

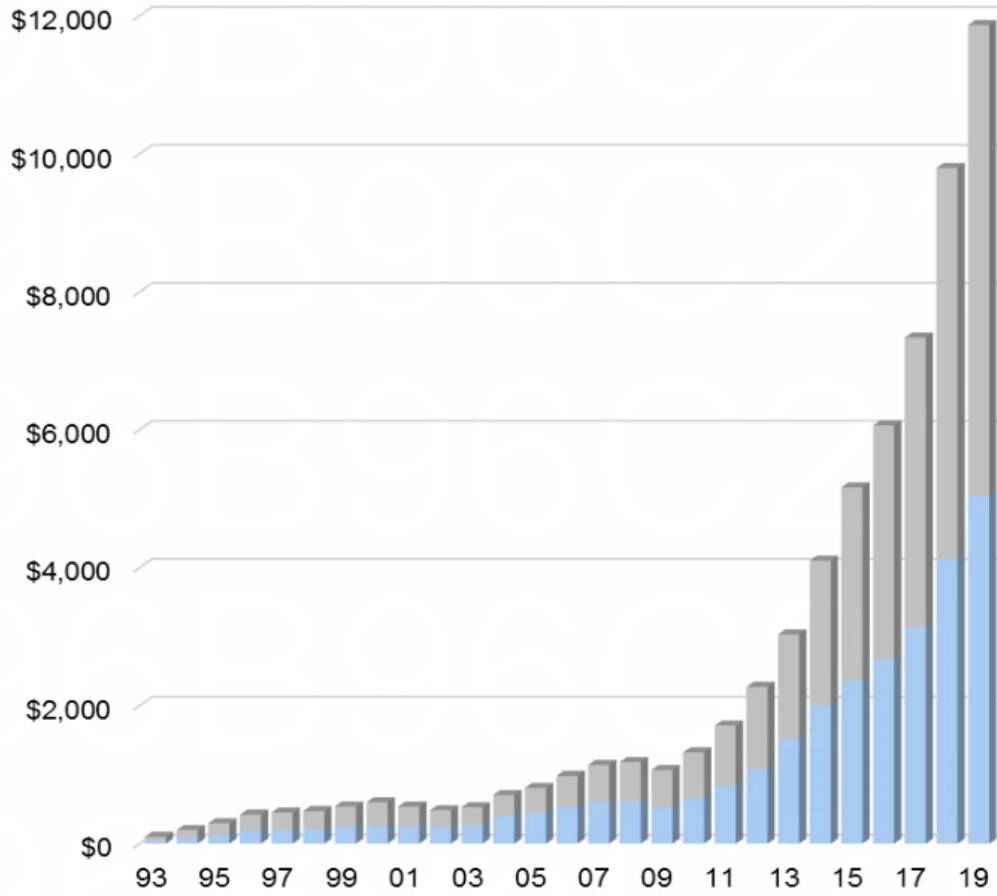


LATEST FINDINGS ON THE SKILLS NEEDS OF THE AM INDUSTRY

Project No. 601217-EPP-1-2018-1-BE-EPPKA2-SSA-B



REVENUES OF ADDITIVE MANUFACTURING WORLDWIDE

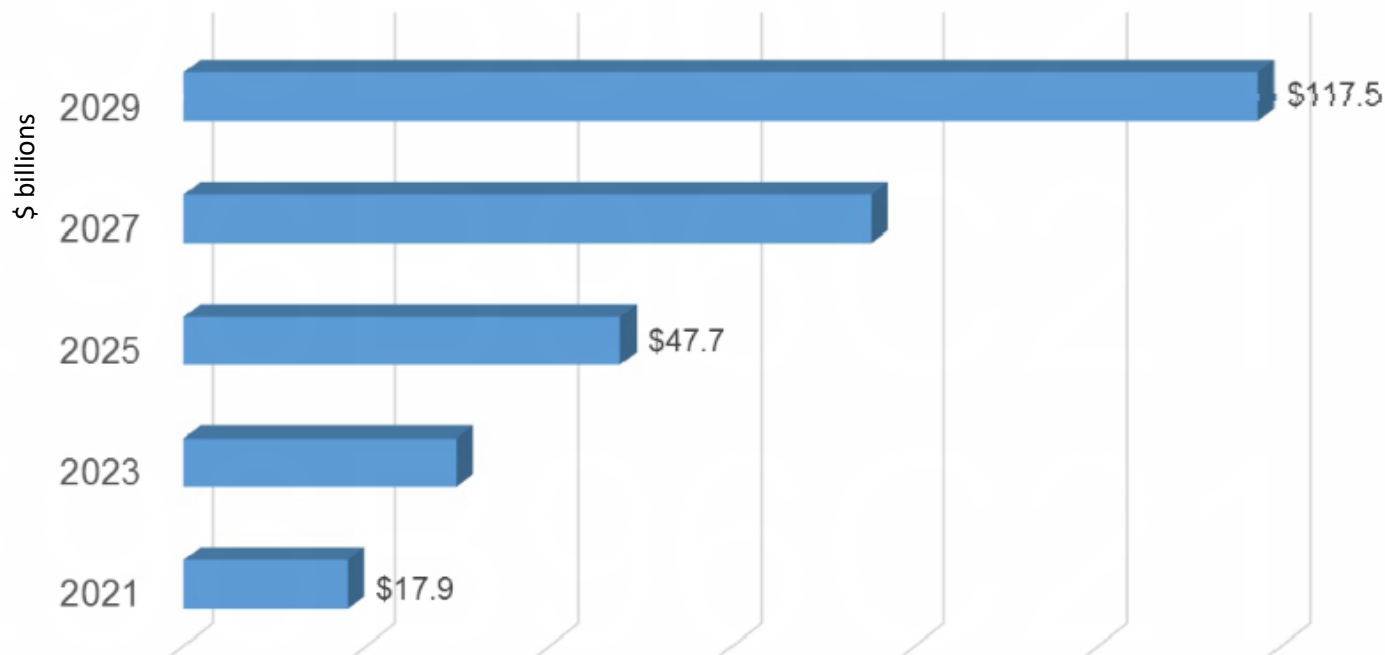


Source: Wohlers Associates, Inc.

- In 2019, the AM industry, consisting of all AM products and services worldwide, grew 21.2% to \$11.867 billion.
- The lower blue segment represents products, while the upper gray segment represents services.
- Products include AM systems, materials, aftermarket products such as software and lasers.
- Services include revenues generated from parts produced on AM systems

AM INDUSTRY EXPECTED TO GROW VIGOROUSLY

AM INDUSTRY REVENUE FORECAST*



Source: Wohlers Associates, Inc.

*Wohler Associates report belongs to the period prior to Covid-19. New report will be published in March 2021.

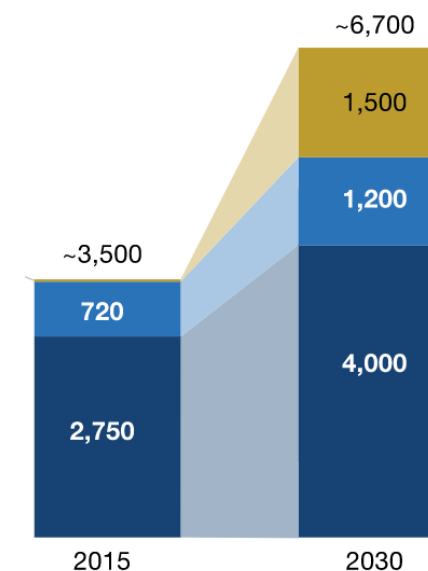
AUTOMOTIVE INDUSTRY REVENUE FORECAST

- Global Automotive Industry Revenues (all sales, aftermarket, all other services) is expected to be \$6,700 billion in 2030.

Brown : Revenues from new services such as car sharing, data connectivity services and apps.

Light Blue: Aftermarket

Dark Blue : Vehicle sales



Source: McKinsey&Company

GAME-CHANGING TECHNOLOGIES ALONG THE VALUE CHAIN

EUROFOUND COUNTS FIVE GAME-CHANGING TECHNOLOGIES:

- Advanced Industrial Robotics (AIR)
- Additive Manufacturing (AM)
- Industrial Internet of Things (IoT)
- Electrical Vehicles (EV)
- Industrial Biotechnology (IB)

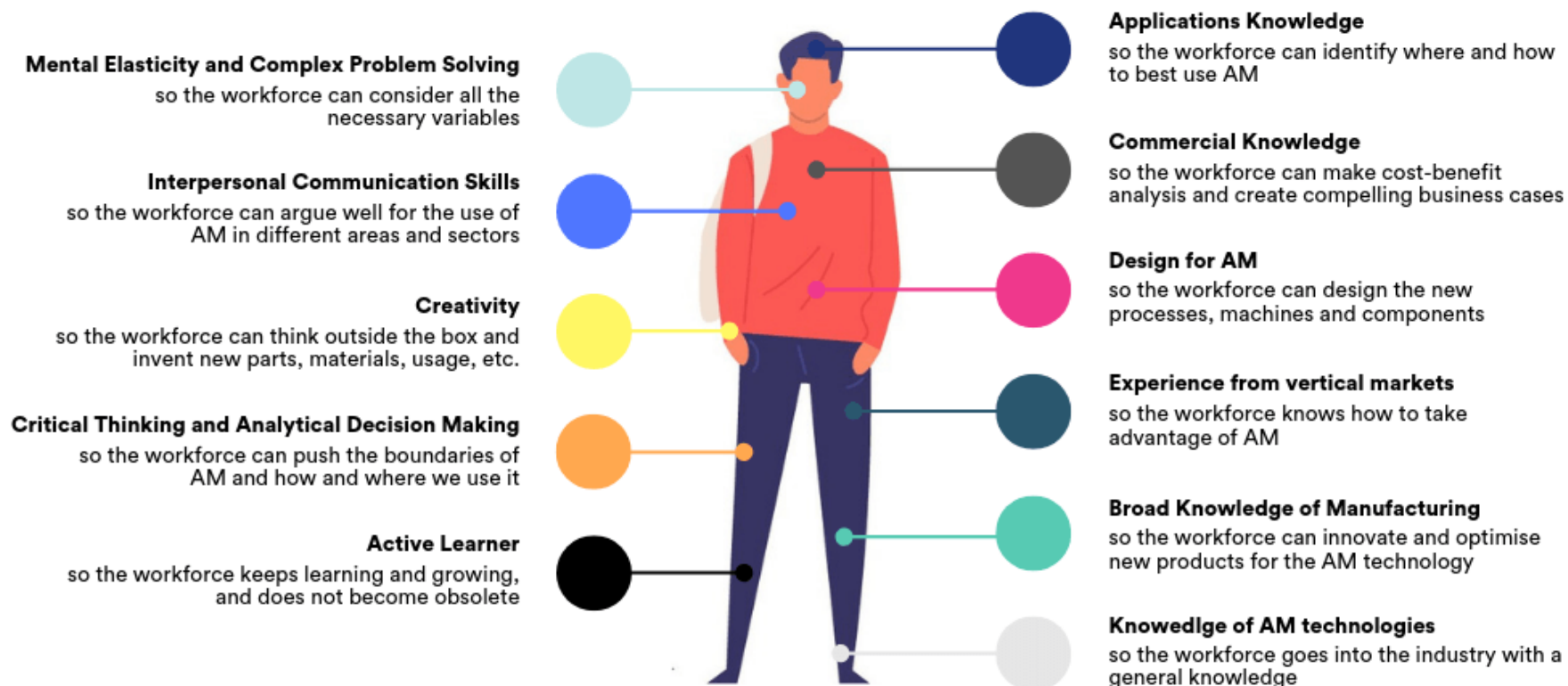
R&D	Design	Logistics (inward)	Production	Logistics (outward)	Marketing	Services
		Advanced industrial robotics				
		Industrial internet of things				
Additive manufacturing						

Source: Eurofound (Future of Manufacturing in Europe, April 2019)

*These sectors describes the
profile of AM Workforce needed!*

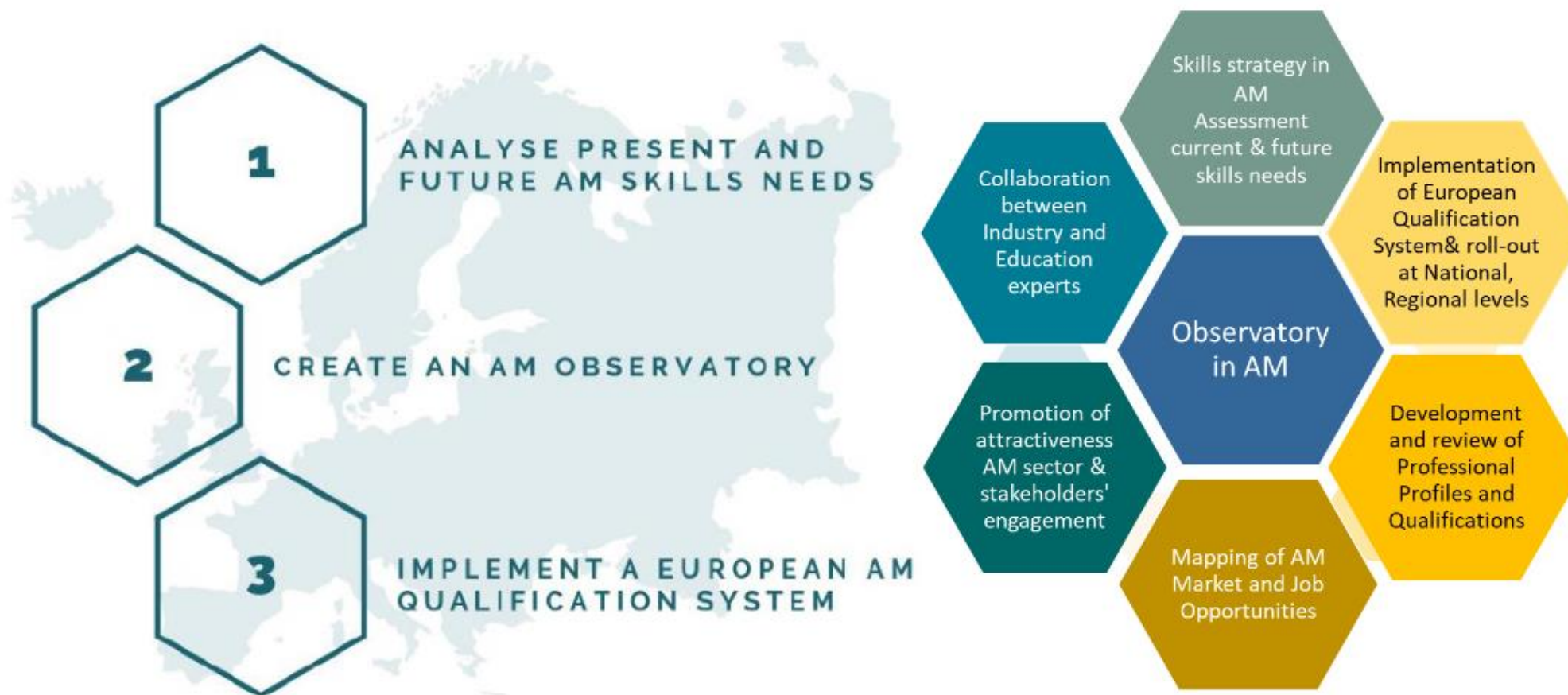
THE AM WORKFORCE OF FUTURE

Stating that the AM industry needs talent is easy. Identifying what type of talent is the challenge. In order to train the future workforce, we must first understand what skills are demanded by the industry, and what sort of talent is required to enable the industry growth.

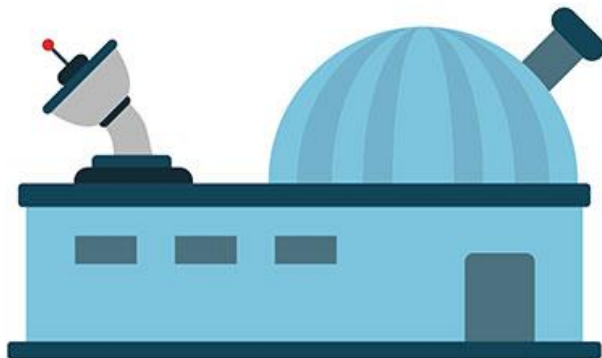


Source: iAM-digital

SAM PROJECT – OBJECTIVES & EXPECTED RESULTS



SAM OBSERVATORY



EU AM Qualification System comprehends a quality assurance mechanism, operational procedures and qualification and training modules' guidelines and EU-wide recognized diplomas.

The core activity of the **AM Observatory** is to monitor skills' gaps and shortages and to identify new professional profiles or competence units for other relevant AM sectors and propose a revision of the existing ones.

Competence unit

CU 00: Additive manufacturing Process Overview
CU 01: DED-Arc Process
CU 08: DED-LB Process
CU 15: PBF-LB Process
CU 25: Post Processing
CU 34: Process selection
CU 35: Metal AM integration
CU 36: Coordination activities
CU 43: Production of PBF-LB parts
CU 44: Conformity of PBF-LB parts
CU 45: Conformity of facilities featuring PBF-LB
CU 26: Introduction to materials (optional)
CU 27: AM with steels feedstock (excluding Stainless Steel)
CU 28: AM with Stainless Steel feedstock
CU 29: AM with Aluminium feedstock
CU 30: AM with Nickel feedstock
CU 31: AM with Titanium feedstock
CU 32: AM with Tungsten feedstock
CU 33: Biomedical metallic materials
CU 61 : Simulation Analysis
CU 62: Simulation Execution

SAM APPROACH TO TACKLE THE SKILLS NEEDS - IAMQS



Implementing Additive Manufacturing effectively will require re-skilling the workforce, since a workforce specialized in digital design, printer operations and maintenance is required to adopt new technologies successfully.

The International AM Qualification System (IAMQS) is composed by a set of qualifications for different proficiency levels in the field of AM technologies.

- Modular structure composed by units for learning outcomes
- Skills acquired by trainees after the successful completion of the training courses.

Currently, the AM Qualification System covers Metal AM Qualifications for Operators, Designers, Supervisor, Inspector, Coordinator and Engineers.

AM MODULAR SYSTEM

THE METHODOLOGY OF SAM PROJECT

During SAM project data collection and feedback phase, the gathered skills' gaps and shortages were framed according to three different scenarios:

Current skills needs and gaps
(Real Case Scenario, 2019)

Short term skills needs and
gaps
(Short - term Scenario, from
2020 to 2021)

Technology Trends that will
need to be considered in the
near future
(Foresight Scenario, from 2022
to 2025)

Data Collection Method of SAM :

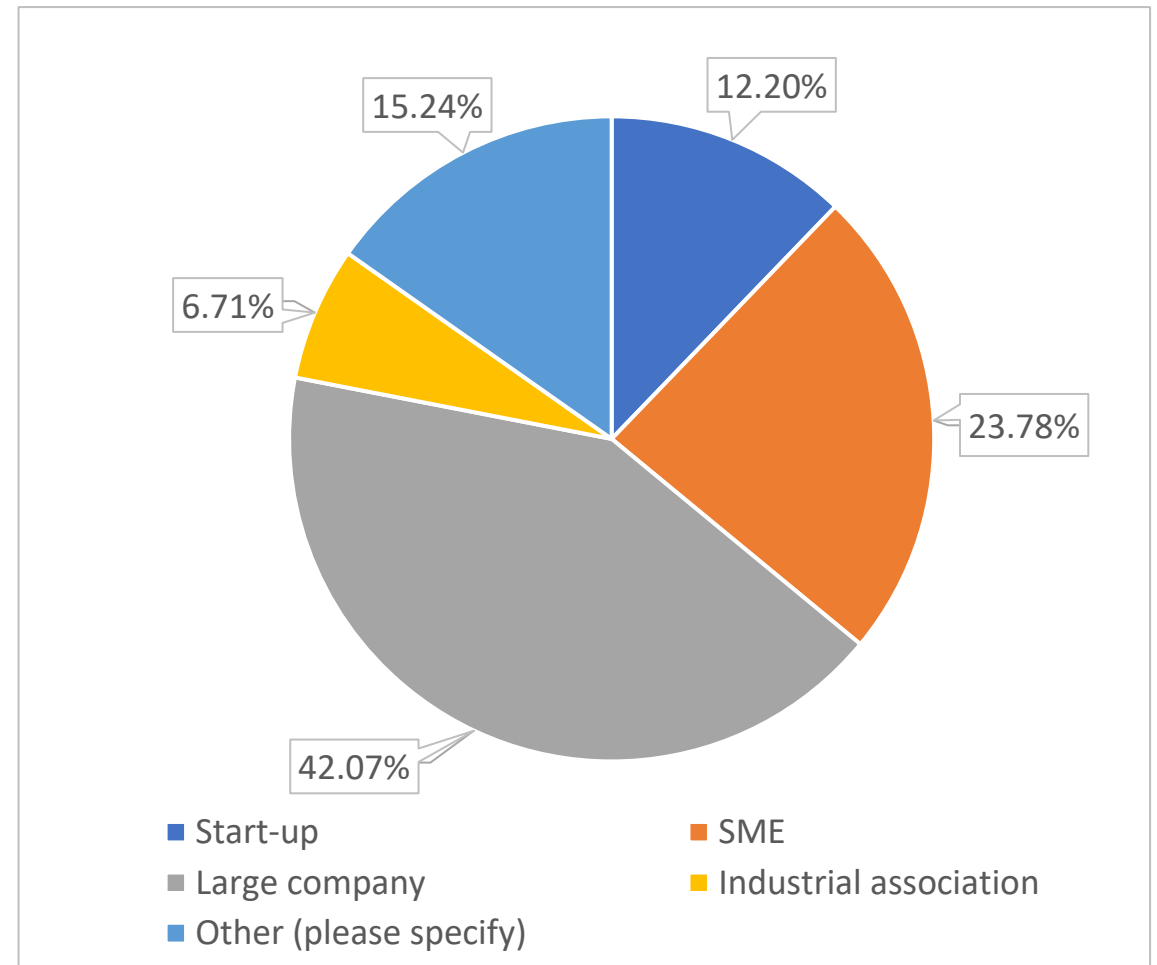
- ✓ Surveys
- ✓ Interviews
- ✓ Internal Workshops

OUTLOOK ON SURVEYS OF SAM

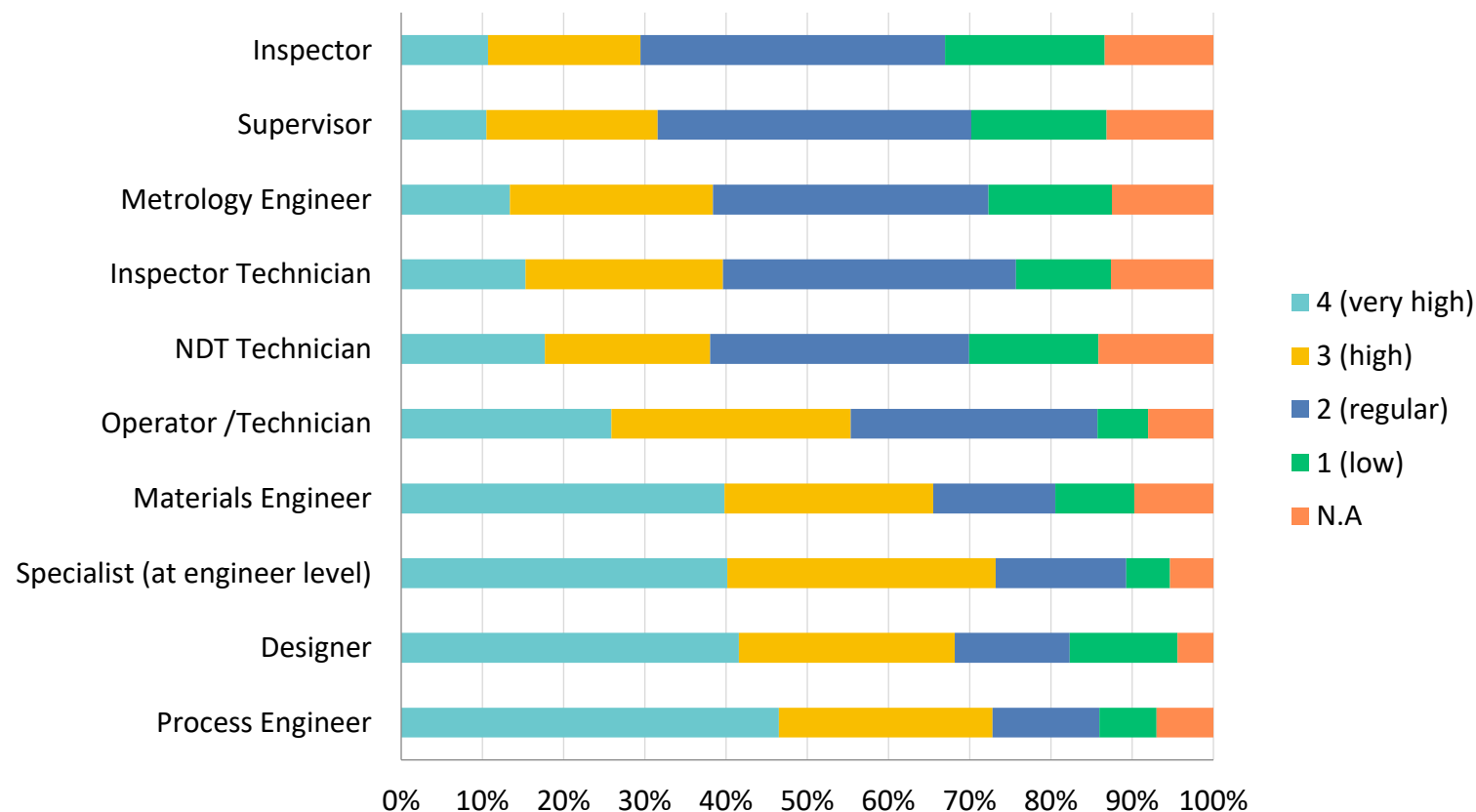
- **Answers :** 164
- **Main type :** large companies
- **Main Countries :** Germany, Spain, and Romania

WE HAVE TWO SURVEYS OPEN:
YOU ARE INVITED TO PARTICIPATE!

- [Survey on AM Skills Workforce](#)
- [Industry Survey on AM Skills](#)

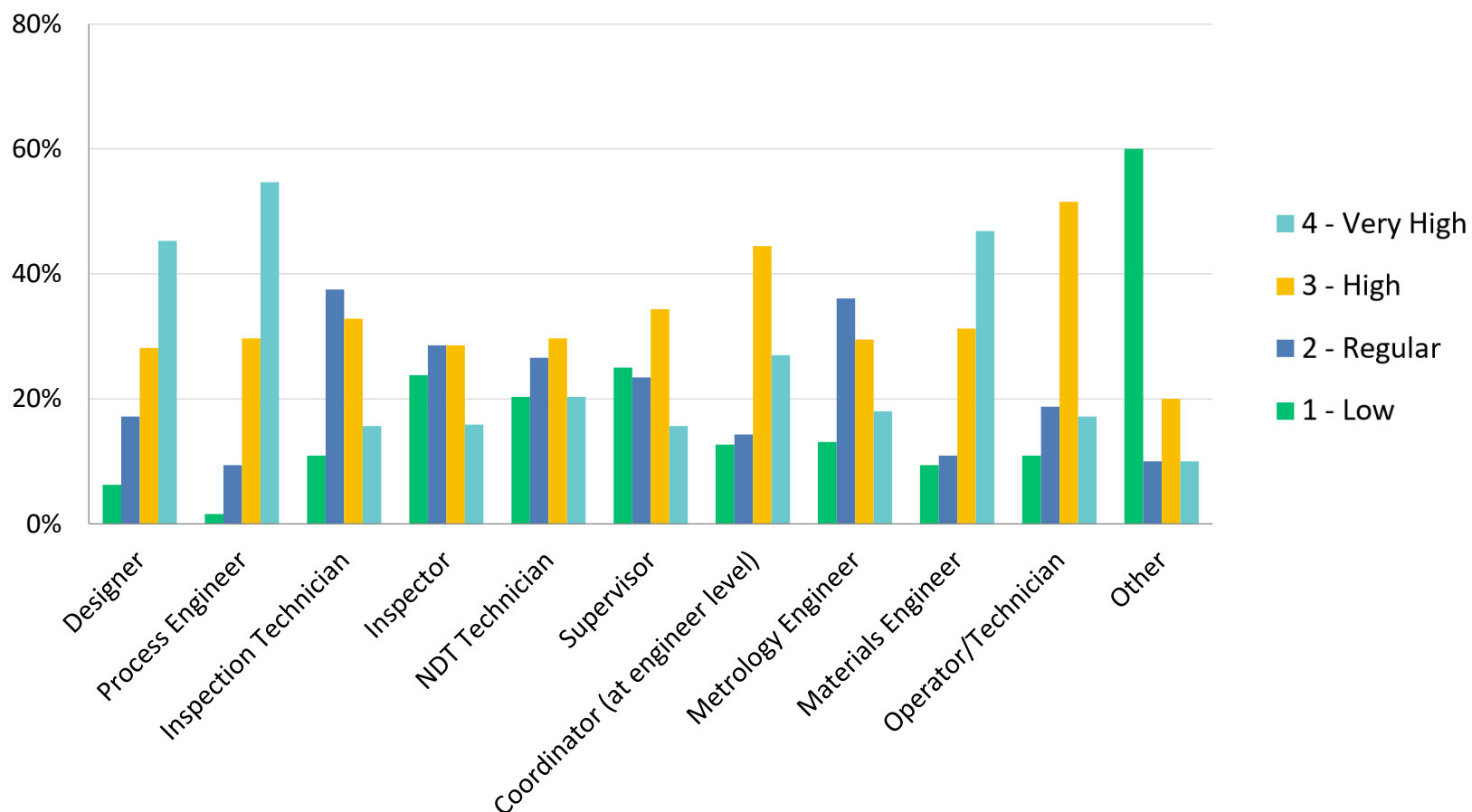


AM PROFESSIONAL PROFILES RELEVANCE (CURRENT)



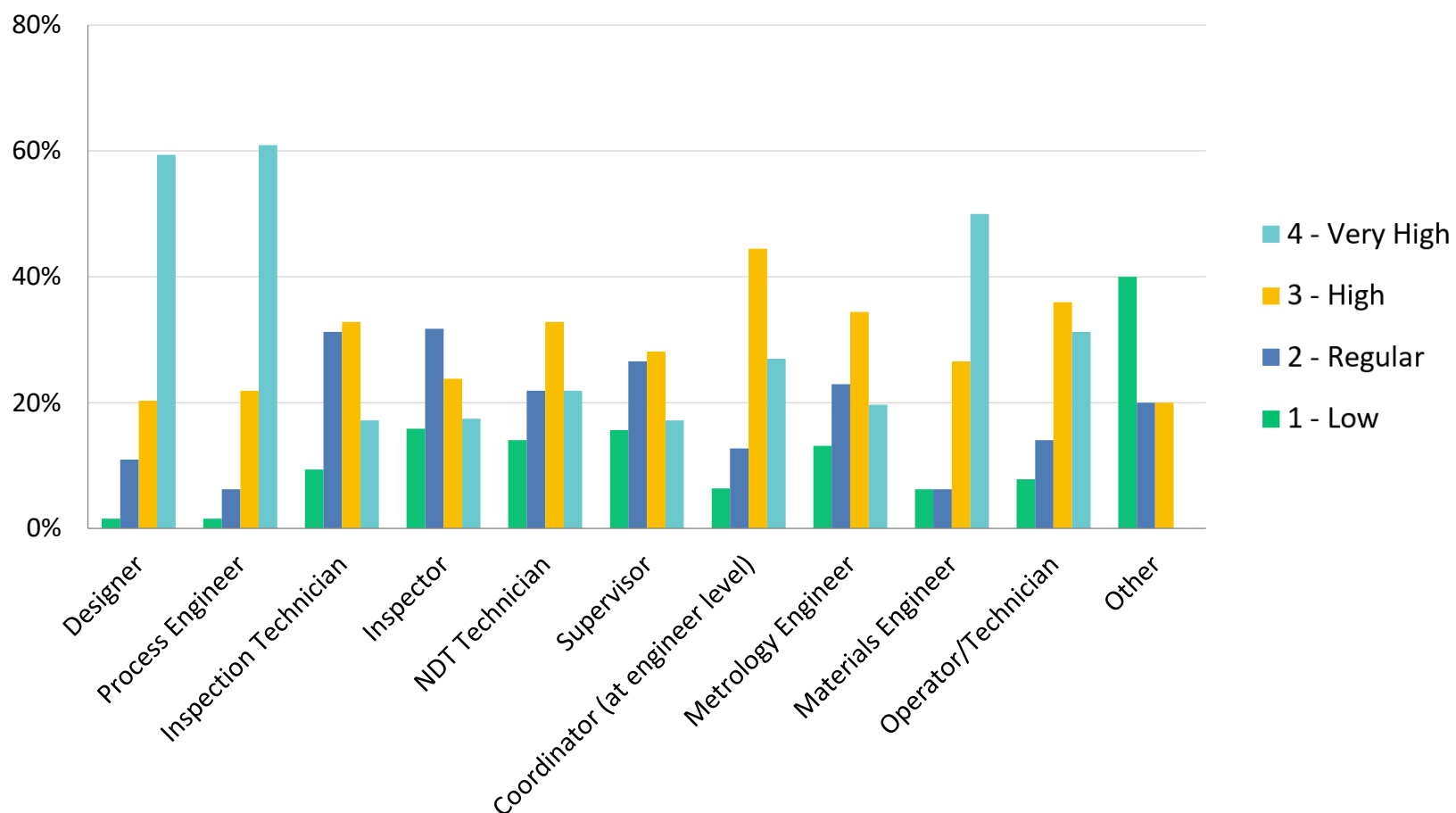
Current status shows that the highest demand is for **AM Process Engineer** (48% of very high relevance), followed by the **Designer profile** (42% of very high relevance), **the Specialist** (41% of very high relevance) and the **Materials Engineer** (41% of very high relevance)

AM PROFESSIONAL PROFILES RELEVANCE (SHORT TERM)



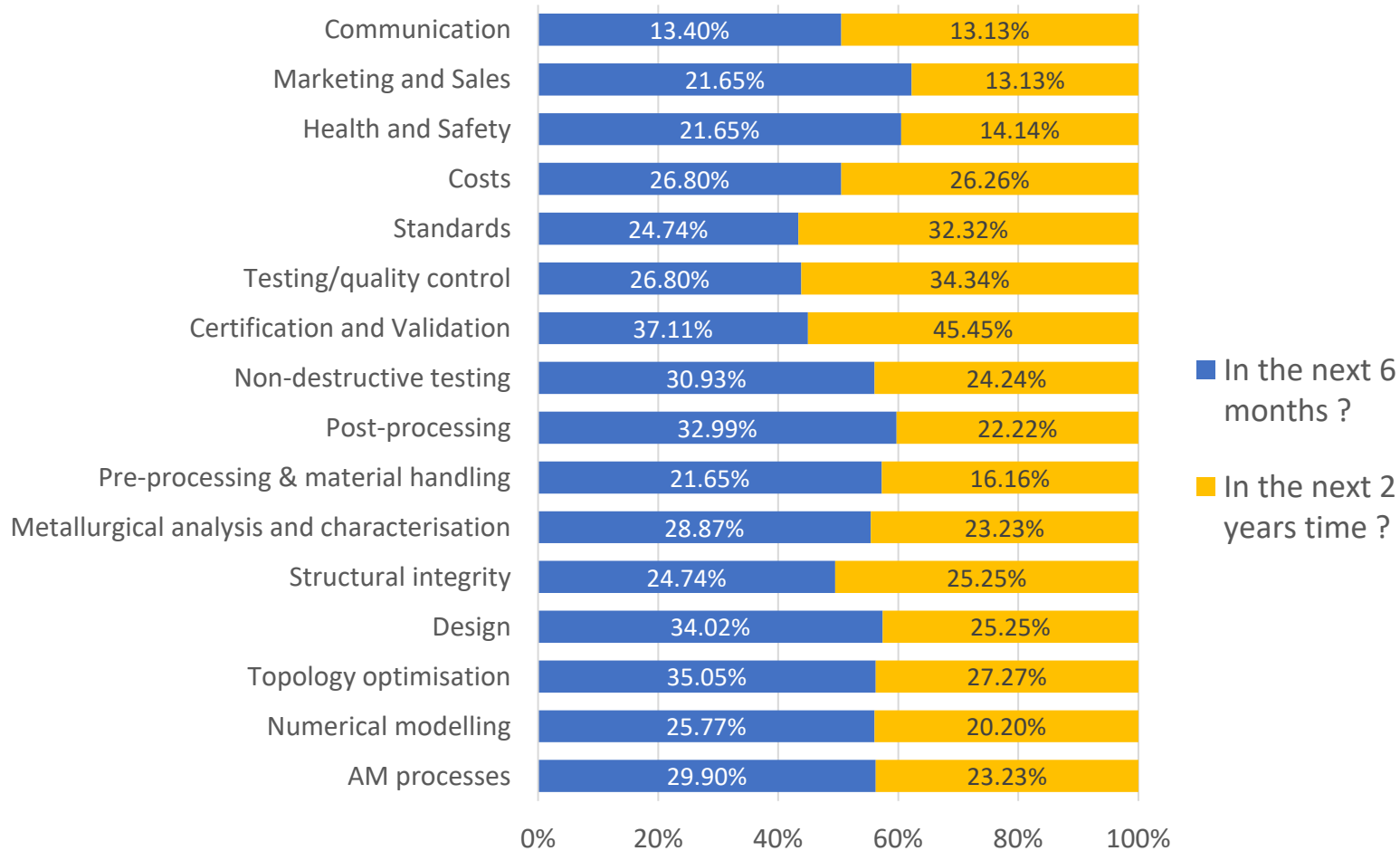
Regarding the relevance of the Professional Profiles required between 2020-2021, **AM Process Engineer (55%)** is the most relevant one, followed by the **Materials Engineer (47%)** and **AM Designer (45%)**.

AM PROFESSIONAL PROFILES RELEVANCE (LONG TERM)



For 2022-2025, the relative relevance continues to be the same

RELEVANT AM KNOWLEDGE LACKING



Next 6 months:

- Certification & validation
- Topology optimisation
- Design

Next 2 years:

- Certification & validation
- Testing & quality control
- Standards

RESULTS OF EXPERTS INTERVIEWS

Scenarios	Industry Survey - results	Industry Interviews— results
Relevant <u>AM knowledge</u> expected to be lacking in 2 years	Certification Quality Monitoring and Control	
	Validation Standards	Qualification Simulation CAD Modelling
Until 2021, relevance of <u>Non-Technological skills</u> for AM currently lacking and in 2 years	Costs	
	N.A.	Value creation
Until 2021, relevance of <u>transversal skills</u> for AM currently lacking and in 2 years	N.A.	Critical thinking, problem solving, learning to learn, working with others.

- Consistent towards the AM knowledge missing the next 2 years: Certification, Quality Monitoring and Control.
- Non-technological skills less relevant when compared with technological ones

AM SKILLS : RESULTS FROM WORKSHOPS

Technological	Entrepreneurship	Digital	Green	Transversal (soft)
<ul style="list-style-type: none"> • AM processes • Numerical modelling • Topology optimisation • Design • Structural integrity • Metallurgical analysis and characterisation • Pre-processing & material handling • Post-processing • Non-destructive testing • Certification and Validation • Testing/quality control • EHS • Standardisation • AM Machine and Feedstock Handling 	<ul style="list-style-type: none"> • Spotting opportunities • Creativity • Vision • Valuing Ideas • Ethical and Sustainable thinking • Self-awareness and self efficacy • Motivation and preserverance • Mobilising resources • Taking the initiative • Planning and Management • Coping with ambiguity, uncertainty and risk • Working with others • Learning through experience 	<ul style="list-style-type: none"> • Design systems • Simulation • Machine learning • Digital data analytics (AI) • Ability to think in 3D • Cybersecurity • Coding / programming 	<ul style="list-style-type: none"> • Resource efficiency management • Sustainability knowledge • Green Awareness • LCA • Eco-Design 	<ul style="list-style-type: none"> • Leadership • Self-management • Motivation • Flexibility • Sociability • Communication • Time-management • Making decision • Critical thinking • problem solving • learning to learn • Planning and organisation

Source: 1st SAM Workshop on Validation Of Needs & Define Priorities, Milan-Italy, December 2019

RECAPULATION

Currents skills needs and gaps
(Real Case Scenario, 2019)

AM Professional Profiles

Process Engineer, Designer and
Materials Engineer

Technological Skills

Certification, Validation, Topology
Optimisation, Design, Numerical
modelling, Standards

Entrepreneurship, Digital and Green
Skills

Costs, Resource Efficient Management/
Sustainability

Short term skills needs and gaps
(Short - term Scenario, from 2020 to 2021)

AM Professional Profiles

Process Engineer, Designer and Materials
engineer

Technological Skills

AM processes, Testing & Quality Control,
Design, Pre-processing & Material
Handling, Topology Optimization,
Certification and Validation

Entrepreneurship, Digital and Green Skills
Resource Efficiency/Sustainability,
Marketing and Sales

Technology Trends that will need to be
considered in the near future
(Foresight Scenario, from 2022 to 2025)

AM Professional Profiles

Designer, Process Engineer, Non- destructive
testing and Inspection Technicians

Technological Skills

Numerical Modelling, Non-destructive
Testing, Metallurgical analysis and
characterization, Pre-processing & material
handling; Data analytics Design, Materials
and process development.

Entrepreneurship, Digital and Green Skills
Resource Efficiency/Sustainability

JOIN SAM GROUPS!

All Students, Trainees and Jobseekers in AM are invited to join SAM project groups.

Sector Skills Strategy in Additive Manufacturing

<https://www.linkedin.com/groups/12231279/>



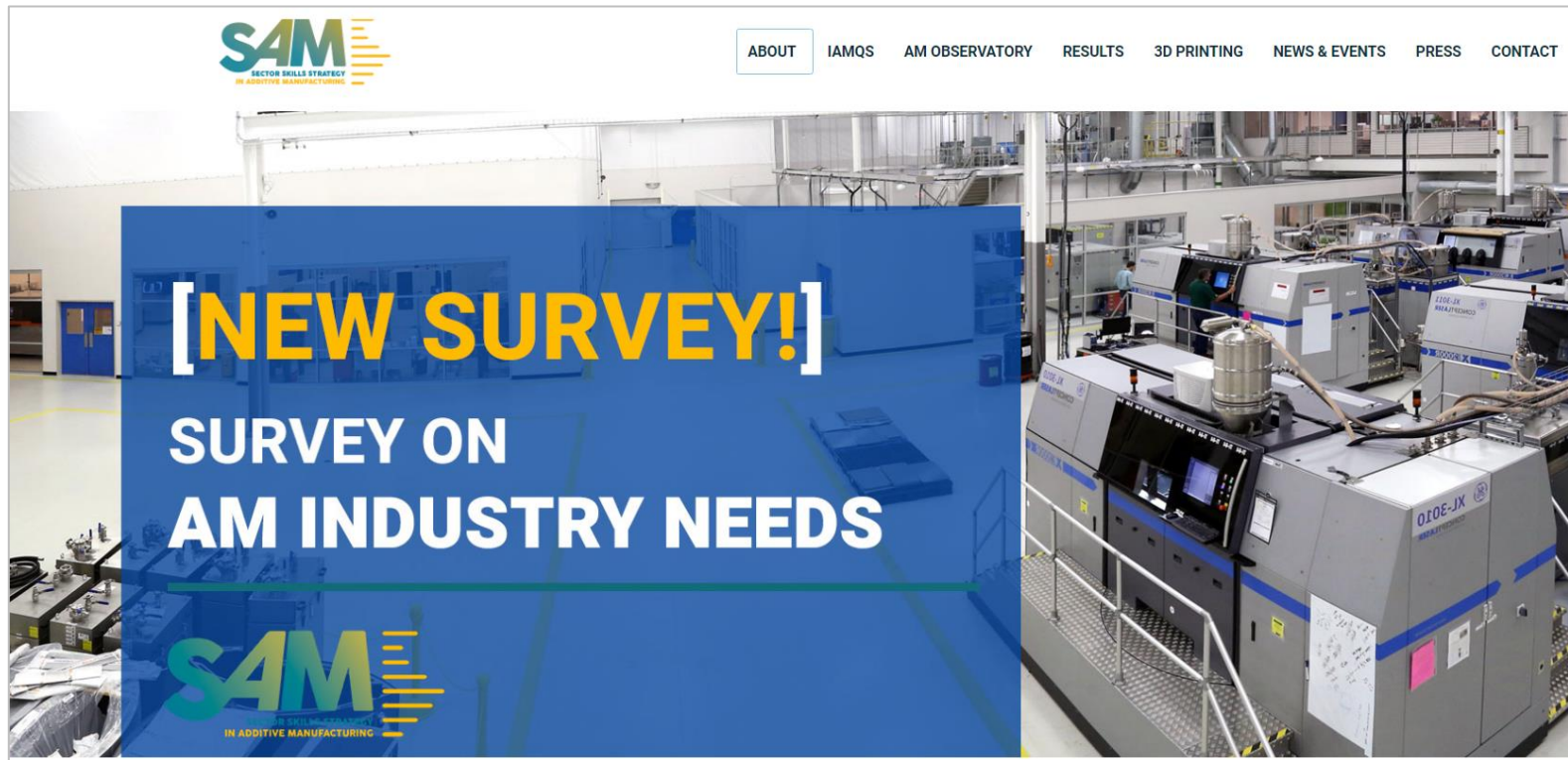
Students, Trainees & Jobseekers in AM

<https://www.linkedin.com/groups/8918566/>



SAM PROJECT WEBSITE



You can find more on SAM project website : www.skills4am.eu



Please take our Survey Question No. 3



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*Thank
you*