# AM-motion: benefits and trends of AM in Europe

**ETN 15th Annual General meeting & workshop**

Pau, 27&28 March 2019

**Dr. Paula Queipo**
**IDONIAL Technology Center**

# Brief introduction to IDONIAL

- We are a technology centre specialized in industrial design, Material development and avanced Manufacturing

- Equipped with the latest industrial innovation technologies for manufacturing products and processes

- IDONIAL has additive manufacturing facilities

Working on AM since 2004: different stages of the value chain: design, process, materials, post-processing, product, quality inspection, certification

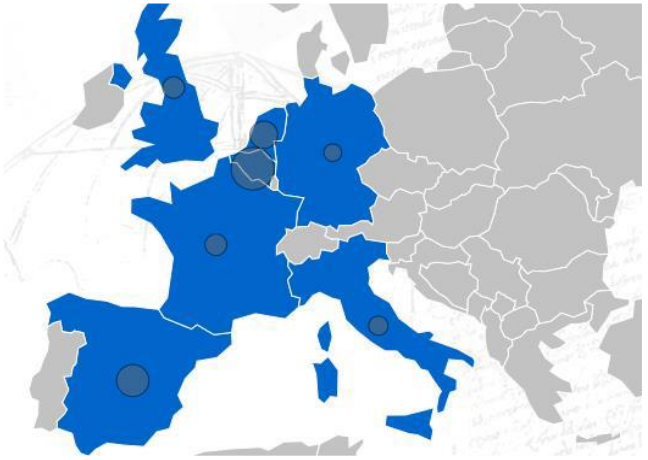
- Wide variety of materials: metals (Al, Ti, Inconel, stainless steel, tool steel, Cr-Co etc.), polyamide (pure and filled with Al), resins (degrees of springiness), ceramics, etc.



www.idonial.com

# AM-motion: A strategic approach to increasing Europe's value proposition for Additive Manufacturing technologies and capabilities

PRODINTEC
TNO
TWI
cea
ERRIN
IDEA
Brainport Development
AIRBUS
EPMA
D'APPOLONIA
SIEMENS
cecimo
European Association of the Machine Tool Industries
materialise
innovators you can count on

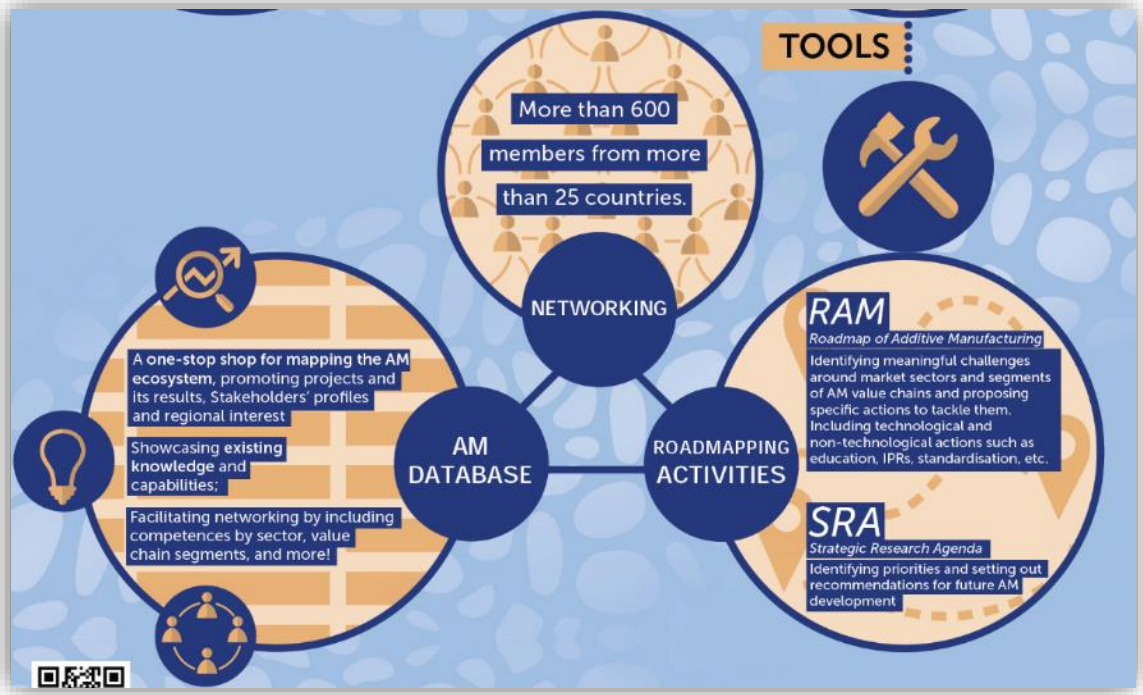


www.am-motion.eu

- **Type: CSA**
- **Topic: *FoF-05-2016***
- **Project start: 1st November 2016 / Duration: 26 months**
- **Grant agreement n°723560**

# Additive Manufacturing Technology Platform

## A community of European stakeholders of Additive Manufacturing.
## Active since 2006



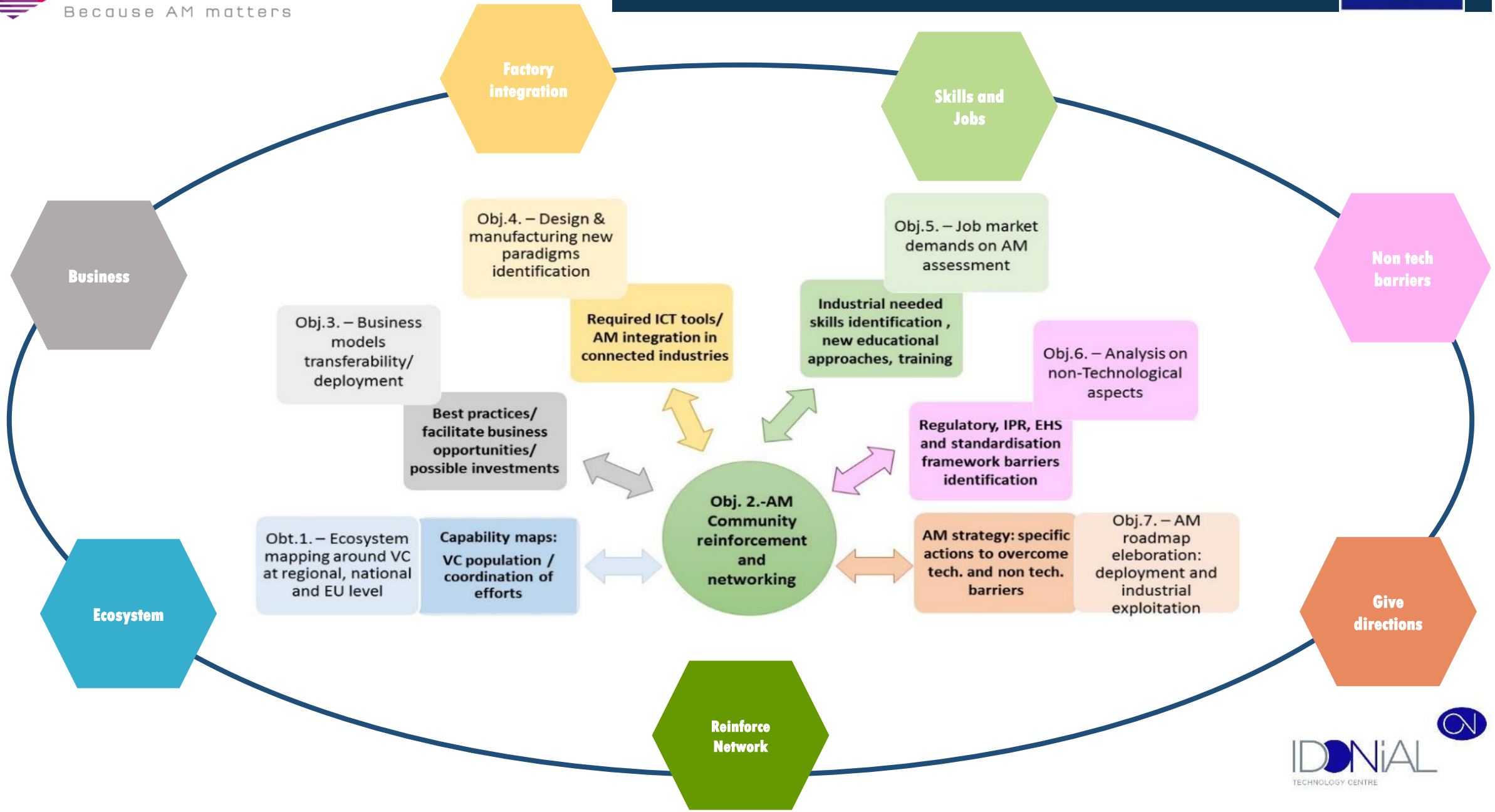

**A point of networking, reference and coordination**

- e-cluster tool /database
- Stakeholders network
- Roadmappping
- News & events

**www.AM-platform.com**

**TWITTER: @AM_EUplatform**

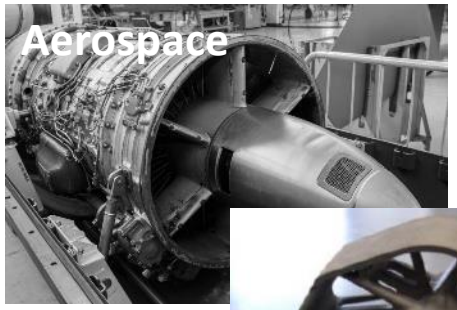
# AM Strategic Action



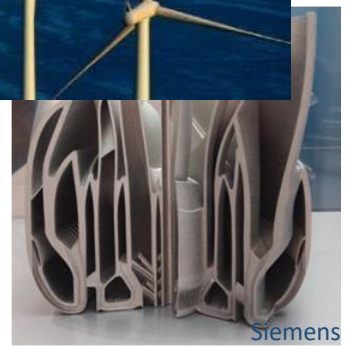
# *WHY?*

# 1. **Europe** has AM potential

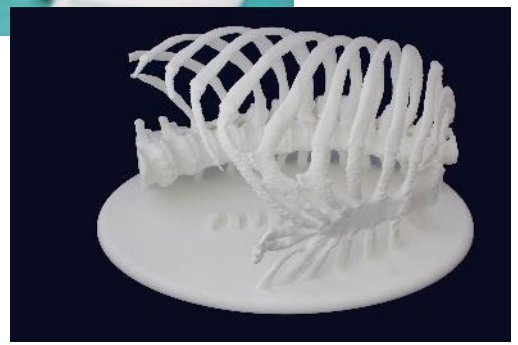
# 2. **Multi-sectorial** technology




Produce at point of use




Fewer component parts; integrated functions


Complexity

Weight reduction, design freedom



Customisation

Tailored to application, client


IDONIAL
TECHNOLOGY CENTRE

# 3. AM needs to be understand

There is not a single technology /solution. *7 process categories, with subcategories, using different materials…FOR DIFFERENT SECTORS*

- Sheet lamination
- Material Extrusion
- Material Jetting
- Vat Photopolymerisation
- Binder Jetting
- Powder bed fusion (PBF)
- Directed energy deposition (DED)

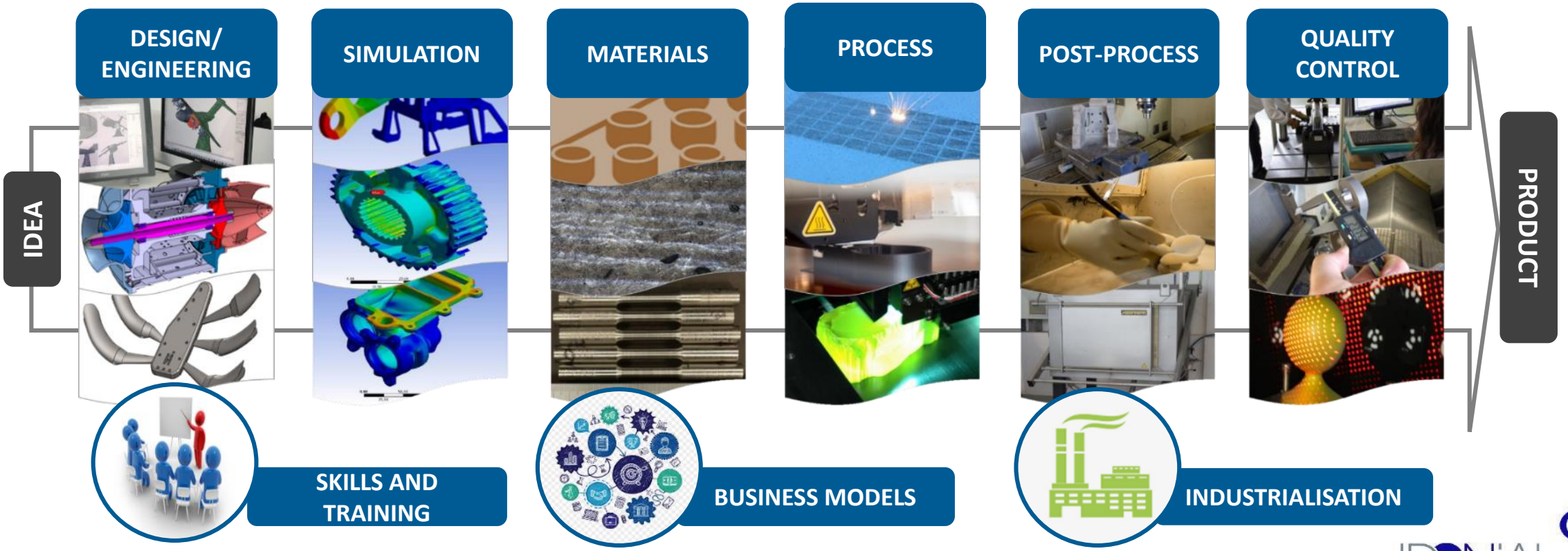
- Health
- Aerospace
- Automotive
- Consumer goods
- Electronics
- Energy
- Industrial equipment and tooling
- Construction

And more!!!

IDONIAL TECHNOLOGY CENTRE

# Production is not a single step

*Need to consider the complete chain / integration of process*



# Confusion / need to keep building confidence


AM vs TRADITIONAL MANUFACTURING

PROTOTYPING / FINAL PRODUCT

AVAILABLE EQUIPMENTS/ MATERIALS

BUSINESS MODEL/ COST-BENEFIT

## Is AM really valid for my Company/ Industry ?

To determine when and how to apply AM, organizations need to assess the market strategy, supply chain, cost-benefit…..

# AM Matters!

*Big challenges .....enormous potential*

**AM-Motion wants to contribute to a rapid market uptake of AM technologies across Europe**

AM-motion
Because AM matters

# International, European, national and regional Mapping

**The AM DATABASE is a e-tool in order to**:

- map of the AM landscape
- have an overview of existing knowledge and capabilities and to better use it
- facilitate networking

It contains information on **projects, regional strategies and main stakeholders** around this set of technologies.

Ecosystem

124 EU Projects mapped (2010 onwards)

| Workprogramme | Number of projects | Budget (€) |
|---|---|---|
| ERC | 6 | 8.291.956,00 |
| MSCA (H2020, FP7-People) | 15 | 16.479.005,92 |
| NMP (H2020 LEIT NANO/AVDMANU, FP7) | 56 | 327.817.513,96 |
| ICT (H2020 LEIT, FP7) | 12 | 43.022.150,25 |
| SME (H2020, FP7) | 9 | 11.054.339,25 |
| TRANSPORT (H2020, FP7) | 5 | 24.600.019,34 |
| INTERREG | 4 | 4.418.926,69 |
| ERASMUS+ | 4 | 2.192.878,00 |
| JTI | 11 | 10.221.863,11 |
| Other | 2 | 3.351.228,78 |
| **Total** | **124** | **451.449.881,30 €** |

More than 150 national & regional AM related Projects mapped

| | | |
|---|---|---|
| 3D Boost and 3D Invest | | |
| HYBRAM | | |
| Välkky | | |
| 3D Hybrid | | |
| 3DRX-online | | |
| 3D-SLS | | |
| ALMARIS | | |
| Almèe | | |
| AMANDE | | |
| ATOMIQ | | |
| Bone printing | | |
| CNRS3D/SATTSE between Nancy & Marseille | | |
| CNRS4D between Nancy & Paris | | |
| CNRS-I3DI between Marseille & Nancy | | |
| Dry to Fly | | |
| ELASTICITE | | |
| FA2SCINAE | | |
| FADIPLAST 2 | | |
| FAIR | | |
| FastPrinting | | |
| FollowKnee | | |
| GPP MULTIMAT | | |
| Grand Est Region 4D between Mulhouse, Nancy, Reims, Strasbourg | | |
| GRMH2TANK | | |
| ILTO | | |
| Itech Mould | | |
| LEMCI | | |
| LIGNOPROG | | |
| MACOY3D | | |
| MATERIAL | | |
| MMLED | | |
| MONARCHIES | | |
| MOSART | | |
| Morilinnov | | |
| 39 | France | SISCob |
| 40 | France | SOFIA |
| 41 | Italy | MADE4LO +2.72.6 |
| 42 | Italy | MANUSPACE |
| 43 | Italy | SICO |
| 44 | Italy | Smart Manufacturing 2020 |
| 45 | Italy | "HIGH PERFORMANCE MANUFACTURING" |
| 46 | Italy | ULTRAHIGH TEMPERATURE CERAMIC MATRIX COMPOSITES BY ADDITIVE MANUFACTURING USING POLYMER PRECURSORS |
| 47 | Poland | AMpHOra |
| 48 | Portugal | add.AM |
| 49 | Portugal | ADIMAQ |
| 50 | Portugal | BIGPROTO |
| 51 | Portugal | FIBR3D |
| 52 | Portugal | FRF |
| 53 | Portugal | HIBRIDMOULDE |
| 54 | Portugal | HIBRIDMOULDE 21 |
| 55 | Portugal | HiPA2I |
| 56 | Portugal | NEXT.parts |
| 57 | Portugal | PRODUTECH SIF |
| 58 | Portugal | RNPR |
| 59 | Portugal | ROBMOLDE |
| 60 | Portugal | SIRBLADE |
| 61 | Portugal | SLMXL |
| 62 | Portugal | TOOLING4G |
| 63 | Spain | JAMES BONE |
| 64 | Spain | KERAMIC |
| 65 | Spain | Implementation of wear-reduction micro textures through additive manufacturing technology over joint prosthesis featuring metal/plastic contact. |
| 66 | Spain | Adaptation of DMLS 3D printing technology for knee prosthesis components |
| 67 | Spain | DECLAMA |
| 70 | Spain | SLSAero |
| 71 | Spain | SOLADI3D |
| 72 | Sweden | 3DTC |
| 73 | Sweden | AT-LAB |
| 74 | Sweden | CAM2 |
| 75 | Sweden | DISAM |
| 76 | Sweden | LIGHTCAM |
| 77 | Sweden | Miljo:FIA |
| 78 | Sweden | RAMp-UP |
| 79 | Sweden | RecAM |
| 80 | Sweden | REPLAB |
| 81 | Sweden | SAMw |
| 82 | Sweden | SUMAN |
| 83 | Sweden | SUMANnext |
| 84 | Sweden | Tolls for AM - SENAI |
| 85 | UK | ALF |
| 86 | UK | AMSURFIN |
| 87 | UK | CAM |
| 88 | UK | CAMBER |
| 89 | UK | CHARM |
| 90 | UK | PROMENADE |
| 91 | UK | RAD-AMP |
| 92 | UK | RAMP-UP |
| 93 | UK | SEAM |
| 94 | UK | SEAMLESS |
| 95 | UK | SHAPE |
| 96 | UK | START |
| 97 | UK | TIME |
| 98 | UK | WINDY |
| 99 | UK | DIGI-TOOL |
| 100 | UK | 3D Screen Printing |
| 101 | UK | Development Improvements in atomising nichel, cobalt & iron based alloys for use in AM |
| 102 | UK | Metal AM Process Informatics for Improved Surface Finish of Complex Parts |
| 104 | UK | RoboWAAM |
| 105 | UK | PowderCleanse - A powder recycling a assurance for en additive manufa material re |
| 106 | UK | Tailorable and A Connected Digital Manufactur |
| 107 | UK | Development commercializat 3D-printed ceramic carbonized its |
| 108 | UK | Unravelling &ad orthopaedics & pr problems by huma design |
| 109 | UK | 3D Fashion: Closures |
| 110 | UK | University of Sheffield Ltd |
| 111 | UK | Wire Arc Addi manufacturing net shapes for Sp propellant ta |
| 112 | UK | High temperature, polymer composit aerospace appli |
| 113 | UK | MEGCAP |
| 114 | UK | Advanced Inverted E cle exhaust heat rec Steam Genera |
| 115 | UK | The University of Sh LPW Technology |
| 116 | UK | Newcastle Univer DePuy Internationa |
| 117 | UK | Gravity Sketch - In Creation |
| 118 | UK | A 3D printing solutio parents pain with or vices |
| 119 | UK | Prototype Developm brid Gas and Ultraso Delivery Sys |
| 120 | N/A | PAM-ROOT |

AM-motion
Because AM matters

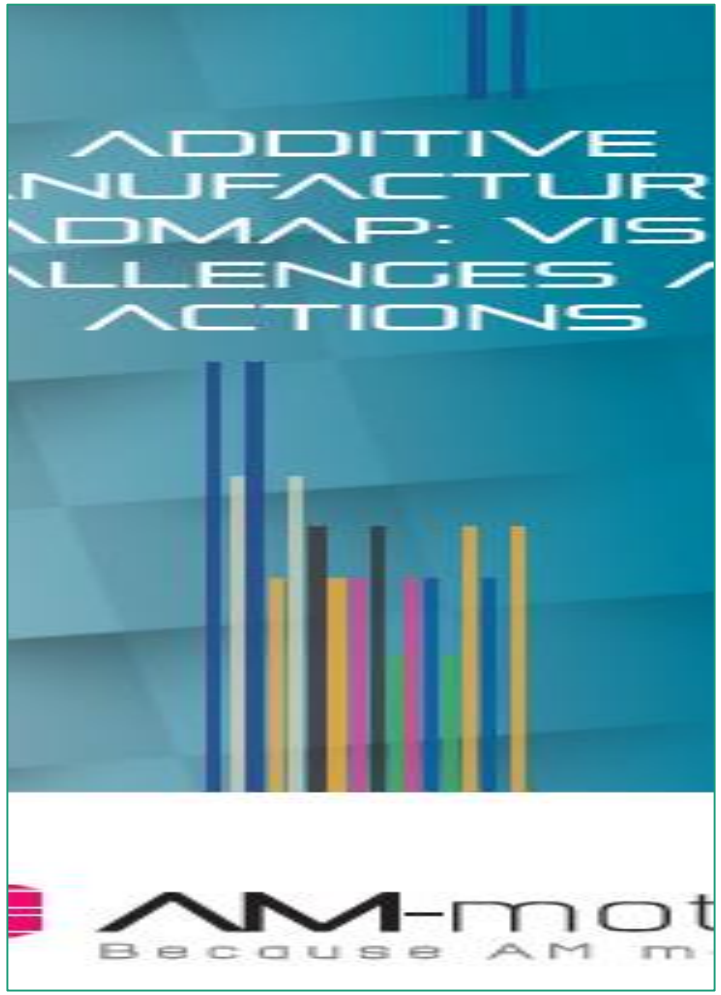
# International, European, national and regional Mapping

Ecosystem

| NAME | SUPPLY CHAIN | WEBSITE | COUNTRY/ Region | Sectors | VC segments | AM processes | AM Materials | Non Tech. |
|---|---|---|---|---|---|---|---|---|
| **RTOs** | | | | | | | | |
| Aalto University Digital Design laboratory | R&D, design, end user | www.aalto.fi | FINLAND/ Helsinki-Uusimaa-Etelä-Suomi | ALL | ALL | ALL | ALL | STD; L, EDU; IE; IPRS, TT |
| ACAM | R&D; Materials; Design | http://acam.rwth-campus.com/ | GERMANY/ Aachen | ALL | ALL | - | Metal, polymer | STD, L, EDU, IE, IPR, TT |
| AIDIMME | R&D, design | www.aidimme.es | SPAIN/ Comunidad Valenciana | ALL | ALL | PBF, VP, MJ, ME | Metal, Polymer, O: wood, natural materials | STD; EDU; IE; IPRS, TT |
| AIJU | R&D, Service Bureau | www.aiju.info | SPAIN/ Comunidad Valenciana | CG | M, Pr | PBF, MJ, ME | Polymer | STD; EDU; TT |
| AIMEN | R&D, Service Bureau | www.aimen.es | SPAIN/ Galicia | AE, AU, E, I&T, C | M&S, D, P | ME, DED | Metal, | STD; EDU; IE; IPRS, TT |
| AIMPLAS | R&D; service Bureau; design | www.aimplas.net | SPAIN/ Comunidad Valenciana | ALL | M; P; PP; Pr, EL | ME | Polymer, food, bio-materials | STD; L; EDU; TT |
| AITIIP | R&D; service Bureau; Materials provider; design | www.aitiip.com | SPAIN/ Aragon | ALL | ALL | PBF; VP; ME; | Metal, Polymer, Ceramic y Bio-materials | STD; EDU; IE; IPRS; TT |
| AMSyst-HTSC-TU/e | R&D | https://www.tue.nl/en/ | NETHERLANDS/ Noord-Brabant | ALL | ALL | ALL | ALL | EDU, IE, TT |
| ANDALTEC | R&D, design, Prototyping | www.andaltec.org/en/ | SPAIN/ Andalucía | AE, AU,CG, E, Food Packaging | M&S, D, M, Pr, EL | VP, MJ, ME, BJ | Polymer, Bio-Materials | EDU, TT |
| BMC | R&D, OEM, Materials provider | www.brightlands-materialscenter.com | NETHERLANDS/ Limburg | ALL | ALL | PBF, VP, MJ, ME | Polymer, Bio-materials | TT |
| Brunel | R&D, design | www.brunel.ac.uk | UNITED KINGDOM/ Outer London - West and North West | ALL | M&S, D, M, P, PP, Pr | PBF; VP; ME; | Metal, Polymer, Composites | STD; EDU; IE; IPRS; TT |
| CAMPT-FPC | R&D, service bureau, design | www.camt.pl/index.php/en/home-en/ | POLAND/ DOLNOSLASKIE- | H, AE, AU, CG, EN, I&T | ALL | PBF, VP, MJ, ME, DED, BJ | Metal, polymer, ceramic, bio-materials | EDU, IE, TT |

| | | | | | |
|---|---|---|---|---|---|
| AM ion | www.3dstep.fi | FINLAND/Tampere | AE, EN, E&T, C, Food | ALL | PI |
| , s | www.3Dceram.com | FRANCE/Limousin | H, AE, AU, E, EN | M, P, PP, Pr | VP |
| er | www.arti90.com | TURKEY | ALL | D, M, P, PP, Pr | PBF, MJ, ME |
| | www.admateceurope.com | NETHERLANDS/ Noord-Brabant | H, AE, AU, E, ALL | M, P, PP, Pr | VP |
| | www.aimsweden.com | SWEDEN/ Mellersta Norrland | H, AE, AU, O (industrial) | M&S, D, M, P, PP, Pr | PBF, EBM |
| id | www.airbus.com | SPAIN | AE | M&S, D, M; PP; Pr | PBF, MJ; DED |
| are n | www.altran.com | GERMANY/ Hamburg | ALL | ALL | PBF, ME |
| | www.atlascopco.com | BELGIUM/ Antwerpen | O (industrial applications) | M&S, D, P, PP, Pr | PBF, ME, BJ |
| er, r | | FRANCE/ Ile de France | ALL | M&S, D, P, Pr | - |
| r | www.croftam.co.uk | UK/Cheshire | AE, AU, CG, E, EN, E&T, C | D, PP, Pr | PBF |
| | www.crit-research. | ITALY/ | AE, AU, E | D, M, P | PBF |

# AM-Motion-Roadmapping




http://www.am-motion.eu/images/AM-motion_Roadmap_Summary.pdf

Give directions

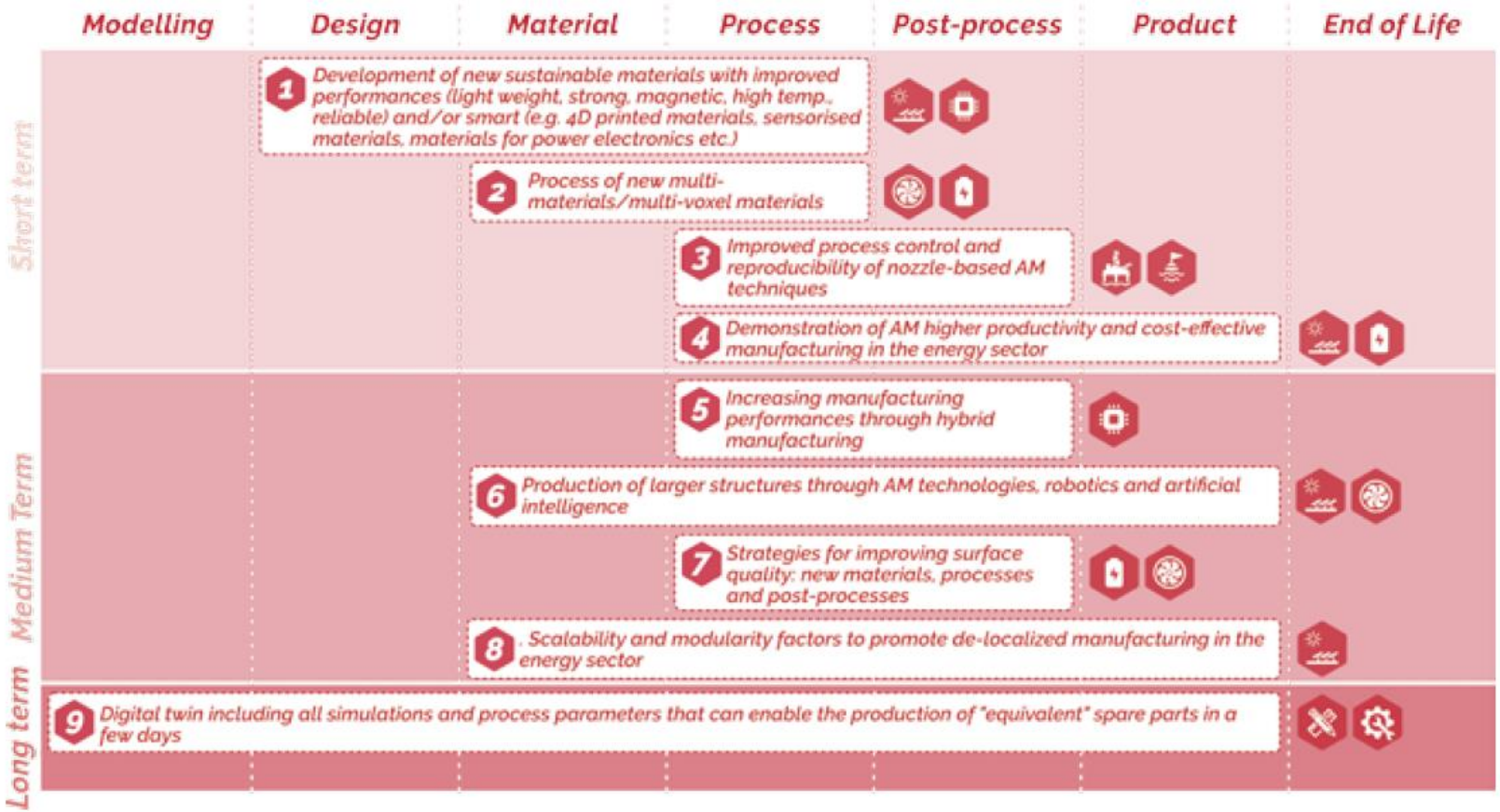
**To develop a strategy and set up the pillars for its efficient implementation** that, ultimately, will contribute to **reinforcing the European ecosystem of AM** and help keep driving Europe to the forefront of AM adoption.

AM-motion
Because AM matters

Give directions

# AM-Motion-Roadmapping

## Energy-specific actions




## Energy target products

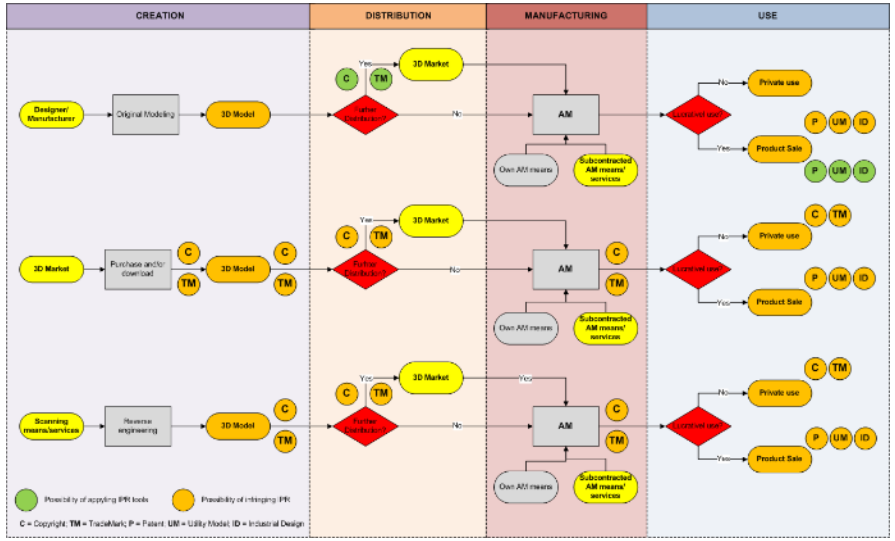

PRODINTEC
FACTORY OF FUTURE

AM-motion
Because AM matters

Non tech barriers

# EHS and IPR frameworks

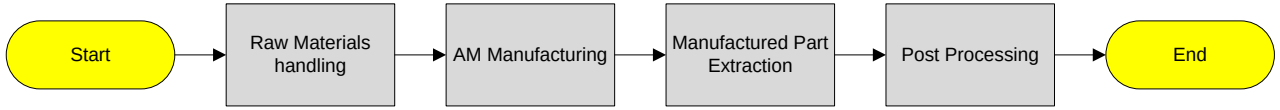
## Intellectual Property Rights




Regardless of the technology used, any AM process begins with a CAD based digital file. However, the way of obtaining such CAD file can be very different and can have different implications.

In the years to come are expected to bring guidelines and specific regulation that will rise awareness between the different stakeholders

## Environment, Health and Safety




- AM health and safety risks are the sum of the risks along all stages involved in its use.
- Different AM technologies, suppose different health and safety risks.
- Powder based AM technologies specially relevant when it comes to H&S management, not only for the powder handling, but for the post processing stages associated risks.
- Material exposure and handling **:** dust, particulate aerosol

*Workers should wear Personal Protective Equipment such as gloves, masks …to prevent inhalation and direct contact with powders*

- Fire, Explosive atmosphere, Laser, working postures..

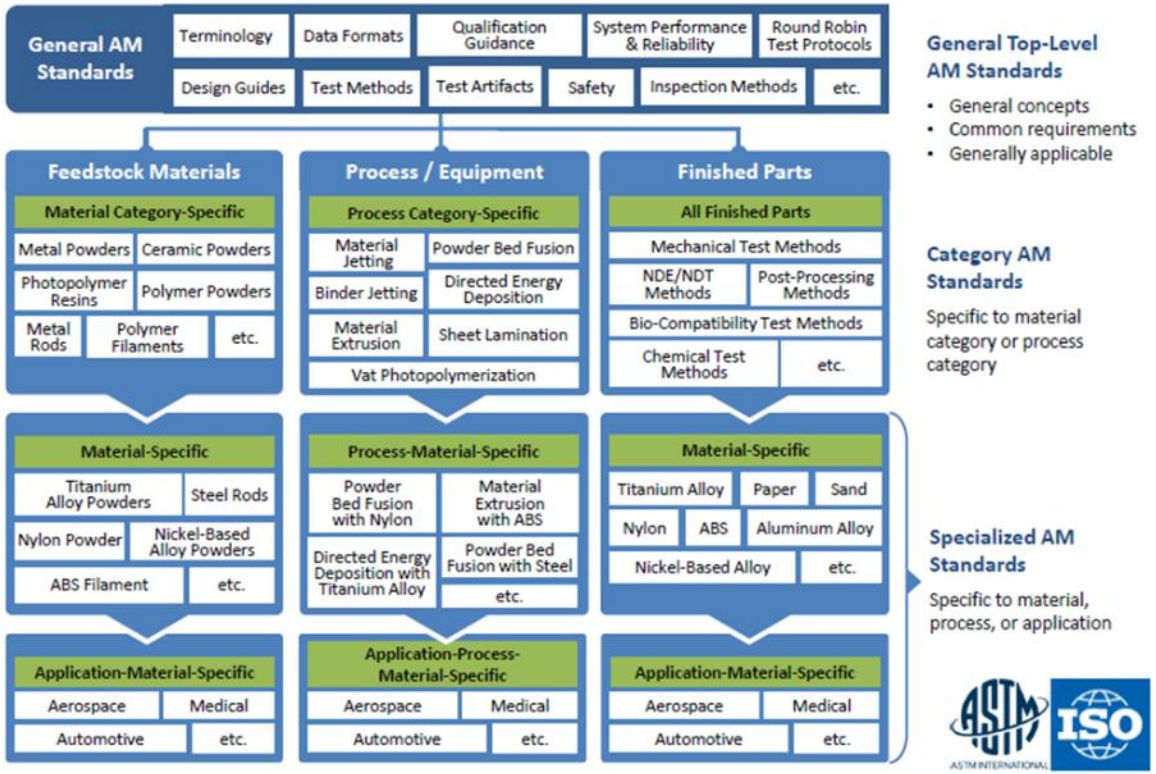
IDONIAL
TECHNOLOGY CENTRE

AM-motion
Because AM matters

Non tech barriers

# Standardisation framework

## Standardisation




- Multiple variables and parameters

  Different machine systems, different set-ups, conditions , that produces different results…, stability and traceability

- Specifying requirements
- Communicating guidance
- Documenting technical data
- Accelerating the adoption of new technologies

IDONIAL
TECHNOLOGY CENTRE

AM-motion
Because AM matters

Skills and Jobs

# AM-Motion-Skills & Job market demands on AM

## Mapping of AM educational initiatives

Existing educational and training courses focusing on AM. It also offers an overview of the EU-funded initiatives, which have looked closely at the issue of AM in the educational context .

## Evaluation of industrial employers needs

Getting a sense of where AM skills are really absent is therefore helpful not only for companies already in the market, but also for manufacturers willing to adopt additive techniques

## Educational Implementation Model

Filling the informational gaps on specific job requirements of AM profiles while also devising sound strategies for maximizing the impact of AM training.

## Hands-on: AM summer school

The programme was spread on 4 Days. On day 1, a general Introduction to AM as well as overviews on AM processes and materials
On day 2, more specific technological courses in the design and processes aspects.

NiAL
TECHNOLOGY CENTRE

AM-motion
Because AM matters

Skills and Jobs

# AM-Motion-Skills & Job market demands on AM

SAM
SECTOR SKILLS STRATEGY
IN ADDITIVE MANUFACTURING


**Partnership:** 16 Partners
3 Umbrella Organisations
7 Industry Representatives
6 Education & Training Providers

**Coordination:** EWF (BE)

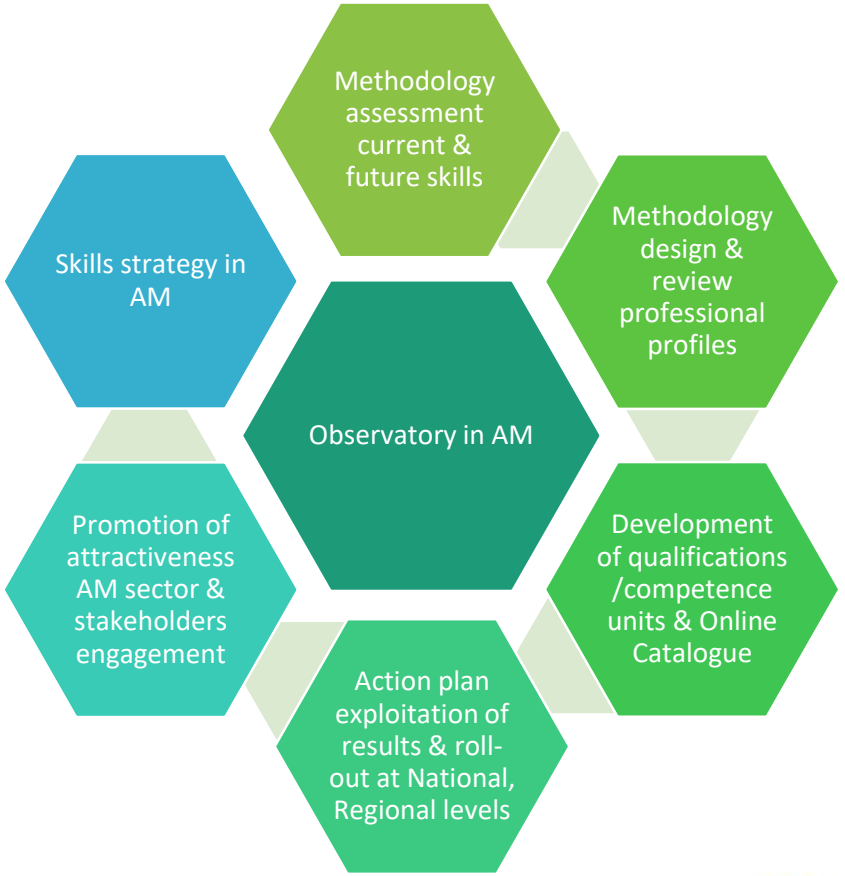
**SSA Blueprint in AM:** Additive Manufacturing skills identification and anticipation /strategic development of skills for the sector in Europe

**Duration:** 1.1.2019 to 31.12.2022 (48 months)

**Budget:** 3.971.076 €

**Aim:** To address the critical issue of workforce development for AM by developing a shared skills vision and collaborative learning solutions. Engage to address current and future industrial AM skills needs.

## Expected Results :



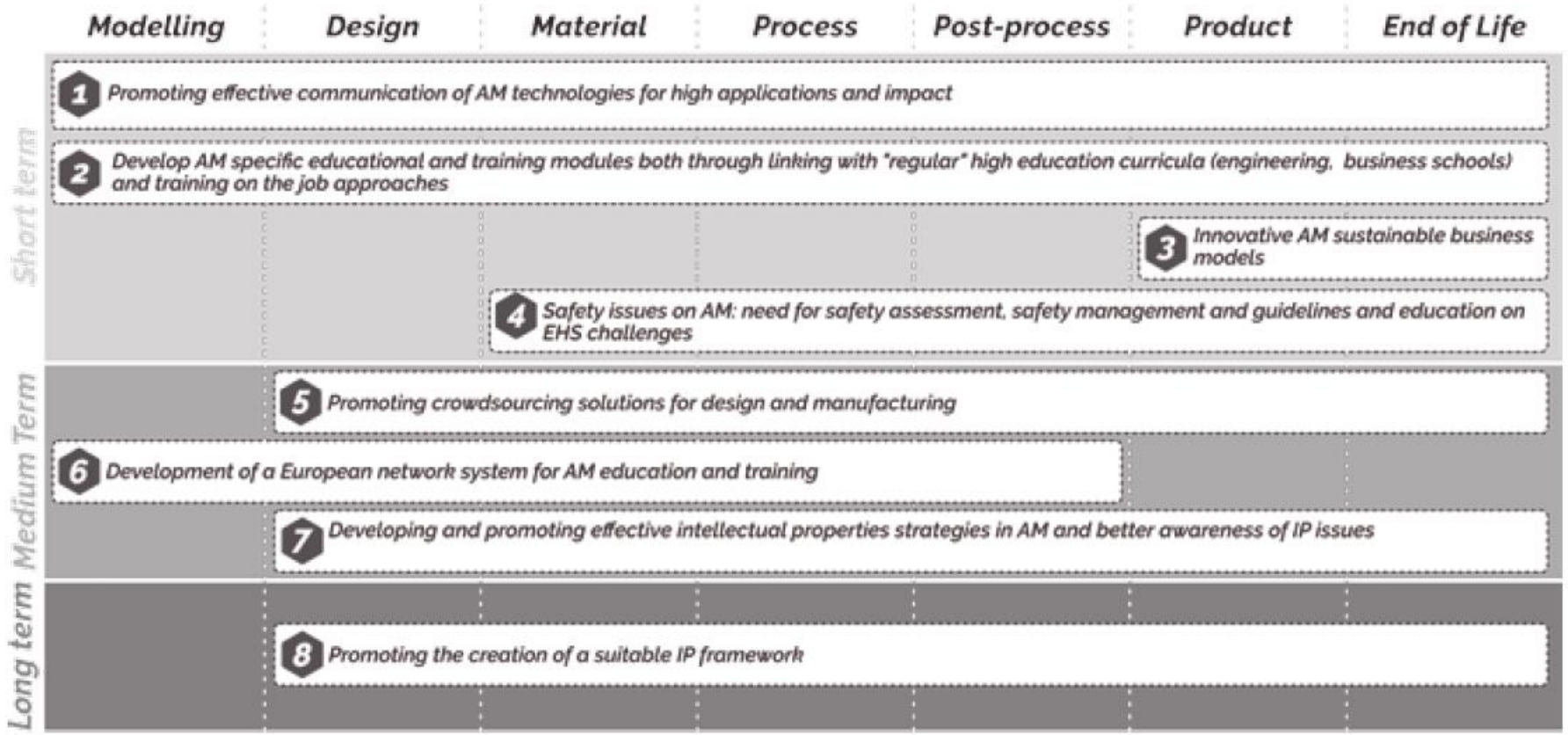

http://www.skills4am.eu/

AM-motion
Because AM matters

Give directions

# AM-Motion-Roadmapping

CROSS-CUTTING NON-TECHNOLOGICAL actions




PRODINTEC
FACTORY OF FUTURE

# In summary

**Intermediary connecting an organization with outside solution providers to facilitate the full market uptake and wider adoption**

- **Bridging complementary capabilities** across Europe and beyond (AM mapping on-going by different initiatives)
- **Cluster approach around sectorial VCs**: entities in diverse VC segments that are often located in different places: Identifying the necessary VC partners to facilitate a quicker implementation. Maximise mutual benefits.
- Integration of "unobvious" actors: from different sectors, domains,….
- **Community guiding:** Roadmap with clear actions: Technological and non-technological aspects both to be considered
- Collaborative environment that helps to bring technology advancements from the lab to the factory floor,
- Regional, MS and EU policy measures: Alignment of policies, initiatives and funding efforts towards industrialization
- Involvement of key entities: Standardisation bodies, IPRs helpdesk, Invest EU, BICs,…

# *THANK YOU!*

**www.am-motion.eu**

http://am-motion.eu/about-the-project2/main-outcomes.html

**www.AM-platform.com**


***More info: Dr. Paula Queipo***

***Email: paula.queipo@idonial.com***

***Phone: +34 984 390 060***

**www.idonial.com**



This project has received funding from the European Union Horizon 2020 Programme (H2020) under grant agreement nº 723560