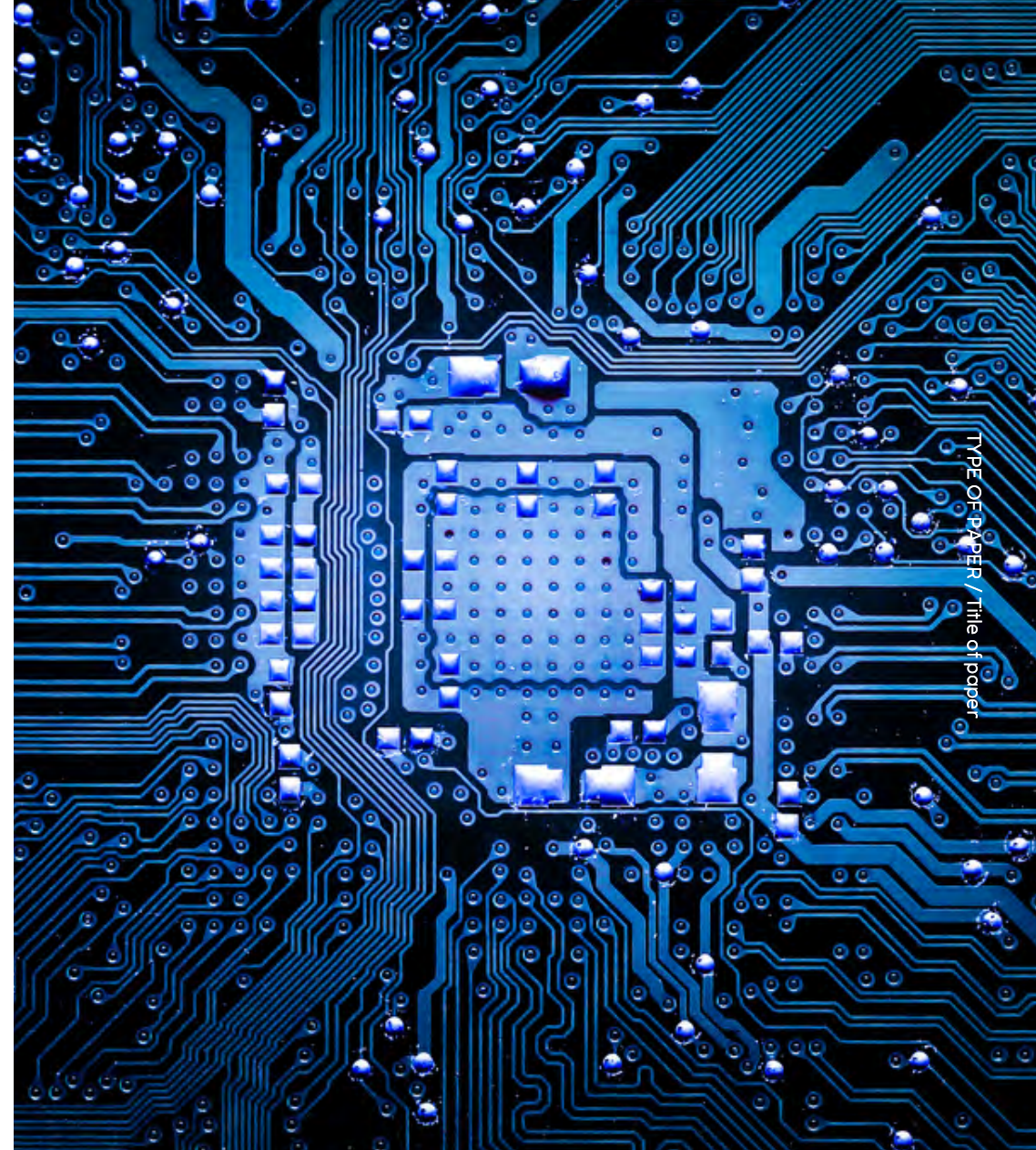
# Authors

**Massimiliano Lunghi**
Sales
Director

**ENGINEERING**
massimiliano.lunghi@eng.it
**in** Massimiliano Lunghi

**Maurizio La Porta**
Digital Transformation
Consultant

**ENGINEERING**
maurizio.laporta@eng.it
**in** Maurizio La Porta

**Luigi Manca**
Head of Simulation &
Decision Science practice

**ENGINEERING**
luigi.manca@eng.it
**in** Luigi Manca

**Zivile Badaraite**
Industries eXcellence,
VP of Marketing

**ENGINEERING**
zivile.badaraite@indx.com
**in** Zivile Badaraite

**Angelo Marguglio**
Head of Digital Industry
R&D Unit

**ENGINEERING**
angelo.marguglio@eng.it
**in** Angelo Marguglio

**Anna Pompilio**
Strategic Marketing &
Content Senior Specialist

**ENGINEERING**
anna.pompilio@eng.it
**in** Anna Pompilio

# Index

engineering

# 01
# Our roadmap for Digital Industry

**Digital** is revolutionising the world in every field, and the manufacturing industry is no exception: the interaction between the virtual and real worlds, and in recent months, the leap forward of artificial intelligence, are providing companies with new ways to design and produce in a more flexible and sustainable way, even integrating their customers' preferences into their processes.

The pace of **change** is such that manufacturing companies must quickly equip themselves to address and overcome a wide range of obstacles in order to meet the **challenges** of the global marketplace and **take advantage** of new technologies. At Eng, we help our clients identify and mitigate risks and prioritise challenges, providing the digital tools and know-how to enable them to choose a **digital transformation path that is concrete**, **measurable**, **secure and responsive** to their unique business needs.

One thing is clear: **to remain competitive**, **organisations must transform**, and one of the key drivers of change is undoubtedly digitalisation.

**Where to start?**

It is often difficult to understand which systems to implement, how to integrate new technologies with existing systems, what the most urgent aspects are, and whether a new system will help improve business value in line with short- and long-term corporate objectives. Having an IT budget is also a necessary but not sufficient condition; before embarking on a digitalisation journey, it is essential that companies first define what Industry X.0 means to them, where they are today and where they want to be in the future.

Over the years, Eng has developed a "**Digital Thread**" and defined a unique methodology to effectively address these issues, leveraging a global team of experts and a collaborative and comprehensive Industry X.0 assessment methodology.

02

# Engineering's Digital Industry: a Digital Thread for the Value Chain

Engineering's **Digital Thread** is the digital nervous system that **interconnects** all the stages of a manufacturing company's value chain, making it possible for **data** to flow and be used in real time, for it to be **utilized in an integrated vision of operations**, for companies to continuously adapt to changing market conditions and to forecast future scenarios.

The **Digital Thread** enables companies to:

- ➔ visualise and govern production processes, leveraging the information flows of the digital space to increase the flexibility and agility of processes;

- ➔ create collaborations throughout the supply chain to increase resilience using real-time information across all stages of production and logistics;

- ➔ provide proactive and predictive technical assistance to clients on products sold;

- ➔ make improvements and more informed decisions by accessing, integrating, transforming and analysing data from heterogeneous systems.

The monolithic enterprise systems of the past are gradually being replaced by vertical apps based on micro-services orchestrated along the Digital Thread, apps that are easier and lighter to develop and maintain. Micro-services offer an effective way to progressively digitalise processes by decomposing applications into loosely coupled services that provide specific functionalities.

For us at Eng, the Digital Thread is much more than a 'concept'. Rather, it is a **complete offering** of software solutions, services and system integration capabilities developed to support and guide industrial clients throughout their digitalization programs.

We work to **evolve** and enrich our solutions, and we believe that it is innovation that makes the difference, marking the gulf between market leaders and others. Providing **the best technologies and skills** to accompany our clients on their Digital transformationjourneys - now and during the challenges of the coming years - is our commitment and our mission.

Our international team's strong **know-how in different production sectors** enables us to deliver a deep understanding of the specific rules and problems of the **market in which each of our clients competes**.
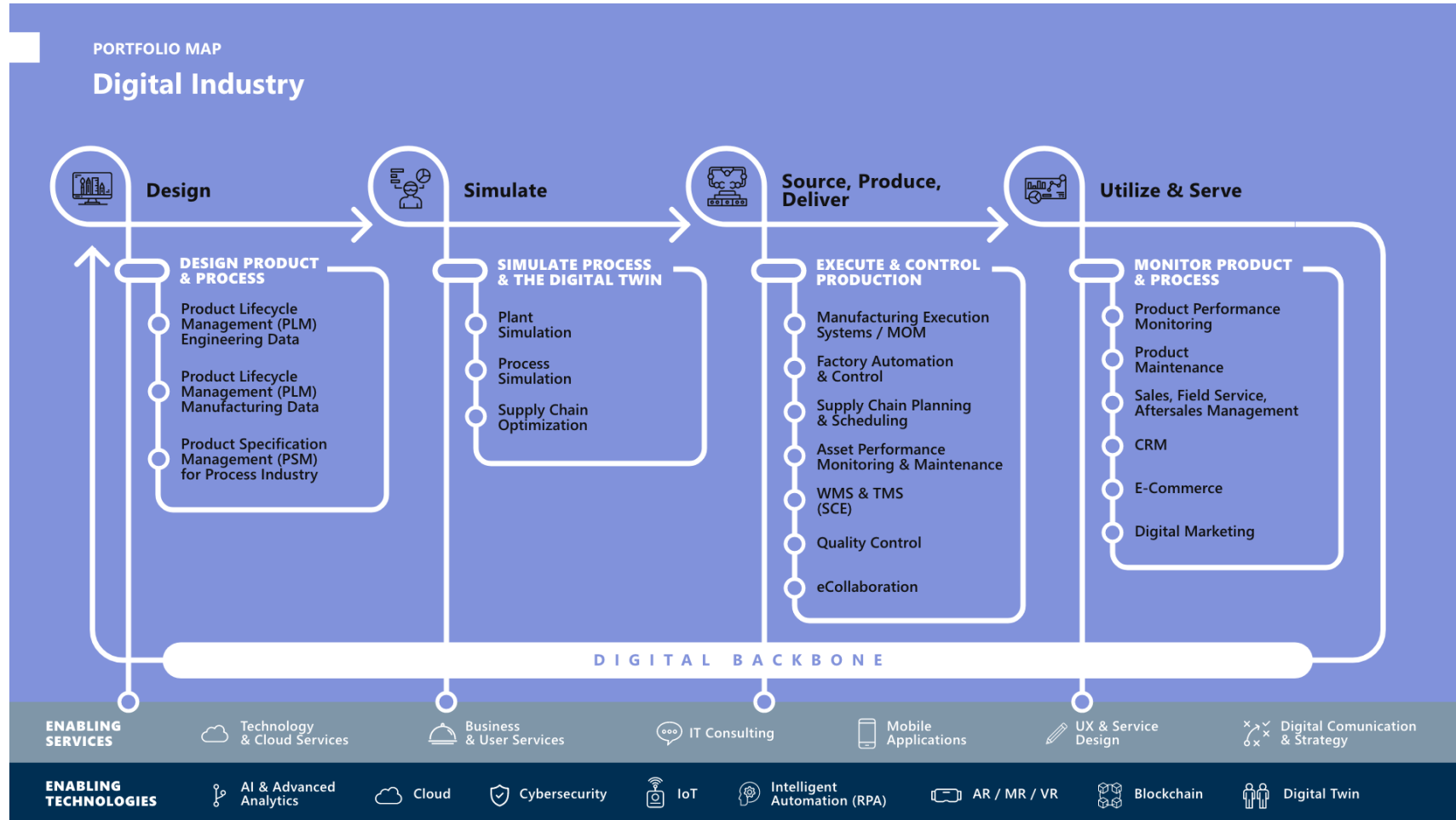
This is why our solutions can ensure a secure and controlled transformation, not only from the point of view of adherence to industry standards, but also from the perspective of cybersecurity, a growing topic of concern. We can guarantee this thanks to our organisation's commitment to continuous employee training, network control, data protection and cyber-threat prevention.

Thanks to our unique expertise implementing and integrating the entire spectrum of digital tools for Industry X.O, our team supports the selection of the best software vendors and identifies the solutions that are best suited to each organisation's needs and vision.

A diversified and integrated portfolio of traditional and innovative digital solutions covers the **four phases** of our Digital Thread for Digital Industry:

- · **Design**

- · **Simulate**

- · **Source, Produce e Deliver**

- · **Utilize e Serve**

Engineering's Digital Industry: a digital Thread for a Value Chain

Engineering's Digital Industry: a digital Thread for a Value Chain

PORTFOLIO MAP

# Digital Industry

**Design**

**Simulate**

**Source, Produce, Deliver**

**Utilize & Serve**

**DESIGN PRODUCT & PROCESS**

- Product Lifecycle Management (PLM) Engineering Data
- Product Lifecycle Management (PLM) Manufacturing Data
- Product Specification Management (PSM) for Process Industry

**SIMULATE PROCESS & THE DIGITAL TWIN**

- Plant Simulation
- Process Simulation
- Supply Chain Optimization

**EXECUTE & CONTROL PRODUCTION**

- Manufacturing Execution Systems / MOM
- Factory Automation & Control
- Supply Chain Planning & Scheduling
- Asset Performance Monitoring & Maintenance
- WMS & TMS (SCE)
- Quality Control
- eCollaboration

**MONITOR PRODUCT & PROCESS**

- Product Performance Monitoring
- Product Maintenance
- Sales, Field Service, Aftersales Management
- CRM
- E-Commerce
- Digital Marketing

**DIGITAL BACKBONE**

**ENABLING SERVICES**

- Technology & Cloud Services
- Business & User Services
- IT Consulting
- Mobile Applications
- UX & Service Design
- Digital Comunication & Strategy

**ENABLING TECHNOLOGIES**

- AI & Advanced Analytics
- Cloud
- Cybersecurity
- IoT
- Intelligent Automation (RPA)
- AR / MR / VR
- Blockchain
- Digital Twin

# Digital Industry

**250+**
PROFESSIONALS

**500+**
CLIENTS

**100+**
BUSINESS SPECIALISTS

**€170M+**
REVENUE FY2022

**40+**
YEARS OF EXPERIENCE

**15+**
TECHNOLOGY PARTNERS

**We are on a digital transformation journey to make the future of manufacturing possible.**

## Our Proprietary Solutions

### DIGITAL ENABLER

Asset Integration
Industry 4.0
Predictive Maintenance
Process Maturity Model
Assesment

### ADVISORY

### MANAGED SERVICES

### TECHNOLOGY & IMPLEMENTATION

### PROPRIETARY SOLUTIONS

Production Planning **PLM** SOP
**FORECASTING TACK & TRACE** SUPPLY CHAIN
**CRM** **Regulatory** IT Service Management
**Warehouse Management** **Compliant** Digital Manufacturing
**SCOptimization** **FIELD SERVICE**
**SMART FARMING** Maintenance
**CUSTOMER EXPERIENCE** MES / MOM CLM **DIGITAL TWIN**
Big Data / AI **BLOCKCHAIN** Operation
**Digital Marketing**

Engineering's Digital Industry: a digital Thread for a Value Chain

# Design

03

# Product Lifecycle Management (PLM)

The lifecycle of a product includes **conception, design, production and support**. Its **management in a single digital environment** is an indispensable step to avoid errors, facilitate collaboration between business areas and protect know-how.

Our Product Lifecycle Management (PLM) solutions create a **single source of data truth** across the product lifecycle by integrating product design data and production process data, as well as enabling the engineering of every detail of the design and production phases.

Companies can use PLM systems to collaborate right from the beginning of the product lifecycle: from product conception to production process design, from sourcing to manufacturing, assembly and after-sales services, through a system that ensures data consistency and availability.

PLM systems store **3D models and properties of assemblies and components**, which are utilized by production and technical assistance.

These systems can be **integrated with simulation tools** that allow designs and production processes to be

validated from their digital models. PLM also enables engineering and production departments to collaborate effectively, optimise activities, quickly develop prototypes and easily test different design options.

At Eng, we can **identify and design** the best path for the introduction of a PLM system together with the client, to overcome information silos between departments and implement the Digital Thread right from the product design phase. Our experts will identify technological, process-related and organisational gaps to find the best solutions and adoption paths that take into account the current context and operating methods, often based on departmental systems that have become stratified over time.

**Introducing a holistic PLM system means profoundly changing how the company designs and produces its products**.
Leveraging the strength of our international expertise and experience, Eng supports our clients in making technological choices, defining paths for change and adopting the best practices that PLM supports.

The resulting solutions enable seamless data exchange and end-to-end visibility of processes from design to production, saving costs and eliminating errors along the way.

Design

Design

# Model Based System Engineering (MBSE)

The **complexity of modern products requires the development of different models** - structural, functional, physical, Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) - to support the various stages of product design, verification, validation and maintenance. Each of these is likely to evolve throughout the product lifecycle in a manner unrelated to the others, according to the best practices of each discipline, while information between the various departmental silos is transferred via documents, 2D drawings and static drawings.

Model-Based Systems Engineering (MBSE) is the application of digital **modelling** to the system requirements definition, design, analysis, verification and validation phases, starting with the conceptual design and continuing through all phases of a product lifecycle.

**MBSE enables companies to overcome silos** by providing effective digital tools for collaboration, data sharing and process modelling.

Each department contributes its own views to the realisation of integrated, inter-disciplinary models in the same way that an Enterprise Resource Planning (ERP) system helps realise the integration of all the nodes of a supply chain within a single digital tool.

At present, there is not yet a preferred methodology for MBSE on the market. The main open source or commercial tools require external support for their integration and often do not fully meet business needs.

Our "**MBSE Reference Enterprise Architecture**" enables our experts to identify the most appropriate modelling framework and tools to meet our clients' integration needs from their existing IT architecture, taking into account the different applications used in different domains.

Our structured **approach to MBSE is based on these assumptions**, creating a clear path of action. We start from one or more subsystems of particular criticality for the client (pilot projects), which can then be subsequently replicated or extended in a modular manner towards a more sophisticated system (process or product) supported by a progressive evolution of the domain IT architecture.

**Simulate**

04

# Simulate Process & The Digital Twin

**Simulation** is an established methodology for **product design and verification**.

However, many companies do not extend this methodology to other phases of the supply chain, such as planning, production, logistics and financial activities, thus missing opportunities to study the behaviour of processes before they are implemented or modified in the real world.

**Simulation models can bring great benefits as each action involves costly structures, operational practices and change management processes**.

Our consultants have more than a decade of experience in simulation modelling projects.
Our team has extensive technical knowledge and expertise across all the main software players in the simulation and decision science space.

How do we apply these? Combining the use of simulation models and artificial intelligence techniques makes it possible to use Digital Twins for processes and plants in order to train neural networks capable of supporting human operators in making optimal decisions in highly-complex scenarios. This is just one example. In another example, our Digital Twin experts enable clients to

realise the benefits of the 'Shift Left' paradigm in their manufacturing operations. 'Shift Left' is the concept in which digital verification and virtual commissioning of plants leveraging simulation reduces actual design and production times and allows potential risks (interference, bottlenecks, etc.) to be identified ahead of execution of any processes on the physical factory floor.

**Decision science, the new IT discipline to bring companies to the next level of knowledge. From the simple correlation of phenomena to the identification of cause. The power of causal intelligence for decision making.**

Decision science is a set of techniques that mix digital twin, simulation, data analytics and machine learning to support decision-making: in short, on the basis of data analysis, the consequences that could be associated with a particular action or inaction are identified in advance, and the appropriate corrective actions are suggested.

**Advanced technologies such as machine learning and artificial intelligence help to extract relevant information from data, identify patterns, trends and correlations that can support decisions. However, most machine learning and artificial intelligence platforms do not consider the most important aspect: why make one decision over another?**

Predicting an outcome is not the same as understanding what causes a phenomenon and how to improve it. The answer lies in **causal AI**, which enables better decision-making to optimise operational efficiency and improve strategic planning.

**How to use causal artificial intelligence for predictive maintenance to minimise downtime and optimise maintenance schedules?**

The new technologies will revolutionise our understanding of the cause-effect relationships that influence machine performance: they will help identify and mitigate biases in traditional models resulting in more accurate results for more informed decision-making.

**These are advanced computational models that represent a virtual replica of physical assets, processes, or systems. They integrate the principles of causal inference to uncover the underlying cause-effect relationships that manage their behaviour, enabling a deeper understanding of the dynamics at play.**

Causal digital twins thus emphasise causal mechanisms, producing more accurate predictions. In short, the causal digital twin allows us to explore and understand the cause-effect relationships that influence the behaviour of a system of systems.

Simulate

# Manufacturing Plant & Process Simulation

Simulation of industrial factories, warehouse and repair sites has become an increasingly common undertaking, thanks to the development and availability of advanced plant simulation tools.

A Digital Twin is essentially a computerised replica of the physical and production environment of a plant. This 'Digital Twin' can facilitate the evaluation of plant performance and to understand how performance will evolve over time in response to decisions made. **Any changes can be evaluated and analysed within the simulation model**, **making the process much more efficient and cost-effective**.

Process Simulation is another digital methodology that enables companies to use their organisational knowledge and 3D models of products and resources to virtually validate production processes in advance. This is particularly important for meeting the challenges of increasing product and process complexity and ensuring timely, cost-effective and high-quality product launches. Constantly evolving technology enables thousands of analyses to be conducted efficiently and almost automatically within the simulation environment in order to optimise production in advance.

Simulation of the manufacturing process is an important aspect of the Digital Thread, which considers many factors – from personnel to process organisation – and enables careful evaluation of process changes and identification of possible improvements.

By taking advantage of the latest simulation technologies, our consultants can realise Digital Twins of even the most complex production plants and processes, enabling the execution of what-if scenarios to study possible changes in a virtual environment, quickly and economically. This makes it possible to assess costs and benefits in the medium and long-term, verifying the soundness of a business case before any physical work is carried out. Uncertainties can be simulated in the system using statistical and stochastic models, making it possible to assess margins of tolerance and the overall robustness of the identified scenarios.



Simulate

# Supply Chain Optimization

Today's global supply chains are increasingly complex and require constant analysis to adapt to changes in supply and demand.
A well-managed supply chain can improve margins, optimise the customer experience and reduce operating costs. **Supply Chain Optimisation uses computing software, artificial intelligence and reporting to make operational decisions that ensure optimal performance**.

Simulation modelling technology is increasingly important to help companies make smarter decisions and increase the efficiency and profitability of their supply chains. Analysis and simulation modelling tools enable better **understanding and management of large-scale problems and specific aspects of supply chains**.

They are also increasingly used to **train neural networks and artificial intelligence systems to make or suggest optimisation decisions**. The best approach is to combine the various techniques to identify solutions and verify their quality and validity by simulating the impacts on other nodes in the supply chain network.

Our consultants can build Digital Twins of a supply chain to be used for analysing its performance, identifying

bottlenecks, verifying its robustness against disruptive events, studying the impact of corrective actions and digitally assessing which actions to take and their potential return on investment.

Our team's expertise ensures that the client's supply chain is always moving towards a more robust, lean and sustainable strategy.

A Digital Twin, if utilized and implemented properly, provides valuable information for planning and optimisation, assessing what-if scenarios and improving planning across the value chain.

Simulate

© engineering

Simulate

# Source, Produce & Deliver

05

# Execute & Control Production

The **exploitation of data and its analysis**, in a context where the speed and quantity of available information continues to grow exponentially, is increasingly important at all levels of decision-making, strategy, tactics and operations. This is reflected in the production process - from planning to operations to quality control - where digitalisation is the only factor today that can bring significant efficiency gains, ensuring the coordination and full utilisation of resources as well as the reduction of production waste, asset downtime and excess inventory.

**Collaborative Manufacturing**
functionalities facilitate interactions among all the people, work groups, machines and systems involved in the execution of production. Leveraging holistic Collaborative Manufacturing solutions, operators, employees, department heads and suitably-profiled suppliers and clients can visualise and share process and activity data in an optimised and secure way. Workflow automation tools support and ensure compliance with company rules and procedures.

Our team has been delivering digital solutions and projects bridging the gap between the physical and digital worlds of manufacturing for over a decade.

As a result, today we are the only company in the world with the combined vertical competences, global capabilities and technical skills needed to support the digitalization, innovation, optimization and continuous improvement across the lifecycle of all industrial products, processes and supply chains.

Source, Produce & Deliver

# ENGINEERING INDUSTRIES EXCELLENCE

## Global Delivery & Customer Support

Industries eXcellence, or IndX for short, is Eng's competence hub specialized in the development, integration and implementation of innovative digital solutions covering the end-to-end lifecycle and supply chain of all industrial products and processes. With a focus on enabling the digital transformation of manufacturing and transportation organisations, our global team designs and delivers cutting-edge technology solutions that transform the way our customers think about, design, build and deliver their products and services. And with regional hubs across North America, South America, EMEA and Asia-Pacific, this team is leading the advancement of Industry X.0 and shaping the future of the industrial landscape.

**19 INDX HUB**
IN 11 COUNTRIES AND 4 CONTINENTS

**30+**
INDUSTRIAL SECTORS

**725+**
PROFESSIONALS

**1500+**
PROJECTS

**Discover more** +

Focus On

# Manufacturing Operations Management (MOM)

A Manufacturing Operations Management (MOM) solution integrates various systems aimed at the digital governance of the factory floor.
With an integrated MOM strategy and set of integrated solitons, companies can optimise production processes, reduce errors and improve productivity by increasing throughput.

Among the most valuable MOM solutions, a Manufacturing Execution System (MES) is the foundation.
MES enable digital dispatching of production orders and operator tags with drawings and operating instructions to workstations, as well as the collection of field data in real time, both from machines and operators.
MES also improve the quality of collected data and Overall Equipment Effectiveness (OEE) calculation, enabling a more accurate causalisation of micro-interruptions, for

example. Fully digital management of the work card is also possible, allowing the operator and quality specialist to stamp, annotate and sign it completely digitally, thus eliminating paper and providing much more effective control over data and execution.
In the event of non-compliance, photos can be linked with the quality notice, making communication with engineering and report management more efficient as well.

**Integration between PLM, MES and ERP systems is a crucial aspect to ensure sustainable business value and return on investment in Industry X.0 today and in the future**.
The complete, seamless interconnection between systems, people, machines and networks is the entire premise of this approach. For example, the integration between the PLM system and the MES enables error-free management of the production Bill of Materials, allowing for the digital availability of up-to-date drawings, operating instructions and quality checklists specific to the workpiece being processed at each workstation.

As a result, companies see a significant reduction of errors, downtime in searching for documentation, rework and costs across their operations.
ERP integration also allows for greater flexibility and accuracy in the management and dispatching of work orders, as well as better control of skills and certifications of employees for individual jobs.
In addition, real-time production data collection from the MES allows plant managers to be more proactive in production planning and more effective in managing raw materials and optimising machinery utilisation.

Our team of experts in Digital Industry focuses on optimising the integration between different systems, involving business, production and execution layers, down to the machinery itself.

# Factory Automation & Control

Factory Automation & Control is the automation of a production plant using

sensors, tools, computers and data analytics techniques to reduce production costs, increase productivity and optimise operations. Factory automation replaces manual processes with processes performed by machines through programmable control systems such as PLCs.

# Manufacturing Quality Control

Production quality is a key element in the success of a manufacturing business. Quality focuses on product a and process adherence to specifications and customer expectations. The lack of quality in a component can have a negative impact on the company's reputation and, in extreme cases, can even endanger the customer's life.

To meet industry regulations and ensure product quality, manufacturing companies must implement appropriate quality control systems and constantly monitor the production process to reduce the amount of scrap and rework.

Source, Produce & Deliver

Eng offers **customised quality management solutions** that adhere to compliance standards and provide real-time feedback to managers during production, including field/on-line testing, electronic workflows, corrective actions and lean statistical process control tools.

Our solutions help maintain consistency in product quality and integrity throughout the production lifecycle.

**Implementing proper quality control systems means increasing the productivity and profitability of the company**. In a highly competitive market, the implementation of a quality control system can make the difference between business success and failure.

# Supply Chain Management (SCM)

Supply Chain Management (SCM) refers to the **set of processes and technologies used to manage the supply chain**, from

planning to production and distribution to customers. Supply chain planning involves the optimisation of available resources, including employees, materials and equipment, to meet market demands. Lack of accurate planning can lead to high inventory, production and logistics costs and lower service levels.
To meet customer demands, accurate planning and efficient supply chain management is essential.

The adoption of **e-Collaboration** technologies is an important step in effective supply chain management. Digital collaboration removes barriers of time and distance: it facilitates communication between work teams in different geographical locations, integrating inbound and outbound processes and creating a collaborative work environment within the company. This enables managers to make decisions more quickly and provide effective, targeted support to employees.

The primary objective of the **Sales & Operations Planning (S&OP)** process is to determine what, how much and when

one's clients will buy - and to reconcile this with the ability of the business to meet that demand in terms of production, distribution and purchasing.
A further objective of S&OP is to align sales and operations with the company's overall financial objectives in order to establish the optimal production plan.

Advanced solutions improve production planning and scheduling by analysing demand forecasting and other relevant data in order to generate optimal, feasible production plans. A comprehensive production plan covers material requirements planning, inventory management, production volume and turnover forecasting, capacity and resource planning, not to mention production scheduling at finite capacity with optimal sequencing of machining operations.

In addition, **advanced planning and scheduling solutions** make it possible to provide accurate delivery dates for customer orders and to respect the promised dates through a detailed check of the progress of all the processes and

stocks of on which on-time delivery to a client depends, the monitoring of any deviations and an impact evaluation for any corrective actions.

In summary, effective Supply Chain Management includes accurate planning, scheduling, and e-Collaboration approaches as well as the right technology to support them.

The adoption of a comprehensive supply chain management and execution strategy is essential to ensure that industrial organisations meet customer needs efficiently and remain competitive in the global marketplace.
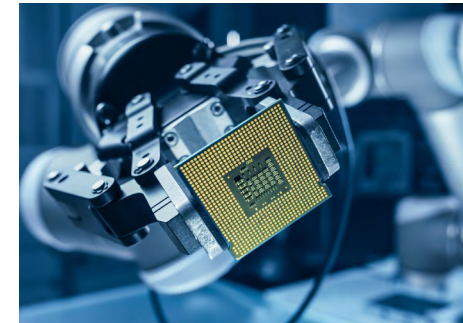
# Management of traceability and genealogy of materials

As supply chains become increasingly interconnected and complex, industrial organisations are looking to implement technology applications and services that meet many parallel objectives.

Compliance, product integrity, product visibility, anti-counterfeiting protection and risk reduction are all areas that companies need to consider when managing their supply chains at full speed and low cost.

**Achieving full visibility within a plant is a critical objective for manufacturers today**. Having a clear understanding of what is happening on the production floor is essential to increase efficiency, cut costs and boost operator productivity.

To remain competitive, companies must also invest in solutions that provide a **reliable chain of uninterrupted information** from product origin to delivery, including how goods are transported and stored.

The information provided by our **supply chain traceability** solutions leads to improved and optimised lean practices, enables integration with other systems, identifies unsafe practices and ensures compliance with company procedures. Traceability tools automatically record all materials entering or leaving the plant and monitor their status throughout the entire production process and across their supply chain journey.

In the event of a product recall or recall for non-conformity, all necessary data is easily accessible. Managers will, for example, be able to trace all the original materials of the product being recalled, quickly determine from which suppliers they originated, and, if appropriate, promptly identify all other products that also need to be recalled for the same reasons (having used the same batches of materials). Recalls are a stressful and costly process.
With effective monitoring and traceability, companies can reduce the time and money spent during these events. In addition, the monitoring and tracking of the data supplied to the ERP system can be used as a cost analysis tool in the evaluation of production costs of end goods.
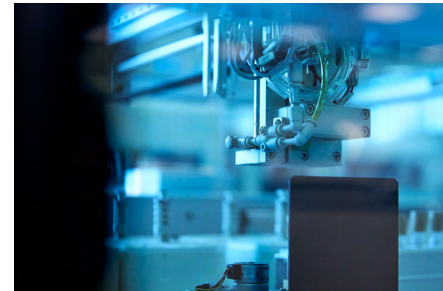


# Warehouse Management System (WMS)

The **monitoring and management of warehouse operations** in production is a critical process that can be extremely time-consuming and error-prone, and thus benefits greatly from digitalisation.

At Eng, we provide leading warehouse management expertise in order to synchronise logistical operations throughout our clients' entire production process and supply chain network.

A Warehouse Management System (WMS) consists of software that enables companies to optimise the control and administration of all warehouse operations, from the moment a good or material enters the warehouse until the moment it leaves.

The system keeps track of the movement of each raw material, work-in-process and the finished product throughout its lifecycle, from receipt, picking, packing to dispatch.

A successful WMS automates and optimises stock receipt and storage, order picking and dispatch, and stock replenishment activities. WMS can be stand-alone applications, cloud-based solutions or be a part of a broader ERP or Supply Chain Execution (SCE) platform.

WMS provide **visibility into a company's inventory** at any time and place, whether

Source, Produce & Deliver

Source, Produce & Deliver

within a facility or in transit. They can also manage supply chain operations from the manufacturer or wholesaler to the warehouse and the retailer or distribution centre.

WMS are often used alongside or integrated with a Transportation Management System and Inventory Management System in order to simplify and align related business processes.

WMS can also interface directly with automation and controls to optimise the management of material-handling equipment such as conveyors, sorting stations and Automated Guided Vehicles (AGVs).

This closed-loop scheme allows manufacturers to gain real-time visibility and control of their warehouses and logistics, thus reducing costs and inventory, improving service and meeting quality compliance initiatives at the same time.

# Asset Performance Management (APM)

Companies operating machinery need to optimise maintenance through Asset Performance Management solutions. It is important to monitor production lines and collect data from these assets, not an easy challenge when hardware is obsolete or not connected. **Gathering data enables Digital Twins of assets** that allow for accurate performance analysis, improved production processes and quality end products, as well as machine performance data analysis to improve maintenance management processes and overall plant efficiency.

Predictive maintenance applications increasingly help to decrease spare parts inventories, reduce downtime and improve productivity. Integrating technologies such as **Virtual and Augmented Reality can further optimise asset maintenance management**.

Source, Produce & Deliver

# 06

## Utilize
## & Serve

The Digital Thread does not end once the finished product leaves the factory. Let's go through the steps from the beginning: the product is designed with a PLM and validated with the Digital Twin. We then defined the optimal way to produce it. Once it was produced, our supply network delivered it to the end consumer. And now?

In order to achieve true Industry X.0 and take advantage of all the benefits and opportunities offered by end-to-end digital transformation, companies need to ensure that seamless integration of data along the value chain relays all the relevant information to continuously improve performance and innovate products. **The Digital Thread is enriched by a myriad of interconnected smart devices and systems generating massive volumes of data**. "Closing the loop" and transforming this data into usable information and business value is a crucial success factor, whether it is leveraging it to improve the performance of production assets, the design of the next product or the production process itself.

# Product Performance Monitoring & Maintenance

Digital technologies such as the Industrial Internet of Things, IoT or IIoT, offer companies the opportunity to monitor product performance in real time, obtaining useful data to improve the efficiency, safety and utilisation of products. Operators can understand how products are being used, the working conditions, which functionalities are being used the most, those that cause the most malfunctions, the load conditions under which they occur and (where permitted) what their location is.

All this provides valuable information for design engineers to make changes, improvements and anticipate new functionalities. Product performance data also helps manufacturers understand the quality and lifespan of their products, enabling them to make informed decisions about improvements and changes in the assembly and build process.

Companies can analyse data collected from sensors and devices to obtain very useful information on product maintenance as well. Such monitoring helps companies better predict failures, plan spare parts inventories, support field service resources with accurate and up-to-date documentation, and ultimately, **reduce product malfunctions and increase product reliability**.

The use of intelligent, augmented and wearable devices in the field - such as AR helmets and smart glasses or watches - also enables maintenance technicians to access guided procedures, visualise content and digital

Utilie & Serve

animations, and request remote support for more effective and safer execution of maintenance tasks. All this contributes to making maintenance more efficient and effective, improving customer satisfaction and growing the business.

## Field Service Management

**Field Service Management refers to the management of technical service activities in the field to improve their efficiency and effectiveness**, with the aim of reducing the number and duration of user disruptions, increasing the quality perceived by the customer and improving customer satisfaction.

The introduction of Industry X.0 technologies has changed the way companies produce, sell and offer after-sales services. After-sales management has become a fundamental requirement for manufacturing companies, a service able to compensate for reduced margins on

product sales and provide a stable revenue stream over time after the sale. Efficient after-sales services can improve customer satisfaction and ensure the survival of the company during periods of reduced growth. It is no coincidence that in recent years, companies that have invested in excellent after-sales management have been able to survive periods of crisis much better.

In the sale of a product, what is handled and processed is material goods, whether they be raw materials or finished products. On the contrary, the sale of services requires first and foremost the ability to handle and process information about the customer, their preferences and their needs. Services, unlike products, cannot be stored and consumed by customers at the time they are produced. This requires an ability to receive and respond to customer needs in extremely short timeframes and to deliver reliable services within binding service levels and with sustainable margins. Thanks to the Digital Thread, product engineering collaborates with maintenance engineering by sharing Key Performance Indicators (KPIs) for maintainability, reliability,

availability and safety. Product servitisation requires the Digital transformationof manufacturing companies and travels along the Digital Thread.
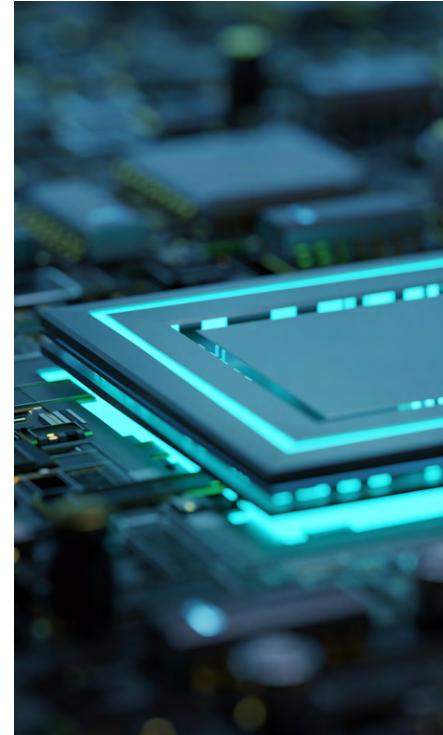
## Customer Relationship Management (CRM)

The transition from selling products to selling services is not immediate for a manufacturing company, which must transition from product-centric to customer-centric in order to accomplish this aim. Digital technologies are radically changing how customer relationship are managed by companies.

The disintermediation driven by social networking, the Internet and communication technologies such as 5G enable manufacturing companies, perhaps for the first time, to get to know their customers and stay in touch with them after the sale much more easily.

As a result, customers are becoming an increasingly valuable resource for companies. Good customer service can significantly impact and increase sales. Customer Relationship Management (CRM) solutions can help companies

better manage customer relationships, improve profitability and gather the right information to anticipate their needs.
An effective CRM system can increase company profits; and since the CRM market is growing, it is important to consider it within any comprehensive Digital transformationstrategy.

Enabling technologies are critical to CRM success. For example, artificial intelligence can help companies better understand customer needs and predict their future requirements.

The Internet of Things can provide valuable data related to product usage patterns. Furthermore, automating sales and support processes through chatbots and other technologies can greatly improve the efficiency of customer interaction.
The integration of these and other enabling technologies can greatly improve CRM effectiveness by providing companies with a deeper understanding of their customers, reducing response times, improving the overall customer experience and increasing profitability.

# E-Commerce

E-commerce is a business model for selling products and services through the Internet. Thanks to digital technologies, e-commerce makes it possible to reach customers all over the world and to offer a personalised and convenient shopping experience and to expand one's customer base. The potential of e-commerce is extensive: customer data can be used to offer tailor-made products, improve the customer experience, increase loyalty, promote brand awareness, expand the market, reduce operating costs and improve overall company profitability. In addition, emerging technologies such as artificial intelligence, augmented reality and blockchain offer new opportunities to improve e-commerce and make it even more efficient and convenient.

# Digital Marketing

Marketing today is very different from what it was just a few decades ago.
Thanks to the Web, special software and other high-tech products, marketers can

collect much more data and have a wider range of tools at their disposal to influence consumers than ever before. Digital Marketing is the marketing of goods and services through digital tools such as the Internet, display advertising, smartphones and other digital media.

Marketing has not historically been a priority for the manufacturing industry. According to recent studies, the average manufacturing company allocates 8% of its budget to advertising activities, but 82% of manufacturing companies that have invested in digital marketing report better performance than in the previous year.

Digital Marketing will be key for market success as the marketplace becomes more competitive; it cannot be ignored.
Once a high-quality, innovative product has been designed, simulated, produced and shipped, it must be purchased and used to achieve its final purpose. Digital Marketing offers a range of tools and approaches that ensure manufacturers are aware of the product and its sales channels by their potential customers.



Utilie & Serve

# Our projects

07

## CUSTOMER JOURNEY

**Improve online customer experience**

Our client needed to optimize the customer experience and maximize the effectiveness of brand awareness and e-commerce. We supported the company in the data transformation process, starting from the data strategy, going through the implementation part to the data analysis and the generation of actionable insights. We managed the tracking strategy for over 150 e-commerce websites and brands, while also handling the technical implementation and analysis of the data collected for the business department.

## SUSTAINABILITY PROCESSES

**A digital supply chain to evolve production process IT systems**

Salov needed to digitalize its factory and streamline its supply chain processes, starting from the production site located in Tuscany in Massarosa, near Lucca.

We developed a new Production Management System based on a Complete Scheduler and a Wonderware MES platform.

28

## SMART MAINTENANCE
**Industry 4.0 and Digital Twin to develop maintenance processes**
Managing the maintenance of an aircraft is a job that requires specific skills and rigorous scheduling of interventions, very complex processes that represent one of the daily challenges for the company.

To meet this need, we have created an exact copy of the physical process, which allows us to simulate the fleet management process and analyze each of its stages by entering different types of data.
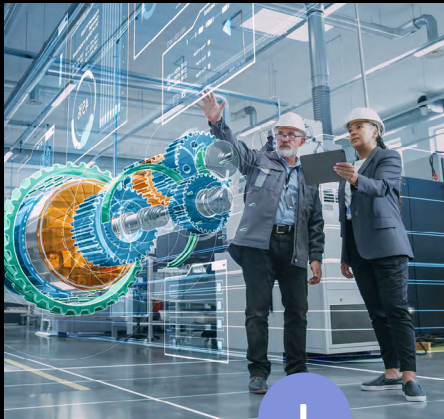
## DIGITAL SALES CHANNELS
**Modernized, cloud-based and monitored digital sales channels**
Our client needed to completely redefine the monitoring of its technological platforms, by adopting an innovative solution, abandoning the existing infrastructural-based solution and focusing on user experience.

We collaborated with the Client across various phases: design, implementation, launch and continuous optimization of the new solution.

## DIGITAL SUPPLY CHAIN
**Evolve Supply Chain Management platform**
Our client needed to face the increasing technological and market discontinuities imposed by digital transformation.
We supported the client for the evolution of their supply chain, with the replacement of their previous and already obsolete information system.

The solution developed consists of an innovative digital platform for the planning and execution of their production, procurement and distribution processes.
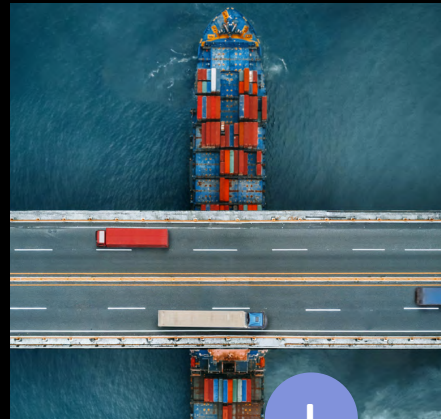
## CIRCULAR ECOSYSTEM
**Circular TwAIn: AI for Recycling, Reusing and Remanufacturing**
Circular TwAIn is a Research Project, which is coordinated by ENG, aiming at the realization of a modular platform whose objective is to improve the performance, resilience and sustainability of manufacturing and process industries by exploiting the benefits offered by the circular economy.
Circular TwAIn proposes a fully digitized value chain, powering AI-based digital twins that use and produce data within secure data spaces.

Our projects

# 08

# What is the future of the Digital Industry?

The global geopolitical situation burdened by wars and pandemics once again demonstrates the need to strengthen our industries by increasing their resilience and flexibility, both in terms of technologies and supply chains, in order to reduce dependencies.

These events also highlight the need **to address together the major challenges of sustainability, inclusiveness**, **digital and green transition**, putting the well-being of the citizen and the worker at the centre of the production process and using new technologies to ensure equitable development, while respecting the productive limits of the planet.

Our solutions and core competencies are already supporting the digital and green transformation of our customers, contributing to the achievement of emissions neutrality and reduction targets through **cleaner**, **more efficient and sustainable industrial processes**.

Help in this can certainly come from the advancement of **AI-based solutions**.

Artificial Intelligence (AI) is a technology that is increasingly present in our daily lives and in the world of work. AI refers to the ability of machines to learn and improve their performance through experience, data analysis and the use of complex algorithms. **Companies can benefit enormously from the use of AI: greater operational efficiency, better customer experience and higher innovation rates**.

AI can be used in **many areas**: logistics, production, marketing, and customer service. For example, logistics companies can use AI to **optimize delivery routes and reduce waiting times and the resulting emissions**, while manufacturing companies can use it to improve supply chain efficiency and **reduce waste**.

Marketing is another area where AI can be very useful. Companies can use it to analyse data and **provide personalized and relevant services**. In addition, AI can help companies identify new market opportunities and improve their marketing strategies. Companies can use AI-powered **chatbots and virtual assistants** to provide quick and accurate answers to consumer questions, reducing staff workload, improving the customer experience and **increasing customer loyalty**.

AI is not the only driver in the manufacturing sector: **more recent lines of research** focus on achieving resilience in value networks through the increased pervasiveness of **distributed intelligence** and the search for **new business models** that provide the basis for the implementation of Manufacturing as a Service on a large scale.

Emerging technologies such as data spaces and Quantum Computing and enabling technologies such as robotics, Artificial Intelligence, the Digital Twin, and the Cloud/Edge Continuum can support digital autonomy and foster industry development. Technology alone, however, is not enough.

And this is why we at Eng work every day in an ecosystemic, responsible, transparent way: to support our customers in their digital transformation journey, also through the continuous search for the most efficient transformation and development models.

**eng**