

# INNOVATIE **NU**

October 2023

09



CONNECTIVITY  
IN THE MANUFACTURING  
INDUSTRY

# A MESSAGE FROM THE EDITOR

**A**t the heart of the manufacturing connectivity revolution in Enschede, Netherlands lies the Advanced Manufacturing Centre (AMC) —a dynamic shop floor managed by the Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente. This collaborative endeavour, linking academia and industry, has emerged as a driving force, pivoting the connectivity landscape for the manufacturing sector. The AMC serves as an experimental playground where manufacturers can explore and implement cutting-edge connectivity solutions in a real-world production environment. Equipped with state-of-the-art machinery and intelligent systems, the centre offers a unique opportunity for businesses to test IoT devices, AI algorithms, and other advanced technologies to enhance their manufacturing processes.

The AMC's affiliation with the Fraunhofer Innovation Platform ensures access to a wealth of knowledge and expertise from researchers and scientists specializing in various fields of advanced manufacturing. This close collaboration allows the centre to stay at the forefront of technological advancements, providing manufacturers with valuable insights and guidance on leveraging connectivity to optimize their physical operations.

As an integral part of the University of Twente, the AMC plays a pivotal role in bridging the gap between theoretical research and practical application. It offers a seamless integration of academic knowledge and industrial needs, fostering a symbiotic relationship that drives innovation and accelerates the adoption of innovative technologies.

The shop floor setting of the AMC allows businesses to witness firsthand the transformative potential of connectivity within manufacturing. From enabling real-time data exchange between machines to implementing AI-powered quality control measures, the centre showcases the tangible benefits of embracing a connected manufacturing ecosystem.

Additionally, the AMC serves as an essential training ground for the workforce of the future. Through workshops, seminars, and collaborative projects, the centre equips individuals with the skills required to operate and manage the interconnected systems, empowering them to embrace the digital revolution in manufacturing.

In conclusion, the Advanced Manufacturing Centre at Enschede, managed by the Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente, embodies the epitome of connectivity within the manufacturing industry. As a dynamic shop floor and collaborative hub, the AMC provides an innovative space for manufacturers to explore, experiment, and realize the true potential of connectivity, propelling the sector towards a more efficient, intelligent, and prosperous future.

**IAN GIBSON**

*Scientific Director*

*Fraunhofer Innovation Platform  
for Advanced Manufacturing  
at the University of Twente*

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# CONTENT

1

## FEATURED

*Boosting*

## ROBOTICS INNOVATION

*in the East Netherlands through*

**EDIH:**

*A technology leap forward*

7

*The*

## FRAUNHOFER INNOVATION PLATFORM

*purpose to industry*

## LESSONS LEARNED

9

*Why connectivity is vital  
TO HIGH-TECH MANUFACTURERS*

13

*Is there value in  
S.E.A. & S.E.O.  
for manufacturers*

17

**DIVE2:**  
*Raising awareness on diversity & inclusion  
in software and manufacturing companies*

19

**AMC NU**

**DISCUSS YOUR  
INNOVATION  
TOPICS WITH ELIAS**

## SUSTAINABILITY

21

**MIND YOUR OWN (SUSTAINABLE) BUSINESS:**  
*A manufacturing approach*

## TECHNOLOGY & INNOVATION

25

**INNOVATION & TECHNOLOGY**  
*for nature management*

29

*Is M.E.S. the “silver bullet” to become a  
TRULY DATA-DRIVEN ENTERPRISE*

33

*Transforming Aerospace Manufacturing:  
THE OMNIFACTORY® - A NEXT-GEN TESTBED  
FOR DIGITAL AND AGILE PRODUCTION*

35

**CONNECTIVITY IN LABORATORIES AND  
ON THE PRODUCTION FLOOR:**  
*A perspective from an analytical  
instrumentation developer*

37

**SMALL STEPS LEAD TO GIANT LEAPS:**  
*Smart start to 5G manufacturing*

39

**THE CO<sub>2</sub> FOOTPRINT**

41

*The paradigm shifts in manufacturing:*  
**5 KEY TAKEAWAYS FROM 2022**

45

**EMPOWERING PRODUCTION:**  
*How Gemineers the realizes the  
Digital Twin metal cutting*





# BOOSTING ROBOTICS INNOVATION IN THE EAST NETHERLANDS THROUGH EDIH: A TECHNOLOGICAL LEAP FORWARD →

## Revolutionizing the Robotics Landscape in the East Netherlands

In the age of digital transformation, robotics and automation stand as powerful pillars of innovation, propelling industries towards newfound possibilities. In Europe, a visionary initiative is taking centre stage, breathing new life into the robotics sector and fostering a vibrant ecosystem of technological advancement—the European Digital Innovation Hub (EDIH). Within the East Netherlands, cutting-edge Fieldlabs and knowledge institutes are connecting their powers to reshape the future of robotics and ignite Europe's technological landscape. Embracing the spirit of collaboration, these institutions have united to propel innovation through a multifaceted approach that encompasses diverse offerings. Among

these offerings are skills-building and training programs, test-before-invest projects, and investment support. This holistic approach nurtures a thriving robotics ecosystem, positioning the East Netherlands as a trailblazer in technological excellence and an inspiration for Europe's innovation landscape.

## Unravelling the EDIH Ecosystem

Amidst the rapidly evolving technological landscape, the EDIH sets its sights on the core pillars of 'Robotics & Sensing' within the region's most vital sectors: Manufacturing, Agrifood, and Health. It is a clarion call to companies—both established players and startups—to seize the unparalleled opportunities this innovative ecosystem presents. EDIH is driven by a compelling mission: to future-proof over

350 SMEs in these sectors by fostering digital maturity and raising awareness about digital transformation among 1500 SMEs.

In the heart of this technological revolution lies the EDIH BOOST Robotics initiative, a supportive haven for SMEs looking to take the leap into the digital age. The journey commences with a crucial foundation: awareness creation. Through a technology assessment scan, vital insights into the current state are gained. This essential step seeks to answer fundamental questions that lay the groundwork for the SME's transformative path. What are the company's specific needs and aspirations for digitization? What objectives do they hope to achieve in the short or long term? How can cutting-edge technologies be harnessed to elevate their operations to unprecedented heights?

## Benefiting the Journey of a Company

The technology scan serves as a guiding compass, aligning the company's aspirations with the vast array of offerings and opportunities provided by EDIH BOOST Robotics. By gaining clarity on their digitalization goals, the company is better equipped to explore potential projects and opportunities that precisely resonate with their vision.

This critical phase benefits the company throughout the entire EDIH journey and well into its future endeavours. With a thorough understanding of their unique requirements, the SME can navigate the landscape of transformative projects with purpose and confidence. As they delve into the digitalization process, the technology scan will provide the roadmap towards the specific goals and needs of the company. Within the EDIH this can result in the continuation of the journey through a skills and training programme,

investment strategy and support, or a tailored project execution, encompassing one of the four potential topics:

**Technology Benchmarking**, conducting in-depth assessments of cutting-edge digitalization opportunities;

**Feasibility Study**, exploring the practicality and viability of implementing specific digitalization solutions;

**Technology Assessment**, adapting and integrating digitalization within the company's production environments; and

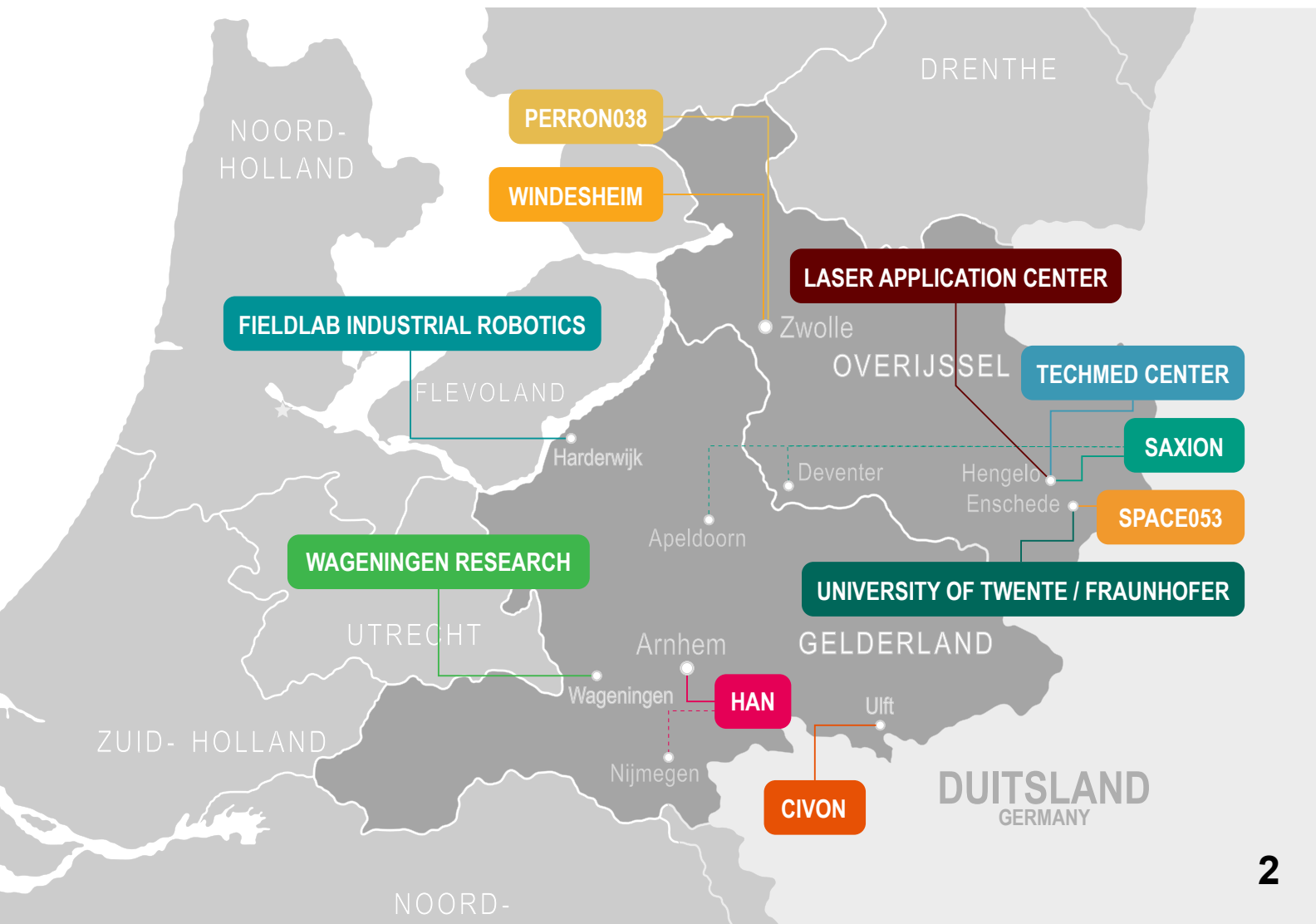
**Technology Testing**, validating and refining state-of-the-art digitalization solutions.

With expert guidance, companies can adapt, integrate, and implement digitalization strategies tailored to their unique production environments. Through

EDIH's backing, SME's have the freedom to explore, train, and find the funding opportunities matching their roadmaps.

## EDIH BOOST ROBOTICS: A Regional Dynamo

EDIH BOOST ROBOTICS emerges as a luminary within the EDIH constellation, with a mission to infuse unparalleled vigour into the robotics domain within the East Netherlands region. Nestled within the provinces of Gelderland and Overijssel, the East Netherlands has long been celebrated as a beacon for manufacturers, and EDIH BOOST ROBOTICS adds a captivating new dimension to its legacy by clustering available expertise. At the forefront of this powerful ecosystem, the EDIH programme for 'Robotics & Sensing' encompasses 11 Fieldlabs and knowledge institutes, each with its unique capabilities and remarkable achievements.





## Perron038

Perron038 connects high-tech companies with educational and research institutions, by facilitating innovative R&D projects where talent development is key. Machine builders and technical product developers work together with students to develop innovative demonstrators, prototypes and modules of high-tech machines. Through a multidisciplinary approach, Perron038 has facilitated groundbreaking projects like the implementation of robotics and IoT in smart manufacturing, and the optimization of logistics and supply chain processes through advanced sensing technologies.

**Location:** Zwolle, NL

**Technology skill sets:**

X Robotics & Logistics

X Vision & Optics

X Additive Manufacturing



## Windesheim

Windesheim University of Applied Sciences is an education and knowledge partner that offers personalised education and innovative projects. Windesheim has been at the forefront of advancements in robotics and sensing technologies. By integrating robotics in healthcare applications and developing autonomous vehicles for agricultural tasks, Windesheim has contributed significantly to the region's expertise in these domains.

**Location:** Zwolle, NL

**Technology skill sets:**

X Robots & Cobots

X Machine Learning

X Digital Twinning



## Laser Application Center

Laser Application Center (LAC) specializes in laser technology applications across various industries. Their projects have included precision laser cutting in manufacturing processes and robotic laser welding training and applications techniques.

**Location:** Hengelo, NL

**Technology skill sets:**

X Welding Automation

X AI in (welding) Production

X Manufacturing Systems





## TECHMED CENTRE

### TechMed Center

The Technical Medical (TechMed) Center is a frontrunner in the integration of robotics and sensing technologies in healthcare. The TechMed Center is equipped with state-of-the-art infrastructure, including research laboratories, preclinical testbeds, and simulated hospital environments, driving technological advancements in healthcare. Their projects have focused on surgical robotics, rehabilitation through exoskeletons, and AI-driven medical diagnostics.

**Location:** Enschede, NL

**Technology skill sets:**

X Digitization

X Knowledge & Technology Transfer

X Experimenting & Testing



## SAXION UNIVERSITY OF APPLIED SCIENCES

### Saxion

Saxion University of Applied Sciences is a knowledge institution that provides test-before-invest facilities through its various Fieldlabs on (circular) innovations in manufacturing, as well as in its involvement in T-Valley, the robotics and mechatronics Fieldlab in Twente and Garden of Kairos, the Fieldlab on big data, AI and IoT-technologies.

**Location:** Enschede, NL

**Technology skill sets:**

X Smart Industrial Robotics

X Augmented interaction

X Applied data science for situational awareness



## SPACE<sup>53</sup>

### Space053

Space053 has emerged as a hub for space-related technology development, including robotics for satellite maintenance and space exploration applications. The aim is on creating the preliminary conditions for the successful development and application of unmanned systems with the combination of high-tech knowledge and skills, facilities for testing and experimentation.

**Location:** Enschede, NL

**Technology skill sets:**

X Technology Development

X Testing & Training

X Technology Application



## Advanced Manufacturing Centre by Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente

Managed by the Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente, the Advanced Manufacturing Centre (AMC) excels in fostering collaboration between academia and industry to drive innovation in manufacturing processes. With state-of-the-art facilities and a strong team of expert researchers, the AMC pioneers cutting-edge projects in robotics, automation, and additive manufacturing.

**Location:** Enschede, NL

**Technology skill sets:**

X Digital Twinning

X AI in Manufacturing

X Industrial Additive Manufacturing

X Flexible automation



## HAN

The HAN Academy of Engineering and Automotive is host to 3 large research groups: automotive research, balanced energy systems, and Lean & world class performance. The aim is on application of Robotics and Data Science in production processes.

**Location:** Arnhem (Nijmegen), NL

**Technology skill sets:**

X AR, vision and manufacturing

X Application of Robotics in Manufacturing

X Process Mining and Machine Learning in Manufacturing



## CIVON

The Center for Innovative Craftsmanship East Netherlands (CIVON) strengthens the manufacturing industry in the field of High Tech Systems and Materials. The focus is mainly on Middle Management Engineering and (Smart) Industry with crossovers to education, healthcare, ICT, and construction.

**Location:** Ulf, NL

**Technology skill sets:**

X Digital Twinning

X AI in Industry

X Robotics



## Wageningen Research

The Fieldlab AgriFoods builds on the Wageningen University & Research (WUR) shared research facilities. The platform is developed in close collaboration between WUR and FoodValleyNL to represent all phases of the innovation process: from research and product development, to demonstration, upscaling and production facilities.

**Location:** Wageningen, NL

**Technology skill sets:**

X Sensing and Robotics

X AI Applications

X Computer Vision



## Fieldlab Industrial Robotics

The Fieldlab Industrial Robotics (FIR) focuses on empirical research into best practices for industrial robotization, development of knowledge into teaching material, and assurance of quality level of knowledge in the field. They have facilitated projects like the integration of cobots in assembly lines and advanced robot-based quality control systems.

**Location:** Harderwijk, NL

**Technology skill sets:**

X Robotics

X Concept Testing

X Workshops and Trainings

## Embrace the Future with EDIH BOOST Robotics

Are you ready to unlock the full potential of your business and lead the charge into the future of robotics and digitalization? The European Digital Innovation Hub (EDIH) BOOST Robotics beckons you to join a dynamic ecosystem of innovation, collaboration, and transformative possibilities. Take the first step on an empowering journey of awareness where your company's unique aspirations and objectives for digitization will be harnessed with expert precision. Benefit from our array of cutting-edge Fieldlabs, each specializing in real-life testing, implementation, and scalability of new digitalization technologies. ■

**To start your journey, please visit:**

<https://boostsmartindustry.nl/nieuws/edih-boost-robotics-east-netherlands>



THE

# FRAUNHOFER INNOVATION PLATFORM

## PURPOSE TO INDUSTRY

**A** Fraunhofer Innovation Platform (FIP) offers a unique framework for co-operation between one of the German Fraunhofer Institutes and an international partner organisation. It allows for the combination of cutting-edge research by the international university with Fraunhofer research focused on practical application. Together, the partners are able to provide a unique source of knowledge and competencies as well as a one-stop shop for clients that want to profit from this knowledge.

Through the FIP, the university and Fraunhofer Institute assist their clients to enhance their performance by improving existing products, developing entirely new offshoots, and cutting costs in areas such as manufacturing and distribution. This benefits local companies that want to stay one step ahead by continuously seeking out improvements and launching new products.

The FIP also offers market analysis, feasibility and profitability studies as well as innovation consulting services.

“Through the FIP, the university and Fraunhofer Institute assist their clients to enhance their performance by **improving existing products, developing entirely new offshoots, and cutting costs** in areas such as manufacturing and distribution.





# WHY CONNECTIVITY IS VITAL TO HIGH-TECH MANUFACTURERS

*[...] 83% of survey respondents believe that smart manufacturing is the key to their organization's success.*

Despite the unstoppable rise of Industry 4.0, most shop floors still use some form of ad-hoc or custom industrial connectivity. Adoption of newer solutions, such as edge networks and private 5G mobile networks is still far from universal, but this presents a huge opportunity for forward-thinking manufacturing firms looking to join the race for modernisation.

## Building a smarter shop floor

According to the latest Annual State of Smart Manufacturing report by Rockwell Automation, 83% of survey respondents believe that smart manufacturing is the key to their organization's success.<sup>1</sup> The secret to that success is starting with

In the world of high-tech manufacturing, staying competitive means adopting more sustainable business models and making informed decisions based on facts rather than emotions. That in turn requires the ability to collect, process, and act upon data from various sources rapidly and at massive scale.

Because of this, connectivity has become the backbone of modern manufacturing operations across Europe and beyond. Given the rapid acceleration of digital innovation in manufacturing, organizations that prioritise connectivity in their operations are well ahead of the game, both in terms of streamlining their processes and reducing waste.





# 5G

the right foundation which, in this case is a secure and dependable network architecture that can grow with the business and work seamlessly with both new and legacy technologies.

Smart manufacturing is the defining characteristic of the fourth industrial revolution. High-tech manufacturers are now integrating industrial internet of things (IIoT) devices, such as sensors and actuators, into their production workflows. At the same time, cloud computing, machine learning, and analytics are becoming critical enablers of enhanced efficiency. Moreover, many factories are now investing in additive manufacturing techniques like material extrusion, sheet lamination and photopolymerisation. What all of these

systems have in common is that they generate data. That data must be timely and accessible for it to deliver maximum value.

For that to happen, factories need exceptionally reliable connectivity that offers the bandwidth to accommodate increasingly massive data sets. Redundancy is also essential, especially in the case of devices used to monitor and maintain recommended operating conditions, detect environmental hazards, or carry out predictive maintenance. Today, these technologies are helping manufacturers solve some of their biggest challenges, but they can only do so when connectivity is guaranteed.

## Improving supply chain visibility

Manufacturing supply chains are complex and multifaceted, not to mention prone to disruption due to global instabilities in the availability and pricing of raw materials and components. As such, the supply chain has long been notoriously hard to track and optimise, to the point they end up being many single points of failure. Without complete visibility into the supply chain, it is only a matter of time before serious problems arise. For example, if a manufacturer cannot predict, with a reasonable degree of accuracy, when certain supplies will arrive, they cannot be confident about fulfilling orders, meeting production quotas, and keeping customers happy.





Rather than resorting to stockpiling resources or changing suppliers, manufacturers should prioritise proactive supply chain planning to mitigate risk and accurately anticipate demand. Once again, data is the key to delivering on those goals. Connectivity both within and outside the shop floor is vital for enabling the seamless flow of data, thus allowing the back office to track inventory and assets on the move. For example, manufacturers can track the location of assets like shipping containers using GPS tracking devices that keep manufacturers informed of the exact location of their supplies in real time. However, the timeliness and accuracy of the information depends on the quality of the network transmitting it.

## Enhancing communications

When we talk about Industry 4.0, we usually focus on the role of automation and AI in modern manufacturing. However, we must also not forget the vital human element which, for too long has been stunted by communication and collaboration challenges. These have been further exacerbated by the increasing complexity of production

lines and supply chains which, in turn, have led to operational siloes where different departments are inadequately prepared to share information. With hybrid work now being the new norm for knowledge workers, the challenges are often even greater.

Rapid innovation requires close collaboration between research and development, sales and marketing, customer service, supply chain management, and personnel on the shop floor. If team members cannot communicate efficiently, excess waste and mistakes are inevitable. Fortunately, connectivity enables unified communications, where departments can collaborate using any internet-connected device, whether that means hopping on a quick call, joining a video conference, or simply sharing

production plans or instructions. With a truly connected environment, manufacturers can also share essential insights to make profitable decisions in near real time.

## The rise of intelligent networking

To reap the rewards of Industry 4.0, manufacturers need to implement a network architecture that can support these new business models and processes. Bandwidth needs to be scalable, connectivity reliable, and latency as low as possible. Conventional local area networks are no longer enough, even when they do offer exceptionally high bandwidth. In fact, there is no one single physical solution that can provide all the connectivity today's high-tech manufacturers need.

*Smart manufacturing is the defining characteristic of the fourth industrial revolution.*

*To reap the rewards of Industry 4.0, manufacturers need to implement a network architecture that can support these new business models and processes.*

Instead, manufacturers should look to newer network types like software-defined wide area networks (SD-WAN) and 5G. Both these technologies complement one another to create a seamless networking experience where everyone has access to the right data at the right time, no matter the device they are using. SD-WAN, for example, offers improved cloud connectivity, high availability with multiple redundancies, and simplified management via a centralised administration dashboard.

At the same time, 5G provides networking features that are essential for smart manufacturers, such as the ability to support IIoT and edge devices with very low latency and high bandwidth. Another unique benefit of 5G is how, unlike previous generations, it allows companies to set up their own private networks to extend connectivity far beyond what regular wireless or wired networks can achieve.

Digital transformation is now well underway in manufacturing. For those who have not done so already, now is high time to build a network infrastructure that can support the factory of the future.

[The Fraunhofer Innovation Platform at the University of Twente helps manufacturers turn their ambitions to build the factories of the future into reality. We offer industrial technical benchmarking, develop proof of concepts and process and production developments. Get in touch today to discover how we can support you. ■](#)

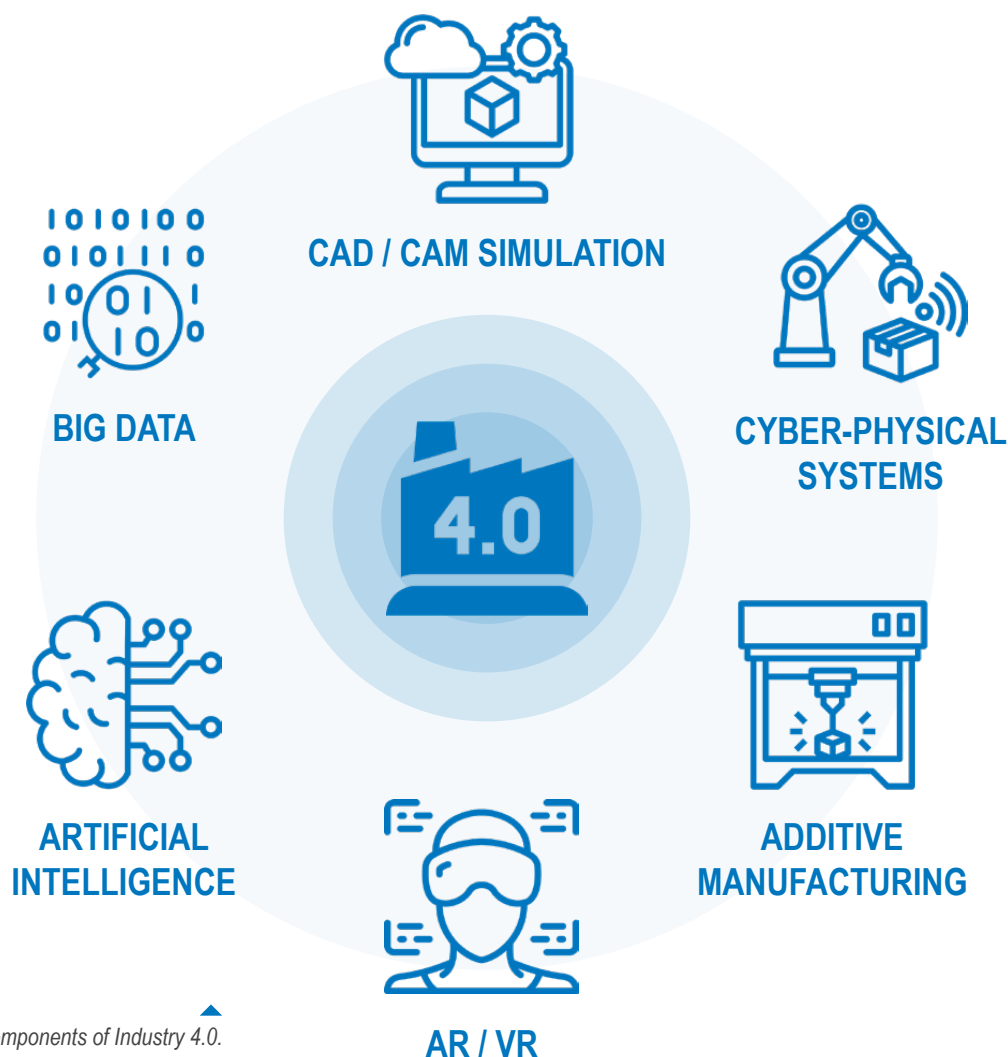
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The components of Industry 4.0.



IS THERE VALUE FOR

# S·E·A AND S·E·O FOR MANUFACTURERS?

**S**EO (Search Engine Optimization) and SEA (Search Engine Advertising) are areas that look similar to each other but have two different purposes and functions. SEO and SEA efforts and strategies contribute to websites and companies, and you can get very successful results when carried out together with a coordinated and correct manner.

The most fundamental difference between SEO and SEA is the way they appear in the top positions of Search Engine Results Pages (SERPs). These are the ways of appearing in the top ranking while SEO experts aim to be included in the search results organically, SEA experts aim to reach the top positions by giving paid advertisements. But actually, when they are used together, they can work for the brand's visibility, reputation as well as sales conversion both in the short and long run. Let's dive deeper into this particular relationship between SEO and SEA.

## How SEO and SEA Complement Each Other?

When users want to find a product on Google results, they check their online presence. These results both include ads shown at the top, and also organic listings which are the result of good SEO performance.

*“Engineers, purchasing agents, and B2B customers may find your company online more easily with the use of SEO.”*

Combining search engine advertising (SEA) and search engine optimization (SEO) into a marketing plan creates a variety of chances to get high-quality traffic from prospective clients. In order to accomplish this goal, the paid media team and the SEO team have to cooperate with one another.

This indicates that they should agree on the content development approach as well as the keywords that will be utilized to motivate prospective clients to take action. Additionally, the SEO team can use the data provided by the paid media team to determine which keywords or queries are responsible for driving traffic to the website.

Based on this data, the SEO team can then create relevant content. Then, when you transfer the results of your SEA optimization to your SEO optimization, you have the option to improve the keywords and phrases that have a high conversion rate.

## How Manufacturers Can Benefit from SEO and SEA?

While most industrial companies associate the SEO, SEA, and digital marketing efforts with e-commerce companies and stay skeptical about their role in industry and B2B business, nowadays, if you are looking for new-age B2B leads, new markets, new suppliers and vendors, you turn your gaze to Google rankings again.

Engineers, purchasing agents, and B2B customers may find your company online more easily with the use of SEO. You may be passing up significant development chances if you don't have SEO and other effective digital growth strategies in place, such as online advertising.

## Key Benefits in Investing SEO and SEA for Manufacturers?



### *Increased online visibility:*

Manufacturers and industrial businesses may increase their online exposure and make it simpler for prospective clients to locate them when they search for relevant goods or services by optimizing their websites for search engines and making use of paid search advertisements.



### *Cost-effective marketing:*

When compared to conventional types of promotion, SEO is a more affordable marketing tactic. Manufacturers and industrial businesses may reach more prospective consumers by concentrating on optimizing the content and structure of their websites for search engines without spending a lot of money on paid advertising. Similarly to this, SEA enables businesses to define an advertising budget, guaranteeing that they only spend for clicks and impressions that are likely to generate leads and sales.



### *Targeted marketing:*

SEA enables manufacturers and industrial companies to target certain demographics and keywords to reach their target market. They are able to provide higher-quality leads that are more likely to result in sales as a result.



### *Measurable results:*

Manufacturers and industrial companies may monitor the performance of their marketing activities and modify their tactics since SEO and SEA both provide quantifiable outcomes. This enables companies to make data-driven choices regarding their marketing initiatives and optimize their return on investment (ROI).

**S**earch **E**ngine **A**dvertising



**S**earch **E**ngine **O**ptimization



*The most fundamental difference between SEO and SEA is the way they appear in the top positions of Search Engine Results Pages (SERPs).*

## SEA Tips for Manufacturers to Boost Your Visibility and Ranking on SERPs

### **Again, Keyword Search for Ads**

Using paid search advertisements to target relevant keywords and phrases that prospective buyers are typing into search engines is a quick and effective strategy.

### **Google Ads Strategy**

Ad development is coming up with eye-catching pictures and language for advertisements that will entice viewers to click through to a website.

### **Targeting and Remarketing**

To make sure that advertising is reaching the proper audience, targeting entails specifying precise targeting criteria, such as demographics and geography.

## SEO Tips for Manufacturers to Ensure Your Company is Found First

Manufacturers and business organizations in the industrial sector should concentrate on the following SEO essentials:

### **Keyword Search**

With the use of keyword research, you can create content for your website that is optimized for the relevant terms and phrases that prospective clients are using to search.

### **On-page optimization**

This entails making website content, titles, and meta descriptions as well as the navigation and structure more search engine friendly.

### **Off-page optimization**

This entails constructing trustworthy backlinks to the website from other authoritative websites, which raises the website's authority and positioning in search engine results.

## Top Searched Keywords For Advanced Manufacturing in the Netherlands

By using the Google keyword planner, you can also look at local searches and use keywords based on your target market.

All these keywords can help you to rank in Google search results in higher positions. By conducting comprehensive keyword research, you can choose the ideal keywords to compete with others, optimize your website text, headings, and even images based on those words, create content around these keywords and also you may choose to publish ads that target those

keyword searches to boost visibility. All these actions will bring your website more traffic, hence, more leads and eventually more sales.

## Conclusion: Is SEO and SEA valuable for industry?

SEA and SEO are useful for businesses of all sizes, including the manufacturing and advanced technology market. Businesses may increase their online exposure and get more natural traffic to their websites by using search engine optimization. Search engine advertising, on the other hand, allows companies to reach certain consumers via focused advertising campaigns. Together, these tactics may assist companies in expanding their internet presence, generating leads, and eventually increasing income. Although

<input type="checkbox"/> Keyword (by relevance)	Avg. monthly searches
Keywords you provided	
<input type="checkbox"/> fabricage	100 – 1K
<input type="checkbox"/> productiebedrijf	100 – 1K
<input type="checkbox"/> geavanceerde technologie	10 – 100
<input type="checkbox"/> geavanceerde fabricage	0 – 10

Top searched keywords for Advanced Manufacturing in the Netherlands.

these strategies may require an initial investment, the long-term advantages make it an investment that is worthwhile. In general, each company's digital marketing plan should include SEO and SEA. ■

Author:



**Senad Dzaferovic**  
CEO  
Hubion Marketing



# Hubion Online Marketing

On target with **digitally tailored** and **tactical solutions**

Search Engine Advertising  
Search Engine Optimisation  
Conversion Optimisation  
Social Media Marketing  
Content Marketing

Hubion is the **leading expert** in the digital marketing realm, covering **search engine advertising, optimisation, and conversion improvement.**

Hubion's **"no nonsense"** outlook and passionate commitment are the keys to our success in helping our customers reach maximum online results.

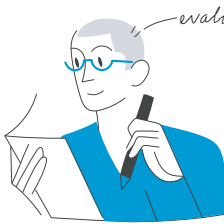
# DIVE2:

## RAISING AWARENESS ON DIVERSITY & INCLUSION IN SOFTWARE AND MANUFACTURING COMPANIES

### 01 AWARENESS



### 02 CONSIDERING IMPLEMENTATION



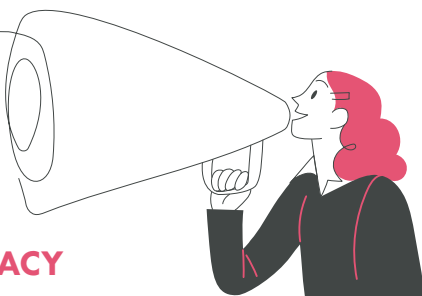
### 03 APPROACH & IMPLEMENTATION



### 04 RETENTION



### 05 ADVOCACY



DIVE2, a follow-up project to 'Dive in Twente\*', is developed in collaboration with software and manufacturing companies in the Twente region. The project has the goal to raise awareness, through a collaborative board game, about the companies' current state of diversity and inclusion approaches.

### Diversity and Inclusion in the region

In recent years, corporate initiatives on diversity and inclusion (D&I) have been advocating for a diverse company staff where employees with different backgrounds can feel included and respected within the organisation. Implementation of these initiatives can benefit the company's working culture, contribute to the well-being of employees, and widen the talent pool for future hires.

As discovered in 'Dive in Twente', companies in the region have multiple areas of opportunity when it comes to create a diverse team and an inclusive work environment. Companies can start by addressing diversity aspects such as gender, age, and nationalities; the starting focus areas of Dive in Twente. To support this process, the student team developed a board game and guiding materials to support D&I discussions within a company.

*\*Learn more about the first part of the project Dive in Twente in InnovatieNU Number 7.*

◀ The journey to navigating diversity in workspaces. (Credit: Dive in Twente)



## D&I journey in a game

DIVE is a collaborative serious game that opens the space for players to share their experiences on different aspects of D&I such as the recruitment process, policies, management, and career growth. Serious games allow players to practice skills and acquire knowledge on specific topics beyond enjoying a leisure activity. Players go on a journey to discover their company's D&I level by discussing multiple research-based questions. Guided by the moderator players get to vote yes or no on each question, based on whether the topic is addressed or not by their company. By the end of the game, the players will discover where the company is situated between the five different D&I stages: awareness, considering implementation, approach & implementation, retention, and advocacy. The game developed by the student team is the first of its kind focusing on D&I within a corporate environment.

## Collaborating partners

During the follow-up research, DIVE2 has focused on validating the materials created by testing them with employees from the software and manufacturing industry. This collaboration is supported by three regional companies with on-going efforts on D&I, their experiences will contribute to improve the board

*Playing this game at a cross functional level encouraged us to reflect on our DE&I journey from a practical angle, it's fun to do and it provided us with new insights that will further strengthen and support our way forward.*

- Royal Grolsch

game and other materials. The companies involved are Demcon, Grolsch, and Movella; all renowned companies in the Twente region interested in furthering their efforts on diversity and inclusion.

## The research process

DIVE2 embarked on a three-phase process of validating the board game design with the input from all three companies. First, for each company a game session was organised with employees from different departments and seniority levels followed by a short survey. Second, the student team conducted one-on-one interviews with employees who played the game to further investigate their experience during the session and the features of

the game. Third, a second survey with previous players took place to allow the student team to complete the final deliverables.

## Conclusion and future steps

The student team completed the project by delivering the new version of the materials to each company. The resulting serious game considers the importance of promoting interpersonal communication elements such as trust, self-awareness, empathy building, among others, throughout the gameplay. Moreover, each company received custom recommendations for the future steps of their D&I approach. After collecting the input from more than 50 employees, the partnering companies now have a tool for their HR and D&I teams to continue their diversity journey.

By playing the DIVE game, companies have the opportunity to discuss and reflect on 25 aspects relevant to diversity and inclusion within their organisation. Future gameplays will take place in collaboration with Expat Center East Netherlands as part of the 'Happy in Twente' project. This collaboration will allow new partnering companies to start the discussion on D&I and prepare them as they take the next steps. ■



◀ Game session with partner company. (Credit: Dive in Twente)

# AMC NU

# ADVANCED MANUFACTURING PROGRAM<sup>(AMP)</sup>

Powered by: **Regio Deal Twente**

**T**he Fraunhofer Innovation Platform for Advanced Manufacturing (FIP-AM), together with the regional government and partners, has developed the Advanced Manufacturing Program (AMP) to create a transition framework to Manufacturing 4.0 and to strengthen the industry in the east of the Netherlands.

The Advanced Manufacturing Program (AMP) provides subsidies through the RegioDeal, supported by the Province of Overijssel and the Dutch State. The aim is to stimulate the rapid development of Twente and other

regions in The Netherlands by creating an Advanced Manufacturing hub with an outward-looking, European image.

In this way, the AMP strengthens the reputation and climate of the region. Within the AMP, the Fraunhofer Innovation Platform is developing innovation projects in the field of production technology together with the University of Twente.

Each AMP project is built around a solid industrial collaboration. During the project, the companies will have access to relevant knowledge and

the latest technological and industrial methodologies. These can be shared with other high-tech manufacturing companies in the region via the hub.

The companies that are members of the AMP can solve their specific technological problems and answer market-oriented questions. This is done by developing and creating demonstrators with direct technological insight. FIP-AM then works through workshops and master classes on the dissemination of this newly acquired knowledge.

*The Advanced Manufacturing Program (AMP) is a grant program that helps us businesses support your transformation to Industry 4.0. This is made possible by the RegioDeal, supported by the Province of Overijssel and the Dutch State.*



Rijksoverheid



# THEME 01\_

## PROJECT PARTNERS WANTED

*For a research project on innovative industrial communication technologies*

New means of communication, such as 5G, can significantly improve connectivity between people and machines, but also from machine to machine. This offers enormous advantages in the field of, for example, safety on the shop floor and quality control, through real-time data monitoring and control.

A possible application is the use of 5G in motion tracking devices in the production or logistics environment. The available real-time two-way communication makes human-robot collaboration significantly more effective. This is an interesting case for, for example, sheltered workshops or technology suppliers.

**We are currently forming a consortium for a new AMP-funded project on this topic.** Do you want to join or do you have a challenge in your production environment for which your current communication technology is not sufficient? Please contact us!



# THEME 02\_

## LOOKING BACK: WORKSHOP

*Integration of AGVs and mobile robots in the manufacturing industry*

It's been a while now, but we'd like to take a look back at the **workshop on the integration of AGVs and AMRs**, that we organised on Thursday, April 13 together with Novel-T!

With about **40 enthusiastic participants** we have learnt from the presentations of Twin-Tech Engineering about the software side of the integration of AGVs in the current processes, AMRobotics

took us through the (im)possibilities of the hardware and the general manager of metal company MCM told us about his practical experience with the integration of AGVs in his production process. He talked about the issues he ran and still runs into, and the advantages and disadvantages AGVs and AMRs brings him. We then split up into five round tables, in which each group worked out its own case under the guidance of an expert table host. The

aim was to inspire the participants, to transfer knowledge, and to provide insight into the advantages and disadvantages in practice. **Judging by the enthusiastic reactions, we can look back on a successful first event in our new building!**

*Do you have an issue that you would like to attend an open and interactive knowledge session about? Let us know!*



# THEME 03\_

## NEW PROJECT LAUNCHES

*With the Advanced Manufacturing Program*

A number of cool projects have recently started with help of the Advanced Manufacturing Program! The project **Heats** looks into adjustments in the product design of their hybrid heat pumps to be able to scale up production, **ToolICM** focuses on a predictive model to timely anticipate tool wear in the metal industry,

**FRT** stands for Feature Recognition Tool, which will be researched to have the input files automatically meeting to the requirements of the production software, **Vitals** is about monitoring machines using sensor technology for predictive maintenance in an accessible way, and in **TIMELY** an AI-based scheduler will

be developed, to solve parallel machine scheduling problems faced in the semiconductor industry.

*More information about our projects? Please contact us. ■*



# MIND YOUR OWN (SUSTAINABLE) BUSINESS: A MANUFACTURING APPROACH

## Introduction

Sustainability. We hear that word everywhere nowadays. But, what does it mean? And what can industry do about it? The term sustainability is generally defined as the balance between social, economic, and environmental aspects. Every product in our built environment is manufactured somewhere, using many human, energy and material resources, and producing a certain amount of waste, only to (partially) end up in a landfill once it reaches the end of its functional life.

For industry, more and more companies are realizing that there are substantial economic and social benefits resulting from adopting sustainability. Resource efficiency, workforce satisfaction, reduction in fossil fuel dependency, and use of new technologies are just a few examples of sustainability-related activities that will help the industry thrive for years to come. From a business perspective, sustainability offers economic benefits that can be leveraged through the balance of the social and environmental areas. But, reaching that balance is proving to be the most challenging aspect of sustainability.

For the manufacturing industry, there are a couple of important questions to answer:

- *How can we make the products we manufacture more sustainable?*
- *And, how do we quantify those benefits in a way that helps shape a greener future for manufacturing?*



## Sustainable manufacturing? Or manufacturing sustainably?

Making industry more sustainable means making the manufacturing process more environmentally friendly (sustainable manufacturing), and in a manner that can still bring long-term social and economic benefits (manufacturing sustainably).

A product, service, or process usually follows a linear lifecycle, also referred to as cradle-to-grave, that consists of four main phases:

- 1) **Material Sourcing (cradle),**
- 2) **Manufacturing,**
- 3) **Retail and Use, and**
- 4) **Disposal (grave)**

When talking about sustainable manufacturing, we talk about measuring the impact of a product throughout all the phases of a product lifecycle. As can be seen in Figure 1, the transport required for bringing the (un)finished product to its destination for the next phase, and the resource input and waste output, are also important parts of the product lifecycle to consider. Everyone who takes part in

manufacturing, regardless of company size or their role in the product lifecycle, can play a part in reducing the negative impact of their operations. This is what we call sustainable manufacturing.

When talking about manufacturing sustainably, we refer to the ability to keep a business operational. This is done by providing a positive impact to society and the environment, without compromising the industry's ability to grow or create value. Manufacturing sustainably may mean offering properly remunerated jobs, a healthy and safe work environment, manufacturing products with large societal value, reducing resource and waste streams, aiming for circular processes, or offsetting carbon outputs through alternate environmental activities such as reforestation. So, should we strive for sustainable manufacturing or to manufacture sustainably? For the manufacturing industry, the answer is both.

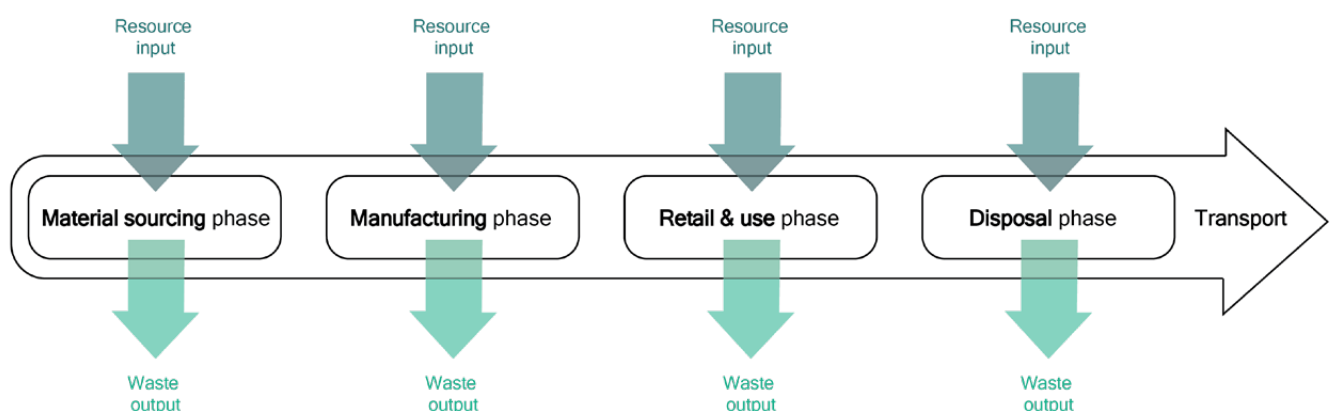
## Measuring sustainability

Measuring the footprint of an organization, whether it is from an environmental, social, or economic perspective, is the critical step for keeping a business relevant in a market

that is constantly subjected to the effects of climate change. Most of the time, organizational strategic decision-making processes are economically driven. Not necessarily because organizations are not concerned about their societal or environmental impact, but because the impact is difficult to quantify and translate into indicators that may provide valuable business insights. Lack of knowledge around climate change, lack of awareness around corporate sustainability developments, and lack of accurate impact assessment methods are contributing to a delay in corporate climate action. But no company should go through change alone. Recognizing the need for action is already a good first step on the road toward sustainability. The second step should be translating impact into social and environmental indicators that kickstart corporate action.

## Kickstarting sustainability

You work in industry and you want your company to become more sustainable, but where to start? A Sustainability Officer (SO) can help carry out a holistic analysis of the organizational status, as well as fill in the knowledge gaps necessary for further action.



**Figure 1.** Phases in a product lifecycle from Cradle-to-Grave including resource and waste streams.





A SO should be able to help your organization answer the following questions:

- *Are you aligned and connected to global and corporate sustainability objectives?*
- *Are you prepared to face the most important sustainability challenges for manufacturing?*
- *Do you have the tools to measure your environmental and social impact?*

The answers to these questions will vary on a case-by-case basis but will help shape the appropriate next steps for your organization. In most cases, the results will depend on the organization's strategic priorities, market position, growth opportunities, and change-readiness level. Most companies will want to measure the **ecological footprint**<sup>1</sup>, or **ecological impact** of a certain product, service, or process. One way to measure impact is through an LCA (Life Cycle Assessment), which offers a standardized approach to understanding the impact associated with products, services, or processes.

### Why you need an LCA

Measuring the ecological footprint is not an easy feat. The LCA framework as defined in ISO 14040:2006, is a methodological approach consisting of four phases as shown in Figure 2.

#### 1. Goal and scope definition:

The first step is always to define what the goal of the study is, and the assessment boundary conditions. In a layman's terms, the extent of lifecycle phases and processes to be included or excluded from the study.

#### 2. Inventory Analysis (LCI):

The second step is to create a detailed list of all the resource and waste streams related to each of the phases and processes. This will help identify the amount of resources allocated to creating a product and its environmental contribution related to the organization in question.

#### 3. Impact Assessment (LCIA):

This part involves categorizing the identified impacts, quantifying the relationships, and assigning relative values to be compared with benchmarking values. This can all be translated into a single-score indicator.

#### 4. Interpretation:

Finally, the most critical aspect of an LCA is what to make of all the resulting information. An SO is important to have to provide a valuable and objective perspective on how to convert the results into corporate actions. This is arguably the most important step of all, considering that the organization may be able to use this information to disclose its role and impact on the planet.



#### <sup>1</sup>Ecological footprint:

An analysis that compares human demand with the planet's capacity to regenerate. In most cases, especially in manufacturing, the footprint is represented by the amount of biologically productive land and sea needed to regenerate the resources consumed and absorb the corresponding waste generated by the production process.

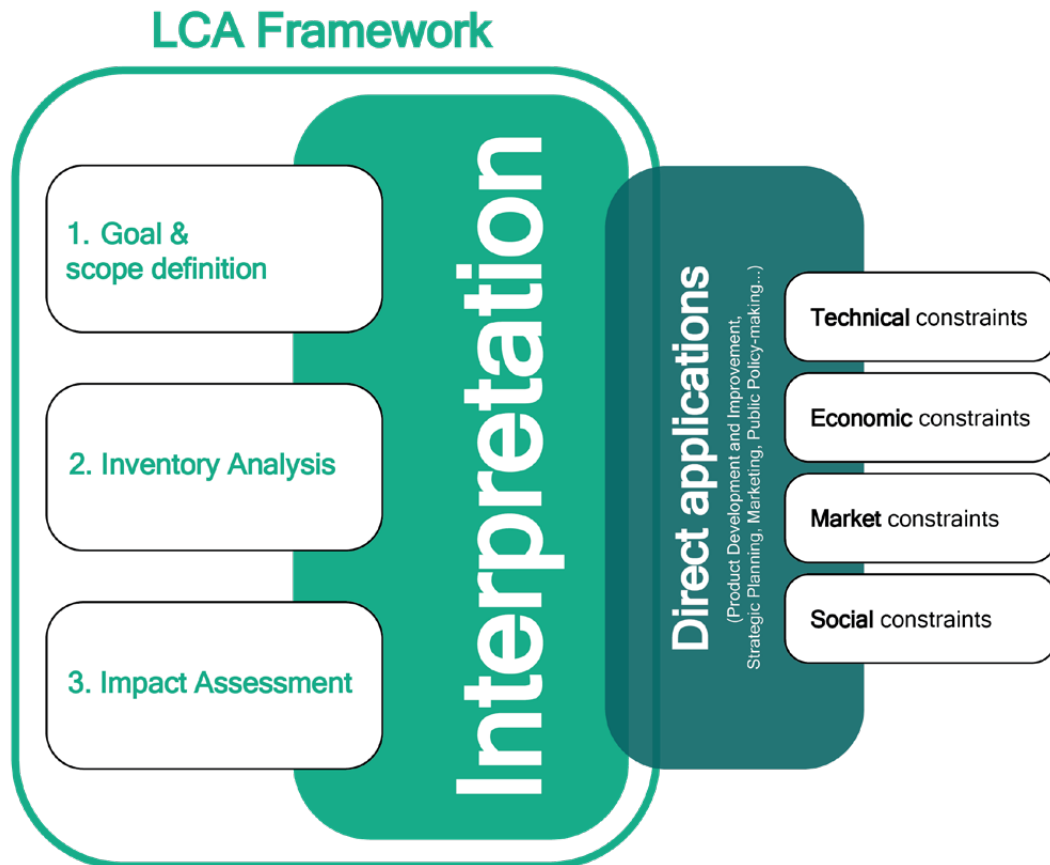


Figure 2. Phases and applications of LCA adapted from ISO14040:2006

Altogether, an LCA can bring the manufacturing industry multiple benefits. It can help by:

- **Environmental Impact Evaluation:** Identifying improvement opportunities for the environmental performance of a product
- **Regulatory compliance:** Informing stakeholders such as industry, governmental, and non-governmental organizations
- **Sustainable design:** Encouraging the use of eco-design principles by providing insights into environmental hotspots
- **Resource efficiency:** Highlighting resource and energetic consumption patterns to optimize use and save costs
- **Waste reduction:** understanding the environmental impact of waste generation and promote recycling or material reuse.

- **Decision Making:** Selecting relevant indicators for environmental performance that can be translated into corporate action
- **Marketing and consumer perception\*:** communicating environmental performance can boost consumer confidence and attract environmentally conscious consumers.

\*It is important to highlight that any product in the market with environmental claims, ecolabels, or social impact statements, should have gone through an LCA process that includes a critical review from an external party or SO. This is done to limit greenwashing schemes, enable consumers to make informed decisions, and support science-based claims. However, it does not mean that all product labels or claims have indeed gone through a standardized and critically reviewed LCA process.

## A green takeaway

Regardless of your motivation for sustainability, it is clear that the world is moving in a greener direction. The train of sustainability is full of opportunities for manufacturers of all kinds, it brings all kinds of short and long term benefits. Whether it is a happier and more productive workforce, a smaller (negative) environmental impact, or resource efficiency and cost reduction, the journey towards a greener future starts with you. ■

Author:



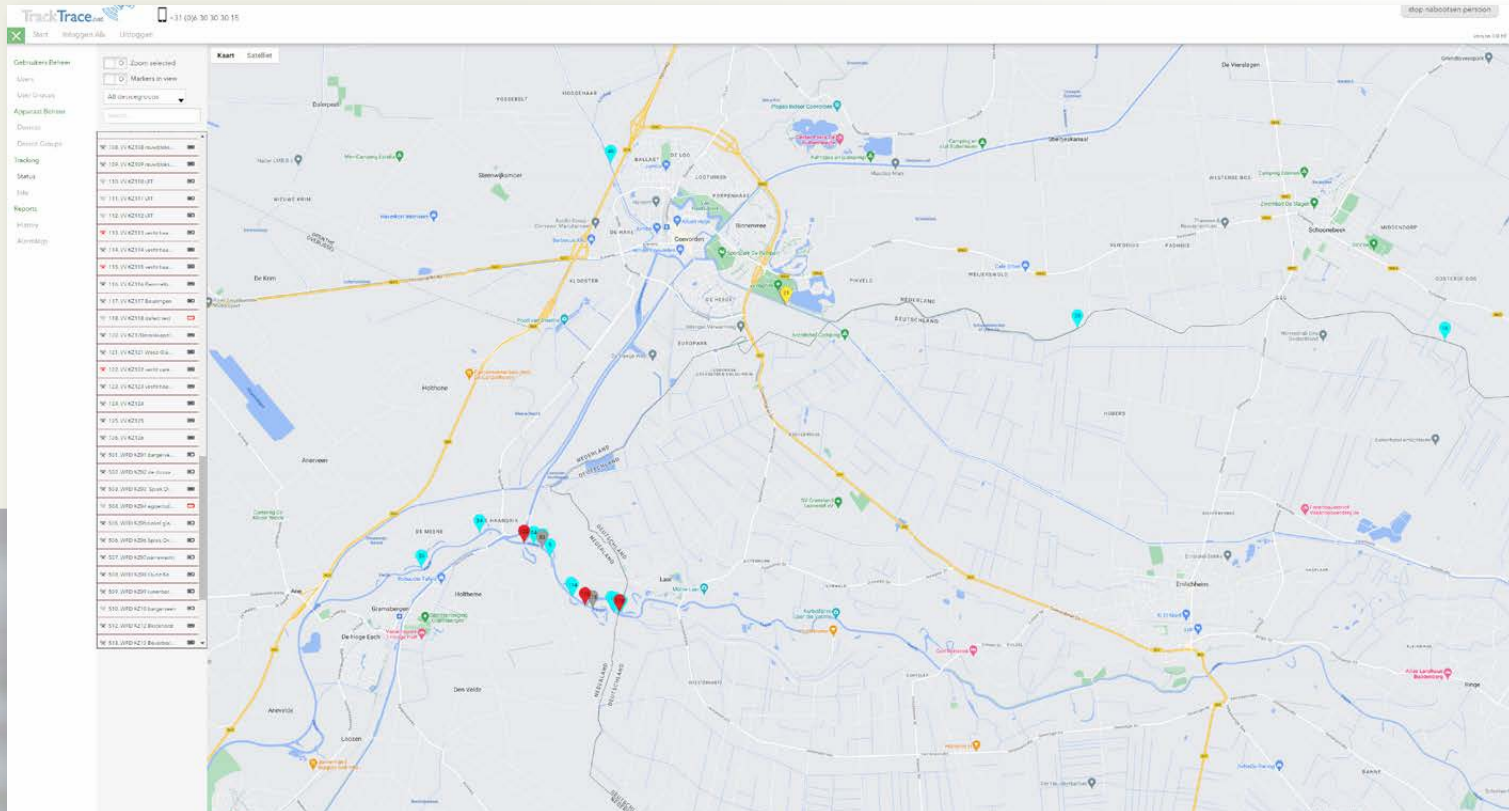
**Ale Sarmiento Casas**  
Research Engineer  
Fraunhofer Innovation Platform  
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# INNOVATION & TECHNOLOGY FOR NATURE MANAGEMENT

*The **Smart Life Trap** is a trap that is equipped with a camera system, PIR sensor and AI software to automatically determine which animal to trap.*







Online platform for visualizing the status of all traps.

The Union of Water Boards is the association of the Dutch water boards. Water boards handle water management and water treatment. In total, there are 21 water boards in the Netherlands.

Muskrat and Beaver rat management in the Netherlands is conducted by the water boards. The Muskrat and Beaver rat are invasive alien species that do not belong in the Netherlands. They cause damage because they dig tunnels and burrows in dykes and make extensive underground tunnel systems. They also disrupt biodiversity. These animals are controlled using various methods including live traps (cages).

With the use of live traps, muskrat controllers must inspect (visit the cages) every 24 hours to check whether an animal has been caught in the cage. This is a time-consuming task involving many hours.

Robor Electronics started producing a birth alarm for horses in 1995. The birth alarm was a precursor to IoT (internet of things) devices and, with the necessary further developments, is still a product that is sold widely in Europe. Another product developed by Robor Electronics, the GPS tracer (click trace) was Robor Electronics' first true IoT product that could be monitored on an online platform.

By combining these products into one product, the trap detector was developed. The trap detector is attached to a live trap. A dashboard shows the location and status of each trap.

The moment the trap door closes, an alarm is generated and a notification is visible on the online platform. The muskrat controller will simultaneously receive a message on his/her mobile phone.

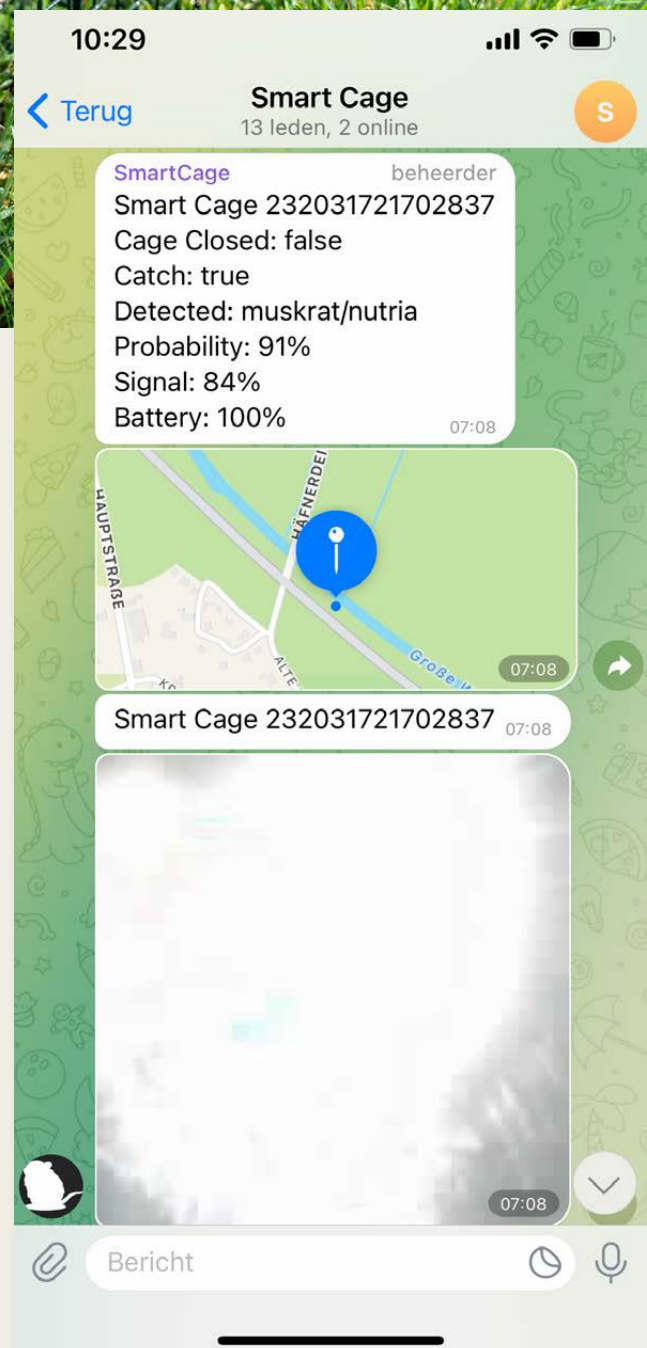




▲ An example of a Smart Life Trap.

By implementing this technology, the muskrat controller only needs to visit the cages that indicate they are closed. This allows the controller to carry out his/her work more efficiently and the control has also become more animal-friendly because bycatches can be released faster.

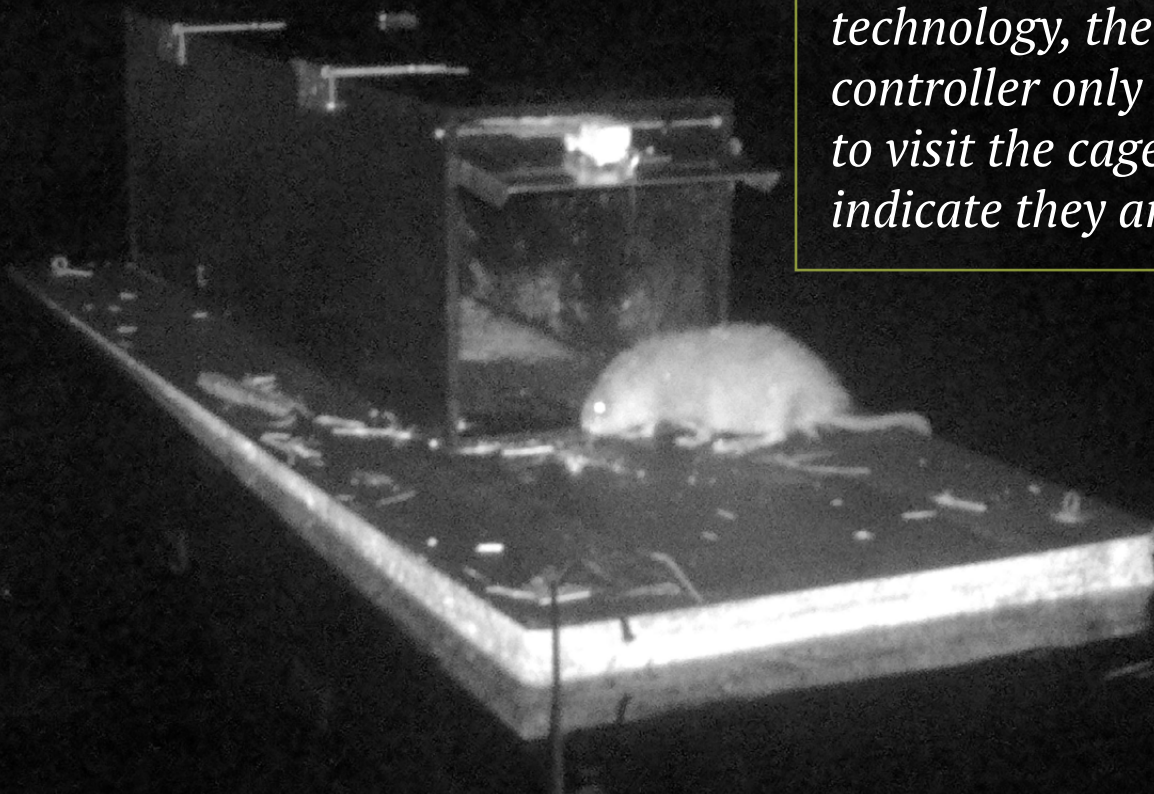
To make the control of Muskrats and Beaver rats more animal-friendly, the water boards and several knowledge institutes with fellow organisations in Belgium and Germany in the Life MICA project (<https://lifemica.nl/>) conducted several studies on monitoring and control methods. Robor Electronics took part in one of the themes called Smart Life Traps.



► A screenshot of the end-user interface showing the activated trap details.



*By implementing this technology, the muskrat controller only needs to visit the cages that indicate they are closed.*



▲ Night photograph of a Smart Life Trap in use.

The Smart Life Trap is a trap that is equipped with a camera system, PIR sensor and AI software to automatically determine which animal to trap. The operation of the Smart Life Trap is as follows; when an animal enters the cage, it is detected by the PIR sensor which then activates the system from “sleep” mode. The camera system starts taking pictures and data analysis takes place locally. If the animal is classified as Muskrat or Beaver rat, the door closes. After the trap is closed, a message is sent to the end-user with details of the capture, the location of the trap and a photo of the animal.

For other classification, for example, a duck or an otter, the cage door stays open so that the animal can get out on

its own. This prevents bycatches and unnecessary stress of animals that are not a target species.

This method also saves a lot of time and costs by optimising technology and operational execution.

The Smart Life Trap development has provided challenges (e.g., connectivity in areas with poor network coverage, analysis software, etc.), but also showing that the concept is functionally workable. With the achieved project results (lessons learned, conclusions and recommendations), the importance of technology development for nature management has become even more clear. We hope to see many new developments and techniques from

the market in the future to contribute to saving and protecting humans, animals and the environment through innovation and technology. ■

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# IS *MES* THE “*SILVER BULLET*” TO BECOME A TRULY DATA-DRIVEN MANUFACTURING ENTERPRISE?



**T**oday there are several pressing reasons why manufacturers need to act now to become data-driven organizations. At the most fundamental level — data helps manufacturers become better at what they do. Let’s look at some tangible ways how data helps connect the dots in driving smart, sustainable and resilient operations:



## Energy efficiency

Data helps to operate machines and mixing recipes as efficiently as possible.



## Sustainability progress

Collecting relevant ESG data for reporting enables transparency of sustainability improvements and regulatory compliance.



## Knowledge preservation

Capturing invaluable expertise of an aging workforce ensures business continuity.



## Product quality

Data helps to control production processes more granularly and guide operators better in optimizing machine settings, leading to better quality and efficiency.



## Customer experience

Better products lead to happier customers.



## Rework and wastage

More first-time-right (FTR) production eliminates the need to repeat unnecessary additional steps, reducing cost, wastage and labor.

## Data needs to be accessible and fit-for-purpose

Given the wide-ranging benefits, many manufacturers are exploring how to become truly data-driven enterprises. In my work with manufacturing clients, I find that, broadly speaking, there are those that develop an organization-wide data repository as a foundation to begin their data journey. Others explore and develop experience in advanced data analytics, including machine learning models, to improve product quality and asset performance. While this is a promising start, many falter on the next steps. Where do we go from here? How do we scale successful data initiatives and expand them to other locations?

While there is no shortage of data, data silos across people, processes and machines make accessing and integrating all relevant data difficult. Differences in data historians\*, definitions and management frameworks result in data that is not usable, traceable

or comparable across assets and plants. Critical information that provides valuable context to machine-generated data may even be “lost” in spreadsheets or other documents.

Here’s where a manufacturing execution system (MES) comes in. According to the Manufacturing Enterprise Solutions Association (MESA), an MES is a dynamic Information System or application “that drives the execution of manufacturing operations, and by using current and accurate data, MES guides, triggers and reports plant activities as events.”

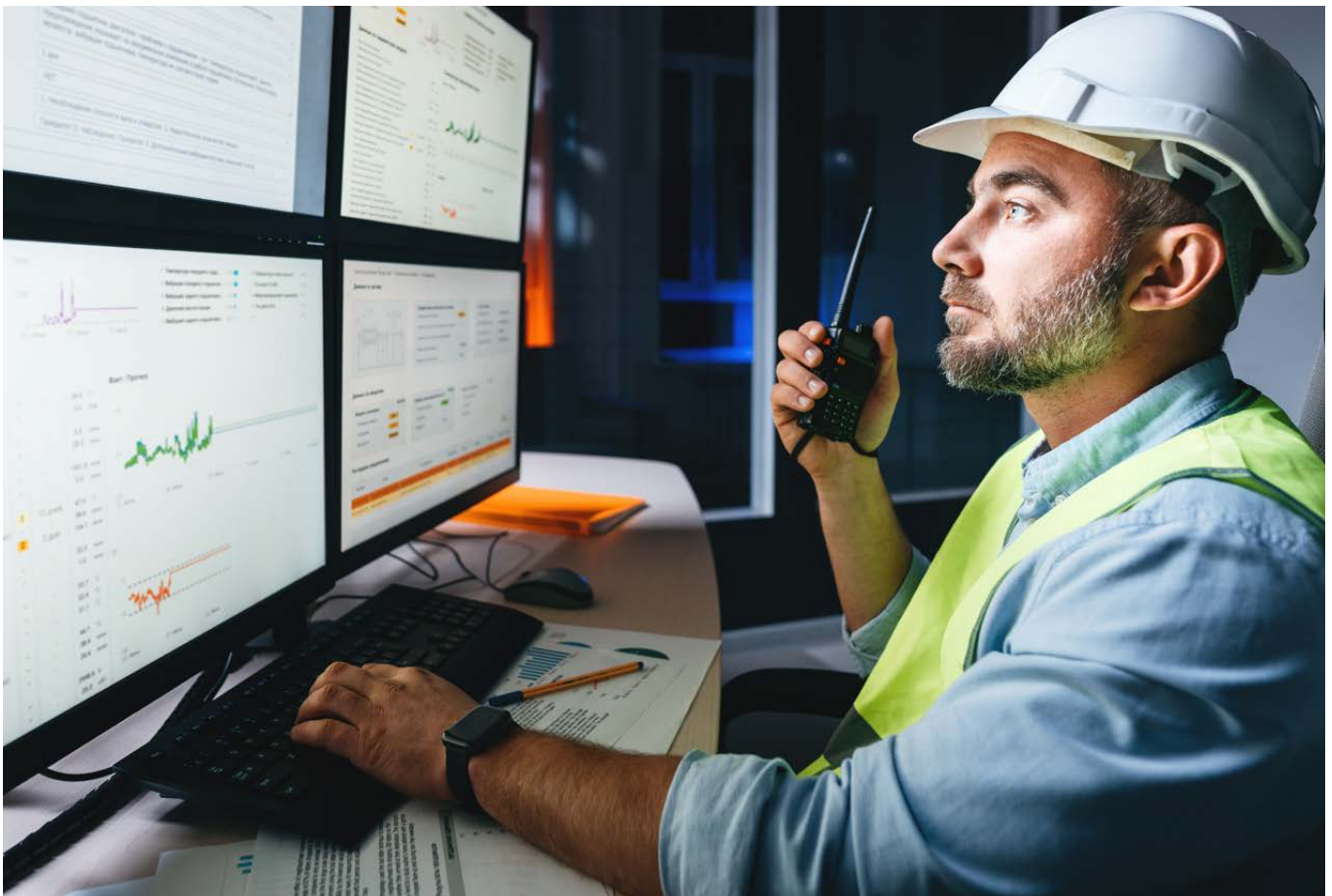
An MES has two crucial roles to play in a data-driven organization. The first is to collect data in a way that it can be processed to provide insights. An MES gathers data from all the machines and operators and makes the data comparable across plants, production units and machines by standardizing aspects like energy consumption data and reason codes for machine breakdowns. Access to comparable

data across plants and machines hugely accelerates the ability to benefit from advanced analytics. The second crucial role is as the interface back to the shop floor. Once you have all the data and use it to optimize processes — from energy efficiency to quality — the MES sends the data back to the machines and production process. Here’s where the rubber meets the road. Updated, optimized machine settings are communicated to machine control systems through the MES or displayed to operators to guide them in fine-tuning the production process.

An MES is essential to close the loop — from data to analytics to the production process.

—

*\* A data historian is software that automates the collection of time-series data from sensors across the plant for operators and engineers to use as and when required.*



## Key benefits of an MES

An MES ensures manufacturers have the right information and insight to make the best possible business decisions and improve performance levels across the supply chain. Apart from being the starting point for implementing data-driven manufacturing, the top five benefits of an MES include the following:



Improved quality control typically leads to a reduction in product defects.



Faster identification and implementation of changes to the production process based on evolving market, customer and business needs.



Faster deployment of innovation as a result of comparable processes and MES implementations across all your sites.



Less work in progress (WIP) and reduced lead times through better operational visibility and control.



Significant reduction in data entry time, paperwork and typing errors through automatic and on-the-spot data capture.

## Critical success factors for implementing an MES

- **Secure organization-wide buy-in** so that everyone in the organization (not just the OT department or a few plant managers) understand the rationale, the program's size and scale, as well as the required resources and change management.
- **Get your data in order** by connecting or replacing existing historians, making sure all data definitions are clear and a governance structure is in place, including data ownership.
- **Don't boil the ocean** by starting with the basics, such as monitoring production orders and gaining better visibility of your production process.
- **Ensure you have the right talent pool** for making sure you assign or hire the right people with the skill sets to run an MES or collaborate with a trusted partner that has the skills and capabilities to support you or, ideally, a combination of both.

Unfortunately, there are no "silver bullets" or known shortcuts to improve your manufacturing performance; however, implementing an enterprise-wide MES is one of the most prominent must-haves and a key step in becoming a data-driven manufacturer.

Connecting the dots in manufacturing involves leveraging various strategies to facilitate data-driven innovation and collaboration. Encouraging collaboration between different departments, supported by strong relationships with suppliers and customers, enable data sharing opportunities. Collaborative platforms and shared data repositories drive supply chain visibility improvements as well as demand forecasting and product development. By adopting these strategies, manufacturers can connect the dots between data-driven innovation and collaboration, enabling them to drive efficiency, quality, and competitiveness in their operations. ■

# CGI

Author:



**Marcel Mourits**

Vice-President, Consulting Expert  
Manufacturing at CGI







# Print. Race. Repeat.

Forward-looking engineering firms choose Additive Industries' MetalFABG2 AM printer because there's nothing else like it. That's why the Alfa Romeo F1® team is utilizing it to manufacture precision-engineered components on this season's car.

The MetalFABG2 AM printer's unique configurations enable you to upgrade its functionality at any time, scaling up as your production needs grow and protecting your investment. It allows you to automate any workflow: from remote job starts to de-powdering and sieving, to production runs with multiple back-to-back builds.





# TRANSFORMING AEROSPACE MANUFACTURING:

**OMNIFACTORY**  
MANUFACTURING REDEFINED

THE OMNIFACTORY® - A NEXT-GEN TESTBED  
FOR DIGITAL AND AGILE PRODUCTION

**T**he Future Automated Aircraft Assembly Demonstrator Phase 2 (FA3D2) project delivered the **Omnifactory®**, a national experimental testbed and technology demonstrator in digital and informatics enabled aerospace manufacturing technologies. It is an enhancement of a proof-of-concept FA3D Phase 1 technology demonstrator developed and funded by the University of Nottingham with £1.5M and commissioned in June 2016. The proposal for FA3D2 was created as a result of strong interest and 'pull' from numerous international aerospace companies, some of which are already benefiting from the **Omnifactory®**.

The **Omnifactory®** provides a unique opportunity for manufacturing businesses to test and validate world leading technologies, so that they can compete on cost and quality with the best rival offshore businesses. It aims to reduce the Capital Expenditure or Non-Recurring Costs (NRC) of production facilities by implementing novel assembly approaches. By providing higher levels of automation driven by model-based enterprise technologies, companies will benefit from increased productivity, upskilled labour force, a robust tolerance to demand variability

and dramatically reduced Recurring Costs (RC) to enable industry to successfully compete with lower wage economies.

The FA3D2 project successfully completed on 31st March 2023, which culminated in the launch of **Omnifactory®** on 1st March 2023. This FA3D2 project addressed a strategic shortfall in the national infrastructure for the development of a next generation aerospace flexible assembly system by:

- Providing a **national experimental testbed and technology demonstrator** in digital- and informatics-enabled aerospace manufacturing technologies
- **Building on the successful FA3D proof of concept demonstrator** funded by the University with an investment of £1.5M mitigating the risks associated with building a larger facility
- Converting the strong interest from industry (Airbus, Airbus Helicopters, BAE Systems, GKN, GE Aviation, Rolls-Royce and others) into future projects for **building UK assembly & manufacturing capability**

- **Providing support** for major ATI and Clean Sky 2 initiatives
- Developing a **national aerospace assembly demonstrator** for digital technologies
- Providing **significant projected return of investment**

The **Omnifactory®** provides a unique agile production infrastructure in both the digital and physical domains. It combines an innovative reconfigurable floor solution with an integrated software stack connecting design, lifecycle-management, simulation, planning, validation, virtual commissioning, and control.

The reconfigurable flooring system was designed by University of Nottingham to meet the unique requirements of a future production environment for high-value, high-complexity, variable-rate products. The solution is scalable and can be installed in new factories or retrofit into existing facilities. Modular connection points allow for any existing or future assets to be deployed and can also interface with metrology systems to enable high accuracy motion control.

The integrated software architecture demonstrates an end-to-end model-based systems engineering approach to the design and delivery of reconfigurable production systems. Commercial software packages are integrated using in-house knowledge and augmented with bespoke developments to push the boundaries of automated code generation, artificial intelligence, and data analytics. It is believed that the **Omnifactory®** is unique in the UK, in terms of the close integration between the physical and digital domains, and in the ability to demonstrate the digital capabilities in the context of an automated physical production environment.

By developing a digital manufacturing approach to leverage the digital capabilities, and combining it with a physical environment that enables fast, repeatable, and accurate asset location and reconfiguration, the University of Nottingham has delivered an environment that can:

- **Cost effectively manufacture complex products in small volumes**
- **Rapidly respond to demand and volume fluctuations**
- **Accommodate changes in product design, mix, and scheduling priorities**
- **Dramatically reduce time-to-market and support rapid production scale up**

**Omnifactory®**, where different digital technologies are implemented to improve traditional manufacturing practices, is revolutionising the world of manufacturing by making it more efficient and cost-effective.

**Omnifactory®** is a unique facility that enables manufacturers to develop, demonstrate, and rapidly implement the latest digital manufacturing technologies in industry.

Working closely with our industrial partners, we are transforming current practices and improving productivity across the sector by developing the next generation of smart, highly agile, and efficient factories, which is also supporting localised manufacturing supply chains. By leveraging technologies such as the Industrial Internet of Things (IIoT), artificial intelligence (AI), and data analytics, we are dramatically accelerating the development and sustainable manufacturing of new products and delivering significant societal, economic, and environmental benefits to the sector.

Manufacturing processes have a significant impact on the environment, with a large proportion of the carbon footprint of some products being created during their production and logistics. By creating a new generation of smart, highly efficient factories embedded in local supply chains, we are contributing to the net-zero agenda and make a significant step towards the circular economy.

One example of how this facility is being utilised is in the Innovate UK / ATI project Enhanced Low Cost Automation Technology (ELCAT) project, where we developed flexible manufacturing systems without the need for expensive 'black box' integration, by fusing real-world industrial experience with game-changing theoretical proposals backed by academic analysis.

The ELCAT project has enabled this thinking to be taken to a point of physical reality, maturing and de-risking the associated technology threads to a level ready for final development and adoption in GKN Aerospace.

The **Omnifactory®** facility is also hosting the FLEXCELLE project, in which aerostructure assembly processes are being reimagined and demonstrated with BAE Systems and Spirit Aerostructures. Through this project, the optimisation of facility architecture for variable rate assembly is being developed and demonstrated. The utilisation of large-volume, non-contact metrology supports the assembly of adaptively machined structural components. The project is validating the use of workpiece positioners in aerospace assembly as part of a reconfigurable assembly system by assembling a fuselage demonstrator in the **Omnifactory®** environment.

**Omnifactory®** also contributes to industry by providing a working demonstration of an end-to-end digital industry solution. By using commercial software in a real working deployment, the real-world challenges around integration are explained. By generating this know-how and offering it to the industry, **Omnifactory®** helps companies to understand the business case and be a better customer. Building on an already strong relationship with the technology providers, and leveraging their contacts in industry, the team at Nottingham are also helping to refine and improve the technology offerings available to industry. ■





# CONNECTIVITY IN LABORATORIES

AND ON THE

# PRODUCTION FLOOR

A PERSPECTIVE FROM AN  
ANALYTICAL INSTRUMENTATION DEVELOPER



**Malvern  
Panalytical**  
a spectris company

## Connectivity on the shop floor is increasing

The manufacturing industry is undergoing a digital transformation that promises to improve efficiency, productivity and customer satisfaction. Malvern Panalytical is experiencing increasing demand for digital solutions, which require cloud connectivity for instruments in laboratories and on the production floor. Two key reasons for the interest in cloud connectivity

are the ability for remote or location-independent working and monitoring, and access to large-scale computing.

Remote access to data has recently gained importance because of the COVID-19 pandemic. Remote working has become more prevalent. Therefore, it has become more important to be able to track key parameters relating to production quality, independent of the location of the scientist responsible. An additional benefit is that experts – for example, service engineers –

can monitor instrument performance remotely and in real-time, hereby flagging potential issues before they occur, and preventing unexpected downtime.

Another advantage lies with the increased ability to get intelligence from local data. By connecting shop-floor equipment to the cloud, there is access to almost unlimited computing power, allowing for more complex data analysis and use of AI. Data from multiple sources can be combined and



*By connecting shop-floor equipment to the cloud, there is access to almost unlimited computing power, allowing for more complex data analysis and use of AI.*



predictions can be made; for example, on the performance or lifetime of a product, early in the manufacturing process, to avoid costly waste or failures further along the line.

## Challenges of connectivity

As with any technological change, connectivity also comes with a set of challenges. Two subjects to consider are security and reliability.

As more devices and systems are connected to the internet, they become more vulnerable to cyberattacks that can compromise data integrity, privacy, and functionality. Strong encryption, authentication, and access control mechanisms are needed to protect data and devices from unauthorized access or manipulation. Processes must be in place to monitor and update network security regularly to mitigate or prevent potential attacks.

As we move forward in capitalizing on the power of connectivity, there will also be more dependency on remote resources, both human and digital. Any disruption or delay in connectivity can result in costly downtime, quality issues or safety risks. These risks can be mitigated by ensuring that network infrastructure is robust, resilient, and reliable; capable of handling high volumes of data and traffic without compromising on performance.

## Malvern Panalytical's connectivity opportunity

Many aspects of our modern world have been created or improved by first understanding their fundamental chemical, physical or structural make-up – whether that's developing vaccines, making stronger and more sustainable concrete, monitoring soil and water quality, or making chocolate and coffee taste even better. Technologies developed by Malvern Panalytical allow industries and researchers to understand the world, from biomolecular structures to quantum dots. The portfolio of scientific instrumentation covers a broad range of technologies, including particle size analysis, X-ray fluorescence, and X-ray diffraction.

Many of Malvern Panalytical's systems operate in 24/7 environments; for example, in quality control for manufacturing. Operating high-tech, complex equipment within such demanding settings presents stringent requirements for robustness and performance. By viewing instruments as part of a bigger, interconnected system, the doors are opened to digital opportunities that help ensure instruments' performance and provide a new range of workflow optimizations.

Authors:



**Marc Zinck**  
Digital Business innovator  
Malvern Panalytical



**Martijn Fransen**  
Director Digital Solutions  
Malvern Panalytical

## Malvern Panalytical's connectivity solution: Smart Manager

Cloud connectivity allows the industry to solve existing problems in new ways. Smart Manager was developed by Malvern Panalytical to connect its analytical instrumentation to the cloud through secure and reliable Internet of Things (IoT) infrastructure. With this solution, Malvern Panalytical can help customers get the most out of their instruments. Potential issues can be detected through proactive and predictive monitoring services, and solved before any downtime occurs. Additionally, customers can manage their fleet of instruments remotely, optimizing utilization and gathering instrument performance data across different production processes and plants.

Beyond getting the most out of the instrument, Smart Manager is the gateway to access more valuable data generated during manufacturing processes. In many cases, most of this data is left unused. Exposing this data to analysis and machine learning, and combining it with known models, libraries, or other data sources, allows benefits such as increased crop yields, optimized workflows in medicine development, and reduced waste and shortened production times in battery manufacturing.

At Malvern Panalytical, we see that the digital journey is just starting. We would like to call on you to contact us to engage in mutual learning opportunities and further explore the possibilities and challenges along this transformation journey. ■





# SMALL STEPS LEAD TO GIANT LEAPS: SMART START FOR 5G MANUFACTURING

Global challenges such as reducing environmental impact and the increasing shortage of skilled personnel in all segments are impacting the industrial landscape. These are paired with ever increasing volumes and the trend for customisation of individualised products at large scale that require an agile and flexible production process.



**T**ools and technologies that enhance the production capabilities to work smarter, faster and safer can help to master these new circumstances. The tools can be summed up as ICT-enabled production tools. They enable the industrial metaverse which leverages the use of enhanced software technologies like Artificial Intelligence (AI), video recognition and analytics or augmented or virtual reality. Furthermore, they can be used to build digital twins, solutions for remote control of machines, robots and vehicles and automated guided vehicles (AGV) or autonomous mobile robots (AMR). In order to close the communication loop between the physical and virtual world, many of those

connections are wired today. But due to the need for flexibility in production, 5G as a wireless technology catering for high reliability comes in.

A smart start to automation is possible both in greenfield and brownfield scenarios. Especially for new sites, it is important to choose the connectivity infrastructure that makes the integration of intended use cases possible whilst planning and building their shop floor on a green field. Besides that, many manufacturers are acting in a brown field needing retrofitting instead of planning a new plant. Most factories have deployed wired connectivity, but these fixed assets make it difficult to reconfigure the facility, whether

to create individualised products or simply shift to a new product. That is where the advantages of mobility come in because the ability to adapt quickly and be flexible is vital if factories are to successfully compete in ever-demanding modern markets.

## 5G private networks: the enabler

This is a task that can be solved and 5G private networks can be the key enabler. First step to automation is the ability to collect data, process it and make decisions. Only then will manufacturers have the insight into operational performance to automate

processes and drive greater efficiency across the shop floor. A 5G private network refers to a dedicated cellular network that utilizes 5G technology to provide wireless communication within a limited geographical area, typically designed, owned, and operated by a single organisation or entity. Manufacturers are increasingly seeing the value of a private network to make their business more agile because they can leverage the network capabilities and tailor them towards their specific needs. This is achieved by introducing highspeed connectivity, predictable low latency, and strong performance in high device density environments. This combination of high data volume and low latency can create the business edge needed to optimise operations. A private network also offers the needed level of security. End-to-end security is built-in from core to edge down to the device level, ensuring that data is more secure and inaccessible to outside parties.

## Choosing the right use cases – Small steps...

Before heading to space with a 5G-connected factory, the project owners must decide, which is the most relevant use case for them. We have identified five types of use cases, that will enable manufacturers to conduct their operations more efficiently:



Autonomous mobile robots (AMR) for real-time production chain automation.



Collaborative robots for more efficient operations.



Augmented Reality (AR) for efficient quality inspections and remote experts.



Asset condition monitoring for increased uptime.



Digital twins for optimised operations.

## ...leading to giant leaps

The question, which use case has the largest impact with the simplest implementation can only be answered on a very individual basis. Various factors like the degree of digitisation in the company shall be considered. It helps if those responsible for production are involved in the process at an early stage. Otherwise, the manufacturer runs the risk of developing a prototype for a smart application that goes far beyond the actual needs and capabilities. Another tip on the way to a productive solution is to leave the R&D lab as early as possible and validate the solution extensively on the shop floor. This is the only place where possible challenges - such as the interplay with established production processes or certain local environmental factors - can be seen unfiltered. This paves the way for using the solution in commercial operations.

Sometimes the key to success is not a single use case, but a combination of different approaches. To find this out, tools such as the Smart Manufacturing Value Calculator from Ericsson help to calculate the potential ROI of the use cases mentioned above depending on relevant company key parameters. Finally, it is important not only to focus on the here and now – but to look into the future: What kind of use cases may be relevant in five years? To answer this, consultancies can support additionally.

With this advice in mind the implementation of a use case for smart factory will perhaps not be as easy a walk on the moon for an astronaut, but at least become a manageable task. Building or retrofitting smart manufacturing is crucial for economic success in the future. Relying on a 5G private network will enable the manufacturers to implement the right use case for their company and prepare them for many future competitions.



## Test before investing:

*Experience 5G at Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente (FIP-AM@UT) or at the 5G-Industry Campus Europe*

A lot of manufacturers are ready for takeoff – but don't have a rocket yet. They perhaps want to head to the **Ericsson Private 5G area at Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente located at 701 Hengelosestraat, Enschede** where companies can test new technologies before having to invest in the infrastructure and without impacting their day-to-day production processes. Potential use cases should ideally answer questions about the suitability of a local 5G network for companies and their applications around connectivity and mobility.

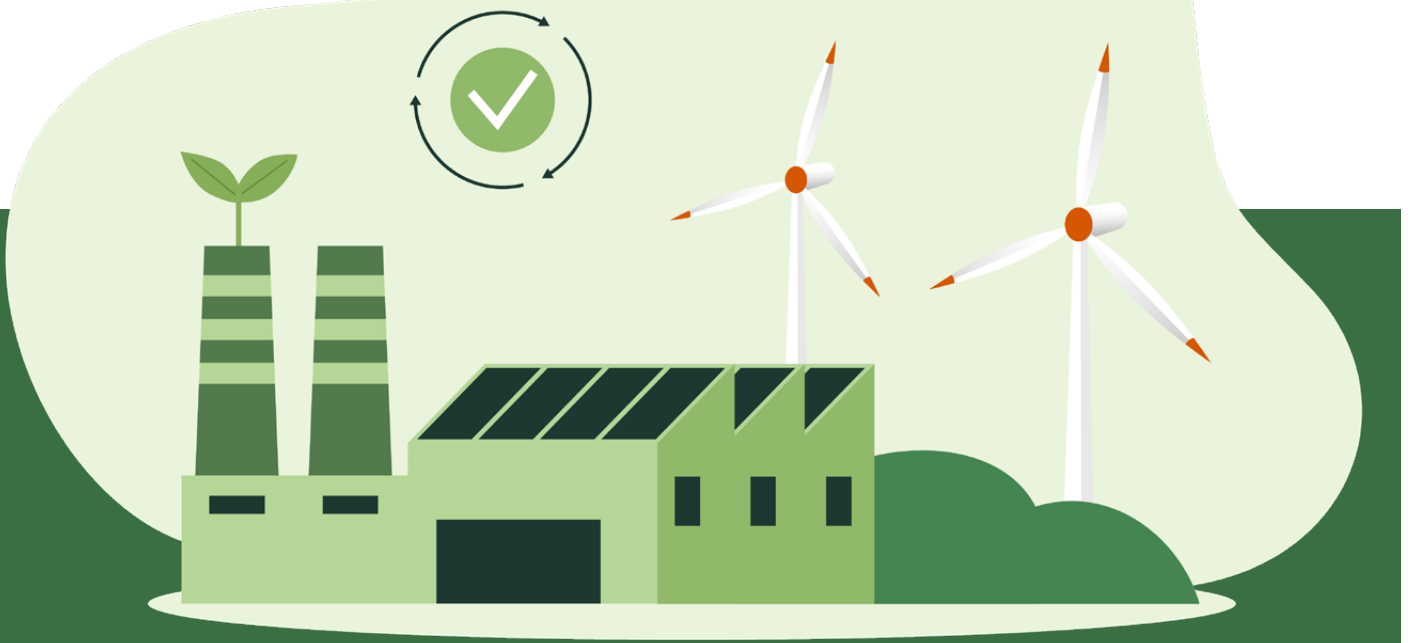
Companies may also use the capabilities of the **5G-Industry Campus Europe** in Aachen, Germany. It is the first site in Europe with a comprehensive 5G network to explore and test new applications for 5G in production environments under real-world conditions. With an outdoor network of around 1 km<sup>2</sup> and a shop floor of 8000 m<sup>2</sup>, the network covers the area of the RWTH Aachen Campus Melaten and the entire machine hall of the Fraunhofer IPT. ■

Author:



**Joe Wilke**  
VP, Head of Center of Excellence  
5G Industry 4.0, Ericsson

# THE CO<sub>2</sub> FOOTPRINT



In a world where sustainability is becoming more critical, the demand for transparency and measurability of production in the manufacturing industry is growing. As a manufacturing company, having insight into the ecological footprint is essential to take targeted measures that reduce the environmental impact. In this interview, Henk Schoemaker, Head of Product at ECI, discusses the challenges of transitioning to a uniformly defined production chain. He also shares how ECI is working with a collective to tackle this issue by leveraging the European Digital Product Passport.



**T**he increasing awareness of man-made climate change is leading to stricter laws and regulations aimed at promoting sustainability. ESG (Environmental, Social, and Governance) has been introduced and further developed as a response. This European legislation focuses on measuring sustainability, social impact, and governance. Specifically for the

manufacturing industry, companies must record data on CO<sub>2</sub> emissions, the origin of raw materials, and working conditions to enable the traceability of fair production. Large OEMs such as Philips and ASML will be required to comply with the law from 2024. However, Henk explains that the movement towards compliance still presents a significant obstacle.

## Uniformity of data

Following the implementation of stricter ESG law, the first major suppliers of a final product must be able to report the required production data of all links in the supply chain to ESG. The delivery of an end product results from the collaboration between different production companies, each of which has played its role but together contributes to the stated sustainability performance. In an ideal world, companies within the supply chain exchange the required information digitally so that the supplier of the end product does not have to make extra efforts to combine this information for a degree of sustainability. However, the reality is that uniformly automated data capture is proving to be the biggest challenge in pursuing compliance with legislation. "The diversity of companies within the chain ensures different ways of recording and reporting data, for example, via Excel or Word templates. This makes it difficult to merge different formats unambiguously and report fully and correctly to ESG," says Henk. It is, therefore, necessary to introduce a system in which data exchange takes place in an automated way so that the digital footprint, according to the supply chain, is increasingly enriched with the required ESG information, or as the term speaks better for itself: the European Digital Product Passport.

## The European Digital Product Passport

The NXTGEN HIGHTECH Growth Fund subsidises digital projects to keep Europe's manufacturing sector at the forefront. It comprises a selection of forward-thinking firms in the industry, with the European Digital Product Passport being a major assigned initiative. In cooperation with the SCSN (Smart Connected Supply Network) foundation, research is currently being conducted to evaluate whether the prevailing network in the Netherlands could be harnessed to improve the European Digital Product Passport. As it stands, SCSN is already integrated with all types of ERP platforms on the market, making it appropriate for the transmission of 'purchase to pay' data. Crucially, much of the info that needs to be provided in such a passport can be obtained from ERP software. Furthermore, an ERP link forms the foundation of the so-called digital highway for data transfer. In this way, all contributing suppliers' product passports can be appended to the passport of the supplier of the end product. According to Henk, a significant technological advance is within reach by taking advantage of the existing ERP systems and the SCSN infrastructure in such a pioneering way. This could offer a completely automated solution to an accounting and legal challenge.



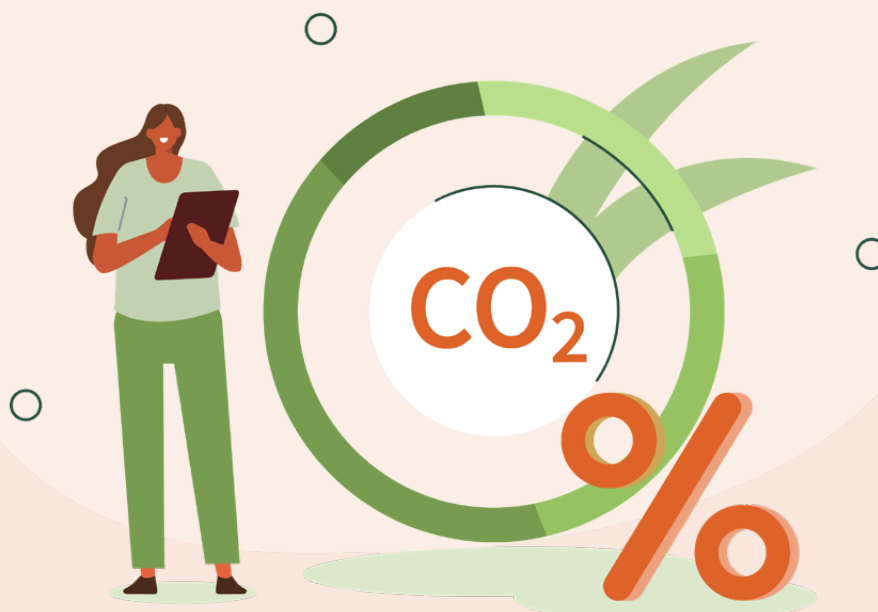
## Want to know more?

ECI supports companies in the manufacturing industry to automate business processes, and in addition to various ERP software, offers access to the digital highway via ECI Gatewise. Would you, as a manufacturing company, like to learn more about further developing this SCSN-network to build the European Digital Product Passport in the future? Feel free to contact us at +31 (0)88 63 63 910 or via e-mail: [nl-bdr@ecisolutions.com](mailto:nl-bdr@ecisolutions.com). ■

Author:



**Henk Schoemaker**  
Head of Product  
ECI Software Solutions





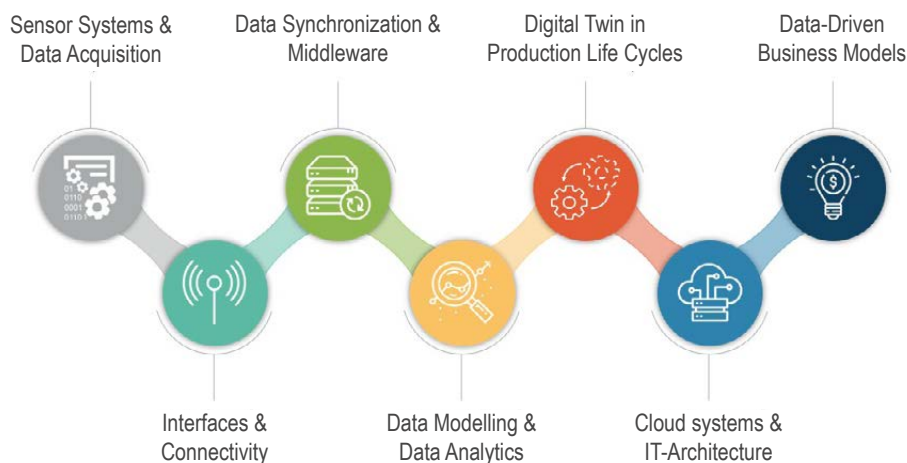
# THE PARADIGM SHIFTS IN MANUFACTURING:

## 5 KEY TAKEAWAYS FROM 2022

The world is changing rapidly and the manufacturing sector also has to meet ever new challenges such as digitalization or more sustainable production. To help manufacturers innovate and adapt, the Fraunhofer International Center for Networked, Adaptive Production (ICNAP) brings together a growing international community of thought leaders in production methodology, digital enablement, and research and development.

In 2022, the ICNAP carried out five studies chosen via a voting process involving all community members. This helps ensure their relevance to the manufacturing sector as a whole. In this article, we will summarise some key takeaways from those studies.

### ICNAP Topic Fields



## 1 Pricing models for monetizing industrial data

The increasing digitalization and connectivity in manufacturing have resulted in the generation of large

volumes of data, which companies can harness to offer data-driven services and enhance their product portfolios. However, pricing these offerings presents significant challenges to manufacturers. Their intangible nature and difficulty quantifying customer

benefits contribute to these pricing complexities.

Data-driven service offerings in manufacturing may be categorized into data products, smart products, digital products, and X-as-a-Service offerings.

Each of these categories involves varying levels of data processing and integration. As for pricing, there are four main models: flat rate, pay-per-use, pay-per-output, and pay-per-access. The most suitable pricing model depends on the nature of the offer and the customer's needs. Offerings with direct impact can provide immediate savings of cost or increase in revenue and may enable the prediction of unplanned failures or autonomous reactions, so a ~20-25 % participation in the value created is reasonable. As indicated above, the value created is based on project experiences.

We conducted several case studies with our industry partners to gain practical insights into pricing data-driven service offerings. The studies highlighted companies' challenges in quantifying the utility potential, selecting pricing models, and determining price points.

Recommendations that emerged from the findings emphasized the importance of defining a clear value proposition, consolidating offerings, quantifying

impact on customer economic potential, and selecting appropriate pricing strategies.

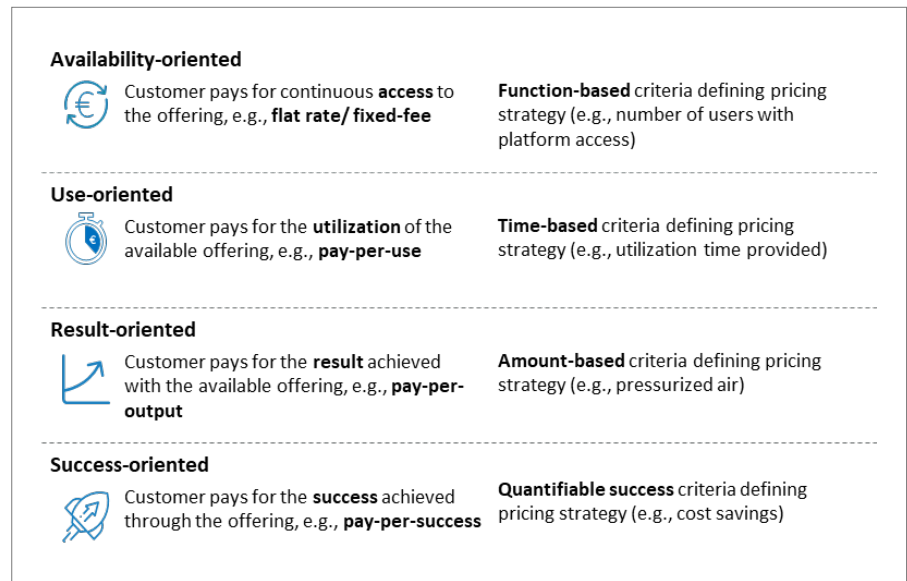


Illustration of potential price strategies in price modeling (non-exhaustive)

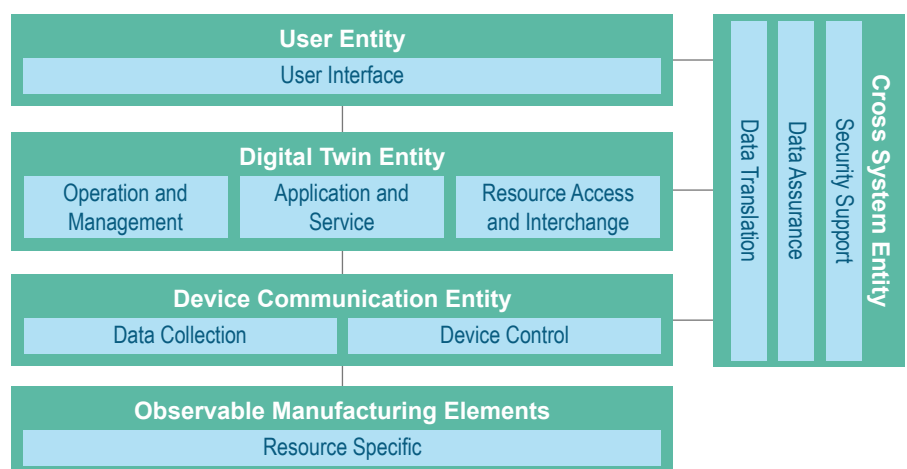
## 2 Enabling rapid innovation with real-time digital twins

Digital twins are virtual representations of physical assets that serve as sandboxes for testing potential changes and upgrades to the shopfloor. They can reduce costs, increase efficiency, and enhance product knowledge throughout the value chain. Digital twins can use real-time geometric, kinematic, and behavioral data to accurately map real-world assets into digital environments, making them ideal for error analyses, testing, and optimization.

Production systems must be integrated with sensors and other computing devices for real-time monitoring and optimization. Protocols such as MQTT, LWM2M, or OPC UA facilitate universal sensor and actuator connectivity, thus enabling live monitoring and optimization. However, meeting hard real-time requirements at the field level remains challenging because current solutions only support retrospective analysis.

The ICNAP study "Real-time Digital Twin" explored the potential use of digital twins in a real-time context. This involved evaluating software frameworks, including the Asset Administration Shell, OPC UA, Eclipse Ditto, ROS2, and MQTT + Sparkplug. While each framework has advantages and limitations, no one fulfills all requirements for hard real-time use cases.

Key research areas for real-time digital twins include usability improvement, model creation and calibration, and establishing trust in data, models, and procedures. Standardization, interoperability, metadata, uncertainty quantification, and validation strategies are crucial in building trust and reliability.



Digital Twin Framework of ISO 23247

Source: Automation systems and integration — Digital twin frame

# 3

## Leveraging digital for sustainable and profitable production

One of the fundamental goals of digitalization in manufacturing is to achieve more sustainable and profitable production. Enterprises face the global challenges of climate change, pollution, and resource scarcity, and they need to address all these areas to stay relevant and profitable. Integrating information and communication technology (ICT) systems in manufacturing processes helps enterprises monitor, analyze, and optimize operational sustainability.

Government laws and standards, such as ESG directives and sustainable

development goals guide sustainability efforts. Environmental aspects, social standards, and corporate governance also play vital roles in building sustainable organizations. Life cycle management and assessment allow for evaluating a product's environmental impact throughout its lifecycle.

Green digital infrastructures are essential for supporting sustainability goals. Examples include innovative cooling concepts for data centers, like direct liquid cooling and the use of renewable energy sources. These help reduce energy consumption and environmental impact. Green 5G networks aim to meet traffic requirements while minimizing power consumption thanks to energy-saving

technologies and AI integration. Green coding approaches focus on software design and implementation that proactively addresses energy consumption. The list goes on.

Implementing sustainable digital infrastructures requires continuous innovation, collaboration, and a strong commitment to sustainability throughout the end-to-end manufacturing lifecycle. To make that happen, manufacturers must explore and adopt innovative solutions built with long-term sustainability in mind.

# 4

## Promoting security in the manufacturing sector with cybersecurity labs

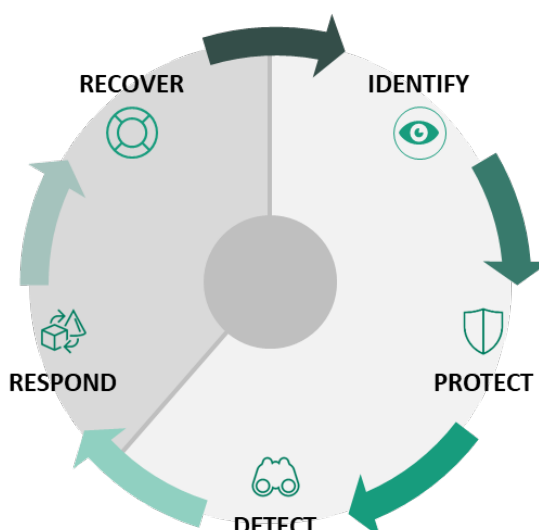
Dealing with cyber risks is crucial for secure networked production in the manufacturing sector. Cyberattacks are increasing, with the manufacturing sector becoming one of the most targeted in Europe. Small and medium-sized enterprises are particularly vulnerable.

The separation of IT and operational technology (OT) has left the latter neglected and exposed to greater risk. To address this challenge, we established a cybersecurity lab for demonstrating attack infiltration and its potential damages in a mock real-world scenario. A security guideline was developed based on these insights to help companies implement effective protection measures.

The guideline includes a security strategy known as 'defense in depth', which employs layered protection mechanisms for all assets. It covers policies, human elements, physical security, network security, system and component security, and the assets themselves. The National Institute of Standards and Technology (NIST) security framework, consisting of five phases, is incorporated to guide companies in adopting industry-standard security measures.

The study provides theoretical knowledge, industry best practices, and use cases to support manufacturers in selecting and implementing suitable cybersecurity technologies for their production processes. By following the guidelines and leveraging the NIST framework, companies can enhance their security postures and mitigate cyberattack risks.

Five phases of the NIST security framework





# 5

## Industrial data spaces for flexible data-driven production

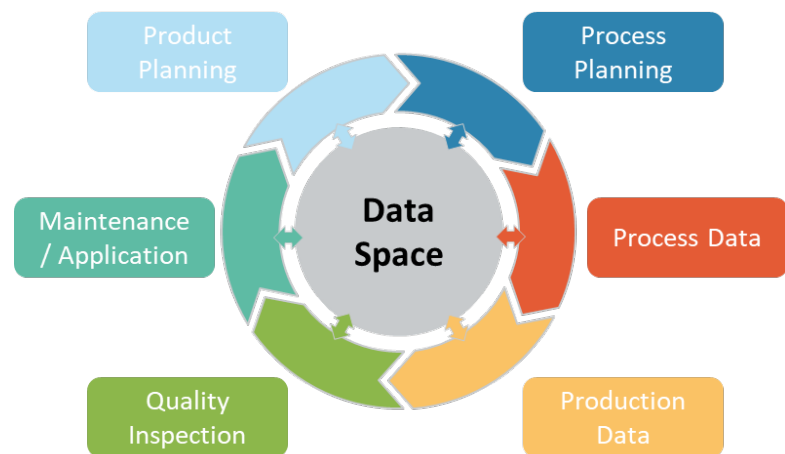
Data exchange throughout the product lifecycle can optimize production, logistics, and business processes. Digital infrastructures equipped with mechanisms for publishing and consuming data are vital to ensure the security and sovereignty of shared information. Industrial data spaces help by facilitating versatile data exchange while preserving data sovereignty and self-determined data sharing.

The International Data Spaces Association (IDSA) plays a central role in promoting the concept of data spaces. They have developed a reference architecture model (IDS-RAM) that serves as a technical standard for the development of data spaces. The IDS connector, a key component of the IDS ecosystem,

facilitates the connection between data owners and data consumers. It ensures interoperability between different implementations, allowing data to flow securely and efficiently.

A practical implementation of data spaces was applied to monitor manufacturing machines. The use case involved data exchange between different facilities, demonstrating

the capabilities of data space connectors in a real-world scenario. The implementation utilized existing data space connectors and involved data generation, processing, and analysis at different locations. The Fraunhofer Edge Cloud platform served as the deployment environment, enabling secure data exchange and communication between the components. ■



Industrial Data Spaces

Read the full report to find out more!  
Go to <http://bit.ly/ICNAP2022report>

You want to shape Industry 4.0 together with our international community of leading manufacturing and digitalization companies as well as emerging startups? Feel free to contact us at [community@icnap.de](mailto:community@icnap.de) !

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# EMPOWERING PRODUCTION

*HOW GEMINEERS REALIZES THE DIGITAL TWIN IN METAL CUTTING*





*“As the first morning light pierces through the windows of a manufacturing company somewhere in Europe, a machinist steps into a bustling workshop. He grabs a cup of coffee from the vending machine, hoping to chase away the last bits of morning fatigue. With a flutter of excitement in his heart, he approaches his CNC machine. Flicking the switch, electrical drives hum to life, cold light illuminates the machine room, and an endless stream of numbers rushes over the control panel.*

*He retrieves his tablet PC and routinely presses on a symbol showing two colorful semicircles. His web browser opens, and a dynamic animation materializes into a captivating symbol of a digital twin. Logging in, he instantly accesses a detailed overview of the products machined in the night shift, feeling a sense of contentment with the productive outcome. A lined-up set of bright and greenish digital twins is floating on the dashboard, one for every finished workpiece sitting in the pallet storage right next to him, indicating that chips were flying smoothly while he was still in his dreams.”*

**T**his is how the startup gemineers envisions just a small part of everyday life in a digitized manufacturing environment. And this is how they have already been able to demonstrate it to numerous companies in the machining industry.

Founded in 2021 and emerging as a deep-tech startup from Fraunhofer Institute for Production Technology IPT, gemineers offers an innovative and application-oriented digital twin solution to customers, with a strong focus on machining technologies. gemineers' digital twin platform revolutionizes the way metal cutting processes are optimized and managed. By combining real-time data, technology know-how and advanced analytics the platform enables manufacturers to create precise virtual replicas of their manufactured products. These digital twins provide valuable insights into machining operations, optimizing efficiency, reducing waste, and improving overall productivity. In addition to technological and economical characteristics, the platform can also be used to precisely quantify and optimize ecological indicators such as resource consumption or CO2 footprints in production.

Following a start-up funding from the Fraunhofer-Gesellschaft in 2019, subsequent research transfer funding from the German government in 2021, and its recent seed investment round in 2023, gemineers is now an advancing company with customers in various industries such as mold and die, aerospace, and semi-conductor. Since the beginning of 2023, the Aachen based startup also supplies its platform upon customer request to two of the largest european machine tool manufacturers, DMG MORI AG and Grob-Werke GmbH & Co. KG.

The gemineers team consists of passionate experts in manufacturing technology and software development. From their own experience in the planning and implementation of machining processes, the team's strong desire from the beginning was to provide machinists with an application-oriented everyday working tool. Accordingly, the gemineers digital twin platform is tailor-made to support process monitoring and optimization tasks in machining, as they occur for example in the prototyping or ramp-up phase of new products. Apart from that, the ability of the platform to create a precise digital twin of a machined product predestines

◀ *The gemineers digital twin platform creates precise virtual replicas of manufactured products and provides valuable insights in the condition and quality of the component.*



it for the application as a data-based quality assurance solution, providing 100% quality control and documentation immediately on the shopfloor.

Thereby, conventional tactile or optical measurement efforts can be reduced to a minimum.

It was probably not only the technological innovation potential of the gemineers digital twin platform that moved Ronny Blaauwgeers of the Dutch company Aeronamic to test the system in his own production. With its capability of precisely calculating important productivity and quality indicators, even across series production, the platform possesses a high level of attractiveness not only for machine operators but also for production engineers and management. Accordingly, Ronny is pleased that theoretically, an insight into Aeronamic's machining processes, from annual production output down to a single cut, is always just a browser click away, for him and for everyone else in the team. However, Aeronamic is recently facing a large customer order for a very complex and demanding component from the aerospace sector and is therefore currently putting the gemineers digital twin platform through its paces from a technological perspective first.

"At the moment, we are testing the gemineers digital twin platform with regards to process monitoring and optimization in the ramp-up phase of a complex aerospace part," says Ronny Blaauwgeers. "We firmly believe

*We firmly believe that solutions such as the gemineers platform are the future of metal cutting.*

*- Ronny Blaauwgeers  
Director Manufacturing Engineering*

that solutions such as the gemineers platform are the future of metal cutting. While our company is still in the testing phase to understand its capabilities, I am confident that the outcome will be positive. This platform has the potential to revolutionize our metal cutting operations, optimizing processes and driving efficiency.

The fact that the gemineers software solution runs on multiple machine brands and multiple machine controllers, makes this an attractive solution. We successfully tested it on a Grob G550T with Siemens and on a Hermle C22 with Heidenhain controller. Meanwhile the data is kept on-premises within Aeronamic. We made parts of the data accessible for support by gemineers in a controlled way, so we do have data security and at the same time maximize the potential of the gemineers software."

In the coming weeks, gemineers will continue to closely support the Aeronamic team in further testing of the platform in production. As always, production testing is also a valuable source of feedback for gemineers to further improve and exactly meet the customer's expectations in terms of functionality and return on invest. The entire project team is confident that everything continues to run smoothly, and that the assessment can be finalized in the second half of the year, eventually aiming for a production roll out of the system. ■

*For more information please contact:*

*[info@gemineers.com](mailto:info@gemineers.com)*

*Tel.: +49 241 4095000*

*Bendstraße 50/52, 52066 Aachen, Germany*

*Aeronamic is a full solution provider for the development, production, assembly, testing, and servicing of high-speed rotating components and precision parts for commercial & defense aircraft industry.*





# gemineers

## Digital Twin Technology for Manufacturing



### **Quality Inspection**

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### **Process Optimization**

Use of the digital twin to reduce process time by up to **30 %**



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Use of the digital twin to reduce scrap by up to **20 %**

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1

### Industry 4.0 Quick Scan

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2

### Current State Analysis

Receive an expert breakdown of your current processes and Industry 4.0 competencies.

3

### Benchmark & Gap Analysis

Identify your competitive environment, your position within the industry, and potential gaps.

4

### Road Map Development

Create a custom implementation and action plan based on your vision and goals.

5

### Follow Up Support

If desired, implementation support and workshops are available.

## The 4<sup>th</sup> Industrial Revolution isn't 'on its way' - it's already here.

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