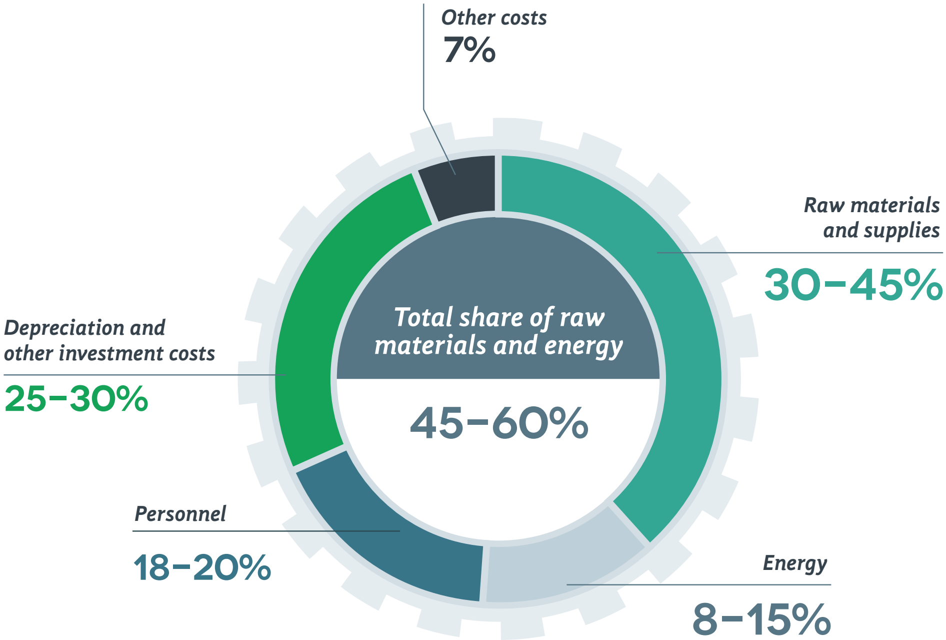
MEMAN

INTEGRAL MATERIAL AND ENERGY FLOW MANAGEMENT IN MANUFACTURING METAL MECHANIC SECTOR

UNLOCKING THE RESOURCE SAVING POTENTIAL OF THE **METAL-MECHANIC SECTOR**

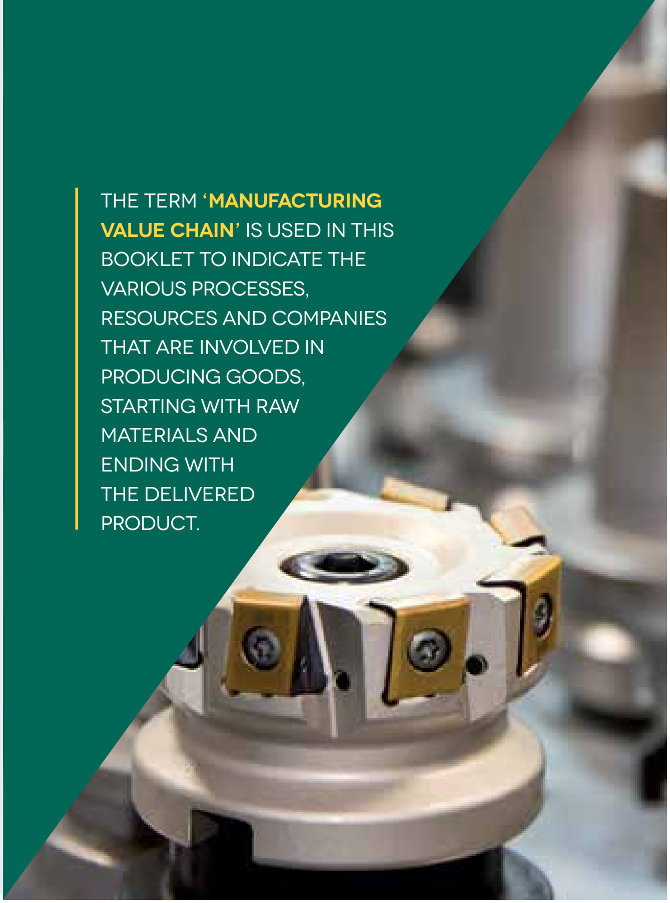
I. USING LESS TO DO MORE IN MANUFACTURING

Raw materials and energy are the most expensive inputs for the manufacturing sector, together accounting for up to 60% of total production costs. By contrast, labour costs represent only 20%. It is therefore not surprising that **resource efficiency has been shown to have a clear impact on European competitiveness**. In fact, the current inefficient use of resources costs the European manufacturing industry an estimated €100 billion per year[1].



But the scarcity and cost of resources are not the only challenges for the manufacturing sector. Fierce global competition increases pressure on suppliers to cut costs, at the same time as providing more high-value services. Industry must also keep up with the trend towards smart manufacturing and sustainable supply chains, while respecting a stricter regulatory framework to reduce the environmental impact. In this landscape resource efficient manufacturing becomes a necessity, not only for environmental reasons, but also for the profitability and competitiveness of Europe's manufacturing sector. All this pushes companies to innovate and **'do more with less'**.

[1] Resource Efficiency Potentials of Manufacturing Industries, Greenovate! Europe et al.



THE TERM '**MANUFACTURING VALUE CHAIN**' IS USED IN THIS BOOKLET TO INDICATE THE VARIOUS PROCESSES, RESOURCES AND COMPANIES THAT ARE INVOLVED IN PRODUCING GOODS, STARTING WITH RAW MATERIALS AND ENDING WITH THE DELIVERED PRODUCT.

"THE **RESOURCE EFFICIENCY** OF A MANUFACTURING COMPANY OR PROCESS IS THE RELATIONSHIP BETWEEN PRODUCT OUTPUT AND RESOURCE INPUT. THE TERM '**RESOURCE**' ENCOMPASSES RAW MATERIALS, ENERGY RESOURCES AND ALL OPERATING SUPPLIES REQUIRED FOR VALUE GENERATION."

THE UNTAPPED POTENTIAL OF ADDRESSING WHOLE VALUE CHAINS

'Resource efficiency' is not a new concept. Manufacturers have been applying its principles for at least the past thirty years: analysing their production processes to reduce energy and resource use, and adapting to stricter legislation on carbon emissions, social corporate responsibility and environmental requirements.

But **the vast majority of methodologies and software currently available for manufacturing companies are limited in their scope**, focusing only on a single company, process or resource. What is massively overlooked is the untapped potential to save resources across whole industrial value chains.

Optimising resource efficiency across the whole value chain can save up to 70% of the resources used in manufacturing processes, according to a pilot study Greenovate! Europe conducted for the UK Department for Environment, Food and Rural Affairs. The study demonstrates that resource savings are at least five times higher compared with optimising at a single company level.

Single company optimisation neglects the critical impact of mismatches and conflicts arising when different manufacturing units interact within the same value chain. By also exploring these interactions, value chain optimisation unearths hidden resource saving potential.

Resource efficiency optimisation (RE opt.) is higher at value chain level rather than single company, resource or process level.

"WE BELIEVE THAT OUR WORK CAN INSPIRE POLICY MEASURES AND WILL CONTRIBUTE TO DEVELOP NEW BUSINESS MODELS FOCUSING ON THE COLLABORATION OF COMPANIES OPERATING IN THE SAME VALUE CHAIN. THIS WILL FINALLY HELP TO INCREASE RESOURCE AND ENERGY EFFICIENCY, BRINGING IMPORTANT COST SAVINGS IN PRODUCTS AND INCREASING EU INDUSTRIAL COMPETITIVENESS."

Joseba Bilbatua, Mondragon Corporation,
MEMAN Coordinator

MEMAN: UNLOCKING THE RESOURCE SAVING POTENTIAL OF THE METAL–MECHANIC SECTOR

The Horizon 2020 research project MEMAN ("Integral Material and Energy Flow Management in Manufacturing Metal Mechanic Sector") was conceived to unlock the potential of resource efficiency at value chain level.

Since 2014, MEMAN has been designing a comprehensive methodology and a toolbox to support the full validation of new business models based on the collaboration of different metal-mechanic companies in their entire value chain. The project has applied and tested its methodology, developing a wide range of recommendations on energy and material optimisation for **three different competence clusters: Casting, Machining and Surface finishing**.

In this way, MEMAN provides an approach to achieve major cost reductions, reduce emissions and improve environmental performance, as well as improve regulatory compliance. At the same time the project methodology supports the incorporation of smart manufacturing innovations as solutions for integrated value chain optimisation.

The project achievements can be attributed to a dynamic collaboration between a diverse group of organisations: metal-mechanic manufacturers, excellent research centres and universities, technology providers, sensor and data integrators, and final end-users.

This booklet presents the results of the MEMAN project to support a faster up-take of resource efficient processes and value chain optimisation in the European manufacturing industry.

2. MEMAN INNOVATIVE METHODOLOGY FOR IMPROVING RESOURCE EFFICIENCY IN METAL MECHANIC VALUE CHAINS

Strategies to improve the economic and environmental performance of companies are usually pursued on a limited scale, rarely considering interactions across the entire value chain. Besides, each method uses different data and Key Performance Indicators, making it more difficult to compare the respective results. This is why global improvements of industrial processes are rarely achieved.

To solve these shortcomings, the MEMAN project has developed **an integrated methodology that, for the first time, covers both company and value chain levels to reveal hidden resource saving potentials on a global scale.** The methodology comprises the development of a decision-making toolbox that helps companies to assess and decide about strategies to improve their resource efficiency.

As the MEMAN methodology aims to unlock resource saving potentials in value chains, it needs to cope with the following challenges:

- **Manufacturing systems are complex systems**. Complexity is further increased when connected systems – and not only single companies – are analysed.
- **Companies within value chains are not willing to share their full know-how and data** with other value chain actors. However, strong cooperation and extensive data is needed to identify hidden saving potentials. The fact that more and more data about production processes is available due to digitalisation is facilitating the analyses.
- **An "off the shelf" software to fully address the challenges of the MEMAN project is not available**. On top of this, the application of existing software tools requires a high degree of expert knowledge.
- **Companies typically pursue multiple targets** (technical, economic, environmental, social) when analysing and improving manufacturing systems, meaning a conflict among targets may arise.

HOW DOES THE MEMAN METHODOLOGY WORK?

The MEMAN methodology aims to increase the resource efficiency in factories and value chains based on two pillars:
1. an improvement procedure
2. a new software tool ("decision-making toolbox")

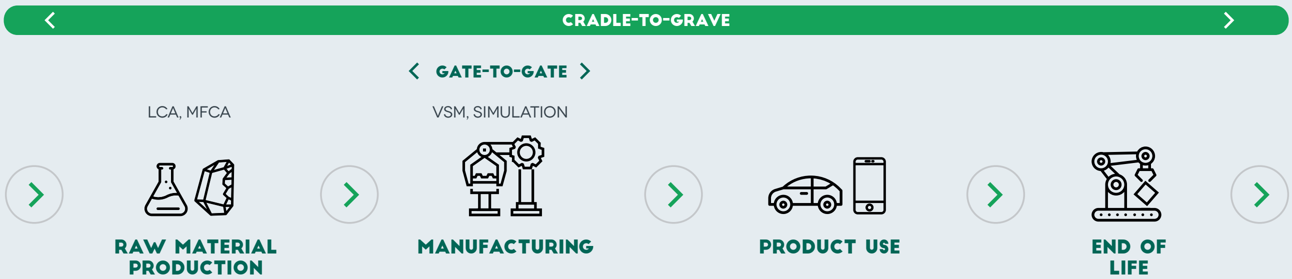
The main target of the methodology is to provide a holistic analysis of value chains, including:

- **multiple evaluation dimensions** (technical, economic and environmental) and respective Key Performance Indicators for each dimension (e.g. energy use or greenhouse gas emissions per part)
- **multiple vertical levels of manufacturing systems**, ranging from machine level, process chain level, factory level up to value chain level
- **different product life cycle phases**, covering raw materials phase, production phase, use phase and end of life phase.

As a consequence, the methodology allows users to identify synergies and target conflicts within the value chain. To do so, the MEMAN methodology combines and adapts different existing methods and approaches:

- **Value Stream Mapping** (VSM) - to assess the **technical performance** of in-house process chains
- **Material flow simulation** - to assess **dynamic aspects** related to both material flows and resource demand patterns of production equipment
- **Life Cycle Assessment** (LCA) - to assess the **environmental performance** of manufacturing
- **Material Flow Cost Accounting** (MFCA) - to analyse **economic aspects** related to resource flows along the life cycle of products.

The figure below shows the phases of the product life cycle covered by the methods applied in MEMAN

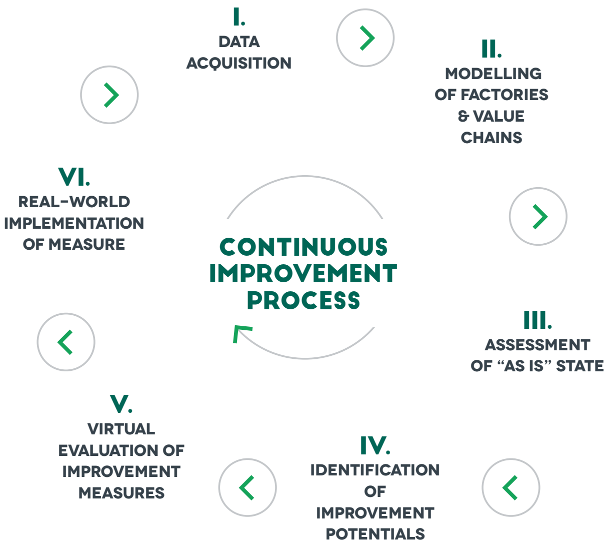


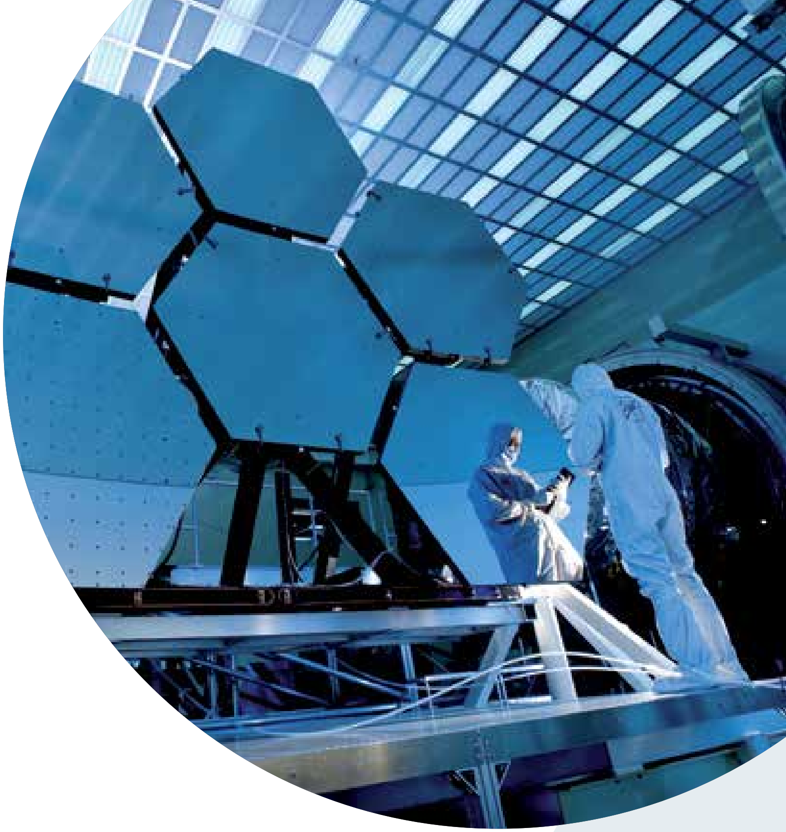
RESOURCE EFFICIENCY IS ONLY SIX STEPS AWAY

The overall improvement procedure of the MEMAN methodology contains six steps:

1. **Data acquisition:** collecting data from the system for analysis. This includes data on different manufacturing system levels such as process data (e.g. processing time to manufacture a product on a specific machine) or factory data (e.g. shift system of the production).
2. **Modelling of factories & value chains:** factories are modelled and connected to a virtual value chain model.
3. **Assessment of the 'as is' state:** an assessment of the technical, economic and environmental aspects is made on the basis of the above model.
4. **Identification of improvement potential :** "hotspots" are identified and suitable measures to reduce related resource demands are elaborated
5. **Virtual evaluation of improvement measures:** benefits and drawbacks of different options are holistically analysed before real-world implementation.
6. **Real-world implementation of measures**

The procedure is designed to be iterative in the sense of a continuous improvement process.





A NOVEL TOOLBOX TO HELP COMPANIES MAKE THE MOST EFFECTIVE CHOICE

The MEMAN toolbox is a **software tool to support decision-makers** in the practical application of the MEMAN methodology. It integrates **different methods** for a combined technical, economic and environmental evaluation. Value chain objects such as factories, products and machines are pre-configured in the software, which automatically applies methods such as Value Stream Mapping and Life Cycle Assessment.

The **effort to run the tool is quite low** compared with other software solutions on the market, because it does not require extensive skills and expertise. Moreover, both the toolbox and the methodology can be applied by different stakeholders, both internal to the company but also by externals (e.g. consultants).

By using the MEMAN toolbox, companies can significantly increase their competitiveness by reducing their production costs and increasing cooperation and knowledge transfer.

The MEMAN toolbox can answer many different questions related to resource efficient manufacturing, such as:

- **Production planning and control:** Does it make sense to produce smaller batches and reduce the existing inventory?
- **Quality control and management:** Would an alternative raw material improve product quality?
- **Design and development:** Is a redesign of the product favourable with respect to cost savings?
- **Procurement related issues:** Should renewable energies be used to reduce environmental impacts?
- **Factory planning:** Is the factory layout suitable for increasing the production capacity?
- **Manufacturing planning:** Do process changes alter the product's properties? How does this affect customers?

THE (BRIGHT) FUTURE OF ECO-MANUFACTURING

Partners have tested the MEMAN methodology in the three metal-mechanic clusters chosen as case studies (casting, machining and surface finishing), and **its effectiveness has been successfully proven**. In fact, the industrial partners of the project decided to keep using this methodology for future optimisation of the use of their resources.

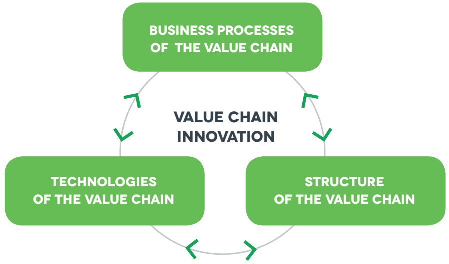
Even though the methodology has been tested only in the metal-mechanic sector, **partners are planning to adapt and extend its application to other sectors**, such as process industry.

If companies get persuaded to follow cooperative approaches like in MEMAN, they could considerably improve their environmental and economic performance, thereby triggering the next wave of eco-innovation.

3. THREE METAL-MECHANIC CLUSTERS AS CASE STUDIES

To demonstrate the MEMAN methodology to improve resource efficiency in a real-life scenario, partners chose the three most representative processes in the metal-mechanic sector: **Casting, Machining and Surface Finishing**.

MEMAN is addressing the challenges of resource efficiency with one **common approach for innovation in sustainable value chains**, testing the **three dimensions of value chain innovation**, as shown in the figure opposite.



Three dimensions of value chain innovation. Each dimension is tested within MEMAN in a specific setting by one of the three MEMAN clusters.

3.1. CASTING CLUSTER

The casting cluster developed and tested innovative technological processes in three Spanish companies from the Basque region involved in the value chain to produce automotive parts for the largest car manufacturing companies in the world.

The goal of the cluster was to demonstrate a significant **reduction** in **energy** consumption, **environmental impact** and **cost** during the **life cycle** of an **automotive part**. To do so, partners decided to act on the **technologies** of the production **value chain**.

The component analysed as a case study is the **knuckle**, which attaches the wheel to the suspension and direction system. This part allows vehicles to ride smoothly on bumpy roads and keeps the car in a stable motion.

Partners analysed the whole value chain of the knuckle production to assess the changes the three companies could make in the value chain to improve their resource saving potential.

The knuckle is traditionally made of steel. But to produce **more lightweight vehicles** the new trend is to switch to aluminium, especially for luxury cars. The MEMAN methodology validated the benefits of a new design: a hollow aluminium knuckle with even less weight.

The new design produces more aluminium residues, which are then recycled in-house. As the recycled aluminium has exactly the right chemical characteristics needed in the casting process, the manufacturing company can re-employ it directly for the new knuckles. So **less raw material** is needed in the production process.

PERFORMANCE OF THE CASTING CLUSTER

Switching to the new design with these lightweight parts brought as a result:

- **21% reduction in the use of raw materials**, resulting in almost 22% less CO_2 emissions during the manufacturing phase (cradle-to-gate)
- **22% total reduction of CO_2 emissions**. This includes the impact of emissions saved during the use phase, due to lighter vehicles consuming less fuel (cradle-to-grave)
- **9% reduction in energy used in the process** (gate-to-gate) and 22% if we consider cradle-to-grave
- **21% reduction in life cycle cost** of the hollow knuckle.

INDIVIDUAL RESULTS & INNOVATIONS

A number of specific innovations were developed within the casting cluster:

DESIGN AND MANUFACTURE OF A HOLLOW KNUCKLE

Hollow knuckle

Partners developed a new manufacturing process for a hollow part in LPDC (Low Pressure Die Casting), which brought:

- **21% reduction in weight** of the final part
- **Optimal process in terms of saving energy and raw materials.**

Inorganic core machine

DESIGN AND MANUFACTURE OF A NEW INORGANIC CORE MACHINE

Partners achieved a disruptive development in the inorganic core making process. They introduced innovations in the motion system, heating system, drying gas heating, pressurised gas generation and sand blowing system, which generated:

- **70% reduction** in the **energy** used in motion
- **25% reduction** in blowing **gas** pressure
- Near to **zero error** in **positioning**, which means exact repeatability
- More than **50% reduction** in the **heating** energy used by the tooling.

DEVELOPMENT OF A NEW IN-HOUSE SCRAP RECOVERY SYSTEM

As the hollow knuckle process generates more aluminium scrap, partners developed a new in-house delacquering line for cleaning and preheating aluminium scrap, which provided:

- **98% material recovery**
- **20% energy savings**
- **Clean material** at more than 250º C ready to be fed to melting, reducing dross formation
- Possibility of a **wide range of scraps to be recycled in the process** resulting in a wide choice and **reduced cost of materials** for parts manufacturing
- **Elimination of the need to transport** and sell to external re-melting companies.

Chip recovery system

Energy efficiency actions

EFFICIENCY ACTIONS IN ENERGY INTENSIVE PROCESS STEPS (FAGOR EDERLAN - IK4 IKERLAN)

Partners made additional efforts to improve the energy efficiency of the manufacturing processes:

COMPRESSED AIR FOR LPDC COOLING:

- **45% savings of process step electricity** caused by change of cooling method. This was partially validated in some lines, but it requires a mould design change for widespread implementation. The previous cooling method was responsible for more than **15% of gate-to-gate electricity consumption**.

THERMAL TREATMENTS:

- Potential **15% savings of process step natural gas** through heat recovery and re-use in heat treatment furnaces. This accounts for 36% of gate-to-gate gas consumption and stack gases still have significant energy content.

NEXT STEPS ON THE MARKET

For a wider uptake of these innovations – especially for the hollow knuckle and the in-house scrap recovery – the interest of big manufacturers and of the clients of the casting cluster companies is necessary. Partners have already approached them to pitch the benefits of these novel technological improvements.

The energy efficiency actions need to be further developed. They are now the focus of a new Horizon 2020 research project.

3.2. MACHINING CLUSTER

The Machining cluster brings together a French business cluster with two of its companies specialised in aeronautics, as well as a research centre and an innovation consultancy expert in mechanical engineering. The purpose of the cluster is to support the transformation of companies specialised in machining into global manufacturing actors, improving the quality, cost and flexibility of their industrial process.

In MEMAN, the work of the cluster focuses on the **'structure of the value chain'** of an aero-structural component and a jet engine component.

One of the components being produced – and taken as a case study – is the 12H beam. This is a **part of engines for passenger aeroplanes** (such as Airbus and Boeing) used in the turbines to reduce speed while landing and therefore needs to be very sturdy and light.

To optimise the use of resources needed to produce 12H beams, the MEMAN partners analysed the entire value chain to spot inefficiencies in the manufacturing processes. The analysis of the value chain showed that the manufacturing company could save resources by bringing the heat treatment and the surface finishing in-house from the external subcontractor.

In the aerospace industry, for quality reasons, the amount of raw materials used to make the components can be huge in comparison to the weight of the final product (up to 9 times), so raw materials become the largest cost in the processes. Partners identified the preparation of rough parts for the aerospace industry as a process in the value chain that has the potential to save a large amount of raw materials.

On top of this, the cluster focused on digital innovations and the **Industrial Internet of Things**, as they give the opportunity to monitor industrial processes and the associated machines with more accuracy. On this basis, the machining cluster developed several innovations linked to predictive maintenance.

The partners also designed a **virtual demonstrator** to show companies the best practices to save resources, as well as **a serious game** based on actual data to learn about resource saving potential. This should make complex information on resource efficiency more digestible to encourage their uptake.

PERFORMANCE OF THE MACHINING CLUSTER

The application of the MEMAN approach to the machining cluster brought the following results on the value chain of a specific part (12H beam), by combining innovations on the structure of the Value Chain:

- **23% reduction in energy consumption** (Cumulative Energy Demand) for the product from cradle-to-gate and 39% cradle-to-grave
- **6% reduction in CO_2 emissions** for the product from cradle-to-gate and **14% cradle-to-grave**
- **10% reduction in the lead time** for delivery.

INDIVIDUAL RESULTS & INNOVATIONS

A number of specific innovations were developed within the machining cluster:

IN-HOUSE INTEGRATION OF THE HEAT TREATMENT IN THE MANUFACTURING COMPANY

Special processes such as heat treatment are done in the middle of the value chain between machining operations and require transport operations, which cause significant delays (up to 4 weeks).
Bringing the heat treatment in-house brought about:

- **65% reduction** in the duration of the **heat** treatment
- **15% reduction** in overall **production time**
- **10% cut** in **CO_2** emissions.

Heat treatment

INTEGRATION OF SURFACE TREATMENT

Special processes such as surface treatment are done in the middle of the value chain between machining operations and require transport operations, which cause significant delays (up to 4 weeks).

Bringing the surface treatment process in-house is expected to bring about:

- **20% reduction** in the **processing time**
- **10% cut** in **CO_2** emissions.

Surface treatment

ROUGH PART OPTIMISATION

Partners introduced a more sophisticated process, similar to water jet cutting, to prepare the rough parts that go into machining operations.

This can lead to:

- **More precise** and complex **cutting** (such as 3D shapes)
- Up to **20% reduction** in **scrapped materials**
- **Reduction of the time or working capital** required, because the process is more flexible and the cutting could be done at a later stage.

Rough part optimisation

PREDICTIVE MAINTENANCE INNOVATIONS

One strategic advantage of introducing the Industrial Internet of Things and associated data analytics comes from the possibility to detect the failure of machines.
This avoids wasting resources due to inappropriate machining. MEMAN demonstrated that the use of the data available in numerical controllers can help to **detect deviations in the accuracy of machine tools**. Future projects will further develop these innovations.

VIRTUAL DEMONSTRATOR

The virtual demonstrator comprises a set of **virtual tours of certain companies** to get an introduction to the current **best practices** in resource optimisation. It consists of visits to Figeac Aero (Figeac, France), STAHL Judenburg (Judenburg, Austria) and to the laboratory of IWF at Technische Universität Braunschweig (Braunschweig, Germany).

SERIOUS GAME

The 'serious game' is the communication and training support for the MEMAN approach. Its objective is to transfer knowledge about the MEMAN approach in a playful and engaging way for users.

The serious game is complementary to the virtual demonstrator. It acts as a teaser to catch the attention of industrial players to direct them to the virtual demonstrator, and encourage them to commit to resource efficiency measures.

The virtual demonstrator and the serious game are available on the MEMAN website: WWW.MEMAN.EU

Virtual demonstrator

Serious game

NEXT STEPS ON THE MARKET

The industrial partners are currently implementing the optimisations proposed in the machining cluster. Moreover, the partners will make available consulting services, based on the MEMAN approach, for all companies aiming to improve their energy, economic and environmental performances in a more effective way.

Next year partners are also expecting to start new demonstration projects and a collaborative work on predictive maintenance.

Finally, industrial players will have online access to the virtual demonstrator and the serious game for 3 years after the project.

3.3. SURFACE FINISHING CLUSTER

The process taken into consideration in the surface finishing cluster is the **manufacturing of steel products** in a German and an Austrian metal-mechanic company. The process goes from the production of raw steel bars, to product finishing through hard chrome plating, with a special focus on this last phase of surface finishing.

The product at the centre is the **hydraulic piston rod**, which is used in mechanical engineering applications, such as cars, cranes and construction machines in general, and also wind turbines.

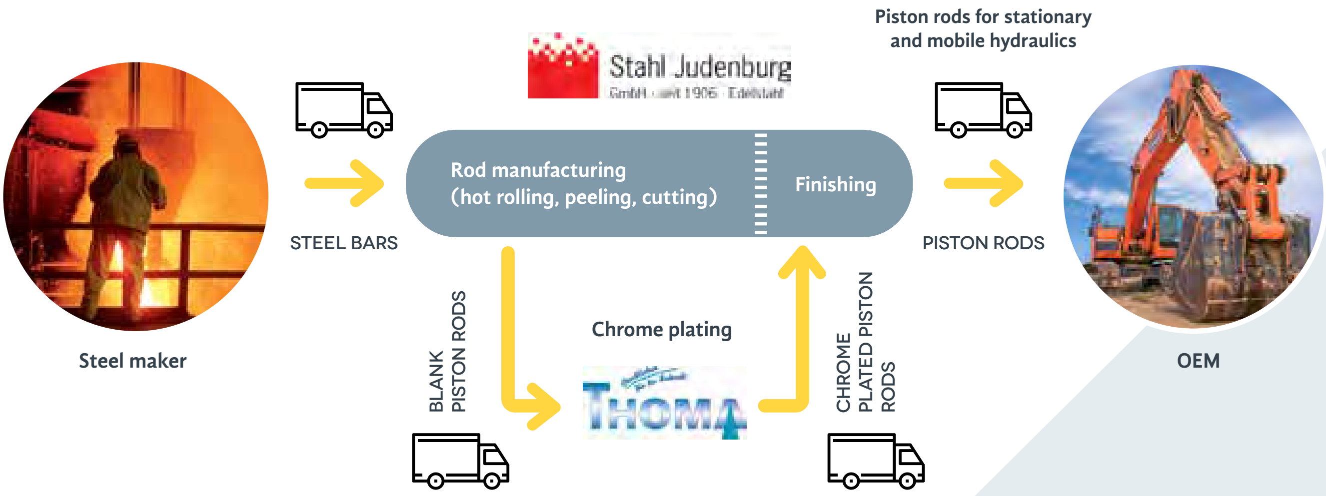
One major cause of inefficiency– and therefore of higher costs – in industrial value chains are the **distortions in the interfaces** between different companies and manufacturing units, which are defined by business processes.

Moreover, the surface finishing sector largely underutilises the vast potential of **digital and information technologies**. Business process innovations can help in this regard, because they are a critical driver for smart manufacturing.

Finally, in a value chain dominated by requirements and standards, business process innovations have the **lowest implementation barriers**, while showing a high leverage effect.

For these reasons, the partners of the surface finishing cluster focused on the **'business process'** dimension of value chain innovation and developed smart manufacturing solutions to support the innovations.

One of the biggest technical problems of plating is the **quality of the steel** that needs to be coated. Partners in this cluster tried to solve this problem by reducing the pores in the steel to avoid that the small micro-fractures in the metal could affect the coating. In fact, the plating process does not conceal any fault in the steel texture, but on the contrary magnifies it. This leads to several reworking cycles, sometimes involving even the re-melting of the steel component. Partners developed a **'vacuum degassing'** process to solve this issue in the first steps of the value chain.



Manufacturing value chain of an hydraulic piston rod

Another problem faced was the **content of chromium salt** in the coating. With the MEMAN methodology partners were successfully able to check the quality of the materials and the chemicals used in the process to reduce the inefficiencies linked to it.

The toolbox also accurately estimates if the changes partners wanted to introduce were effective, while before the effectiveness could only be guessed.

PERFORMANCE OF THE SURFACE FINISHING CLUSTER

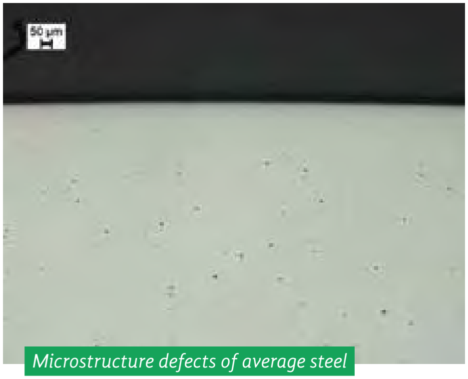
The MEMAN methodology allowed the industrial partners involved to demonstrate:

- **80% reduction in process failures, insufficient quality and scrap** caused by manufacturing disturbances due to supply disorders (e.g. changed qualities of raw material and chemicals)
- Up to **26% improvement in the energy efficiency** of the manufacturing processes along the value chain
- Up to **28% decrease in embodied energy** (the energy embodied in materials used in the production)
- Up to **26% cost savings** along the value chain
- **Optimal specifications of steel quality** (such as steel microstructure, inclusions) necessary to avoid any re-work of the product to be coated
- The methodology also contributed to assess and therefore **reduce the health risks of workers** from serious hazards.

INDIVIDUAL RESULTS & INNOVATIONS

A number of specific innovations were developed within the surface finishing cluster:

DEFINITION OF ADVANCED MATERIAL PARAMETERS FOR OPTIMAL PROCESS EFFICIENCY OF CHROME PLATING


Microstructure defects of average steel


Critical chrome plating defects

The images show typical microstructure defects of average steel in a cross-section polish (at the top), and critical chrome plating defects caused by these steel defects (at the bottom). This can cause substantial manufacturing disturbances, with a breakdown of production efficiency and heavy losses.

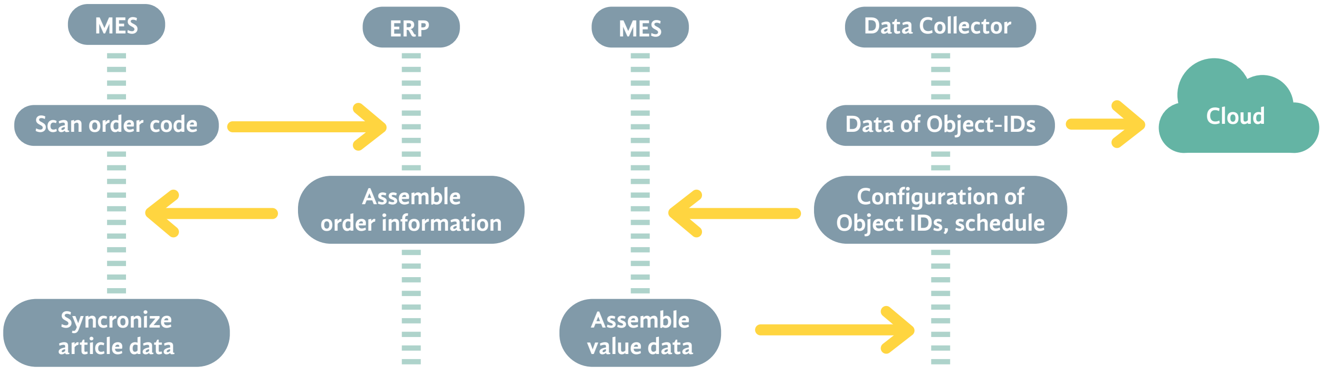
SOLUTION DEVELOPED:

1) Improved base steel quality:

- Reduction of non-metallic inclusions, hydrogen and nitrogen in raw steel, which led to the **reduction of micro-defects by up to 60%**

2) Better control of chemicals composition:

- **Higher, controlled quality of chromium salt** (CrO_3). The critical issue here was to obtain reliable information from suppliers
- **Less contaminations** leading to less side reactions and chemical damages (e.g. pitting corrosion)
- **Control of the process close to the optimal conditions** thanks to MEMAN advanced process simulation.



Integration of ERP and MES systems

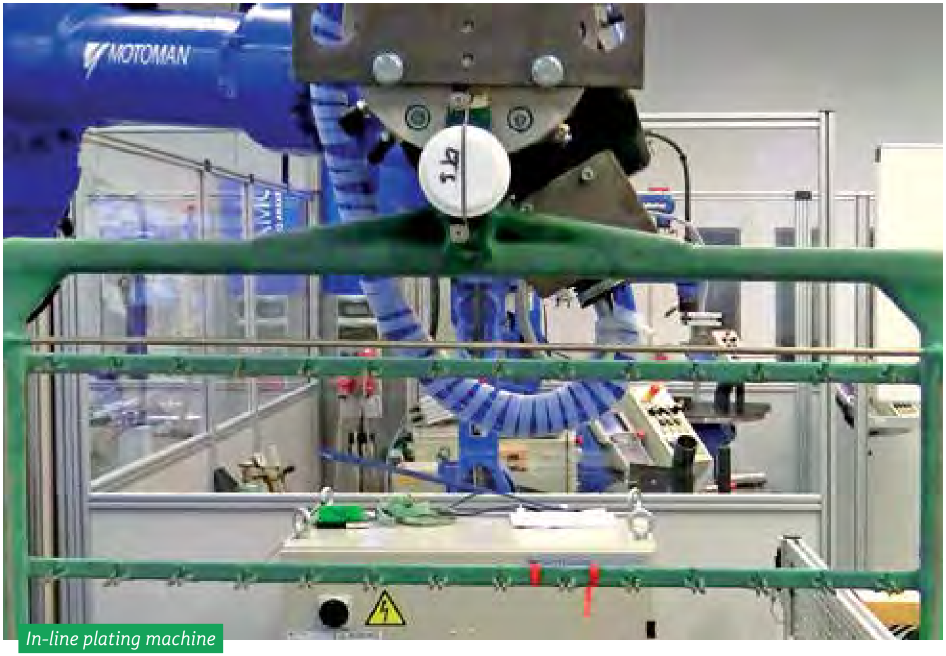
INTEGRATION OF ENTERPRISE RESOURCE PLANNING (ERP) AND MANUFACTURING EXECUTION SYSTEMS (MES)

The graphic above shows the data exchange of MES and ERP (left) and the exchange with MEMAN cloud-based value chain information system.

The integration of the different IT systems – ERP operating at the business level and MES at the manufacturing process level – provides new functionalities that are essential to implement smarter manufacturing solutions.

Improved functionalities include among others:

- Evaluation of interface disturbance factors
- Monitoring of resource inputs and outputs with an eco-balance perspective
- Transfer of detailed production planning data from ERP to MES for optimising production orders in the plating process in terms of resource efficiency
- ERP evaluation criteria now include resources, quantity, Global Warming Potential (GWP), Cumulative Energy Demand (CED), Euro.



In-line plating machine

FEASIBILITY OF FULLY AUTOMATED "IN-LINE PLATING MACHINE":

According to the conventional business model in the electroplating industry, electroplating is performed in centralised plants, operating in external factories. The new in-line plating business model breaks away from this old concept and integrates fully automated electroplating units directly into the production line of a mechanical manufacturing company. Despite required specialisation, the units will be reconfigurable so that the in-line plating concept is supporting smart and reconfigurable factories.

The high process efficiency, reduced logistics and elimination of transport could enable:

- **Energy savings of up to 20%**
- **Cost savings of up to 15%** along the value chain (cradle-to-gate).

NEXT STEPS ON THE MARKET

All the innovations developed in this cluster reached a quite mature stage and will therefore be prepared for scale-up or commercialisation.

Stahl Judenburg and Thoma decided to implement the advanced material parameters defined in MEMAN for the optimal process efficiency of chrome plating.

Softec and DiTEC will commercialise respectively the improved ERP and the MES software.

A pilot project in Germany is developing a pilot plant for a fully automated "in-line plating machine".

Eiffo in collaboration with the industrial partners of the cluster will implement the integrated resource efficiency and risk management solution for better regulatory compliancy.

CONSORTIUM PARTNERS

CASTING CLUSTER

MACHINING CLUSTER

SURFACE FINISHING CLUSTER

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WWW.MEMAN.EU

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