SECTOR SKILLS STRATEGY
IN ADDITIVE MANUFACTURING

4.6 Follow up and impact of AM Training Report

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Contents

1. Introduction

This report provides an overview of the results obtained with the follow-up to the participants involved in the 1st stage of SAM piloting activities, six months after the training occurred. These activities included the piloting of the methodology for creating professional profiles and skills through the implementation of revised training guidelines for the IAMQS (International Additive Manufacturing Qualification System), including its Quality Assurance System.

The SAM piloting courses, conducted under WP5 (5.3 Piloting events of the 1st Stage Real Case Scenarios), addressed the implementation of the revised guidelines for Metal AM (Additive Manufacturing) Process Engineer Powder-Bed Fusion and two individual Competence Units (CUs)/ Units of Learning Outcomes (LOs) from the Metal AM Designer for PBF Processes; namely: Simulation Analysis (CU61) and Simulation Execution (CU62). In total, 13 CUs were implemented virtually and 4 on-site, as in-person training and face-to-face meetings, from November 2020 to February 2021. The implementation of the 1st Stage Real Case Scenarios counted with more than 500 participants (about 22% female) in the lectures, from which 408 students completed the assessment.

The report compiles the information obtained through the implementation of D2.6 *Kit for tracking students, future employees and job seekers in AM* (developed in Work package 2) as well some recommendations to improve future training sessions, collected among the participants of the 1st Stage Real Case Scenarios Piloting Events. Despite having close to 500 participants in the AM pilot courses, only 136 responses were collected with the 6-month follow-up questionnaire.

2. Tracking and follow up survey results

After 6 months of the 1st stage piloting course taking place, participants were invited to provide their feedback regarding the impact and usefulness of the AM Training courses received. A total of 136 answers were collected, and the findings are described below.

2.1 Participants background

In terms of profile and current job position, the survey participants were Process Engineers (22%), followed by Operator/Technician (19%) and Student (19%), Designer (11%), Manager (8%), Researcher (7%), Supervisor (3%), Materials Engineer (2%), R&D Engineer (2%), Inspector & Quality Assurance (2%), Other (5%), such as Assistant Lecturer; Calculation Engineer; Energy Engineer; Machine Safety Specialist; Principle Manufacturing Engineer; Projects/Manufacturing Engineer; and Associate professor, as seen below in Figure 1.

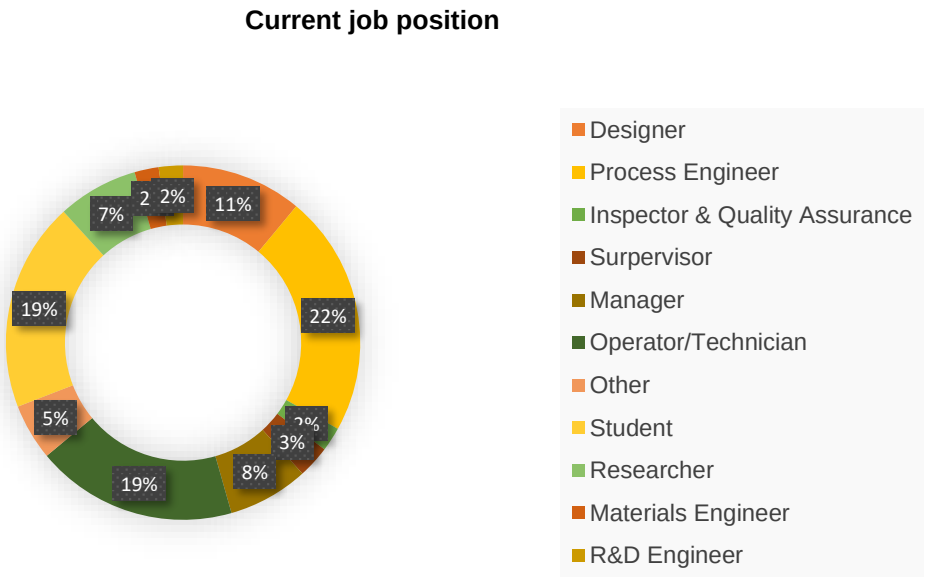

Figure 1 Current job role within your organisation

In terms of employability data, 85% of the participants replying to the survey were employed before starting the training, compared to 15%, who were unemployed, as represented in Figure 2.

These findings are quite positive, as they show participants' commitment to lifelong learning and re-skilling towards a specialization and/or acquisition of knowledge in the AM field. As for the unemployed participants, it means that they are investing in learning about AM to improve their future career/ employability and to increase their opportunities to integrate into the labour market.

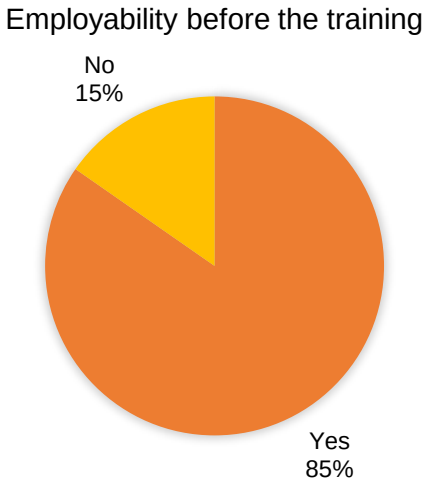

Figure 2 Employment before the training

2.2 Competence unit course (SAM Pilots) feedback

The 136 questionnaire participants had attended the following training courses, which are distributed among 17 different CU/ULOs as shown in Figure 3, by decreasing order:

- 15% attended CU 26: Introduction to Materials;
- 14% attended CU 35: Metal AM Integration;
- 13% attended CU 01: DED-Arc Process;
- 10% attended CU 27: AM with Steels Feedstock (excluding Stainless Steel);
- 10% attended CU 15: PBF-LB Process;
- 8% attended CU 00: Additive Manufacturing Process Overview;
- 5% attended CU 44: Conformity of PBF-LB parts;
- 5% attended CU61: Simulation Analysis;
- 5% attended CU 25: Post Processing;
- 5% attended CU 43: Production of PBF-LB parts;
- 4% attended CU 30: AM with Nickel Feedstock;
- 3% attended CU 34: Process Selection;
- 3% attended CU 08: Directed Energy Deposition-Laser Beam;

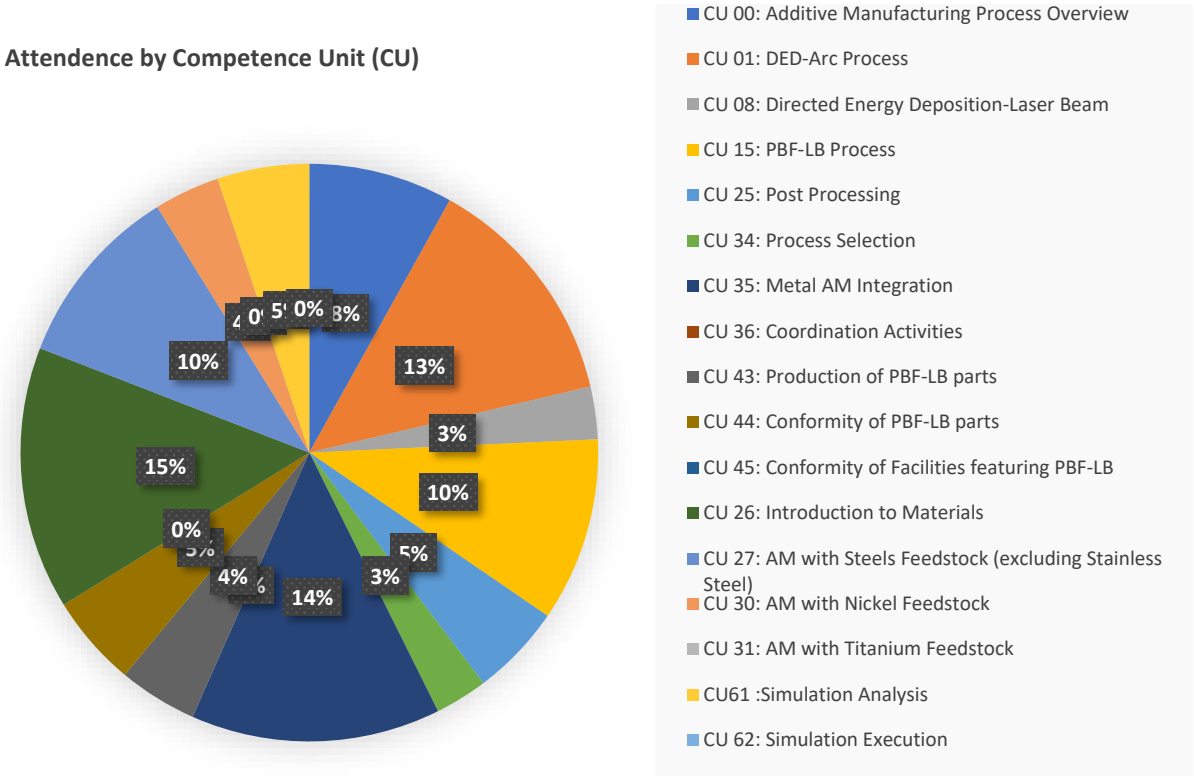

Figure 3 Attendance by CU

2.3 Applicability and future training

In terms of **applicability of the knowledge and skills** acquired into the professional activity**,** 83% of the participants considered it highly positive (see figure 4), namely **very good (**rated by 40% participants) **and good** (rated by 43% participants). Only 17% of participants considered the applicability as reasonable (rated as fair by 14% and poor by 3%).

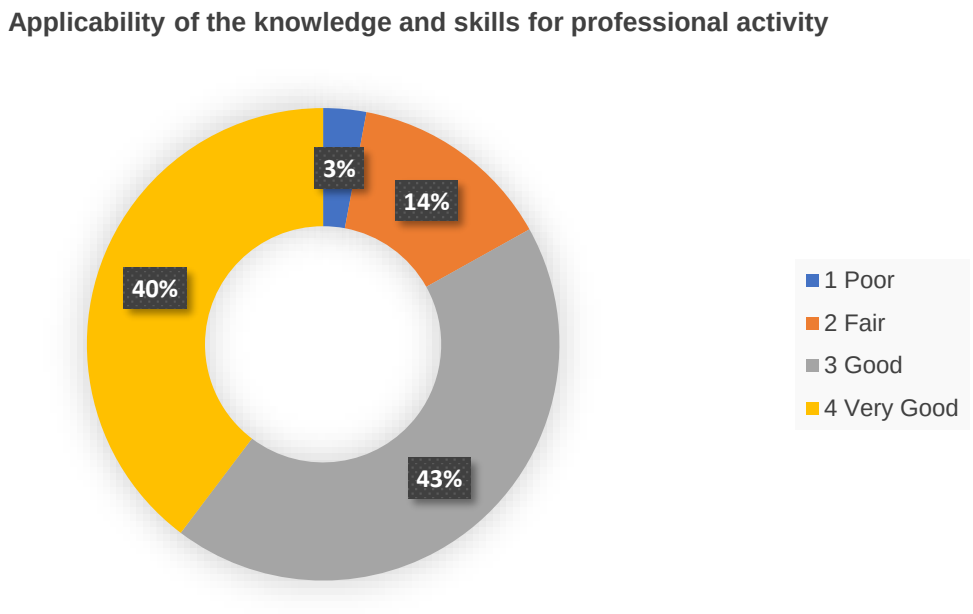

Figure 4 Applicability of the course towards current professional activity

In terms of future participation in training, as seen in Figure 5, 77% of the participants mentioned not having attended any other course/training after the AM course, in opposition to 23% of participants that have enrolled in a new course. From this percentage, 13% mentioned to have enrolled in *Other Courses* such as SAM Pilot Course CUs ; CU “Overview on Polymer Materials and Properties” and the CU "Business for Additive Manufacturing; Hydrogen Technologies; MITxPRO Additive Manufacturing for Innovative Design and Production; Industry 4.0; Management Course; Seminars; and Mechanized Courses; followed by 6% enrolling in coursed leading to Master’s Degree, Post Graduate Certificate/Diploma (EQF Level 7); 2% in courses leading to Bachelor’s Degree, Graduate Certificate/Diploma (EQF Level 6), 1% in courses leading to a Higher Education Certificate/Diploma (EQF Level 5) and 1% in courses leading to National Certificates, Professional Development Awards (EQF Level 4).

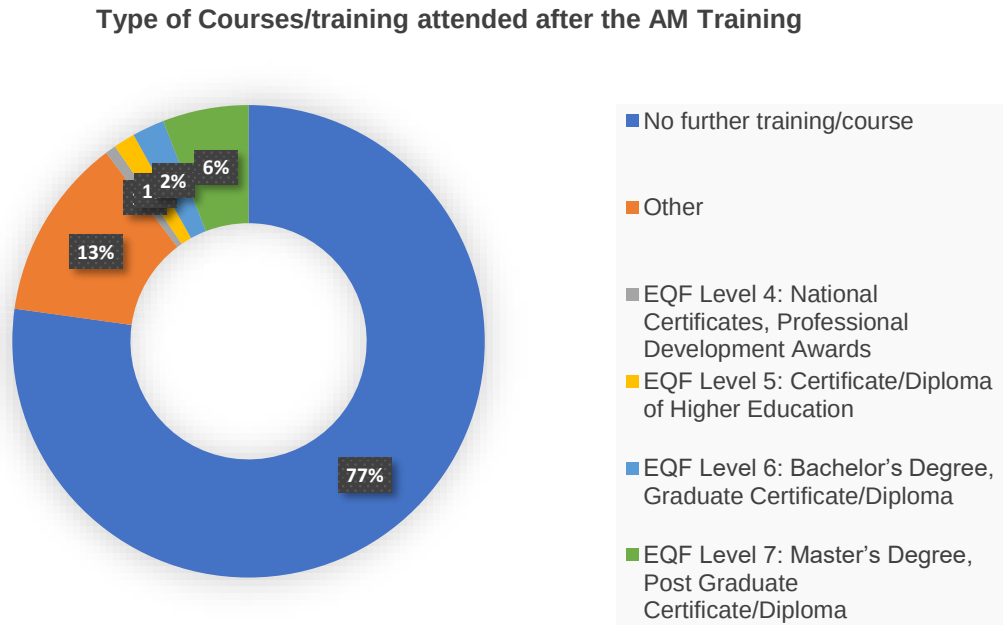

Figure 5 Attendance of courses/training after the training course

2.4 Qualitative Feedback

Based on the comments left by the participants of the pilot courses, it was possible to conduct a SWOT analysis aiming to identify the pilot courses main strengths, weaknesses, opportunities and threats, as follows:

SWOT Analysis		
S trengths	characteristics of the course considered as **advantages** over others	Helpful content for professional use (CU 15: PBF-LB Process)
W eaknesses	characteristics of the course that place it in **disadvantage** comparing to others;	Examination /exams questions Examination time Compliance with deadlines in providing feedback and/or content
O pportunities:	external elements to the course that can be **exploited** in its favour;	Provide more examples from people in the industry (CU 15: PBF-LB Process) More prompt feedback in providing feedback to participants Stick to the deadlines to provide additional content and ensure that all the materials provided work properly (CU 15: PBF-LB Process)
T hreats	external elements to the course that need to be **improved/controlled** to avoid their impact over the course	Funding sources should be expanded, so that students and postdocs can attend (CU 26: Introduction to Materials)

Table 1 SWOT Analysis

This way, the qualitative feedback of the participants can be used for the improvement of future AM training courses.

3. Conclusions

The report compiles the information obtained through the implementation of D2.6 *Kit for tracking students, future employees and job seekers in AM* (developed in Work package 2) among all participants of the 1st Stage Real Case Scenarios Piloting Events. Despite the low number of responses collected during the implementation of the impact and follow-up survey - only 136 answers were collected with the follow-up questionnaire from the overall AM pilot courses 500 participants - it was possible to conclude about the following:

- **AM course contents were attractive for both workers** (85% of the participants were employed before starting the training) **and unemployed people** (15% of the participants had no current working position)
- Diversity of profiles attending the course and replying to the Survey, where most of the respondents are involved in Engineering, Machine Operations, Design, Management and Research tasks.
- The training provided had a **positive impact concerning the applicability and transfer of knowledge and skills into the professional activity** (83% rated as very good and good applicability)
- The training provided had a lower impact as a trigger for enrolling in future training (only 23 % mentioned having started another course).

Finally, some recommendations were left by the participants to improve future training sessions, namely by providing industrial case studies/examples to help understand the course and to revisit the assessment questions and their alignment with the course content delivered.