# EU Market for 3DP Demonstration Equipment and Services – Executive Summary

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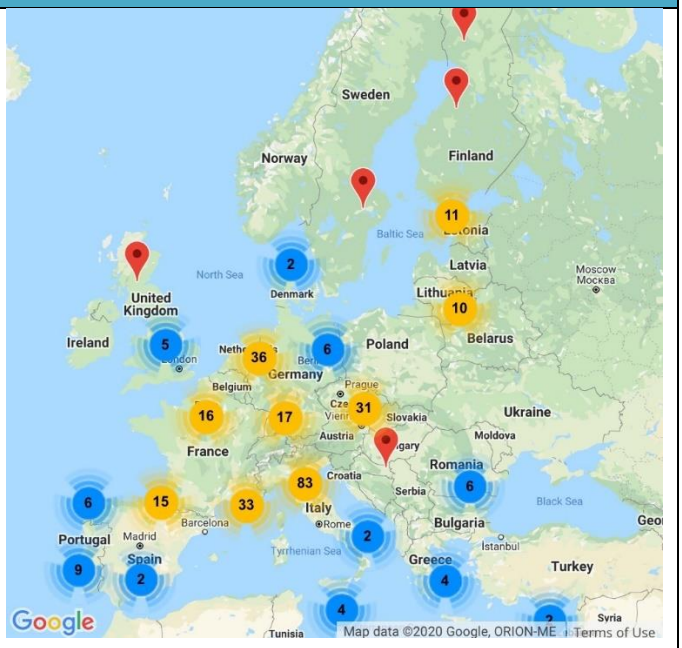
# *Introduction and Context*

This executive summary has been drafted in the context of the **3DP Pan EU Project**[1] and aims at providing a summary of the main results from the report on 'EU Market for 3DP Demonstration Services', which is available in full here. The report aimed at conducting a 'gap analysis' of (demonstration) support services for 3D printing ('3DP'), relying (among others) upon insights derived from the data set complied in the context of the 3DP PAN EU project. More specifically, the report aims at further assessing the alignment of demand and supply of demonstration services now and in the near future as well as to assess how actors providing testing/validations-related services in Europe can, eventually, better serve/anticipate on the needs (current and expected) of the industry.

The core of the report lies on the analysis of the (current and expected) Demand and Supply of **demonstration services**. Such analysis is based on data gathered in the context of the **3DP Pan EU Project** (see table below for a brief overview of the data). To identify and assess current and upcoming industrial trends influencing the demonstration-related activities, the present report starts with a global/overall analysis of the 3D Printing landscape in Europe. Such analysis is based on extensive desk research[2]. Finally, the report concludes with a list of key trends and policy recommendations for an adequate 3D Printing demonstration-services landscape.

*Figure 1: 3DP Pan EU data base – Brief overview*

| **3DP Pan EU Data Base – In a nutshell** | |
|---|---|
| ▸ **380 Facility Centres** (i.e. public or private organisations providing demonstration services (and associated equip.) to SMEs;<br>▸ **1.300 pieces** of Equipment listed and described;<br>▸ 1.**087 services** listed and described;<br>▸ **3.500 searches** between March – October 2020, using available matching tools (i.e. connecting demand and supply of demonstration services). |  |

Below, in the subsequent pages key takeaways from the overall report are presented. Interested readers are invited to consult the full report for further details.

# *Demand Side - Strong dynamism in some segments*

[1] The 3DP Pan EU project is a European Parliament pilot action managed by the European Commission (DG GROW) and implemented by a consortium consisting of Brainport Development, IDEA Consult, ART-ER, CIVITTA and Asterion Europe.

[2] AMFG, (2020), The Additive Manufacturing Landscape Report 2020; EASME (2020). Advanced Technologies for Industry – Product Watch. 3D printing of hybrid components; EASME (2017). Advanced Technologies for Industry – Technology Watch. The disruptive nature of 3D Printing.; Ernst & Young, (2019), 3D printing: hype or game changer?; AM-motion, (2018), AM-motion Roadmap; Wohlers Associates, (2020), Wohlers Report 2020: 3D Printing and Additive Manufacturing - Global State of the Industry

The box below provides a general overview of some **key worldwide trends** that illustrate the extent to which the AM market is increasingly growing.

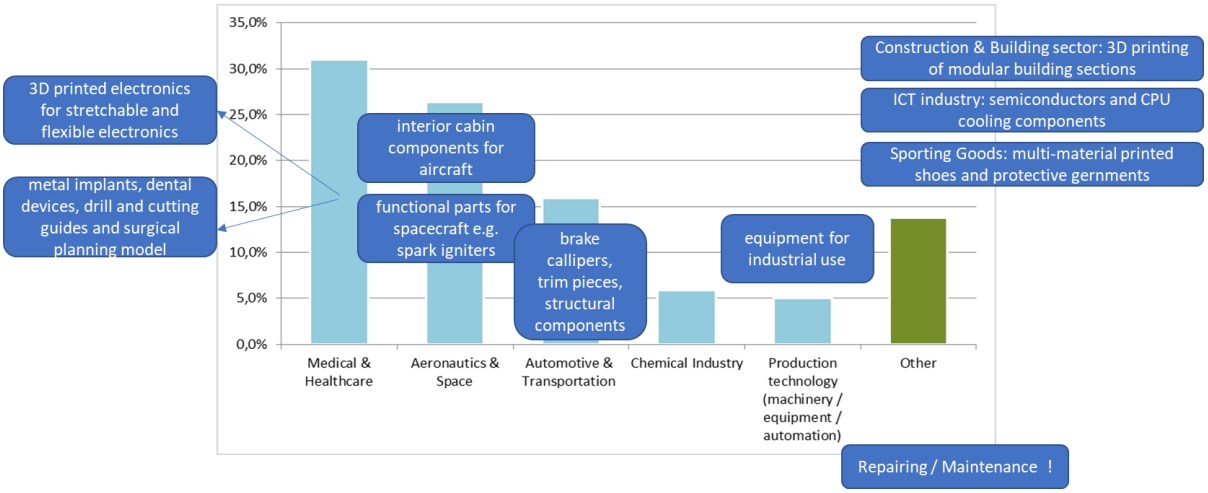
Box 1: The Worldwide AM-market: key trends

| | |
|---|---|
| € | • Revenues for AM Service Providers: +884% from 0,5 to 4,9 billion € (2010-2019)<br>• Total value: x 10, to approach 16 billion € (2019-2029) |
| N° Actors | • Material suppliers: +115% from 71 to 153 (2017-2020)<br>• Manufacturers of industrial systems: +545% from 33 to 213 (2012-2019); 94 in the EU<br>• Overall, EU accounts for 55% of all 'AM' firms, in 2019 |
| N° Printers | • Printers: +474% from 1,4 million to 8,04 million (2018-2027) - forecast<br>• Industrial AM systems: 30k in use in the EU, 20k sold in 2019 (30% by EU companies) |

*Source: IDEA Consult based on AMFG (2020), EASME (2020), EASME (2017), Ernst & Young (2019), AM-motion, (2018), Wohlers Report 2020, SAM (2021), 3DP Pan EU Data*

When looking at **AM current and future applications areas for final products,** as indicated below, the 3DP Pan EU searches made on the 3DP Pan EU platform tend to confirm trends that have been identified through desk researches[3], i.e. demonstration requests were mainly associated to the following sectors: Medical & Healthcare, Aeronautics & Space, Automotive & Transportation, which are sectors where AM is relatively well deployed. However, extensive desk research and industrial expertise enabled to identify 1) new emerging segments/components in the 'traditional' sectors for which 3D printing will be particularly relevant in the future and 2) new sectors where the use of 3D printing will be growing. Such new sectors and segments are highlighted in the figure below and the discussed in the details in the report.

Figure 2: Top 5 sector searches on the 3DP Pan EU Platform, per sector (% of total searches)): a view on upcoming users



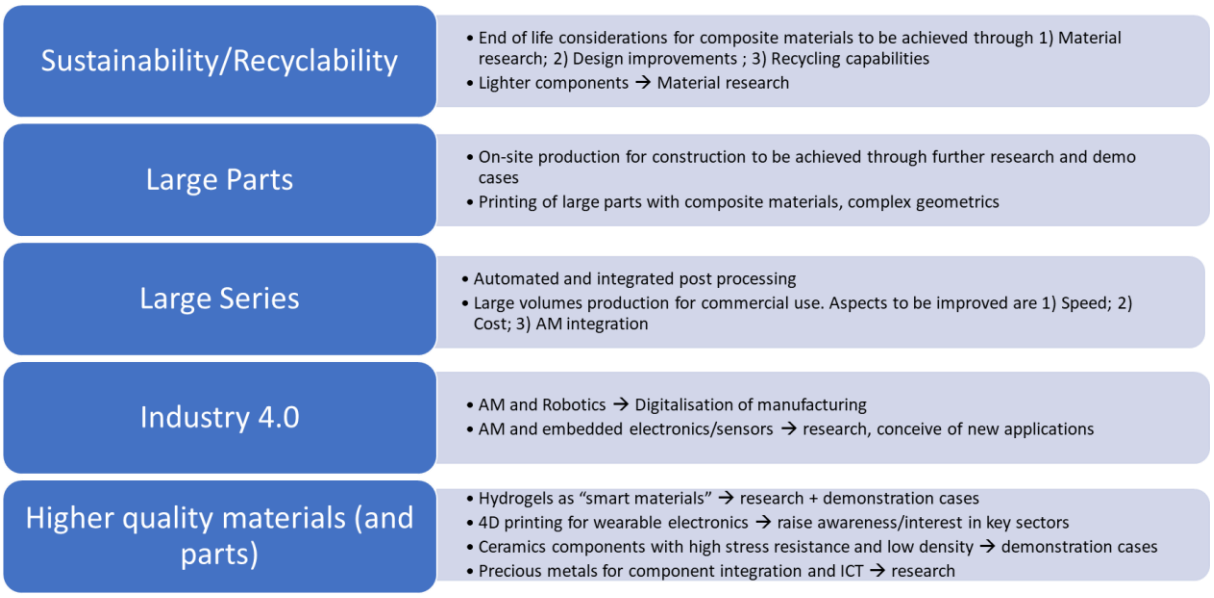

*Source: Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

In terms of **Innovative technologies and processes of 3D Printing** and related demonstration needs, while the proof for where innovations are leading towards in the near future is mainly anecdotal, the figure below provides an overview of 'innovation areas' that will be particularly important in the future. These are 'areas' where the

[3] E.g. Wohlers Associates, (2020), Wohlers Report 2020: 3D Printing and Additive Manufacturing - Global State of the Industry, p. 22.

deployment of innovations is expected in view of strengthening further the position of 3D printing as the key, automated, factory-floor integrator between data and tangible products.

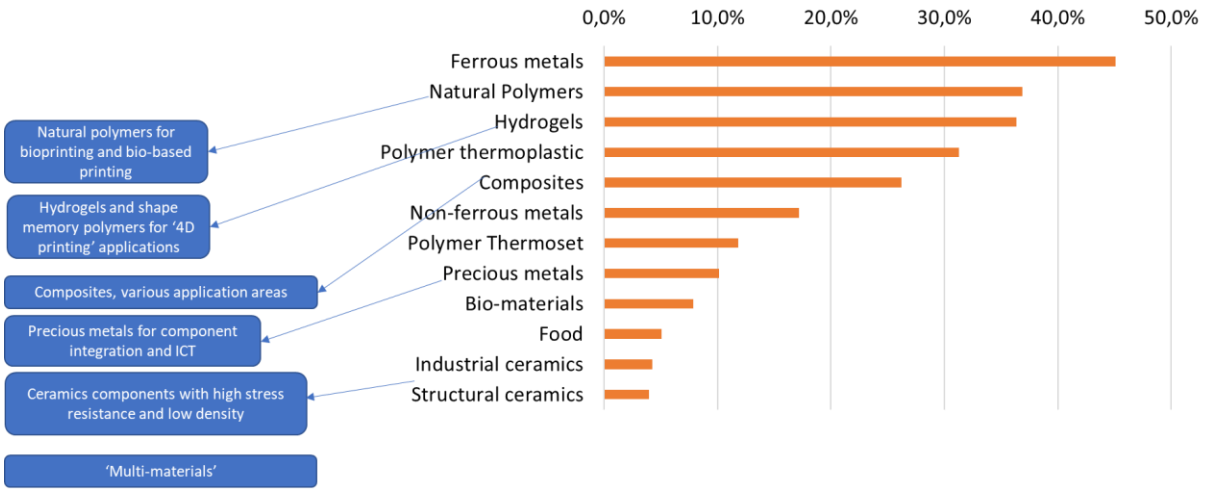
Figure 3: Illustrative list of promising 'innovation areas', where solutions are expected to improve the impact of 3D printing on business outcomes




*Source: IDEA Consult*

When looking in more details at **specific materials** expected to gain in importance, the following figure puts forward the materials that were most often looked for in the 3DP Pan EU Platform (i.e. searches made in % of material-specific searches). This information is complemented by an overview of the materials (and associated applications) that are expected to gain in importance in the coming years. These combinations of materials and applications are detailed in the report.

Figure 4: Searches made in % of material-specific searches and identification of relevant materials-applications in the future

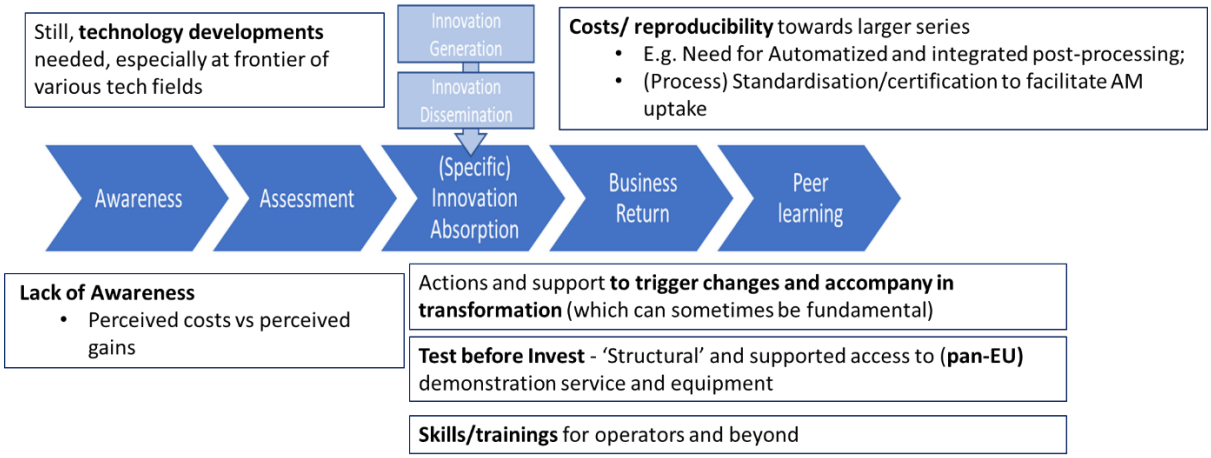



*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021 and Desk Research*

**Some major barriers remain**, however, for further deployment. The figure below presents an overview of main demand-related barriers that do hamper the deployment of 3D printing among SMEs (downstream SMEs, in

particular). These barriers can be associated to various steps in the 'innovation chain' that are necessary for the uptake of innovations. These barriers, among other more technical ones, are discussed more in details in report.

Figure 5: Barriers to uptake 3D printing – A look at downstream SMEs 'innovation chain'




*IDEA Consult, based on DG GROW ADMA project, 2021 and DG GROW 3DP Pan EU project*

## *Supply side - Availability of equipment and services*

The table below provides information about **materials** that are used on the 3D printing equipment of all facility centres registered on the 3DP Pan EU platform. It appears that there is a wide coverage of equipment printing in metal and plastics AM but an overall and relative lack of equipment using materials that will be more and more important in the future: Hydrogels; Precious metals for ICT; Composites – Ceramics.

Figure 6: Number of equipment registered on 3DP PAN EU platform working with different materials and % of the total number of equipment in a country

| | Italy | Spain | Belgium | France | Germany | The Netherlands | EU Total |
|---|---|---|---|---|---|---|---|
| **Polymer thermoplastic** | 157 (43,3%) | 89 (57,4%) | 37 (40,2%) | 34 (42,5%) | 16 (20%) | 57 (50%) | 529 (45,6%) |
| **Non-ferrous metals** | 56 (15,4%) | 40 (25,8%) | 39 (42,4%) | 32 (40%) | 9 (11,3%) | 16 (14%) | 263 (22,7%) |
| **Ferrous metals** | 46 (12,7%) | 27 (17,4%) | 32 (34,8%) | 38 (47,5%) | 28 (35%) | 14 (12,3%) | 244 (22,1%) |
| **Polymer Thermoset** | 19 (5,2%) | 18 (11,6%) | 26 (28,3%) | 24 (30%) | 5 (6,3%) | 19 (16,7%) | 124 (10,7%) |
| **Bio-materials** | 60 (16,5%) | 8 (5,2%) | 3 (3,3%) | 5 (6,3%) | 10 (12,5%) | 1 (0,9%) | 115 (9,9%) |
| **Composites** | 55 (15,2%) | 18 (11,6%) | 13 (14,1%) | 0 | 2 (2,5%) | 3 (2,6%) | 115 (9,9%) |
| **Industrial ceramics** | 48 (13,2%) | 18 (11,6%) | 7 (7,6%) | 4 (5%) | 4 (5%) | 14 (12,3%) | 103 (8,9%) |
| **Structural ceramics** | 29 (8%) | 5 (3,2%) | 8 (8,7%) | 1 (1,3%) | 11 (13,8%) | 0 | 65 (5,6%) |
| **Natural Polymers** | 25 (6,9%) | 11 (7,1%) | 9 (9,8%) | 0 | 4 (5%) | 2 (1,8%) | 58 (5%) |
| **Food** | 20 (5,5%) | 0 | 0 | 0 | 0 | 0 | 20 (1,7%) |
| **Precious metals** | 3 (0,8%) | 3 (1,9%) | 3 (3,3%) | 0 | 0 | 2 (1,8%) | 16 (1,4%) |
| **Hydrogels** | 2 (0,6%) | 0 | 0 | 0 | 0 | 0 | 2 (0,2%) |

*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

The following table illustrates what materials facility centres are able to work with per sector. As an example on how to read the table, it indicates that of all the equipment registered on the platform that manufacturers parts for the Aeronautics and Space sector, 1,8% are capable of producing parts made out of bio-materials. Globally, rather similar trends across sectoral uses can be pointed out.

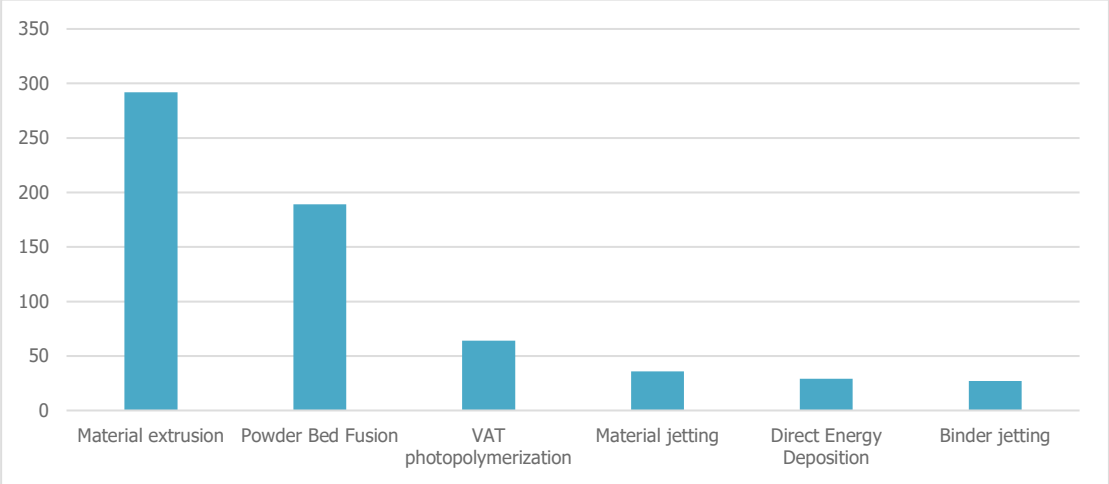
Figure 7: Materials use per sector by facility centres registered on the 3DP PAN EU Platform (in % of the total FCs)

| | Bio-materials | Composites | Ferrous metals | Hydrogels | Industrial ceramics | Natural Polymers | Non-ferrous metals | Polymer thermoplastic | Polymer Thermoset | Precious metals | Structural ceramics | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aeronautics & Space | 1,8% | 3,4% | 18,4% | 0,1% | 1,0% | 4,0% | 20,7% | 17,3% | 14,8% | 8,0% | 2,7% | 5,6% |
| Automotive & Transportation (excluding ships and boats) | 4,9% | 11,0% | 17,5% | 0,2% | 1,9% | 2,0% | 17,3% | 17,7% | 14,0% | 0,9% | 0,7% | 7,2% |
| Chemical Industry | 5,7% | 5,3% | 20,1% | 1,3% | 9,1% | 2,2% | 21,1% | 17,0% | 8,2% | 0,0% | 7,2% | 0,0% |
| Construction & Building sector | 3,6% | 7,3% | 5,1% | 0,0% | 9,3% | 9,7% | 13,6% | 17,2% | 16,5% | 0,1% | 3,4% | 13,3% |
| Consumer Goods & Products (excluding sporting goods, textile and furniture) | 3,6% | 17,9% | 14,8% | 0,3% | 0,9% | 3,8% | 15,0% | 22,2% | 11,9% | 0,5% | 0,0% | 5,2% |
| Energy | 2,8% | 3,8% | 22,6% | 0,0% | 6,8% | 3,1% | 23,1% | 11,1% | 8,0% | 0,7% | 3,1% | 7,1% |
| Environment | 21,4% | 14,3% | 0,0% | 3,6% | 0,0% | 17,9% | 10,7% | 10,7% | 3,6% | 0,0% | 0,0% | 14,3% |
| Food | 0,1% | 0,0% | 20,0% | 0,1% | 0,0% | 0,0% | 19,9% | 20,0% | 20,0% | 19,9% | 0,0% | 0,0% |
| Furniture | 5,1% | 14,3% | 4,1% | 0,0% | 1,0% | 9,2% | 6,1% | 20,4% | 5,1% | 0,0% | 1,0% | 18,4% |
| ICT industry (including electronics, computer and communication related products) | 11,6% | 11,6% | 7,1% | 0,0% | 1,6% | 3,9% | 6,1% | 19,7% | 18,7% | 1,0% | 0,8% | 14,0% |
| Measurement | 4,5% | 1,1% | 3,4% | 2,2% | 43,8% | 3,4% | 2,2% | 6,7% | 4,5% | 2,2% | 5,6% | 16,9% |
| Medical & Healthcare | 2,7% | 3,4% | 19,6% | 0,3% | 0,9% | 1,9% | 19,8% | 18,7% | 13,7% | 11,4% | 1,2% | 2,4% |
| Production technology (machinery / equipment / automation) | 2,9% | 4,1% | 21,2% | 0,0% | 2,8% | 0,8% | 19,2% | 17,6% | 14,2% | 8,2% | 3,1% | 3,3% |
| Ships and Boats | 0,6% | 0,8% | 0,5% | 0,0% | 0,5% | 19,0% | 18,5% | 19,3% | 18,8% | 0,3% | 0,0% | 19,7% |
| Sporting Goods | 0,5% | 19,1% | 18,1% | 0,0% | 0,0% | 0,5% | 12,6% | 20,0% | 16,3% | 0,0% | 1,9% | 0,5% |
| Textile & Fashion | 13,6% | 16,1% | 1,6% | 0,0% | 1,9% | 4,7% | 2,8% | 19,0% | 28,5% | 0,0% | 0,6% | 11,1% |

*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

The following figure provides an overview of what **technologies** the facility centres having registered their equipment on the platform apply within additive manufacturing. Material extrusion (mainly plastics based) and powder bed fusion (for metal AM) are the technologies within additive manufacturing that the highest share of equipment performs (45,5%).

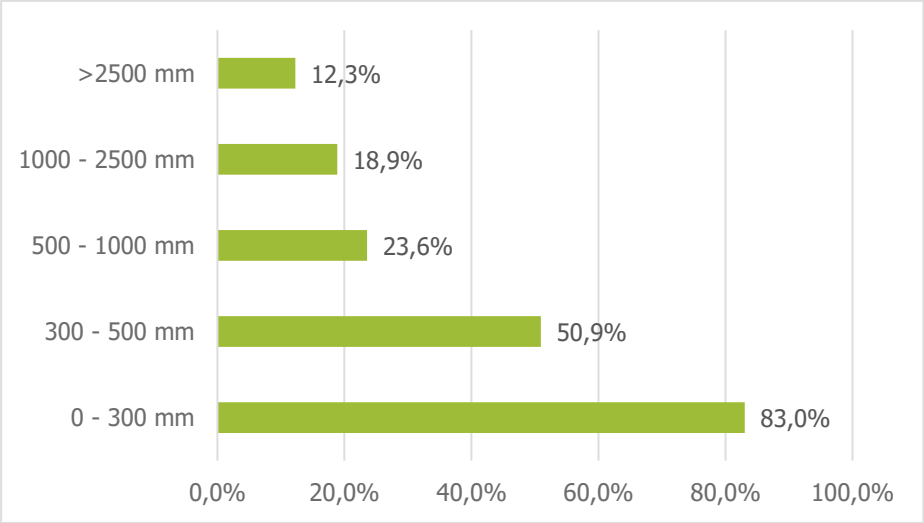
Figure 8: Equipment registered on the 3DP PAN EU platform per AM technology used



*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

Of the facility centres having indicated what **size** parts they are able to produce, 83% indicated to be able to manufacture small parts between 0 and 300mm. As larger parts require larger printers, larger facilities and oftentimes bigger investments, only 12 facility centres with a total of 97 printers and AM systems in Europe are able to manufacture large parts above 2.5m.

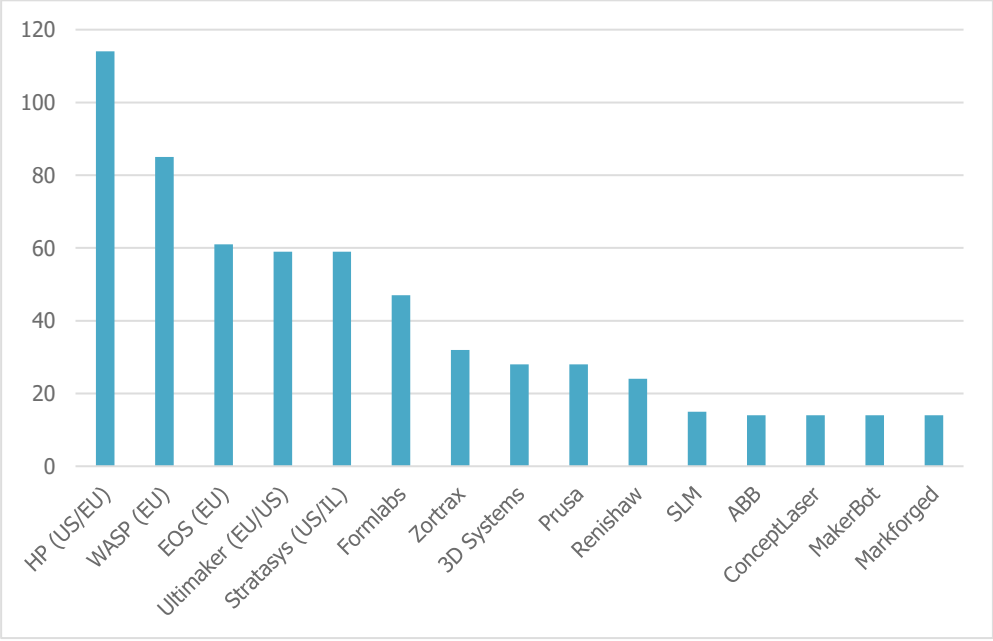
Figure 9: Component size capabilities of facility centres in EU




*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

Over 1300 pieces of equipment have been registered by facility centres on the 3DP PAN EU Platform. **The top 15 brands** represented make up 60% of all represented brands, of which there are over 160. Facility centres indicated the specific brand of their equipment for 1000 out of over 1300 registered pieces of equipment. The top 3 brands of AM equipment registered on the platform are HP, WASP and EOS.

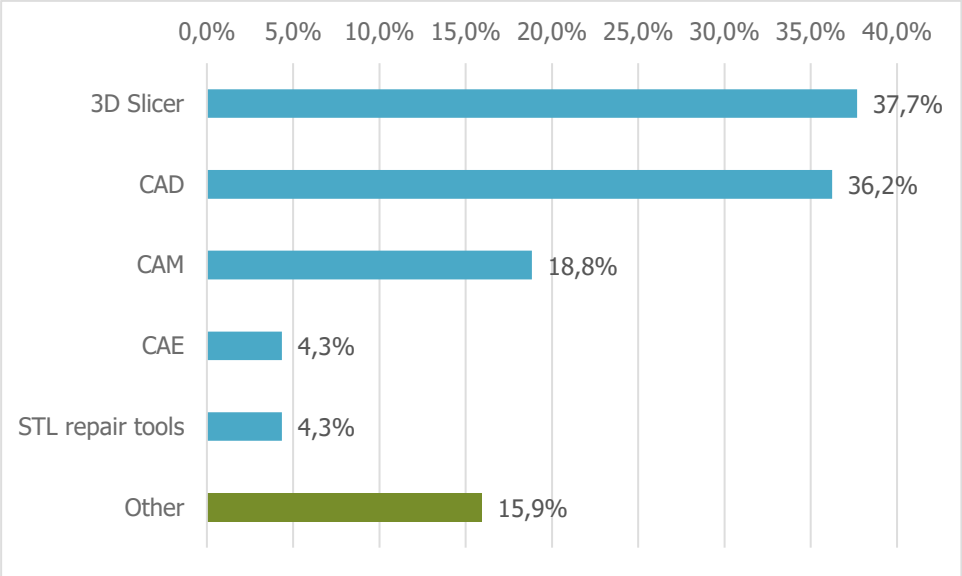
*Figure 10: Top 15 brands of AM equipment registered on the 3DP PAN EU platform*




*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

The **software** that is most used on the equipment is 3D Slicer, used by 37,7% of the 69 registered facility centres having provided information on the software their equipment runs on. A lack of appropriate coverage for Advanced Materials can be pointed out.

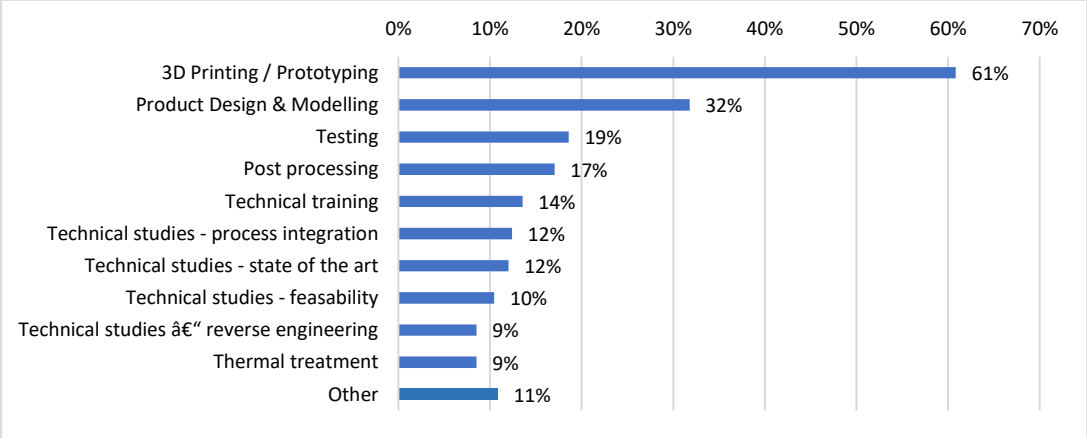
Figure 11 Main software used by facility centres registered on the 3DP PAN EU platform




*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

The 3DP PAN EU Platform counting 381 Facility Centres in October 2020 gives access to a range of **technical services** to all relevant sectors who potentially benefit from AM technologies.

Figure 12: Top 10 services offered by facility centres




*Source: IDEA Consult, based on 3DP PAN EU Platform data, 2021*

Country-specific insights show that relatively more facility centres in Spain are active in automotive & transportation and aeronautics and space, which is aligned with the sector-specific equipment use in the country detailed in the report. France is also relatively more active in these sectors than in others. Activities in German facility centres are relatively more spread out across different industries. In general, however the provided services logically follow the trend of the equipment distribution in the top six countries.

# *Matching Demand and Supply – Gaps*

The figure below provides the generic conclusions based on confronting demand and supply for demonstraton services.

Figure 13: Overall and generic conclusions


More specifically, when looking at the matching between the expected/upcoming demand and supply of demonstration services and the possible gaps that might require corrective (policy) actions. Such analysis is based on the following steps:

1. First, we have identified (relying upon insights from chapters 1-3) some key 'trends' that will characterise the demand for 3D Printing solutions and, in particular, the associated needs in terms of demonstration services. These trends are grouped according to several key categories:
    - Specific future application areas for final products;
    - Production scale (both in component size and batch size) and finishing;
    - Material/applications areas;
    - Technical/technological combinations and segments;
    - Non-technological demonstration services;
    - Ecosystem(s).

    Trends in every of these categories have been identified and selected based on evidences presented in the report, including analysis of the 3DP Pan EU data.
2. Second, an assessment of the expected 'ability' of the EU 'supply side' (i.e. demonstration service providers: facility centres) to address/to cover these emerging needs is provided. Such assessment is based on the current and anticipated EU expertise and capabilities based on the insights gathered through, among others, analysis for the 3DP Pan EU data. Overall, for each expected, trend, two distinct qualitative assessment are proposed:
    a. The equipment/expertise/services and innovation support do seem to already gradually adapt to the trends and are filling in the gaps, without important corrective actions needed;

    *Or*

    b. The equipment/expertise/services and innovation support do not seem to gradually adapt to the trends and corrective actions are needed.

The table below presents the results.

Figure 14: Anticipated demonstration gaps

| **Identified EU-relevant trends in terms of demand of (demonstration) services** | | **Readiness (TRL / IRL)** | **EU Demonstration Expertise and Equipment - A preliminary assessment** | |
|---|---|---|---|---|
| Categories | Key Upcoming Trends | *Higher TRL level reached*[4] | Gaps, but developments on track | Gaps, corrective/supportive policy-actions needed |
| Specific future application areas for final products | Automotive & Transportation (excluding ships and boats): brake callipers, trim pieces, structural components | *8* | x | |
| | Medical & Healthcare: metal implants, dental devices, drill and cutting guides and surgical planning model | *6* | | x |
| | Medical & Healthcare: bioprinting of living tissue | *3* | | x |
| | Medical & Healthcare / sporting goods: 3D printed electronics for stretchable and flexible electronics | *7* | x | |
| | Production technology: equipment for industrial use | *8* | x | |
| | Aeronautics & Space: interior cabin components for aircraft *(relevant to some EU countries only)* | *8* | x | |
| | Aeronautics & Space: functional parts for spacecraft e.g. spark igniters *(relevant to some EU countries only)* | *7* | | x |
| | Construction & Building sector: 3D printing of modular building sections | *8* | x | |
| | ICT industry (including electronics, computer and communication related products): semiconductors and CPU cooling components | *4* | x | x |
| | Sporting Goods: multi-material printed shoes and protective gernments | *9* | x | |
| | Food: edibles for space exploration and vitamin delivery to the elderly | *4* | x | |
| Production scale and finishing | Automatized and integrated post-processing | *6* | | x |
| | Large volume 3D printing for commercial use | *7* | x | |
| Material/applications areas | Multimaterials for all applications and sectors | *7* | | x |
| | Precious metals for ICT industry | *6* | | x |
| | Ceramics for components with high stress resistance and low density | *8* | | ? |
| | Composite materials for all applications and sectors | *7* | x | |
| | Biomaterials for various applications and sectors | *7* | x | |
| | Hydrogels (and shape memory polymers) for various applications and sectors (incl. '4D printing' applications) | *4* | | x |
| Technical/technological combination | Recyclability/energy savings properties in AM | *n/a* | | x |
| | Establishing ICT/AI/AM integration | *n/a* | x | x |

[4] This provides an assessment of the current technology readiness level of the identified trend (i.e. higher TRL level that is currently reached in the EU).

| | | | | |
|---|---|---|---|---|
| s and segments | Establishing IOT/AM integration | *n/a* | x | x |
| | Increased circularity measures in AM | *n/a* | | x |
| Non-technological demonstration services | Skills/training | *n/a* | | x |
| | Standardisation/certification to facilitate AM uptake | *n/a* | | x |
| | Raising awareness of AM possibilities industry-wide | *n/a* | | x |
| | Energy-savings / Circularity-related measures and knowledge in AM (end of life, etc.) | *n/a* | | x |
| Ecosystem(s) | Creating synergies between tech/industrial communities (multisided 'platforms'/integration) | *n/a* | | x |
| | Intersectoral and interregional AM collaborations/synergies for brain-gain and critical mass | *n/a* | | x |

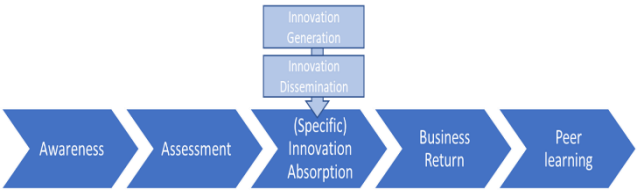
## *Matching Demand and Supply – Recommendations*

Relying upon the gaps identified and presented in the report, we provide below a list of recommendations.

More 'bottom up' and challenges-based actions/activities at EU level should be undertaken to **raise awareness and trigger changes**. The following actions are recommended:

- To support the generation and implementation of activities and events where SMEs could be inspired by e.g. counterparts' testimonials having implemented/taken up AM solutions and realised breakthroughs. Such 'awareness raising' activities can be done more efficiently when relying upon a 'cross regional' / EU coverage, in order to reach critical mass and enable SMEs being inspired by 'comparable but less competing' peers and being able to find the most inspiring, and often not known, cases outside of their own region. Clusters/industrial associations could play a key role in implementing such 'Pan-EU' awareness raising activities. 'Euroclusters' Calls is an instrument that could be activated in this context (however, AM is not one of targeted 'Strands', so it might hamper the deployment of AM-related activities in this context).
- Incentivise and facilitate 'series production' by additive manufacturing in the automotive industry through Europe-wide studies on the state of the market and demonstration cases (portfolio of best practices) comparing subtractive manufacturing with additive manufacturing. As AM is the most mature in Europe in the automotive industry, this would create ripple effects across other industries. Such study can then propose a repository of best practices, illustrating concretely cases of AM-series production.

A step further in the 'innovation sequence', once made aware of the possible benefits of AM, SMEs lack of support in terms of '**initial technical guidance'**, which would enable to go from a wide range of possible solutions up to a specific identified solution and the steps towards actual uptake of that solution. This is to address a gap between 'awareness' and 'the actual design of innovation projects' (i.e. at the level of 'Assessment' in the figure above): many SMEs still need technical guidance for identifying relevant solutions, which can then be taken up in a proper innovation project. SMEs do need to have a facilitated access to support by 'advisors or coaches' able to provide guidance on the best solutions taking into account the SME peculiarities.




- Relying upon advantages offered by cross regional initiatives (critical mass, 'competition' on the supply side of demonstration services, etc.), a dedicated initiative and support could be launched to facilitate organisation of 'challenges-solutions' sequences of activities and events, across various regions. Such support would facilitate the organisation of events where rather 'unspecified (from a technical point of view) needs' are translated into specific solutions (generating proper innovation projects) based on an SME-Facility Centres cooperation facilitated by clusters. Based on this, innovation projects can then be designed and funded (incl. through private funding). At this stage, this aspect was/is addressed in funded EU projects (e.g. the Horizon 2020 Innosup-01 funded projects). However, the approach is often too 'technology push' and focuses on a rather narrow technological scope while it is important to depart from SMEs challenges and have at disposal a very wide and activable supply of solutions. The Vanguard Initiative intends to investigate in the future the

organisation of such 'sequences'/events, relying upon existing best practices, but the implantation of this would require additional support from regional and/or EU initiatives.

When looking at the availability of demonstration equipment and services, as demonstrated throughout the report, there is a growingly adequate 'national'/regional supply of 3DP demonstration services/equipment for 'standard'/usual requests (in terms of materials, etc.). However, when dealing with emerging and complex needs, there is a **need for more supported cross-border cooperation and a facilitated and structural access across 'specialised' demonstration services providers**. In this view, the following actions are recommended:

- To put in place a regular and comprehensive monitoring of the 'demand-side evolutions' and 'supply-side availability', in order to ensure a proactive/timely and efficient EU coverage of the needs (incl. emerging ones). Such monitoring should also help avoiding unnecessary investments' duplications (while still taking into account 'local anchorage' needs). Such monitoring should ideally be extended to complementary Advanced Manufacturing technologies, such AI, Robotics, etc. This would facilitate a more proactive coverage of important emerging needs for the twin (green and smart) transitions. Such monitoring should be built upon/integrated in the current and relevant initiatives that are organised at EU level (Smart Specialisation Thematic Platforms (S3P) and the Partnership on 3D Printing in particular, i.e. VI 3DP Pilot; DG GROW ATI for Industry; etc.).
- In order to reach the critical mass needed to address the aforementioned emerging and complex needs, to continue and to support platforms for interregional collaborations, such as the S3P focusing on Industrial Modernisation (and the partnership on 3D Printing in particular), in order to connect the triple helix cross-regionally, support industry stakeholders and allow small businesses access to developments in AM. For such interregional collaboration to take place efficiently, regional policy makers should be encouraged to take the 'outward looking' perspective more into account when 1) defining core areas of priorities in Advanced Manufacturing (inc. based on the landscape analysis in other regions) and 2) designing 'regional' funding schemes, which also enable supporting cross regional demonstration projects. Such cooperation is necessary in view of timely addressing emerging and complex industrial demonstration needs, promote and support interregional collaboration in Europe, between the different centres of development, excellence and training.

As mentioned already, the AM market is growing, and many segments are consolidating. However, it is important to **ensure continuous connections, cooperation and feedbacks loops between key actors from the Additive Manufacturing community**.

- In this context, we recommend favouring support and initiatives that involve connections and integration of actors active at the different steps of the 'SMEs innovation sequence', presented on page 62. From raising awareness to peer learning; from innovation generation to innovation absorption. In particular, EU or cross-regional initiatives where 'Innovation Generation' and 'Innovation Absorption activities' are explicitly integrated should be supported.
  - E.g. 'punctual' initiatives to ensure 'smart matching' (e.g. challenges-solutions camp, see above) or foresight analysis/studies of the matching between Technology Readiness Levels (TRLs) 2-5 activities and expected industrial needs.
  - E.g. more structural developments of channels for information sharing, where continuous feedbacks loops system/information sharing systems among different communities are put in place. For example, the information about ambitions of SMEs when implementing solutions as well as actual impacts when implementing solutions should be 'recommunicated' to relevant networks/initiatives positioned at lower TRLs: information sharing across TRLs should be improved and made 'circular' in a loop. Such connections can e.g. take place in the context of public-private partnerships (e.g. Made in Europe). It must be noted that Pilots from Vanguard Initiative have initiated discussions with such public private partnerships to ensure, among others, a more efficient 'feedback loops' system across TRL levels.

  As mentioned, it must be noted that some initiatives aimed at creating connections within the AM Ecosystem are in place already (Vanguard Initiative 3DP Pilot, AM Platform, etc.) but could be further supported in order to have resources to address the remaining gaps (in terms of connecting the whole segments of AM actors required in the 'innovation sequence') expressed previously.

As mentioned previously, industrial needs require more and more 'multidimensional' solutions being developed, i.e. solutions are the crossroad of various 'technological communities'. This is especially true for Additive Manufacturing-related solutions: Additive Manufacturing is an integrated/connector between 'data' and 'tangible production' and is intrinsically linked to other Advanced Manufacturing technologies (digital technologies, sustainable manufacturing-related technologies, etc.). **While each of these 'tech communities' is being strengthened and supporter at EU and regional level (Horizon 2020 Innossup-01, Horizon Europe Partnerships,**

**Horizon Europe (Research) and Innovation Actions , etc.), there is a relative lack of initiatives and support that do explicitly address 'joint projects'/'joint initiatives' aimed at avoiding any silos across these technology communities.** There is a strong need to provide support in terms of connecting AM (and associated actors) further with other relevant technological/technical fields related to advanced/smart manufacturing (AI, Robotics, Digital Technologies in general, Circularity and energy efficiency-related technologies, etc.). In this context, the following actions are recommended:

- Support initiatives that ensure connections across technology generators (and absorbers) of various technology fields, that are relevant to address specific industrial challenges (e.g. Smart and Sustainable Manufacturing, gathering actors from Additive Manufacturing community as well as from other digital technologies fields, etc.). This can be done relying upon existing initiatives that are joining/grouping e.g. partnerships from S3P Industrial Modernization (incl. Pilots from the vanguard Initiatives). Such initiatives can take the form of:
  - Networking/matchmaking, incl. online matchmaking tools across tech communities.
  - Foresight studies to identify promising segments at the frontier of various tech fields/requestions input from various tech fields and that might be 'overlooked' by each community when taking individually.
  - Support concrete innovation projects, where eligibility criteria include the 'cross tech' dimension (see point below on funding).

  Overall, we recommend triggering further the emergence of initiatives that are based and nourished by challenges and needs of companies/end-users and that gathering a relevant range of technology fields in order to generate efficient solutions.

In terms of **funding instruments to support industry-led innovation activities (TRL 5-8)**, it is important to encourage further 3DP-related entrepreneurship, and promote the market launch of new innovative technologies, through acceleration systems. While there are currently various instruments to fund AM-innovation projects, there are still gaps for certain segments and we recommend complementing the current landscape by instruments that do target the following projects-peculiarities.

- Structural funding solutions for cross-regional demonstration projects. At this stage, cross regional demonstration projects (while being necessary for emerging/complex solutions and ensuring best value for money solution being deployed for some specific fields) face important barriers in their funding, which can lead to inefficient solutions being put in place. In this context, solutions at regional and EU level should be considered, with a particular attention devoted to the generation of cross-regional funding solutions (e.g. mutualisation of regional funding scheme in a 'cross regional' instrument?), based on existing practices (e.g. IRA-SME, etc.). This should ensure that cross regional demonstration projects can have a timely access to structural funding solutions (vs punctual access to highly competitive EU funding schemes). Regarding solutions developed at EU level, it must be noted that a specific EU initiative 'Interregional Innovation Investments (I3)' should aim at addressing some of the barriers mentioned (N.B. the Call is not open at the time of writing).
- 'Supply chain driven' projects should be further supported. In order to maximize impacts, some funding instruments should explicitly favour projects with the following characteristics:
  - Needs and Solutions associated to foreseen innovation activities that are 'validated'/associated to the needs of leading players/OEMs/end-users in the supply chain, ensuring the validity and impacts once deployed.
  - Projects involving OEMs, tier-1 and tier-2 suppliers and technology providers. Innovation activities aimed at addressing a challenge/an opportunity of the supply chain and facilitating the green and/or smart transition of the supply chain, and of the actors within it. Such instruments and project could support the digitalisation of industrial supply chains and the promotion of shorter supply chains through the coordination of joint efforts in digitalisation.

    Currently, funding of innovation projects within SMEs are indeed sometimes too fragmented (no overarching 'supply chain' project linking the individual project, for impacts maximization) and solutions being developed by 'fragmented' consortia of e.g. SMEs-technologies providers face barriers in their deployment within the supply chain, hampering impacts at SMEs level.
- Targeted support for emerging and strategic fields. As mentioned on page 63, some gaps (in terms of demonstration expertise and equipment) have been identified. To the extent possible, some instruments could target more explicitly and specifically fields of 'strategic importance', answering needs of the industry and where additional support for co-development is needed. In the present study, the following gaps in terms of demonstration expertise/equipment were identified (to be updated regularly). The selection/eligibility criteria

of funding instrument (e.g. Innovation Action Calls from Horizon Europe when needs are at TRLs e.g. 5; or other instruments from EICs at higher TRLs) should therefore favour projects in these strategic fields:

- Automatized and integrated (post-) processing and interlinkages with other associated and relevant digital technologies (digital tech, AI, etc.). Deployment of AM is hampered through a lack of development/expertise/industry-led projects that directly improve AM automation through its integration with other technologies (like AI, digital and green technologies, etc.).
- Multimaterials for all applications and sectors. Multimaterials opportunities allow for multi-functional special part, incl. shape-changing phenomenon of 3D printed objects based on the material's ability to transform.
- Precious metals for component integration and ICT industry. For examples, 3D-printed electronics in which components will be created in a single-build process. Applications for 3D printed electronics include antennas and sensors for the Internet-of-Things.
- Ceramics for components with high stress resistance and low density.
- Recyclability/energy savings/circularity properties of AM and linkages with relevant non-AM technology fields. 'Green-properties' of AM should be developed further and put forward, relying upon connections with other relevant technologies (digital technologies, etc.).

In line with the gaps expressed in the previous section, some initiatives should target and improve **framework conditions**:

- In general, the design of legislation and policies should further promote consultation with industry (SMEs in particular) in order to ensure and promote environmental and economic sustainability of AM.
- In order to guarantee a qualified labour force in the future, engineering curricula in universities could be adapted to include additive manufacturing and training programs/projects on European scale should continue to be supported and developed. In addition, the current workforce should be granted facilitated access to pan-eu training centres (e.g. in relation to Lifelong learning programmes), to adapt to the technologies that are needed in their company.
- Counter the dependence of foreign raw materials (e.g. metal powder) by improving material recycling and further support European raw material suppliers in AM.
- Facilitate targeted investments into additive manufacturing for local and foreign investors though e.g. industry updates and stakeholder mapping.