



AM Entrepreneur®
...qualified to scale

The challenges of the Qualified Additive Manufacturing supply chain

OPTIMAT Network Internal

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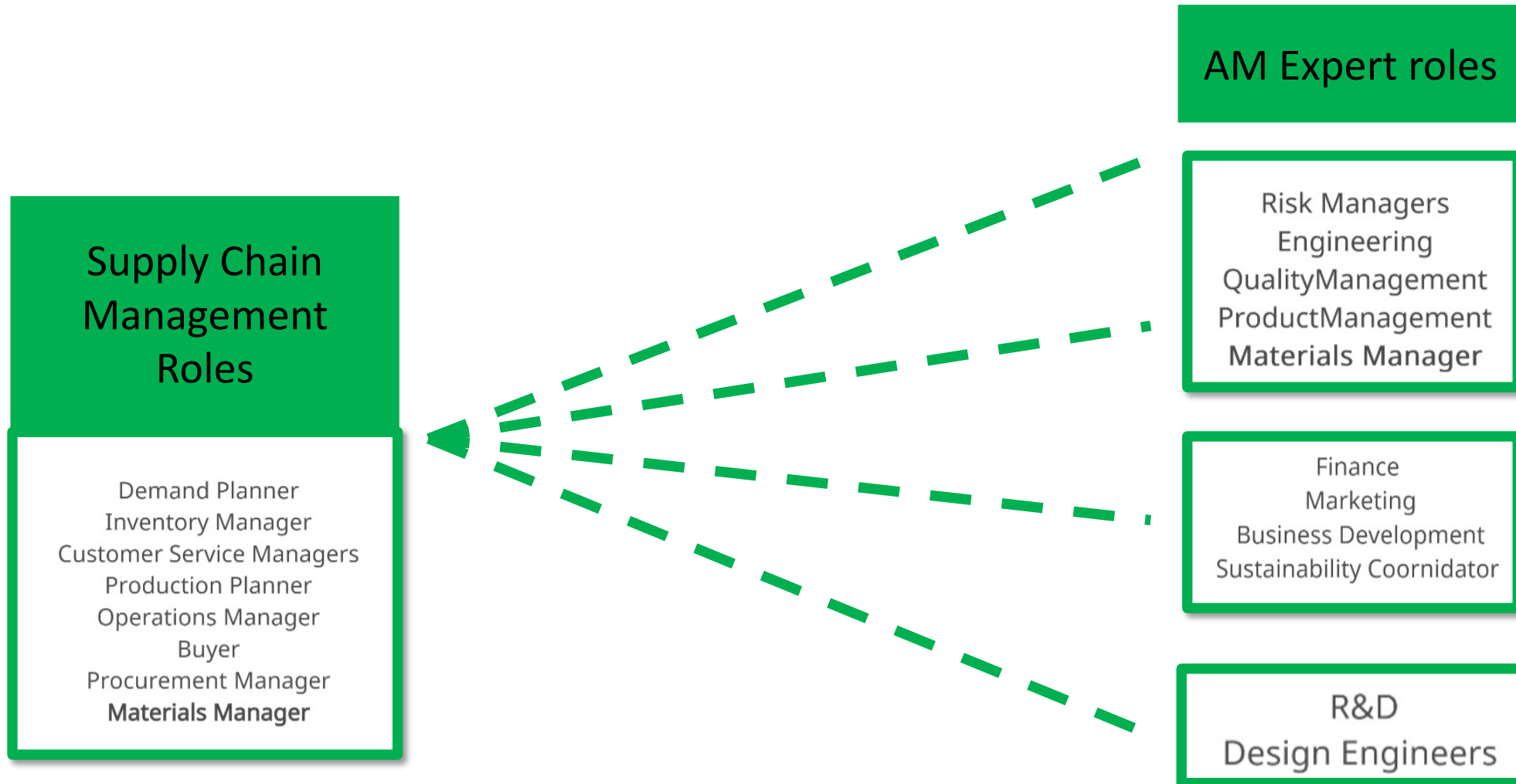
To assure that a global supply chain works, we need standards

The logo for DIN (Deutscher Institut für Normung), consisting of the letters "DIN" in a bold, black, sans-serif font, enclosed within a thick black rectangular border.

DIN

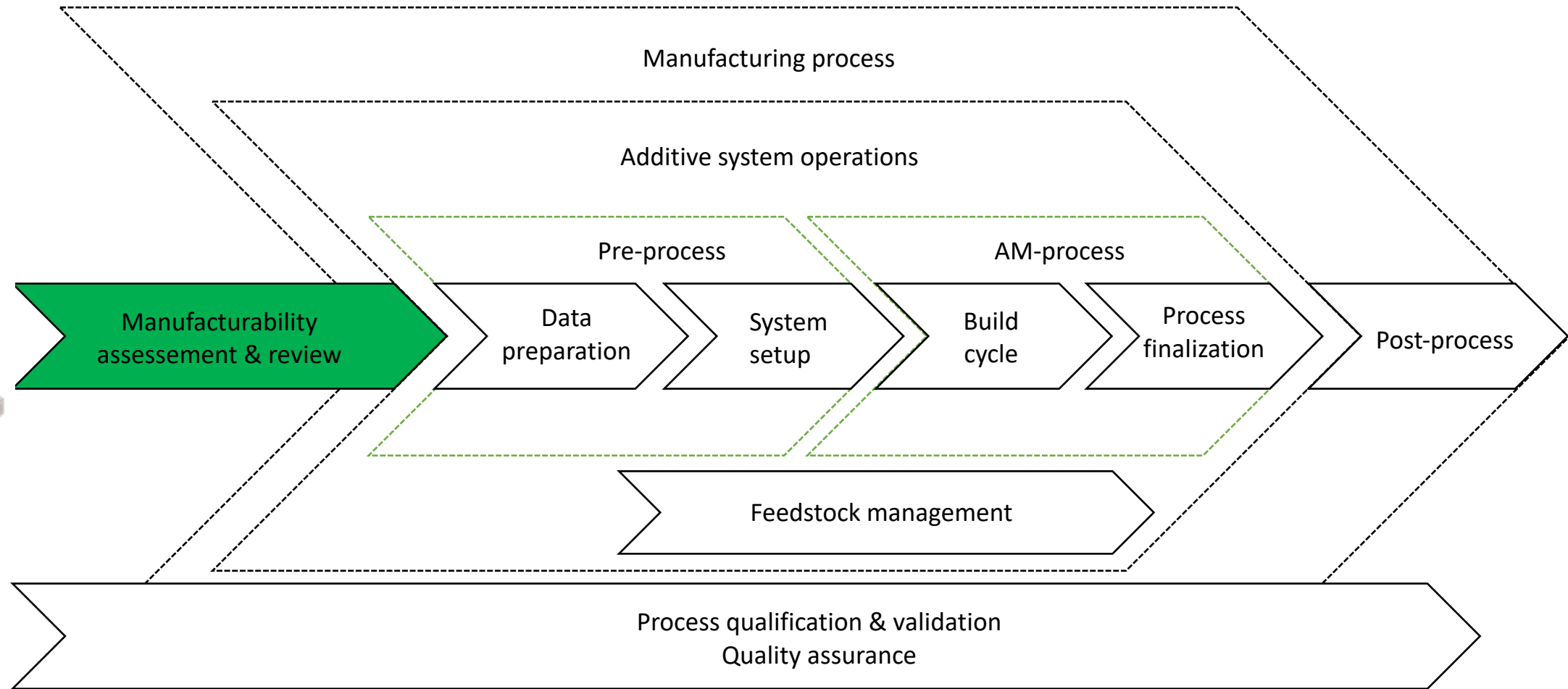
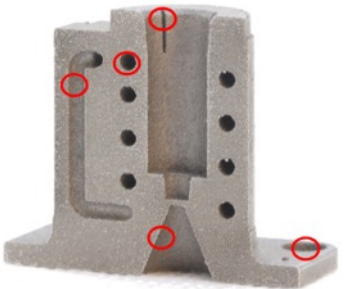


Overview of the responsible roles within a supply chain





The overview of standardised AM processes based on ISO/ASTM 52920:2023

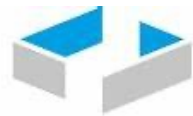




The development and acceptance of the AM Standard



Convener and
Project Manager
of 5 x
**ISO/ASTM
Additive
Manufacturing
Standards**



HOCHSCHULE OSNABRÜCK
UNIVERSITY OF APPLIED SCIENCES





The qualified AM customer groups so far...

Experiences from more than 100 manufacturing sites

Component-specific projects -> Experience with quality-critical component information

Customized + Demand-oriented + Safety-Critical + Highly Complex



ASML



GrOwnValve



How to implement qualified AM?

1. Implement the QMS system + Training



2. Proof of conformity



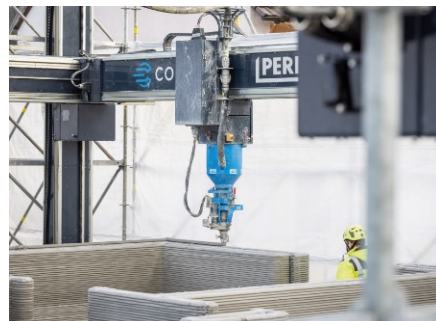
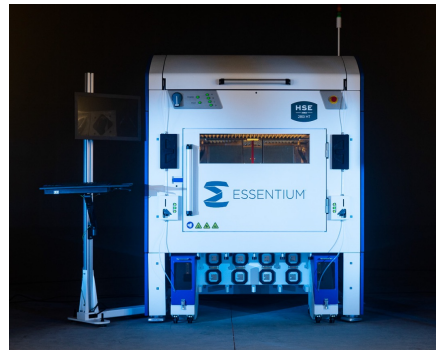
3. Produce + Collect Data + Quantify on demand



ISO/ASTM 52920, 52901, 52904, 52907, 52928, etc..

1. Assessment of Additive Manufacturing System Reproducibility

**AM Design / Primary shaping
has a significant innovation factor**



Exemplary examples and challenges

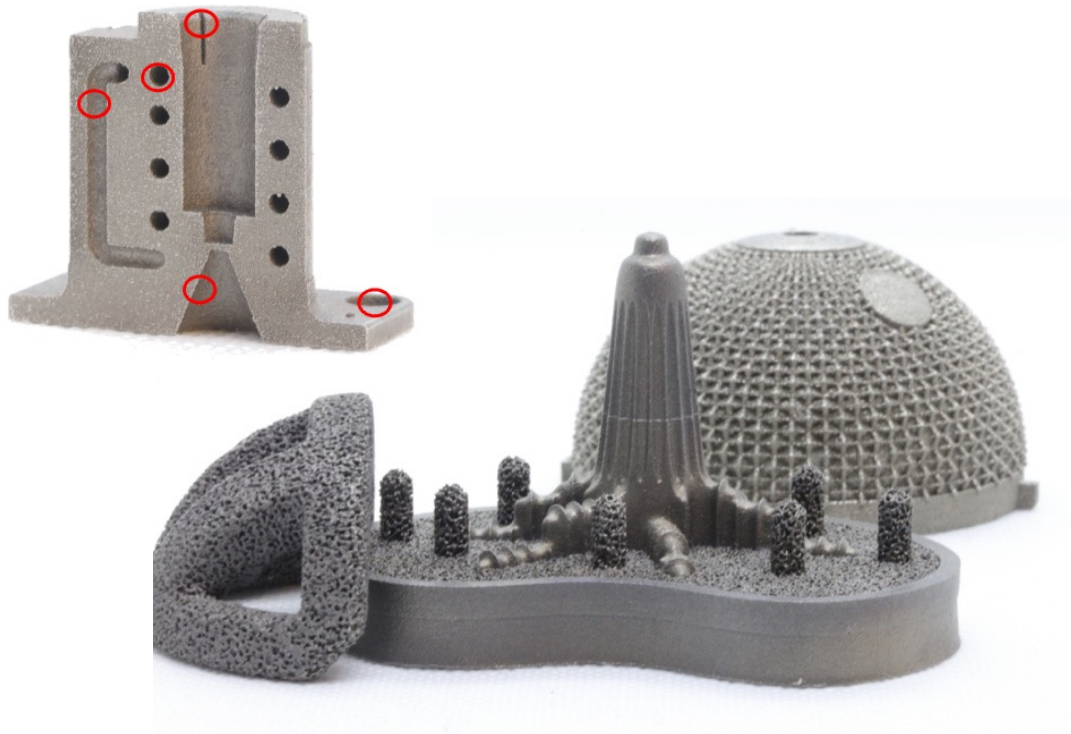
- Material properties develop during the process
- New machine often come without an established IQ procedure
- Complex workflows on the equipment, in the early stage of standardization

Current state of standardization progress:

- Training standards for machine operators and coordinators
- Equipment validation, IQ/OQ/PQ
- Qualification procedures

2. Quality Assurance requirements for component design

Geometric tolerance



Exemplary examples and challenges

- Min. and max. functional part detail accuracy
- Hole diameter and reproducibility
- Min. and max. wall thickness
- Up and -down skin regarding roughness/overexposure
- Long-term behavior (new lattice structure)

Current state of standardization progress:

- Geometries are specified for process validation
- CT scan transfer to simulation data is still often in the research and development stage

3. Quality Assurance requirements for the manufacturing process

Overhang angle-related surface and material properties



Exemplary examples and challenges

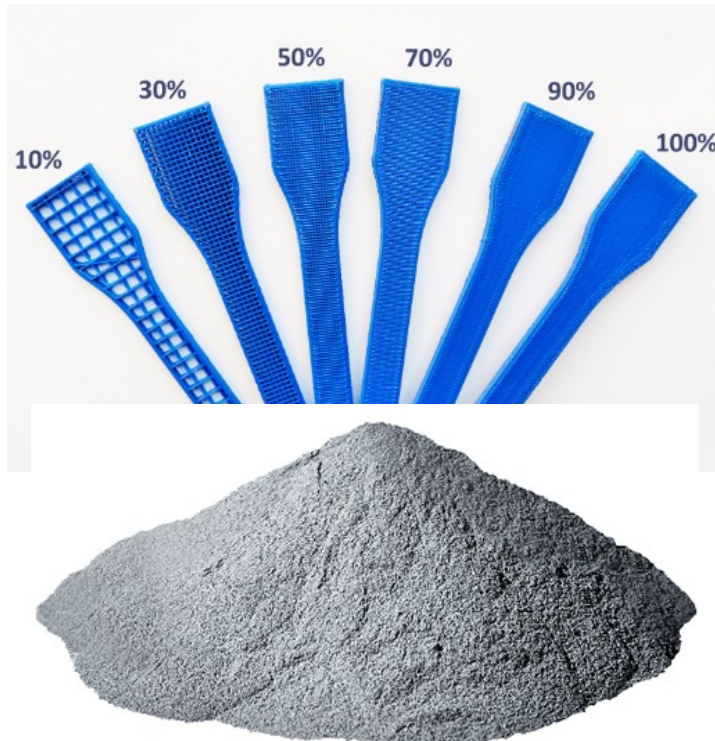
- Up and down skin roughness
- Overexposure
- Junction points
- Freeform shapes
- Positioning (x, y, z) -> Mutual influence
- Nesting
- Support structure geometries

Current state of standardization progress:

- Design for AM standards
- Risk Assessment standards

4. Evaluation of material properties

Mechanical properties



Exemplary examples and challenges

- Orientation/positioning fluctuates
- Direction-dependent material properties
- Anisotropic material properties
- Build process monitoring

Current state of standardization progress:

- ASTM material data sheets
- Additive Manufacturing process standardization
- Rule-setting: makes the difference in transitioning from prototype construction
- Initiative for standardized data sheets



The R&D areas will lead to an AM supported supply chain solutions

1. The definition of part specific QA of the AM process
→ Novel: Structured & standardized methodology to define part specific QA demands
2. AM system & material qualification
→ Novel: Pre-qualified process parameters & materials for a dedicated part group demand
3. Validation of the entire system
→ Novel: Structured process validation methodology
4. The significant portion of digital Quality Assurance factors
→ Novel: Build process monitoring methods

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