

# METROLOGY AND STANDARDS IN A DIGITAL FUTURE

European Metrology Network  
for Advanced Manufacturing

**IN**  
**MEASUREMENT**  
**WE TRUST**

**ALEXANDER EVANS**  
Research Associate, BAM  
Germany

An abstract graphic on the left side of the slide, composed of several overlapping, curved blue shapes in various shades of blue, creating a sense of motion and depth.

## European Metrology Network for Advanced Manufacturing

20th INTERNATIONAL METROLOGY CONGRESS  
CIM2021

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Alexander Evans & Anita Przyklenk et al.

Alexander Evans  BAM

Anita Przyklenk  PTB  
Physikalisch-Technische Bundesanstalt  
Braunschweig und Berlin

Harald Bosse  PTB  
Physikalisch-Technische Bundesanstalt  
Braunschweig und Berlin

Vit Zeleny  MI  
CZECH METROLOGY  
INSTITUTE

Dariusz Czulek  Central  
Office  
of Measures

Alessandro Balsamo  INRiM  
ISTITUTO NAZIONALE  
DI RICERCA METROLOGICA

Daniel O'Connor  NPL  
National Physical Laboratory

Tanfer Yandayan  TUBITAK  
UME

Dishi Phillips  euspen

Felix Meli  METAS

Carlo Stefano Ragusa  POLITECNICO  
DI TORINO

Olena Flys  RISE

# European Metrology Networks (EMNs)

The overall objective is to **create sustainable structures in areas of strategic importance for the future of European metrology.**

EMNs will ...

- cover an area of major strategic importance, with European dimension;
- consist of a core network of NMIs/DIs with a clear commitment to contribute to the network;
- establish close links to a wider stakeholder community;
- strive for scientific excellence;
- plan the activities based on a strategic agenda;
- establish a knowledge, technology transfer and promotion plan;
- plan for sustainable structures;
- develop and coordinate common infrastructure if needed



# Approved/established EMNs



## Currently there are nine EMNs:

- (1) Advanced Manufacturing  
approved by EURAMET in June 2021
- (2) Climate and Ocean Observation
- (3) Energy Gases
- (4) Mathematics and Statistics
- (5) Quantum Technologies
- (6) Radiation Protection  
approved by EURAMET in June 2021
- (7) Smart Electricity Grids
- (8) Smart Specialisation in Northern Europe
- (9) Traceability in Laboratory Medicine



MATHMET



CLIMATE AND  
OCEAN OBSERVATION



QUANTUM  
TECHNOLOGIES



ENERGY GASES



TRACE LAB MED

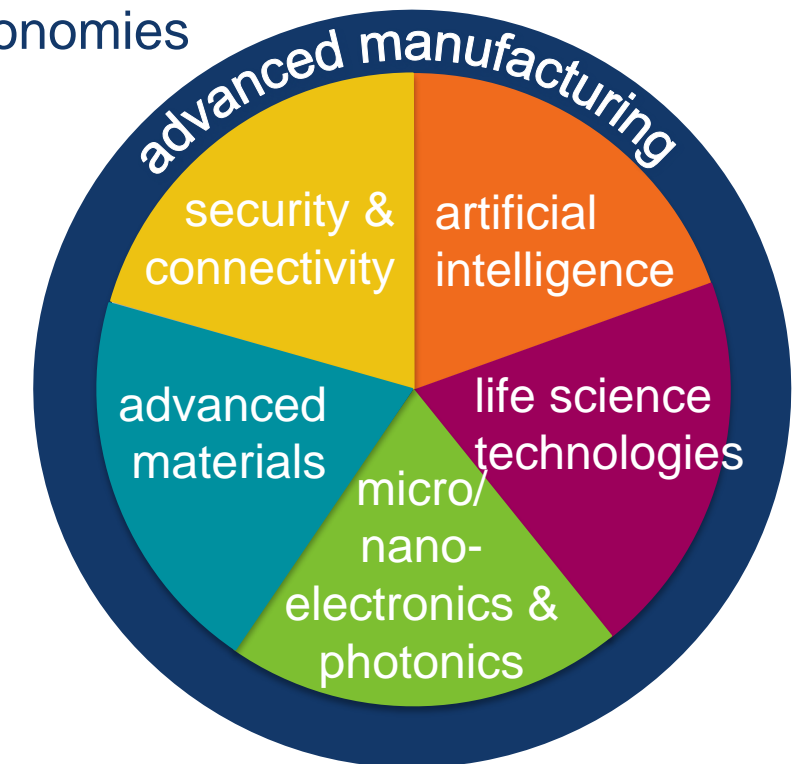


SMART ELECTRICITY  
GRIDS

# Advanced Manufacturing

**Advanced manufacturing (EC):** one of six Key Enabling Technologies (KETs)

- Applications in multiple industries
  - ▶ full exploitation of KETs: creating advanced & sustainable economies
- European Technology Platform **MANUFuture**:
  - ▶ Vision 2030 strategy document (HLG, 12/2018):
- **Manufacturing: backbone of European economy**
- 2014: 2.1 million enterprises, 30 million people, 1 710 B€. However: European manufacturing has been losing ground
- In 2030, European manufacturing will be competitive at global level due to its high-performance and technological level, targeting **zero-defect, zero-delay, zero-surprise and zero-waste production processes**



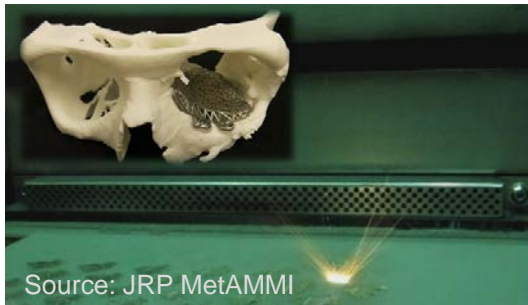
prioritised KETs in the Horizon Europe programme 2021-2027 (EC)



# Metrology demands

## Aim for production processes:

### zero-defect



#### Example:

- Additive Manufacturing:
- in-process metrology
  - fast & holistic metrol.



### EMN sections:

- Advanced Materials
- Smart Manufacturing Systems
- Manufactured components and products

### zero-delay



#### Example:

- Machine tools:
- improved control by 5G sensor technology
  - sensor integration: metrology data interface

### zero-surprise



#### Example:

- Lithography tools:
- full simulation of relevant processes
  - metrology tools using AI data algorithms

### zero-waste



#### Example:

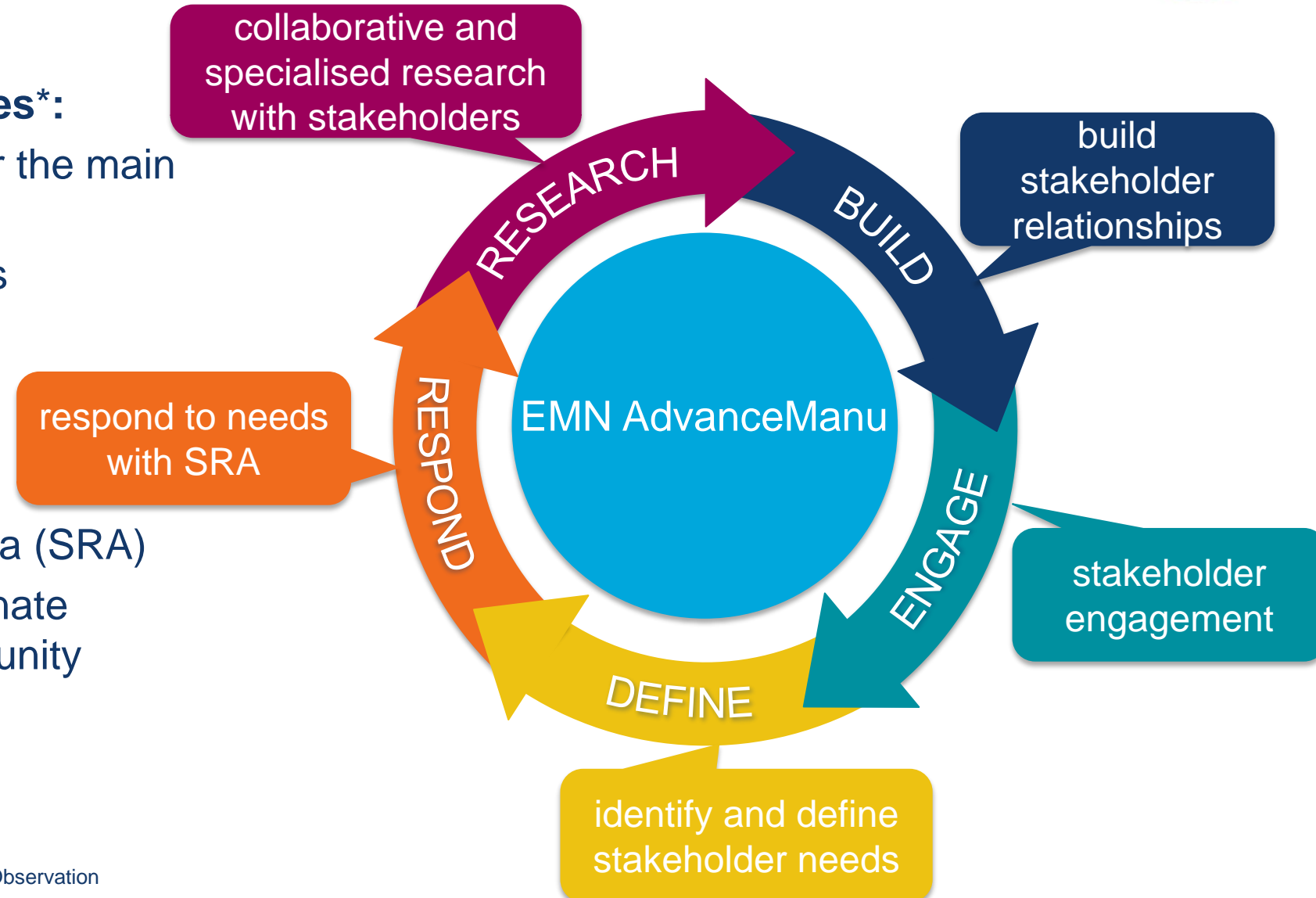
- Machine tools & Additive Manufacturing:
- less scrap via hybrid manufacturing chains (MT & AM)
  - reduced energy consumption by advanced machining processes

# Major activities of the EMN

## Current supporting activities\*:

Provide and prepare input for the main tasks of the EMN

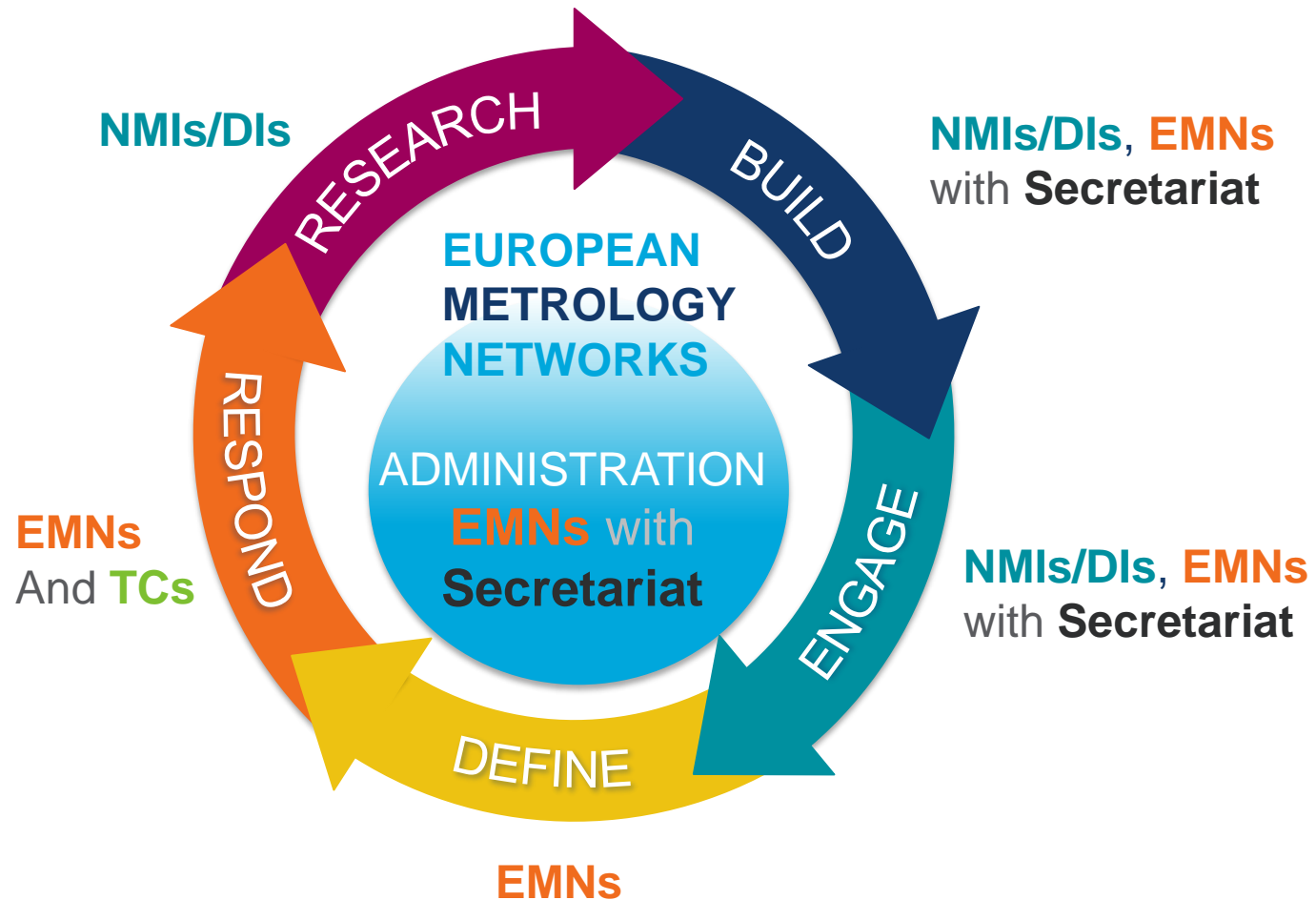
- (1) Preparation of Definitions
- (2) Analysis of stakeholder capabilities and needs
- (3) Analysis to prepare the development of a strategic research agenda (SRA)
- (4) Create impact – disseminate results to relevant community



\*Slide developed according to EMN Climate and Ocean Observation



# Who is leading what?\*



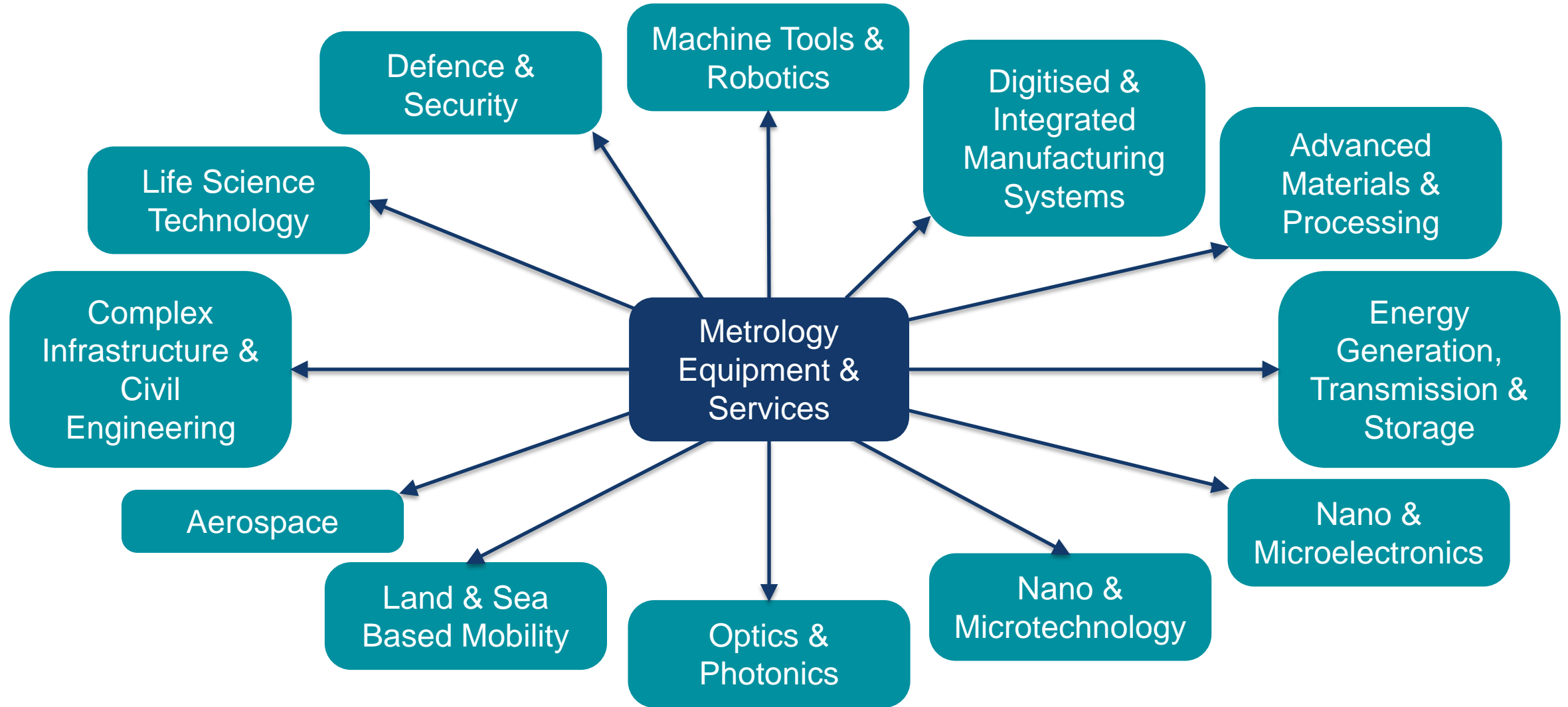
\*Slide developed according to EMN Climate and Ocean Observation

# Definition of Advanced Manufacturing

- Our route to the EMN, require definitions to define the scope
- No current agreed definition of Advanced Manufacturing (ISO or CIRP)
- As a first step to define what ***advanced manufacturing*** is, a bibliographic search was carried out to look for existing definitions and statements.
- Definition extended from agreed definition for Manufacturing.

***“Branch of manufacturing that exploits evolving or emerging knowledge, technologies, methods and capabilities to make and/or provide new or substantially enhanced goods or services, or improve production efficiency or productivity, while ensuring environmental and societal sustainability”***

# Key Industrial Sectors (KIS)



# Gap analysis for metrology for advanced manufacturing



Overlap of gap analysis is crucial to identify the future topics to be addressed by the SRA for metrology for advanced manufacturing

Need a broad input from range of stakeholders:

- questionnaire of metrology experts of TC-L contacts in EURAMET member states  
Q2: metrology demands and national strategies in dimensional metrology
- literature review of academic articles in peer reviewed journals

The next stages ....

- existing roadmaps for advanced manufacturing
- direct stakeholder feedback

# Identified Metrology challenges per KIS from questionnaire of NMIs



In-process measurement and detection in additive manufacturing

Digital Twins

3D Metrology for composites, new (nano)materials and surfaces

Traceability for XCT of internal defects and structures

Defence & Security

Machine Tools & Robotics

Digitised & Integrated Manufacturing Systems

Injection systems

Life Science Technology

Advanced Materials & Processing

In-situ deflection measurements of large structures

Complex Infrastructure & Civil Engineering

Metrology Equipment & Services

Energy Generation, Transmission & Storage

Wind turbine gear metrology

Traceability for XCT of internal defects and structures

Aerospace

Land & Sea Based Mobility

Nano & Microelectronics

Dimensional metrology in micro and nano scale

3D scanning of large structures

Optics & Photonics

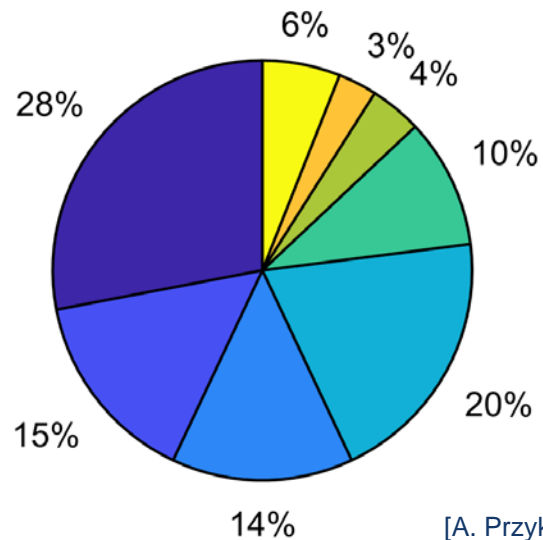
Nano & Microtechnology

Complex asphere and freeform component

Reference nanoparticles

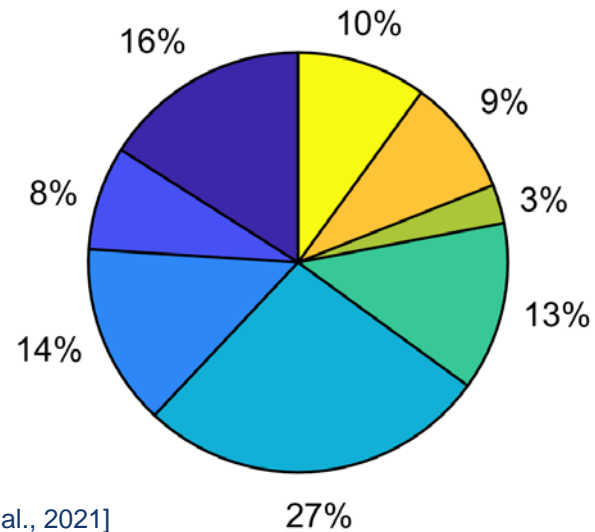
# Literature analysis of identified gaps

Int J Adv Manuf Tech 2019-2020/06

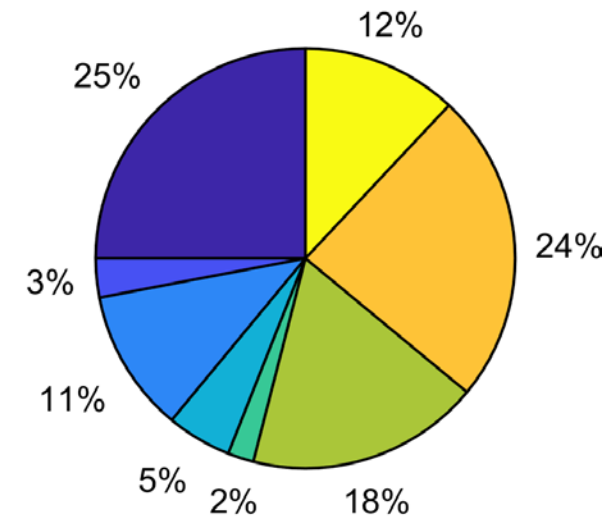


[A. Przyklenk et al., 2021]

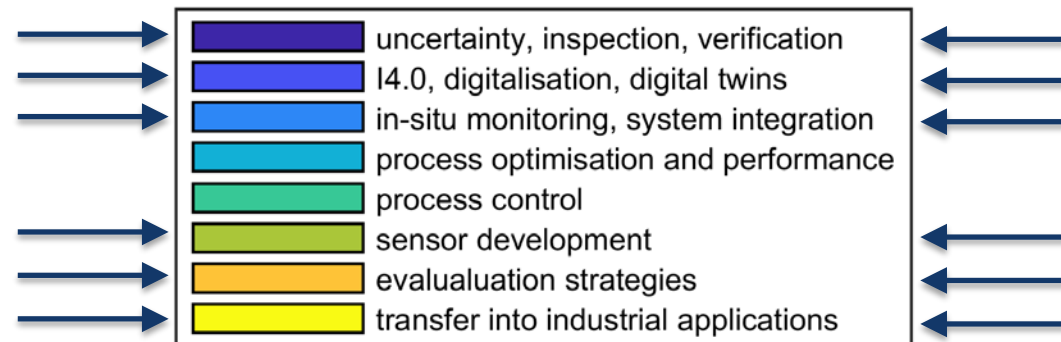
CIRP Ann - Manuf Techn 2019-2020



EMPR: Metr for Ind 2012-2020



topics identified in questionnaires:



Next key step: Identify current and future gaps of stakeholders in advanced manufacturing



# Major activities of the EMN

## Future EMN: Cyclical process\*

### Needs input from:

- stakeholder engagement
- metrology capability analysis
- analysis of roadmaps
- stakeholder feedback

- to a **sustainable** EMN, engaged & well embedded in their communities, **making impacts**



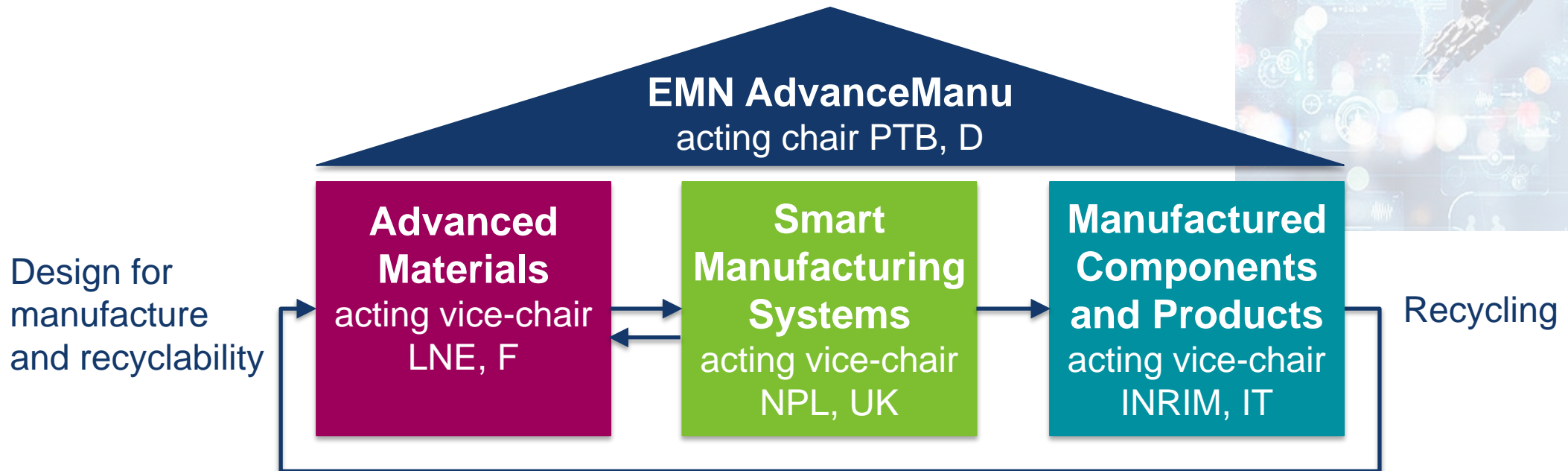
\*Slide developed according to EMN Climate and Ocean Observation

# Relevant EU projects, programmes and networks



# Outlook

- EMN for Advanced Manufacturing approved 07.06.2021
- EMN to be organised into three sections:



- Formal kick-off meeting planned for 11-12<sup>th</sup> Oct 2021
- Stakeholder engagement and preparation of SRA for Metrology for Advanced Manufacturing

# EMN contacts



EMN Chair: Harald Bosse [harald.bosse@ptb.de](mailto:harald.bosse@ptb.de)

<https://www.euramet.org/european-metrology-networks/advanced-manufacturing/>

The screenshot shows the top section of the EURAMET website. On the left, there are search and login options. The main navigation bar includes links for Home, Newsletter, Contact us, LinkedIn, and YouTube. The EURAMET logo is on the right. Below the navigation bar is a menu with categories: ABOUT EURAMET, EUROPEAN METROLOGY NETWORKS, IMPACT, INNOVATION & RESEARCH PROGRAMMES, GUIDES & PUBLICATIONS, KNOWLEDGE TRANSFER & CAPACITY BUILDING, and TECHNICAL COMMITTEES & TC PROJECTS. A breadcrumb trail shows 'European Metrology Networks / Advanced Manufacturing'.

## EMN FOR ADVANCED MANUFACTURING

Advanced manufacturing requires new and enhanced metrology methods to assure the quality of manufacturing processes and the resulting products.

The newly approved European Metrology Network for Advanced Manufacturing will drive the high-level coordination of the metrology community in this field and will foster the impact of metrology developments for advanced manufacturing.

The network is run by National Metrology Institutes (NMIs) and Designated Institutes (DI) in close cooperation with stakeholders interested in advanced manufacturing. The objectives of the network are to set up a permanent stakeholder dialogue, to develop a Strategic Research Agenda for the metrology input required for advanced manufacturing technologies, to create and maintain a knowledge sharing programme and to implement a web-based service desk for stakeholders.



## MENU

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## NEWS

[SEE ALL EURAMET NEWS](#)

**New network for Advanced Manufacturing held introductory meeting**  
28-06-21

Please subscribe to **NEWSLETTER** if you are interested:

<https://www.euramet.org/meta-menu/subscribe-to-newsletter/>

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