

# AM INTERACTION DAYS

Beatriz Lopez, EWF

*Additive Manufacturing Roadmap*



**EU Industry Week**  
2021  
#EUIndustryWeek

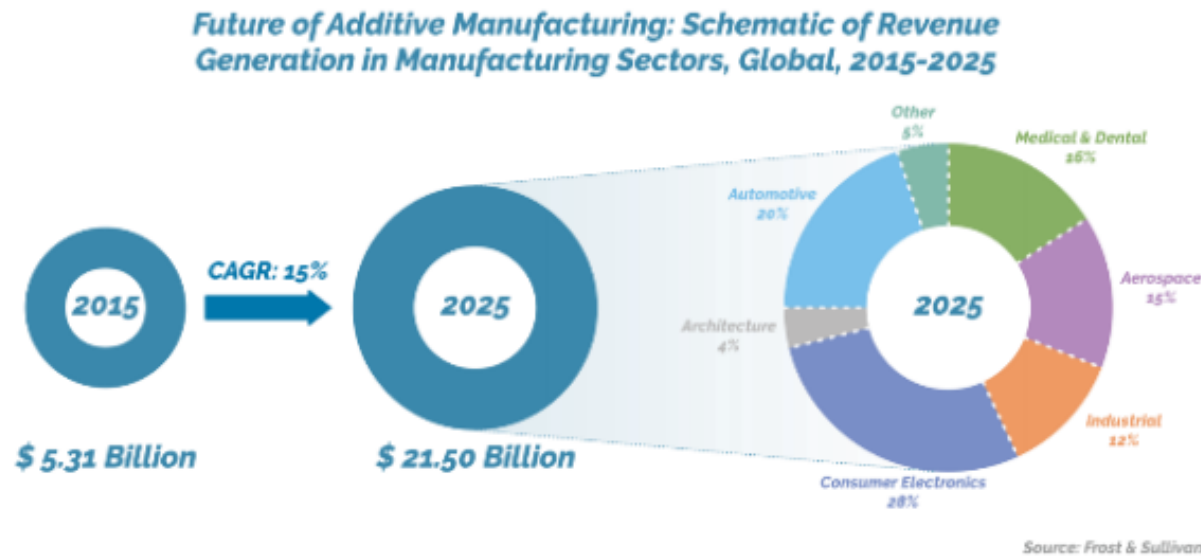


The background features a repeating pattern of pink 3D cubes, each outlined with a dashed yellow border. A large teal rectangle is positioned on the right side of the image, containing the text 'AM Trends' in white.

# AM Trends

# AM Market

ARE YOU—  
**AM**  
— READY?










AM-motion vision for 2030 foresees that **Europe will improve its leading role in Additive Manufacturing**, greatly impacting on the competitiveness of European industrial sectors.



# AM Challenges

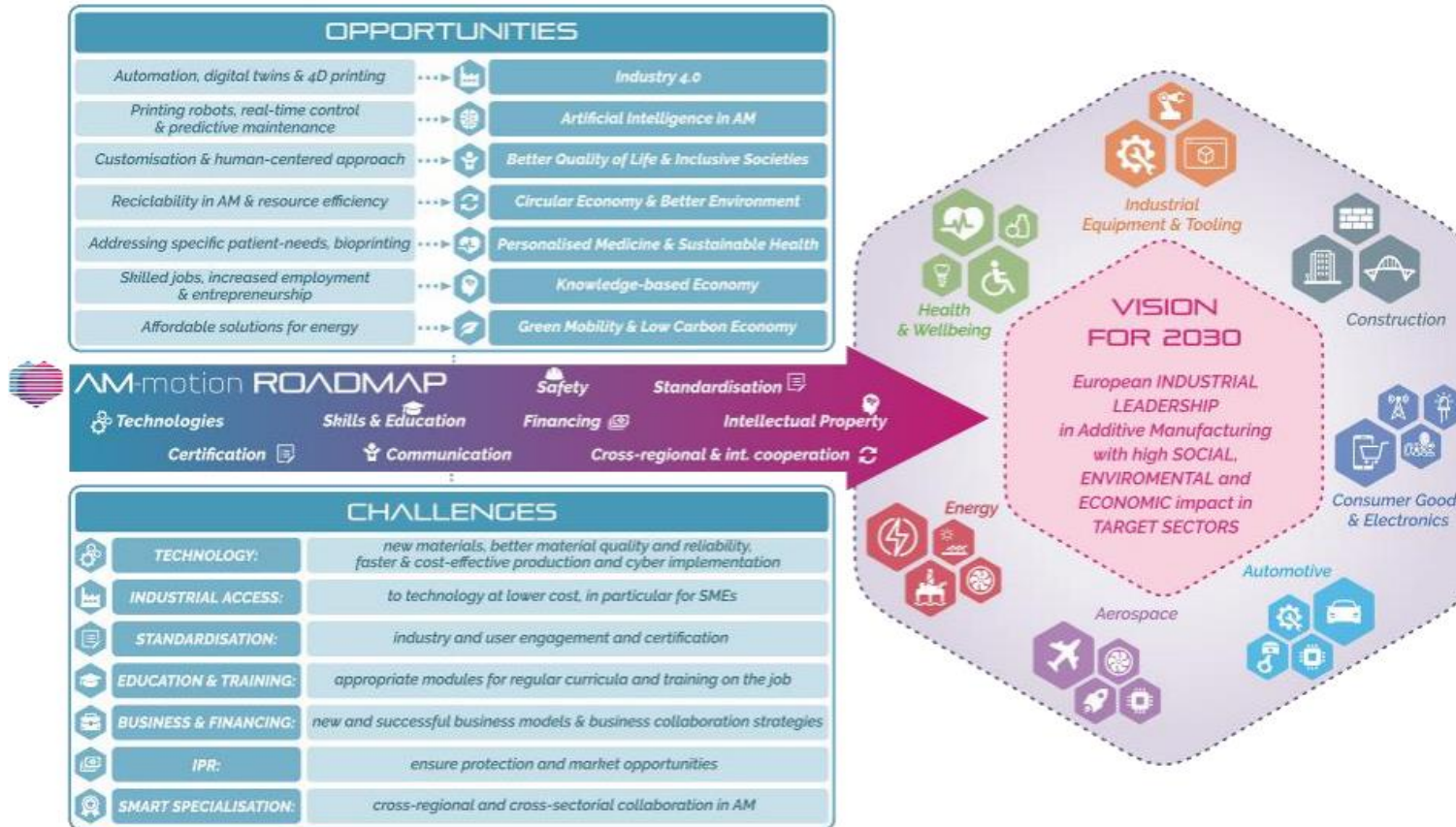
ARE YOU—  
**AM**  
— READY?

Several **technical and non-technical challenges**, which may hinder AM full development and market success must be addressed:

| CHALLENGES  |                                  |  |
|---|----------------------------------|--|
|    | <b>TECHNOLOGY:</b>               | <i>new materials, better material quality and reliability, faster &amp; cost-effective production and cyber implementation</i> |
|    | <b>INDUSTRIAL ACCESS:</b>        | <i>to technology at lower cost, in particular for SMEs</i>   |
|    | <b>STANDARDISATION:</b>          | <i>industry and user engagement and certification</i>  |
|   | <b>EDUCATION &amp; TRAINING:</b> | <i>appropriate modules for regular curricula and training on the job</i>   |
|  | <b>BUSINESS &amp; FINANCING:</b> | <i>new and successful business models &amp; business collaboration strategies</i>  |
|  | <b>IPR:</b>                      | <i>ensure protection and market opportunities</i>  |
|  | <b>SMART SPECIALISATION:</b>     | <i>cross-regional and cross-sectorial collaboration in AM</i>  |

# AM Vision for 2030

ARE YOU—  
**AM**  
— READY?



**AM Roadmap with a common vision** for successful European leadership in additive manufacturing is thus required for supporting **the growth, the innovation and competitiveness of the AM sector**

# Long-term Technological and Industrial Plan

ARE YOU—  
**AM**  
— READY?



Aiming to define a **strategy** for building the fundamental knowledge and actions necessary to **accelerate the design, application and implementation of AM in the market,**

A **long-term technological plan,** which collects the major technological developments foreseen to happen **in the next 10 years** was defined,

By analysing the **common areas/ priorities** of other European initiatives in order to **identify the technological breakthroughs** foreseen to happen until 2030.

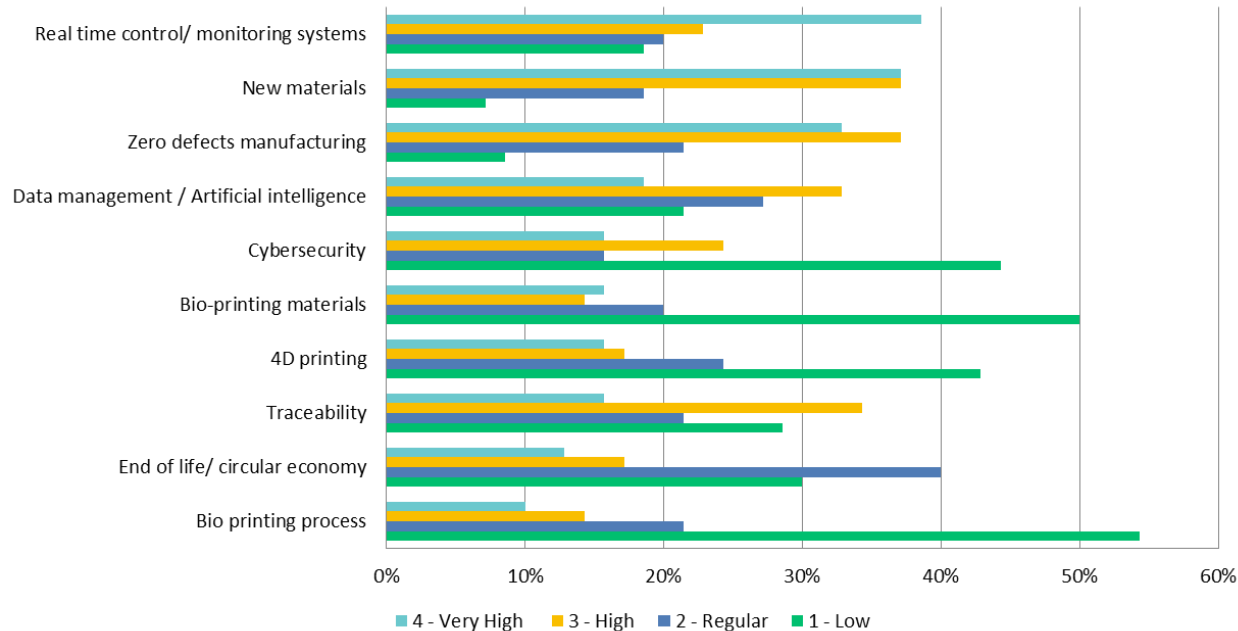


# RTD Identified Needs

ARE YOU—  
**AM**  
— READY?

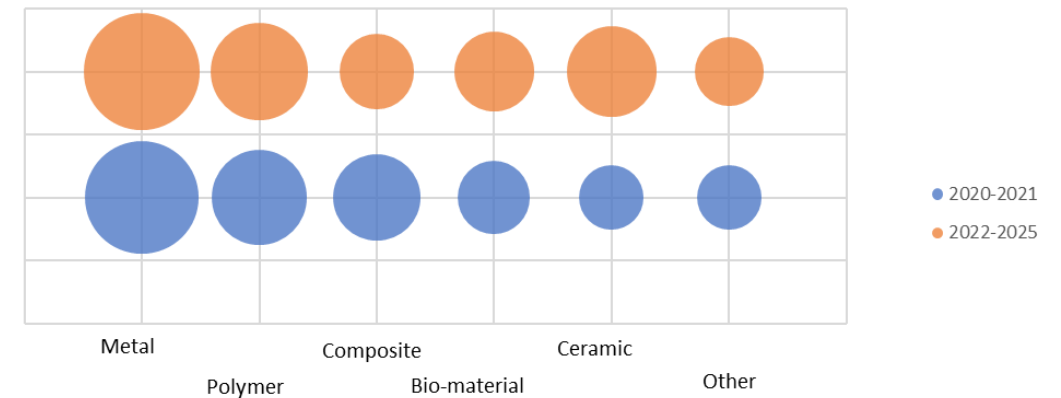


Relevance of different AM technology trends for R&D&I activities for 2020-2021

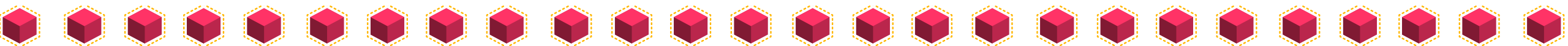


Real time control, new materials, zero defects manufacturing

Relevance of materials in R&D&I activities: 2020-2021 vs. 2022-2025



Metal will continue in top of RTD activities until 2025 followed by polymers



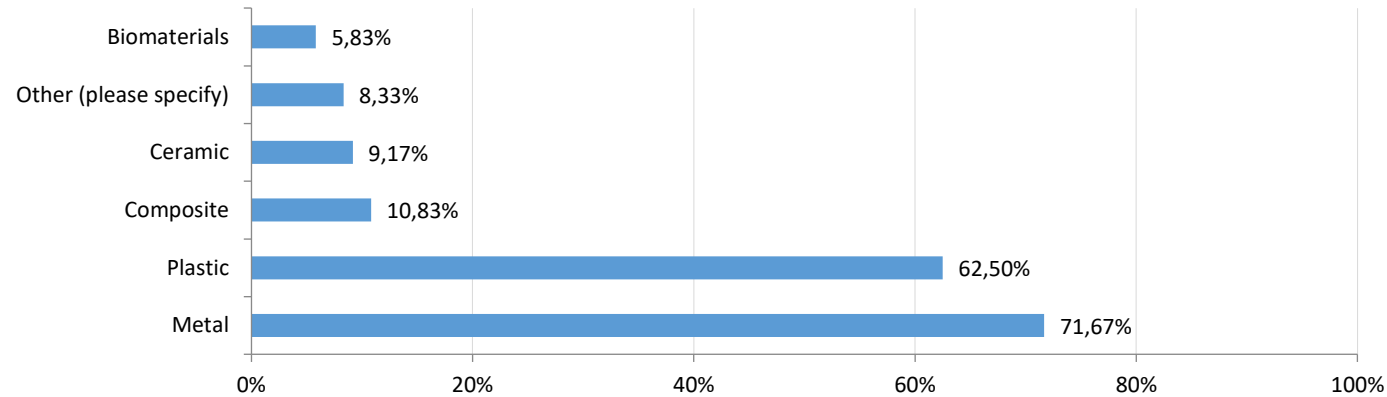


# Industry Validation

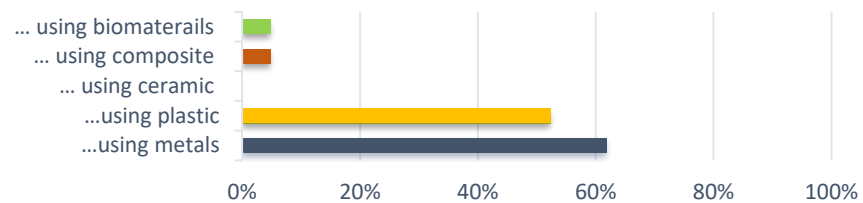
ARE YOU—  
**AM**  
— READY?



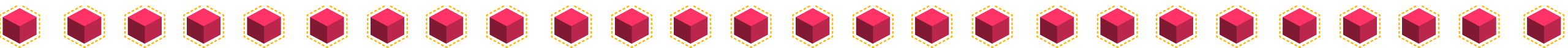
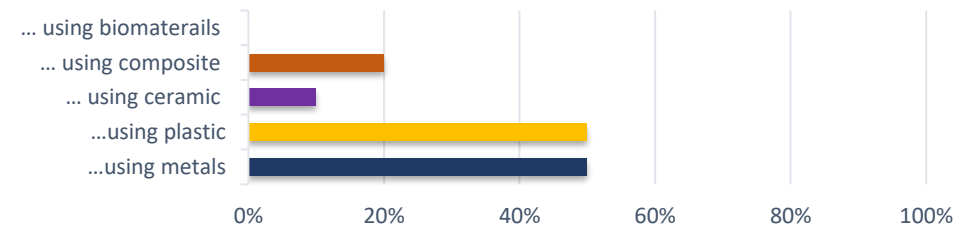
Main AM material used by industrial organisations



Companies dedicated to Aerospace only applying AM



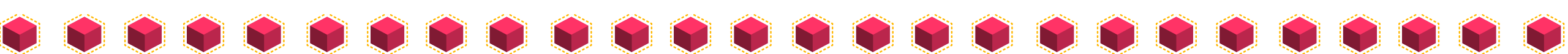
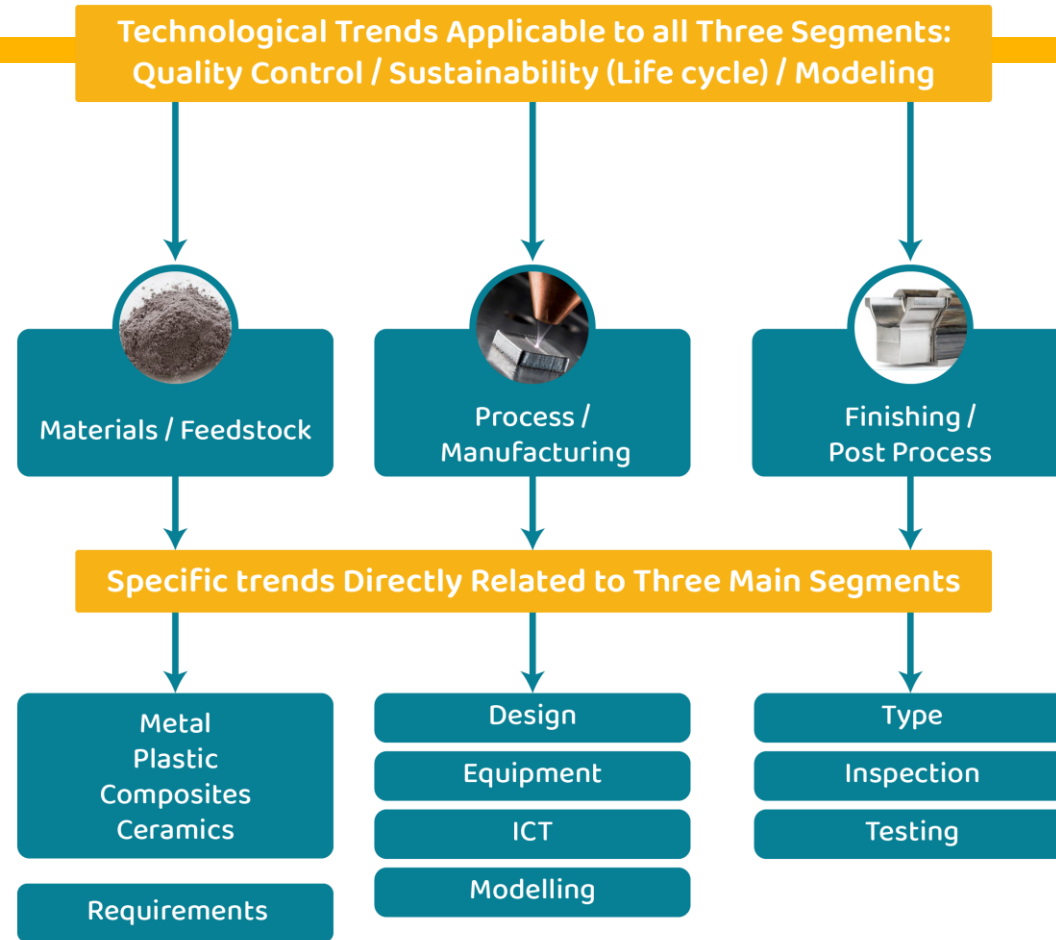
Companies dedicated to Automotive only applying AM





# Industry Validation


ARE YOU—  
**AM**  
— READY?

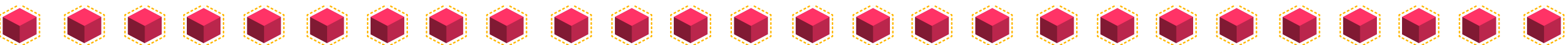


# Technological Trends

ARE YOU—  
**AM**  
— READY?




| <br>MATERIALS |   | Short term 2020 - 2021 |  |  |  | Foresight term 2022 - 2030 |  |  |  |
|--|---|------------------------|--|--|--|----------------------------|--|--|--|
|  | <b>M1</b> Implementation to new applications and products (polymers, metals, composites and ceramics)                                   |                        |  |  |  |                            |  |  |  |
|  | <b>M2</b> Development and standardisation of new materials  |                        |  |  |  |                            |  |  |  |
|  | <b>M3</b> Conventional materials (wires, pellets, sand, wax) for AM applications  |                        |  |  |  |                            |  |  |  |
|  | <b>M4</b> Thermo-mechanical modelling for validation of the mechanical and thermal properties of existing materials and AM technologies |                        |  |  |  |                            |  |  |  |
|  | <b>M5</b> LCA and circular economy  |                        |  |  |  |                            |  |  |  |
|  | <b>M6</b> Fit-for-purpose materials   |                        |  |  |  |                            |  |  |  |
|  | <b>M7</b> Multi-material parts  |                        |  |  |  |                            |  |  |  |
|  | <b>M8</b> Bioprinting (tissue printing)   |                        |  |  |  |                            |  |  |  |
|  | <b>M9</b> Materials for 4D printing (incl. memory shape alloys)   |                        |  |  |  |                            |  |  |  |

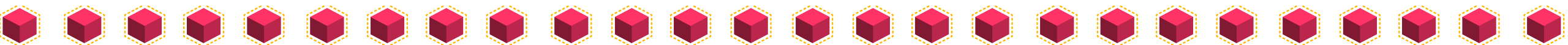


# Technological Trends

ARE YOU—  
**AM**  
— READY?




| <br>PROCESSING |  | Short term 2020 - 2021 |  |  |  | Foresight term 2022 - 2030 |  |  |  |
|---|--|------------------------|--|--|--|----------------------------|--|--|--|
|   | PR1 Software interoperability (all-in-one SW)                                      |                        |  |  |  |                            |  |  |  |
|   | PR2 More agile DfAM development frameworks   |                        |  |  |  |                            |  |  |  |
|   | PR3 Multiscale and multiphysics AM modelling                                       |                        |  |  |  |                            |  |  |  |
|   | PR4 Massive use of desktop and benchtop AM machines                                |                        |  |  |  |                            |  |  |  |
|   | PR5 Faster metal AM machines   |                        |  |  |  |                            |  |  |  |
|   | PR6 New automation concepts at machine level                                       |                        |  |  |  |                            |  |  |  |
|   | PR7 Hybrid machines  |                        |  |  |  |                            |  |  |  |
|   | PR8 AM machines for multi-materials  |                        |  |  |  |                            |  |  |  |
|   | PR9 Multi-functional parts including parts with embedded sensors                   |                        |  |  |  |                            |  |  |  |
|   | PR10 Connected modular printers operated by robots                                 |                        |  |  |  |                            |  |  |  |
|   | PR11 Market uptake of new AM technologies and downfall of existing AM technologies |                        |  |  |  |                            |  |  |  |

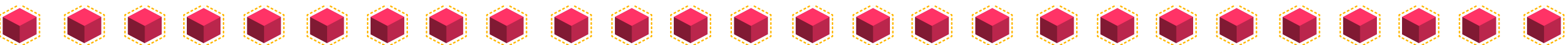


# Technological Trends

ARE YOU—  
**AM**  
— READY?




| <br>POST PROCESSING |  | Short term 2020 - 2021 |  |  |  | Foresight term 2022 - 2030 |  |  |  |
|---|--|------------------------|--|--|--|----------------------------|--|--|--|
|   | <b>PP1</b> Automation of support removal (metal PBF, MEX)                    |                        |  |  |  |                            |  |  |  |
|   | <b>PP2</b> Improved and new heat treatments (sintering, HIP, heat treatment) |                        |  |  |  |                            |  |  |  |
|   | <b>PP3</b> Debinding process   |                        |  |  |  |                            |  |  |  |
|   | <b>PP4</b> Automation of surface finishing                                   |                        |  |  |  |                            |  |  |  |
|   | <b>PP5</b> New surface finishing treatments                                  |                        |  |  |  |                            |  |  |  |
|   | <b>PP6</b> Automation of resin removal (VAT)                                 |                        |  |  |  |                            |  |  |  |
|   | <b>PP7</b> Automation of powder removal (PBF, BJ)                            |                        |  |  |  |                            |  |  |  |
|   | <b>PP8</b> New coating and drying treatments                                 |                        |  |  |  |                            |  |  |  |
|   | <b>PP9</b> Design to minimize post processing                                |                        |  |  |  |                            |  |  |  |
|   | <b>PP10</b> New quality standards  |                        |  |  |  |                            |  |  |  |



# Technological Trends

ARE YOU—  
**AM**  
— READY?



| <br>QUALITY |    | Short term 2020 - 2021           |  |  |  | Foresight term<br>2022 - 2030 |  |  |  |
|--|----|----------------------------------|--|--|--|-------------------------------|--|--|--|
|  | Q1 | Integration of AM in TQM systems |  |  |  |                               |  |  |  |
|  | Q2 | Improved AM-process control      |  |  |  |                               |  |  |  |
|  | Q3 | New inspection techniques        |  |  |  |                               |  |  |  |
|  | Q4 | Digital-twin                     |  |  |  |                               |  |  |  |



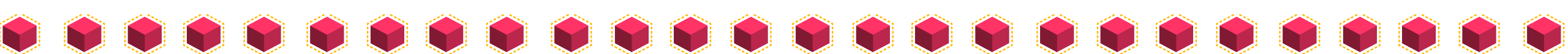
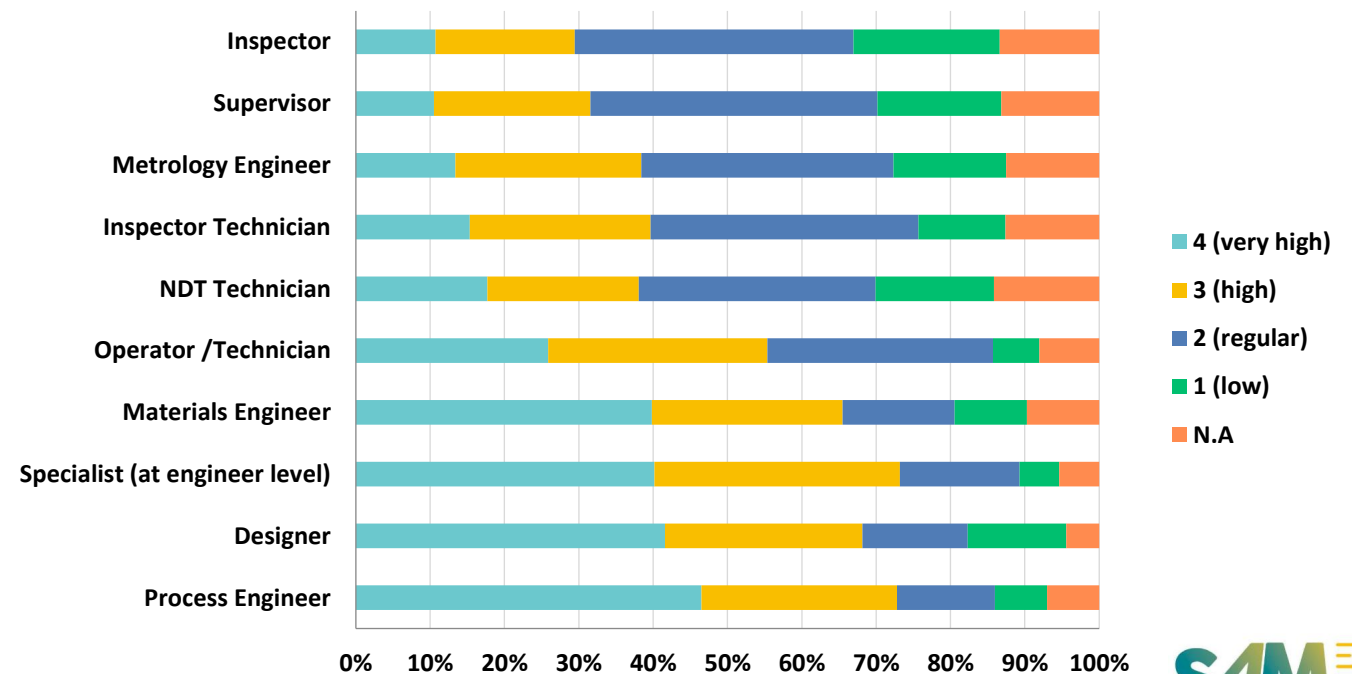
# Non-Technological Trends

ARE YOU—  
**AM**  
— READY?



|                           | Priority Description  |
|---------------------------|---|
| Short Term<br>(2021-2022) | 1. Improving SME access to AM technologies and market through cross-regional cooperation, innovative business models and promotion of effective innovation management approaches  |
|                           | 2. Promoting safety in AM: safety assessment, safety management and guidelines and education on EHS challenges.   |
|                           | 3. Development of educational and training modules both through linking with higher education curricula (engineering, business schools, etc.) and on-the-job training approaches. |
| Med. Term<br>(2023-2027)  | 4. Developing and promoting effective intellectual properties strategies in AM and better awareness of IP issues. Promoting the creation of a suitable IP framework.              |

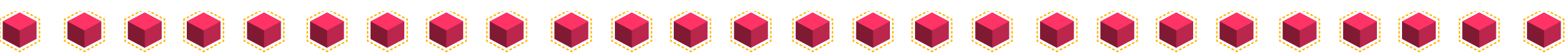
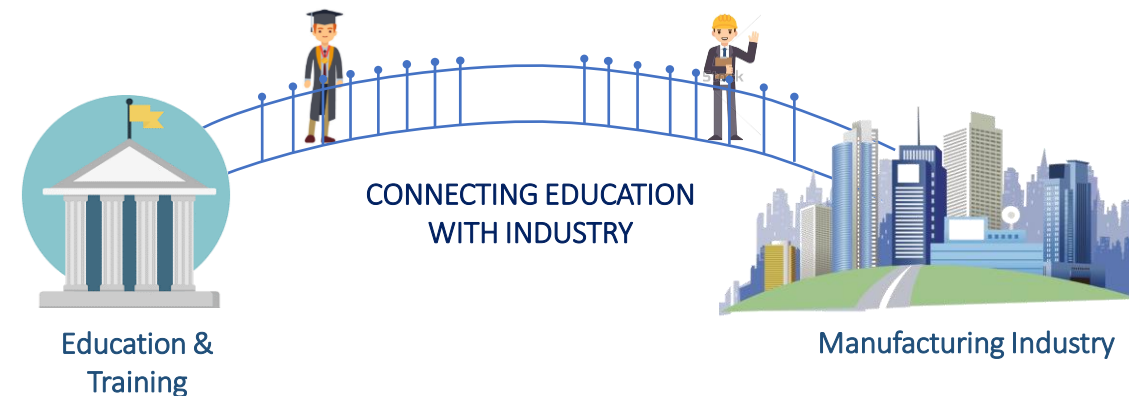
Current relevance of AM professional profiles for industrial organisation activities



# Conclusions

ARE YOU—  
**AM**  
— READY?

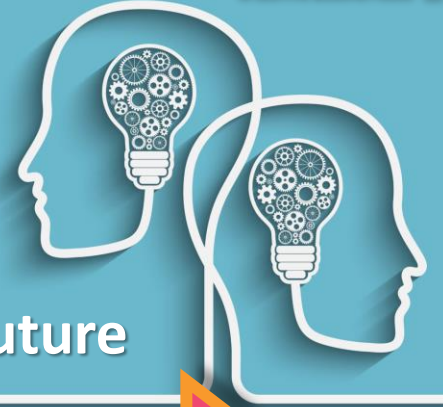
- The identified segments confirmed to be the most required technological breakthroughs at short and long-term;
- Quality in AM appears as the most covered cross-cutting field, indicating the need to address this topic in the future;
- The main future skills defined for AM will be focused on Materials, Processing, Post-processing and Quality;
- The mapping of initiatives in AM are aligned, foreseeing to boost the competitiveness of the manufacturing industry by investing in policies, research and human resources.





The Skills of today ...

... and Skills of the future

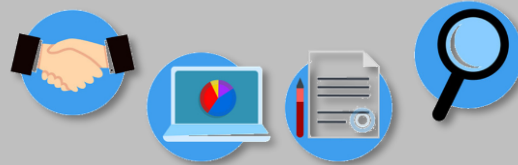


## AM Roadmap

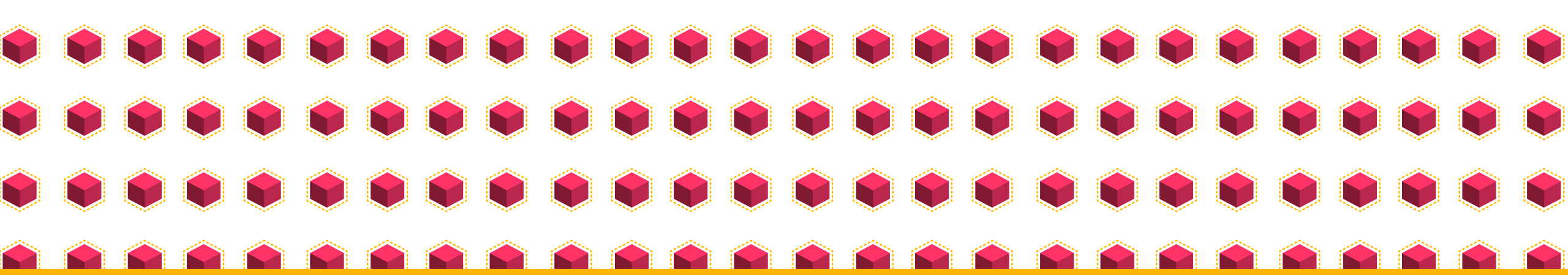
the consequences of a **huge technological transformation** and **continuous evolution** ...

AM adoption support

Services



Implementation



# Thank you!



**EU Industry Week**  
2021  
#EUIndustryWeek

