MANUFACTURE 2030 Vision and Action Plan

COMPETITIVE, SUSTAINABLE AND RESILIENT EUROPEAN MANUFACTURING

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High Level Group

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ManuFUTURE Conferences 2003 to 2019

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Manufuture 2030 Vision and Action Plan

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These are the 10 most liveable cities in the world

Work Life Balance Ranking (index value 0 = bad, 100 = very good)

1. Helsinki - 100,0
2. München - 98,3
3. Oslo - 95,3
4. Hamburg - 93,6
5. Stockholm - 89,1
6. Berlin - 88,8
7. Zürich - 84,1
8. Barcelona - 82,2
9. Paris - 77,8
10. Vancouver - 72,6

* Bewertung von Arbeitsbedingungen, Gesundheitsversorgung, Gleichberechtigung, Toleranz, Glücksscore und allgemeinen Lebensbedingungen

Quelle: Kisi
Overview

ManuFUTURE Vision 2030

ManuFUTURE SRIA 2030

Strategic Research and Innovation Agenda
The Manufacturing Industry Today

Share of world’s total manufacturing investments by region

Source: IHS
Megatrends and Drivers for Manufacturing

- **Political and Environmental**
  - Uncertain global political environment
  - Climate change and scarcity of natural resources

- **Economic**
  - Fierce competition going up the value chain
  - New business models and global value networks

- **Social**
  - Changes in demographics: Increase in the middle class, urban and aging population
  - New consumer preferences and environmental awareness
  - New skills and employment patterns

- **Technological**
  - Accelerated technological progress and adoption
  - Global access to knowledge
  - More complex products, processes and value networks

**MEGATRENDS AND DRIVERS FOR MANUFACTURING**
Today’s Challenges for Manufacturing

• Whether they build consumer products or industrial/capital goods, manufacturers must keep pace with rapidly changing technologies, materials and customer preferences.

• Producers across all industries face the complex challenges of tracking global economic trends and complying with engineering standards while maintaining profitability.
Opportunities for European Manufacturing

- Customer-centric value creation networks
- Leapfrog productivity gains through technology intelligence
- “HU MANufacturing” as a new era of automation
- “Simplexity” – Making complex manufacturing systems simple
- Responsible value creation in a circular economy
- New partnerships for new manufacturing skills
- Manufacturing as networked and dynamic sociotechnical system
Manufacturing innovation system, a complex and highly dynamic sociotechnical system

Value creation networks

MANUFUTURE envisions four relevant archetypal types of value creation networks - that companies may configure or even combine to target different markets or product lines:

1. Highly Integrated Global Supply Networks
2. Regional Value Creation for Global Markets
3. Local Value Creation for Local Markets
4. Dynamic Virtual Value Networks
MANUFUTURE Vision 2030
Competitive, Sustainable and Resilient European Manufacturing
MANUFUTURE High Level Vision and Strategy for 2030

“EUROPEAN MANUFACTURING IN 2030 WILL BE A GLOBALLY COMPETITIVE, INTERCONNECTED AND ADAPTIVE SOCIOTECHNICAL VALUE CREATION SYSTEM THAT ENSURES SUSTAINABLE GROWTH AND SOCIAL WELFARE, IN A RESOURCE-CONSTRAINED WORLD.”
MANUFUTURE Strategy for 2030

Europe needs to build on its proven capabilities and **invest more to ensure its leadership**
Implementation Roadmap

*Three transformational waves*

- **2010**
- **2020**
- **2030**
- **2040**

- **Digital Transformation**
- **Circular Economy**
- **Bio Based Ecosystems**
MANUFUTURE Vision Building Blocks

SCIENCE AND TECHNOLOGY

INNOVATION AND ENTREPRENEURSHIP

EDUCATION AND TRAINING

ManuFUTURE 2030 BUILDING BLOCKS
The Innovation Process

Discovery  
Proof of Concept  
Scale-up/industrialisation  
Innovation

Identified gaps in cooperation and funding

FRONTIERS’ RESEARCH  
APPLIED RESEARCH  
MARKET UPTAKE

1-3  
4-5  
7-9  
TRL

Factories of the Future PPP  
EIT Manufacturing

Open research  
Open innovation

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MANUFUTURE 2030 Vision and Action Plan
MANUFUTURE Strategic Research and Innovation Agenda 2030

Chapter 3: SCIENCE AND TECHNOLOGY CHALLENGES

Chapter 4: RESEARCH AND INNOVATION PRIORITY DOMAINS

Chapter 5: INNOVATION AND ENTREPRENEURSHIP

Chapter 6: EDUCATION AND TRAINING
Today’s enlarged System of Manufacturing

Input
Energy, Materials
Information
Machines, Tools...

Output
Products
Services
Ideally Zero Emissions & Waste

People
Knowledge
Finance
Resources

Public Institutions Government
Product-Services
Factory Equipment Manufacturer
Service-Supplier
Material-Supplier
Research & Engineering Partner

Global Environment
Regional Environment

System Production Lifecycle

Global Information and Communication Network

Reusable materials and components

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Engineering on all Scales: Model of multi-scale Manufacturing Systems

**Horizontal integration**
- Value chain
- Life cycle costs
- Customized products

**Vertical integration**
- Reconfiguration
- Lot size
- Apps
- Constant change

**Integrated Engineering**
- Systems eng.
- Along supply chain
- Dig. factory

**Human centricity**
- Orchestration
- Skills
- Knowledge
- Training
Cyber-Physical-Systems „Industrie 4.0“
single-sign on, look + feel, everywhere, anytime

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MANUFUTURE 2030 Vision and Action Plan

ICT – Networks, Internet, Digital Objects

© Westkämper, Löffler
Research for Technical Intelligence in Manufacturing Systems - going beyond the limits of today

High Engineering Productivity
Knowledge Based CAD
Computerised Modeling

Computational Engineering for Personalised Products

ICT Architecture and Environment for Industry 4.0 Standards
3G - 5G

Real time
Security, Reliability and Capability
Industrial Communication for Factories and Lifecycle of Products
International Standardisation

Leapfrog Performance Gains
High Performance (Time, Cost)
High Quality (Zero Defects)
High Resource Efficiency
Self-Optimisation and Self-Control

Decentralised Technical Intelligence

Networking, Miniaturisation and Functional Integration

Embedded Technologies
- Surface Functions
- Sensor Networks
- De-Materialisation

Human Centred
Tactile Interaction and Visualisation
Flexible and Changeable Systems

Cyber-Physical Manufacturing Systems

Machine Learning and Artificial Intelligence

Multi-Sensor Solutions
Signal Analytics
Real Time and Look Ahead
Process Simulation
Knowledge Network
Road towards technical intelligence

<table>
<thead>
<tr>
<th>Knowledge and Standards</th>
<th>Engineering IT Systems / Tools</th>
<th>Multi-Sensor Networks</th>
<th>Smart / Intelligent Manufacturing</th>
<th>Learning Capabilities on all Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>scientific based models of technical processes</td>
<td>Digital Twin</td>
<td>Inline / real time process monitoring</td>
<td>highly flexible battery manufacturing</td>
<td>AI-assisted engineering</td>
</tr>
<tr>
<td>sensor technologies for process supervision</td>
<td>customer-integrated engineering</td>
<td>Administration Shell (RAMI 4.0)</td>
<td>autonomisation</td>
<td>decentralised intelligence</td>
</tr>
<tr>
<td>signal analytics</td>
<td>Mass Personalisation</td>
<td>micro and nano robots</td>
<td>zero-defect technologies</td>
<td>automated process learning</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>intelligent systems for material development</td>
<td>sensor / smart materials</td>
<td>battery production</td>
<td></td>
</tr>
<tr>
<td>neural networks and other learning methods</td>
<td>co-design bi / mech / el / digital</td>
<td>tech - bio interfaces</td>
<td>bio-intelligence</td>
<td></td>
</tr>
<tr>
<td>edge clouds in decentralised systems</td>
<td>product lifecycle engineering</td>
<td>administration Shell</td>
<td>flexible adaptive manufacturing systems</td>
<td></td>
</tr>
<tr>
<td>standards for data exchange and technical cooperation</td>
<td>ergonomics, regulations</td>
<td>human-machine cooperation</td>
<td>safety, security and regulations</td>
<td></td>
</tr>
<tr>
<td>IT systems and tools</td>
<td>lifecycle optimisation</td>
<td>decentralised ad-hoc communication</td>
<td>decentralised intelligence</td>
<td></td>
</tr>
<tr>
<td>lifecycle optimisation reconfigurable products</td>
<td>reconfigurable products</td>
<td>dematerialisation, data integration</td>
<td>lifecycle data log, cooperation CPS</td>
<td></td>
</tr>
<tr>
<td>ad-hoc manufacturing value networks</td>
<td></td>
<td>intelligent modular reconfigurable component</td>
<td>management systems for smart manufacturing</td>
<td></td>
</tr>
</tbody>
</table>

Research and Innovation Domains:
- Manufacturing Technology and Processes
- Digital transformation
- Robotics and Flexible Automation
- Nano-Technologies and new Materials
- Biological Transformation
- Customer-driven Manufacturing
- Human-centred Manufacturing
- Agile Manuf. Systems Design
- Circular Economy, resource and energy efficiency
- New Business Models and Logistics Networks
## MANUFUTURE SRIA 2030

### Proposed Research and Innovation Domains

<table>
<thead>
<tr>
<th>ENABLING TECHNOLOGIES AND APPROACHES</th>
<th>MANUFACTURING STRATEGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Manufacturing technology and processes</td>
<td>6. Customer-driven manufacturing</td>
</tr>
<tr>
<td>2. Digital transformation</td>
<td>7. Human-centred manufacturing</td>
</tr>
<tr>
<td>3. Robotics and flexible automation</td>
<td>8. Agile manufacturing systems design and management</td>
</tr>
<tr>
<td>5. Biological transformation of products, processes and value creation</td>
<td>10. New business models and logistics networks</td>
</tr>
</tbody>
</table>

- Each domain generates an average of 10 sub-topics
- Sub-topics cover frontiers’ research, applied research and demonstrators and pilot lines
- Sub-topics are cross sectorial, but some sectorial challenges are also considered
Wrap-up

Why do we need an inspiring vision and a clear, coherent guiding SRIA framework?

• We need „synergistic“ actions, i.e. strategically aligned investment decisions and joint efforts in the manufacturing eco-system. It’s not about funding, it’s about mind-sets & capabilities!

What is at the heart of our vision of future manufacturing industry?

• Data-driven, customer-focused and responsible value creation.
  „Real value for the people“ in interconnected, flexible and robust manufacturing systems with decentralised intelligence.
Wrap-up

What are the core topics on our road towards the future manufacturing industry?

- **Foundation**: knowledge and standards
- **Data generation**: multi-sensor networks and intelligent components
- **Data processing**: engineering systems and tools
- **Intelligent manufacturing** in cyber-physical production systems
- **Learning capabilities** on each level
Thank you very much

Heinrich Flegel