



Sector Skills Strategy in Additive Manufacturing Automotive Project Market, Mangualde, Portugal

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Adelaide Almeida, EWF





INTERNATIONAL AM QUALIFICATION SYSTEM

Based on the ONLY Manufacturing
Qualification System

ONE  **FORTY SIX 46**
SYSTEM **COUNTRIES**

30 YEARS OF INTERNATIONAL QUALIFICATIONS



Training Personnel in Welding & Joining



Technical Information



Qualification of Personnel in Welding & Joining



Technical Products



Certification of Personnel / Companies



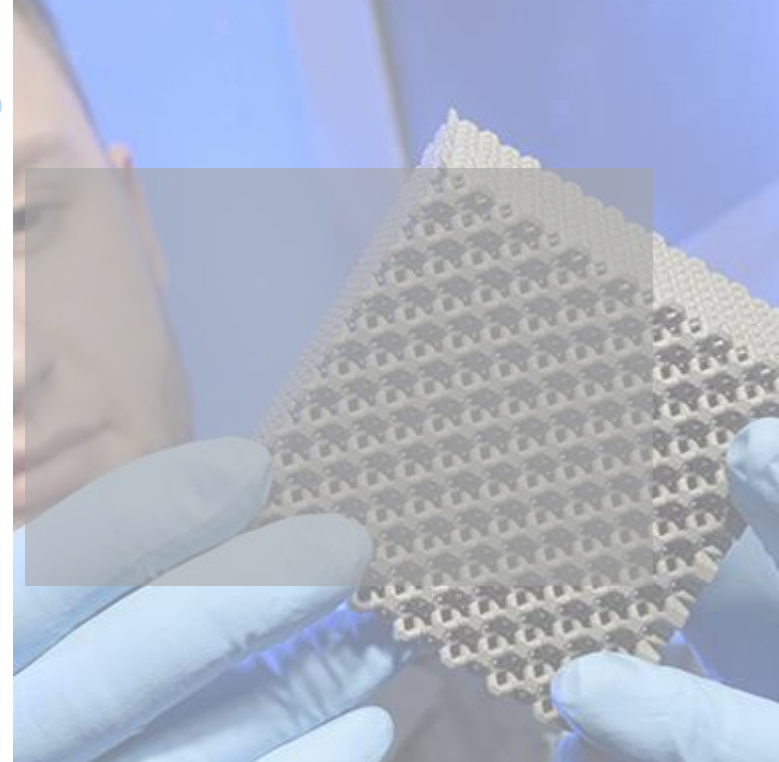
Collaboration Projects





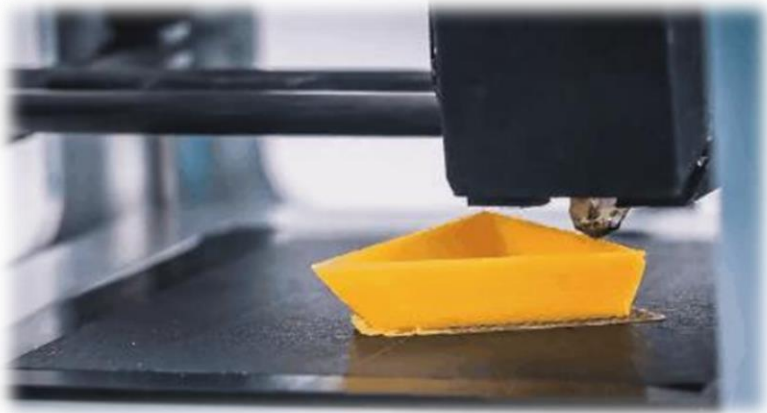
INTERNATIONAL AM QUALIFICATION SYSTEM

The ONLY Manufacturing Qualification
System



What is it ?

ADDITIVE MANUFACTURING or 3D PRINTING



Source: Giphy (2020)

- Design a 3D model of an object using a computer software
- Builds the object by adding (not subtracting) materials layer by layer

3D printing processes – Seven (7) categories

Material extrusion (most common)	<ul style="list-style-type: none">• The material is selectively dispensed through a nozzle
Material jetting	<ul style="list-style-type: none">• Droplets of build material are selectively deposited
Binder jetting	<ul style="list-style-type: none">• Liquid bonding agent is selectively deposited to join powder materials
Directed energy deposition	<ul style="list-style-type: none">• Thermal energy is used to fuse materials by melting as they are being deposited
Powder bed fusion	<ul style="list-style-type: none">• Thermal energy selectively fuses regions of a powder bed
Sheet lamination	<ul style="list-style-type: none">• Sheets of material are bonded to form a part
Vat photopolymerization	<ul style="list-style-type: none">• Liquid photopolymer in a vat is selectively cured by light-activated polymerization

Advantages

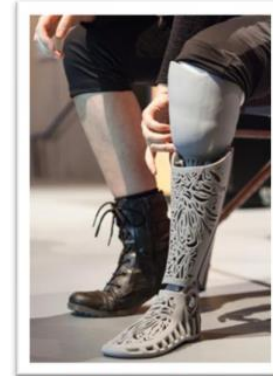
ADDITIVE MANUFACTURING or 3D PRINTING

Why 3D Printing

- ✓ Less waste
 - ❖ Use the right amount of amount of material with little or no material wasted
- ✓ Customisation
 - ❖ Each design can be different, and suited to what you want
- ✓ Complex geometries
 - ❖ 3D Printing can help create complex designs compared to traditional types of manufacturing
- ✓ Fast production
 - ❖ 3D Printing can make objects within a minutes or hours (depending on the complexity)
 - ❖ You need the **3D Model** and a **3D Printer**



Source: Amazon (2020)



Source: 3D Printing industry (2020)



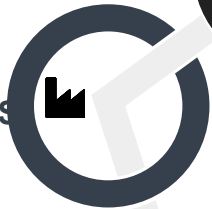
Source: pixabay (2018)



NATIONAL
REQUIREMENTS



INDUSTRIAL
REQUIREMENTS



FAST EVOLVING
TECHNOLOGY



DIFFERENT
LEVELS OF
SKILLS



VET AND HE



Alignment between IAMQS Qualifications and AM Standardization Bodies

Qualification of Personnel Standards:

Designer - ISO/ASTM 52937

Operators - ISO/ASTM 52926

Coordination - ISO/ASTM 52935





IAMQS

**NOW IMPLEMENTED
IN 7 COUNTRIES**

FIND OUT MORE

EWF.BE/IAMQS

Implementing the Qualification System



AM PROCESS ENGINEER



AM SUPERVISOR

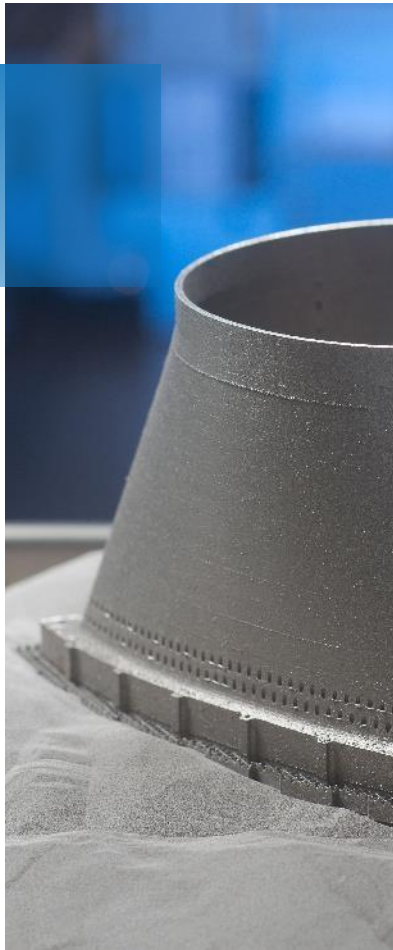


AM OPERATOR



AM DESIGNER

AM MODULAR SYSTEM

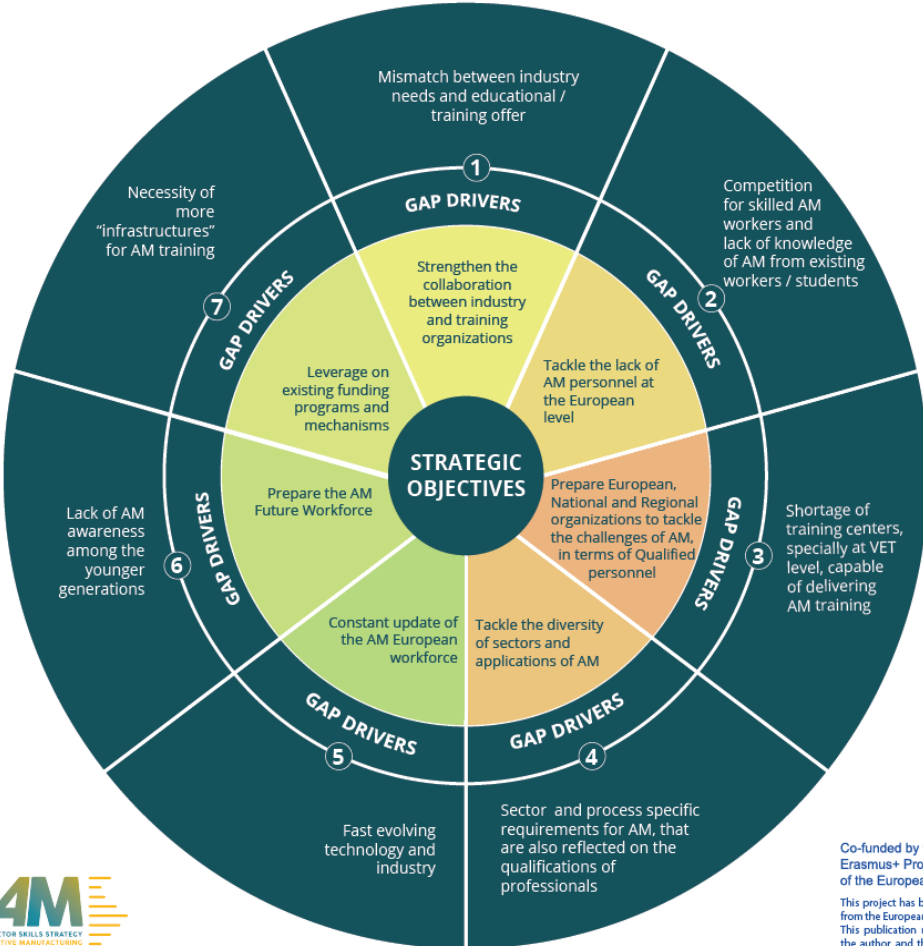




SAM plays a critical role in establishing the International AM Qualification System



Sector Skills Strategy in AM



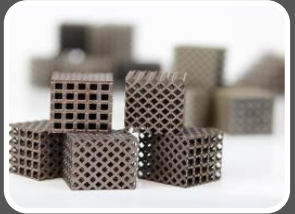
European Strategy for AM Personnel Qualification





Observatory in Additive Manufacturing

Two councils



Metal AM WG



Polymers AM WG



Martin
Schaefer



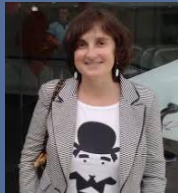
Industrial Council

David
Wimpenny



Qualification Council

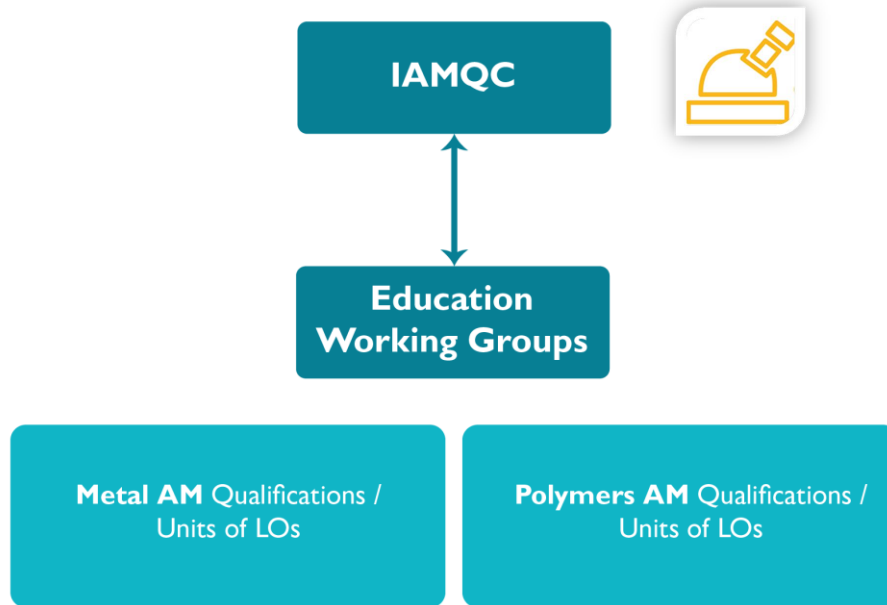
Paula
Queipó





Observatory in Additive Manufacturing

MATERIAL



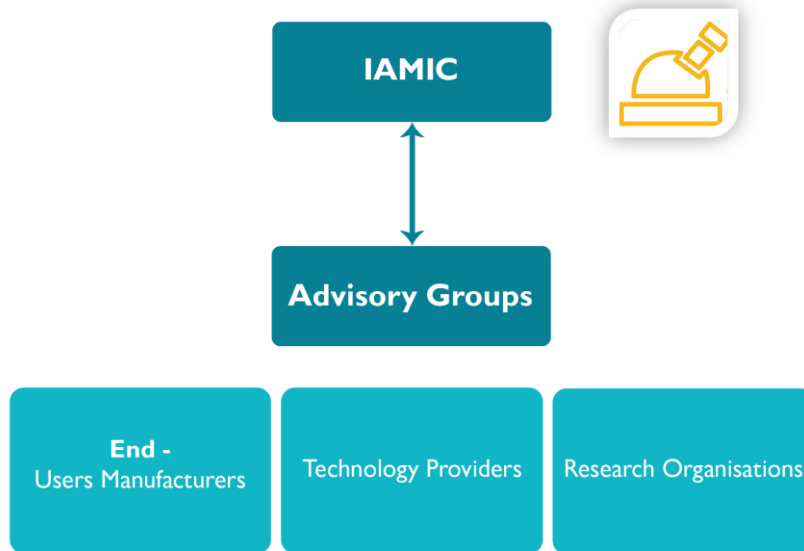
Qualification council

Experts Collaboration

- Participating in the **AM Qualifications review** sessions;
- **Develop new AM Qualifications/ Competence Units;**
- To take part in the **working sessions (2 to 3 meeting/year).**



Observatory in Additive Manufacturing



Industrial council

Experts Collaboration

- To **provide inputs and validate the AM skills needed** and technological trends to enable defining the skills strategy in AM;
- To take part in the meetings and **working sessions (2 to 3 meeting/year)**.

AM Skills Forecast

Real Case

- Annually
- Immediate skills

- Surveys
- Interviews
- Literature review & Job Offers

Short Term

- Every 3 Years
- Short-term skills to be addressed

- Surveys
- Interviews
- Exploratory Methods

Foresight

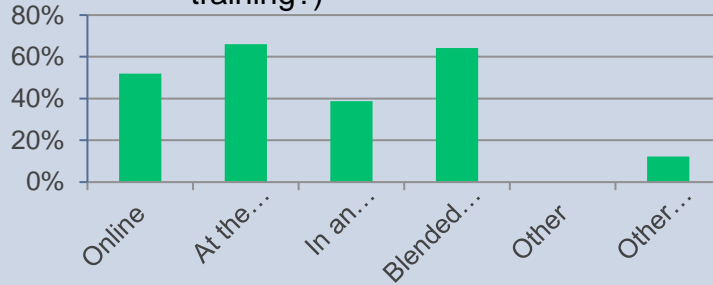
- Every 10 Years
- Forecast skills and trends

- Delphi
- Exploratory Methods

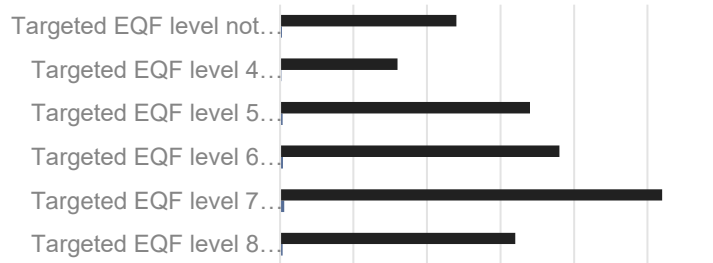


Short Term Scenario - Training

How does your organisation provide training?)

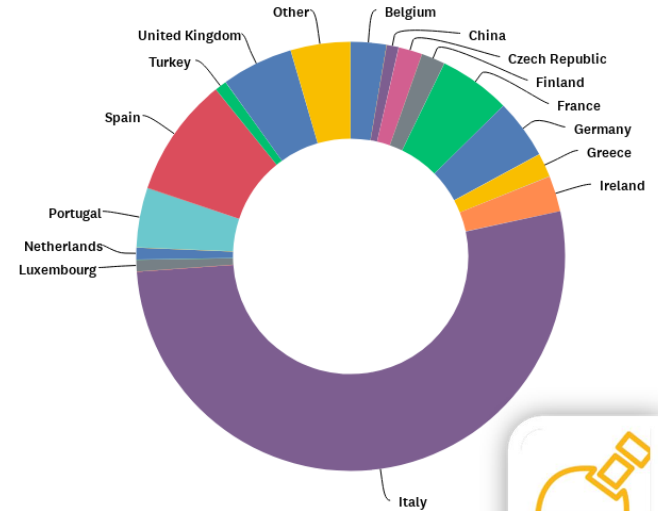


Targeted EQF level



AM Forecast Results

Q2 In which country is your organisation based?



Real Case Scenario – Industry and Employers Needs

AM Forecast Results

Skills	Addressed in AM Courses (Source 2019 survey)	AM Workers Skills Gaps (Real Case and Short term Scenario survey, 2020 - 2022)	AM Companies Skills Gaps (Real case Scenario 2020 survey)
Technological	<ul style="list-style-type: none"> AM Processes AM Applications Design (CAD Modelling) Materials analysis and characterisation 	<ul style="list-style-type: none"> AM processes AM applications Materials' analysis and characterization Design 	<ul style="list-style-type: none"> Post-processing Certification and validation, standards and costs
Entrepreneurial	<ul style="list-style-type: none"> Creativity Working with others Learning through experience 	<ul style="list-style-type: none"> Learning through experience Working with others Vision Spotting opportunities 	<ul style="list-style-type: none"> Creativity Financial and economic literacy Working with others
Green	<ul style="list-style-type: none"> Eco-design, Circular economy Life Cycle Analysis (LCA) 	<ul style="list-style-type: none"> Resource efficiency management Circular economy 	<ul style="list-style-type: none"> Life Cycle Analysis (LCA) Circular economy Resource efficiency management
Digital	<ul style="list-style-type: none"> Cybersecurity Ability to think 3D 	<ul style="list-style-type: none"> Ability to think 3D, Digital data management Digital data analysis 	<ul style="list-style-type: none"> Ability to think in 3D Digital data analysis, Digital data management

AM Companies (2020 survey)	Materials	Required AM Professional Profiles
	Metals followed by Polymers	Process engineer, the AM designer and the materials engineer



AM value chain

Expected developments and technological trends

Impact on skills and occupations

Modelling & Design



- Availability of more public standards for modelling & design
- More reliable simulation techniques for most AM technologies

- More training qualifications and public standards to ensure the widespread application of AM technologies.

Materials



- Cost reduction across AM materials and feedstock
- Main materials will include **aluminium, copper, Inconel** (i.e. nickel-chromium-based superalloys) and **titanium** and emerging materials will include **hybrid materials, composites, functionally graded materials** and **metal alloys**
- Availability of more public standards for materials

- Increased need for more **AM supervisors, digital experts, data managers and specialists** to develop new AM processes and algorithms.

Processes



- Main processes will include **bioprinting, directed energy deposition, metal binder jetting** and **powder bed fusion**
- Cost reduction across AM machines and equipment
- Workflow simplification, increased automation and establishment of AM in series production
- Combination of multiple AM processes for efficient manufacturing
- Availability of more public standards for AM equipment and software

- Training for different roles, such as **AM supervisor, AM engineer, AM designer** to become qualified.

- Predicted occupations include **process experts, data manager / miners, AM designers** and **AM operators**.

- Increased need for AM workers to know the overall AM process supply chain.

- Occupations that will benefit the **reskilling** from "conventional" processes to AM technology include **welding inspectors, coordinators, operators** and **designers**.

- Higher uptake of AM across more industries and sectors.

Post-Processes



- Cost reduction for post-processing
- Availability of more public standards for post-processing stages

Products



- Am products with larger dimensions
- Cost reduction and development of standards for AM products
- The major sectors will be the **aerospace, automotive** and **medical sectors**
- For aerospace, the main AM parts will be fuel nozzles and systems, guide vanes and turbine blades
- For automotive, the main AM parts will be spare parts, low volume interior parts and engine components
- For medical, the main AM parts will be implants, prosthetics and surgical models

End-of-Life



- Availability of established processes and more public standards for end-of-life processing
- Cheaper end-of-life processing options

AM Forecast Results FORESIGHT (Trends until 2030)





New Qualifications and AM Skills

AM Polymers Designer

Overview on polymer materials and properties

Designing Polymers Parts

Post Processing for Polymers

Design for Material Jetting

Design for Material Extrusion

Design for Powder Bed Fusion of Polymers

Design for VAT Photopolymerization

Business for AM

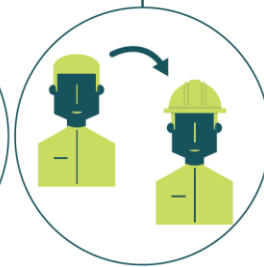
Sustainability for AM

Certification, Qualification & Standardisation

Binder Jetting Process

LATEST RESULTS

New Profiles, Qualifications and CUs





Collaborate with us

THE INTERNATIONAL AM QUALIFICATION COUNCIL

Is a pillar of the European Observatory in AM that will continue beyond the SAM project.

Its role is to assess and supervise entities wishing to become AM Authorised Bodies (ANBs), according to specific rules and procedures and it is also responsible for administering the AM Qualification System

Nominates Education Working Groups and Subgroups composed of experts in education and in AM, who will work towards updating or creating Qualifications/Competence Units with the help from the Industry Advisory Group, if needed.



BECOME A RECOGNISED EUROPEAN INDIVIDUAL EXPERT IN THE AM FIELD

Do you want to find out more?

Visit the link below:

<https://skills4am.eu/callforexperts.html>

WHAT ARE THE BENEFITS?

Influence the development of European skills for industry

Visibility in the European AM Observatory and among public, industry, policy makers at National and European levels, namely among the European Commission.

Recognition as an European Individual Expert

Unique opportunity to exchange experiences with other European Experts in AM

Active role in the development and/or update of the Unique International Qualification System for AM

Invitation for participating in closed meetings/workshops

Invitation and free access to workshops/webinars.

THANK YOU.

madealmeida@ewf.be

www.ewf.be



IAMQS