



D4.6 Pilot Activities Report

3rd Stage Piloting of Short-Term Scenarios
and RPL material:

Competence Units /Units of learning outcomes for lectures:

CU 72 – Metal Binder Jetting Process

CU 73 – Sustainability for Additive Manufacturing

CU 63 - Certification, Qualification and Standardization in Additive
Manufacturing

Recognition of prior learning process:

CU34 – Process Selection

CU35 – Metal AM integration

CU36 – Coordination activities

CU43 – Production of PBF-LB parts



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WP5 Pilot Activities Report

Qualification/Professional Profile: Process Engineer PBF-LB | 2 Competence Units: Metal AM Designer
Project No. 601217-EPP-1-2018-1-BE-EPPKA2-SSA-B

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Abstract

The overall objective of the 3rd stage piloting activities was to test the methodology for creating professional profiles and skills, though the implementation of the International AM Qualification System (IAMQS), where the new developed guidelines for AM competence units are being integrated. As such, the focus of the pilots is not limited to the CU content, rather foresees the quality assurance rules/procedures, such as the use of harmonised training guidelines and internationally approved questions for the assessment, which is being supervised by an external body. Also, material for Recognition of Prior Learning (RPL) for specific CUs was implemented to test if it would be possible to apply RPL tools, such as technical interview and demonstration to determine the status of knowledge and skills on a certain topic that was acquired by other activities than attending formal education and training.

This document is a deliverable of Work Package 4 (Observatory in Additive Manufacturing → D4.6 Feedback Report on Existing Qualifications and Training Modules) in SAM project, whereas the piloting activities were conducted under the scope of Work Package 5 (Piloting of the methodology for creating and revising professional profiles and skills deployment → D5.7: Piloting of the Short-Term Scenarios – New Professional Profiles/Qualifications and Competence Units/ Training Modules). The implementation process encompassed the development of training materials, preparation of the assessment material, delivery of courses, the conduction of the final assessments by authorized nominated bodies (ANBs), collection of participants feedback, handing out certificates of completion or record of achievements to participants who passed the final assessment and development of a national report on the piloting activity as evidence. The piloting of the RPL material dealt with the conduction of a technical interview and - if applicable - AM demonstrations, asking the participants for feedback after the process.

The 3rd stage of testing short term case scenarios was implemented by the SAM consortium between November 2021 and March 2022. The new developed competence units (CUs)/ units of learning outcomes (ULOs) on Metal Binder Jetting (CU72 – Metal Binder Jetting Process) and on Sustainability (CU73 – Sustainability for AM) were piloted by the SAM partners IMR, MTC and POLIMI in March 2022. An external Authorized Training Body (ATB), ITECAM (Tomelloso, Ciudad Real), also piloted “Sustainability in Additive Manufacturing” in March 2022. In addition, the CU on Certification, Qualification and Standardization (CU63 – Certification, Qualification & Standardization in AM) was also piloted by the partner FA in the end of 2021. In addition, recognition of prior learning (RPL) material for competence units CU34 – Process Selection, CU35 – Metal AM integration, CU36 – Coordination activities and CU43 – Production of PBF-LB parts were tested until March 2022.

A total of 4 courses and 15 RPL technical interviews with 9 AM demonstrations on 4 different competence units were conducted. All in all, 15 trainers were engaged in the piloting courses, 15 attendees did one of the PRL interviews and 71 participants attended in the courses. 52 participants of the courses answered to the feedback survey and 34 of them attended in the final assessment.

The feedback achieved in the overall pilots was positive. The dynamic of the sessions and the relevance for own job activities was highlighted by the attendees of the courses. All of them answered that the course met their expectations and that they would recommend it to others. The involvement and support of AM experts in RPL was marked as very good by the participants

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of the RPL process. They had the opinion that the material is suitable to identify candidates with prior knowledge on a certain topic.

During this third stage of piloting, the overall performance of candidates was very positive, since 14 of 15 conducted RPL technical interviews were passed and all 9 AM demonstrations were passed. 32 of the 34 final assessments after the course were passed which corresponds to 94% of the attendees. By applying the experiences and lessons learned from the first and second stage, a significant improvement in the results of the final assessments could be achieved (77% passed and 23% failed in the second stage).

Finally, the results also revealed that the skills and knowledge described in the CUs and taught are suitable for being able to successfully complete the assessment, and ultimately the AM courses. It is concluded that the methodology applied to design training programmes for each CU and the RPL technical interview and AM demonstration were suitable for their purposes.

In terms of specific content of the new CUs, no changes will be introduced to the guidelines. A revision of the RPL questions might be useful to avoid redundant contents and to specify the contents required. As an outlook, it can be stated that all findings and outcomes from this stage of piloting will be fed directly into the IAMQS, the follow up survey after 6 months of the pilot course, will be applied to the attendees to identify impacts of their attendance in the course experience. Moreover best practices collected on conducting piloting activities will be used in WP6, where the full profile of the Metal AM coordinator will be implemented.

1. Introduction

This document describes the piloting activities conducted in the 3rd stage of piloting – focusing on short term scenarios – in November/December 2021 and March 2022. The evidence was collected in December 2021 (for CU63) and in April 2022 for the CUs/ULOs from D5.6. In addition, in the 3rd stage of piloting in SAM project, recognition of prior learning (RPL) material for 4 competence units was tested with 3 to 4 participants per competence unit. The findings were outlined in the single national activity reports and concluded in this overall report.

This overall report is a deliverable of WP4 (Observatory in Additive Manufacturing → D4.6 Feedback Report on Existing Qualifications and Training Modules), whereas the piloting activities were conducted under the scope of WP5 (Piloting of the methodology for creating and revising professional profiles and skills deployment → D5.7: Piloting of the Short-Term Scenarios – New Professional Profiles/Qualifications and Competence Units/ Training Modules). The piloting stage included the implementation of the training courses with a final assessment and the collection of feedback using the feedback kit developed in WP2 (Forecast methodology: assessment of current and future skills in AM) across four project partners and one external ATB. POLIMI, MTC, IMR and ITECAM supported the CU / ULO piloting activities for the 3rd stage of Short-Term Scenarios. The RPL (Recognition of Prior Learning) piloting was conducted in March 2022 for CU34, CU35, CU36 and CU43 with three to four participants each. The partners MTC, AITIIP and IDONIAL were engaged in the piloting of the RPL material that encompassed several interview questions and sometimes also a task for a demonstration. After having passed the interview (and the demonstration task) participants were asked to answer a feedback survey on the process.

The overall objective of the 3rd stage piloting activities was to test the methodology for creating professional profiles and skills, though the implementation of the International AM Qualification System, where the new developed guidelines for AM competence units are being integrated. As such, the focus of the pilots is not limited to the CU content, rather foresees the quality assurance rules/procedures, such as the use of harmonised training guidelines and internationally approved questions for the assessment, which is being supervised by an external body. Also, material for the RPL for specific CUs was implemented to test if it would be possible to apply RPL tools, such as technical interview and demonstration to determine the status of knowledge and skills on a certain topic that was acquired by other activities than attending formal education and training.

Based on the results and feedback achieved from participants and trainers involved in the piloting courses, RPL interviews based on the IAMQS and the final assessment, conclusions can be drawn, whether the methodology and content in the guidelines is appropriate for its purpose (e.g., developing and/or enhance AM knowledge and skills) or needs to be revised.

2. Overview on 3rd stage Short-Term Scenarios' piloting activities

2.1. Selection, distribution and conduction of piloting courses

The results of D4.5 (3rd report on the analysis and validation of needs) showed demands of the AM industry regarding the technological and transversal topics, respectively, binder jetting process and sustainability for AM. Based on these results, the consortium decided to develop a new CU on Sustainability at basic level and a new CU for the Metal Binder Jetting process at independent and advanced level for the 3rd stage addressing Short Term Scenarios' Needs (please refer also to the D5.6 report: "3rd Stage Short Term Scenarios – New Competence Units/ Training Modules and RPL material"). This D5.6 document served as the basis for D5.7 (Piloting of the Short-Term Scenarios – New Professional Profiles/Qualifications and Competence Units/ Training Modules). A competence unit for sustainability and one for Metal Binder Jetting was developed, as well as RPL material for four CUs of the Professional Profile Engineer PBF-LB (interview questions with solutions and task for a demonstration with solution). All the new material developed within D5.6 was implemented and tested in D5.7. In addition, it was decided to also pilot the CU 63 on Certification, Qualification and Standardisation in AM again. It was developed in the prior 2nd Stage of piloting with a focus on Real Case Scenarios in D5.4 (2nd Stage Real Case Scenarios – Revision or New Professional Profiles/Qualifications and Competence Units/ Training Modules) and was also piloted within the scope of the 3rd stage having a deeper focus on the industry than the other courses before which had a more general approach. The outcomes and recommendations for improvement identified in the 2nd stage of real case scenarios were also considered for the piloting activities in the testing period in the 3rd stage on a short-term scenario.

The objective of the piloting activities, in the point of view of consortium members and trainers, was to test the methodology through the implementation of the new guidelines and recognition of prior learning (RPL) material from deliverable D3.2 (Kit of templates – Revision and Creation of Professional Profiles), in order to validate whether the process, content, structure and recommended contact hours and conducted lessons are adequate to develop skills in AM or whether these require a revision process. For the RPL material, the objective was to test if the methodology developed in D3.2 is appropriate to develop RPL scheme and to be able to query and evaluate AM knowledge and skills, that was acquired outside formal education and training, in a harmonized and structured way. While from the point of participants, it was tested, if these can pass the final exam – conducted by IAMQS ANBs – after attending the lectures on a certain CU, when lecture and assessment were both prepared based on the guideline. For the RPL piloting, it was tested if participants with knowledge on AM can answer the interview questions and to perform the AM demonstrations (if applicable for the CU). Not all CUs had a practical demonstration. Below, the new CUs/UOs and the CUs with developed RPL content are shown.

(New) Competence Units / Units of Learning Outcomes (CUs/UOs):

- CU63 – Certification, Qualification & Standardization in AM
- **CU73 – Sustainability for Additive Manufacturing**
- **CU72 – Metal Binder Jetting Process**

New RPL Material on the following Competence Units / Units of Learning Outcomes (CUs/UOs):

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- **CU34 – Process selection**
- **CU35 – Metal AM integration**
- **CU36 – Coordination activities**
- **CU43 – Production of PBF-LB parts**

All CUs above marked in green were developed in D5.6. The SAM partners POLIMI and MTC conducted the courses on CU72 together in March 2022. CU73 was piloted as a shared activity by the SAM partners IMR, MTC, IDONIAL and LORTEK (managed by IMR), whereas ITECAM – an authorized training body (ATB) of the IAMQS - also conducted a course on CU73. All courses on CU73 were performed in March. The piloting of CU63 was done by the SAM partner FA in the end of 2021.

Table 1 shows how the piloting activities were distributed amongst the partners and in which way, country and language the CUs were implemented. The implementation process linked to the pilots on the lectures of the new CUs/guidelines encompassed the following activities:

- developing training materials,
- inviting participants,
- conducting a lecture based on the guideline of the CU,
- preparing assessment material (according to IAMQS Quality Assurance System: independent and comparable final assessment, verified and approved by IAMQC),
- participants doing the final assessment (supervised by EWF or another authorized nominated body),
- participants answering to the D2.7 (Kit to collect feedback on the qualifications and training modules) survey,
- handing out certificates of completion or records of achievement to participants who passed the final assessment,
- writing a national report on the piloting activity,
- participants answering to the D2.6 (Kit for tracking students, future employees and job seekers in AM) feedback questionnaire after 6 months. [These results will be reported in the D4.6 Impact and Follow up report].

The RPL material for CU34 was tested virtually on 7th April 2022 with three participants by MTC. CU35 RPL material was tested by SAM partner AITIIP between 22nd and 25th of March 2022, piloting a total of four technical interviews and four AM demonstrations. CU36 was piloted by the MTC as well, the software TEAMS was used to perform the virtual technical interview. The RPL material on CU43 was tested by IDONIAL with face-to-face meetings. The implementation process linked to the piloting of the RPL scheme and tools had a reduced scope since the focus was on the methodology on RPL:

- translating RPL material (if required),
- inviting participants (15 to 20 participants targeted),
- conduction RPL technical interviews (and AM demonstration if applicable),
- participants and interviewer answering the feedback survey (Feedback Survey to collect feedback from candidates and interviewers of the RPL interview /demonstration),
- writing a national report on the piloting activity.

Table 1: Distribution of piloting activities among partners

Number of CU	Title of CU	SAM Partner who piloted the CU	Country	Language of pilot	Way of implementation
CU63	Certification, Qualification and Standardization in Additive Manufacturing	FA	PT	English	Virtual course
CU72	Metal Binder Jetting Process	POLIMI and MTC	Italy & UK	English	Virtual course
CU73	Sustainability for Additive Manufacturing	IMR and MTC	Ireland & UK	English	Virtual course
CU73	Sustainability for Additive Manufacturing	ITECAM	Spain	Spanish	Virtual course
CU34	Process selection	MTC	UK	English	Virtual RPL process
CU35	Metal AM integration	AITIIP	Spain	Spanish	In-person RPL process
CU36	Coordination activities	MTC	UK	English	Virtual RPL process
CU43	Production of PBF-LB parts	IDONIAL	Spain	Spanish	In-person RPL process

2.2. Structure of the (new) developed and piloted CUs / ULOs

Figure 1, Figure 2 and Figure 3 show the recommended contact hours and subject titles of the respective CUs that were developed in D5.6 (and D5.4) and piloted within D5.7. More information on the particular piloting activities on the new CUs can also be found in Table 2, in section 2.4 and in the Annex.

CU Certification, Qualification & Standardisation in Additive Manufacturing:	RECOMENDED CONTACT HOURS
SUBJECT TITLE	
Certification and Qualification in AM	2
Standardisation in AM	2
Applicability of Certification, Qualification and Standardisation (CQS) to the AM enabled process chain	3
Total	7
WORKLOAD	14

Figure 1: Subject titles and recommended contact hours for CU63 – Certification, Qualification & Standardization in AM

CU : Metal BJ Process	RECOMENDED CONTACT HOURS		
	LEVEL	INDEPENDENT (I) (applied to Operators and Engineers)	ADVANCED (A) (applied only to Engineers)
MBJ Process Steps		4	0
MBJ System – Hardware and Software		4	0
MBJ Feedstock and Consumables		3	0
MBJ Parameters		3.5	0
Sintering Principles		0	5
MBJ Process Capabilities		2	0
Post Processing		1	0
Industrialization of MBJ		0	5.5
	Subtotal Per Level	17.5	10.5
	Cumulated Subtotal	17.5	28
			WORKLOAD
	PER LEVEL	35	21
	CUMULATED	35	56

Figure 2: Subject titles and recommended contact hours for CU72 – Metal Binder Jetting Process

Sustainability for Additive Manufacturing	RECOMENDED CONTACT HOURS
SUBJECT TITLE	
Economic and social context for Sustainability Policies	1
Product Life Cycle	1.5
Additive manufacturing within a sustainable production scheme	3.5
Case studies	1
Total	7
WORKLOAD	14

Figure 3: Subject titles and recommended contact hours for CU73 – Sustainability for Additive Manufacturing

2.3. Structure of the CUs tested with RPL procedure

Figure 4, Figure 5, Figure 6, Figure 7 show the recommended contact hours and subject titles of the respective CUs for which RPL material was developed during D5.6. The material was then tested in the scope of D5.7. Further information on the competence units is available at the

[webpage of the IAMQS](#). Information on the piloting activity is available in the Annex, in section 2.5 or in Table 3.

CU 34: Process Selection		CONTACT HOURS
SUBJECT TITLE		
Economics and productivity		7
AM Job analysis		21
Total		28
WORKLOAD		56

Figure 4: Subject titles and recommended contact hours for CU34 – Process selection

CU35: Metal AM integration		CONTACT HOURS
SUBJECT TITLE		
Production Management		7
AM Commercial Integration		3,5
Case studies		10,5
Total		21
WORKLOAD		42

Figure 5: Subject titles and recommended contact hours for CU35 – Metal AM integration

CU36: Coordination activities		CONTACT HOURS
SUBJECT TITLE		
Communications and coordination		3
Documentation		4
Total		7
WORKLOAD		14

Figure 6: Subject titles and recommended contact hours for CU36 – Coordination activities

CU 43: Production of PBF-LB parts		CONTACT HOURS
SUBJECT TITLE		
PBF-LB process simulation		7
PBF-LB manufacturing strategy		7
Case studies		7
Total		21
WORKLOAD		42

Figure 7: Subject titles and recommended contact hours for CU43 – Production of PBF-LB parts

2.4. Piloting activities for the (new) developed CUs / ULOs

In the end of 2021, partners decided to increase the duration of D5.7 by one month to the month of March 2022, since the material for the courses needed to be developed from scratch and more time for the preparation compared to the previous stages was required. Then, the two new competence units from D5.6 were implemented within D5.7 during the period for testing in March 2022. The development of material and the organization of the courses started in November 2021. Furthermore, CU63 was piloted in November and December 2021 in the scope of D5.7 with modified material from the second stage of piloting. For this third stage of piloting, all the experiences and lessons learning from the first and second stages were considered referring to the preparation, conduction and evaluation of courses (please see also D4.6 Pilot Activities Report – 1st stage pilots and D4.6 Pilot Activities Report – 2nd stage pilots).

Although CU63 (Certification, Qualification & Standardisation in AM) had already been piloted in the 2nd stage, it was decided to run a pilot course name “AM Course "Through AM Industrial Sectors Certification, Standardization, Qualification" with specific target on participants from others sectors, such as, aerospace, automotive, health, maritime and construction. The goal was to understand in which sense the CU content could be added value for specific sectoral applications. CU 63 pilot course was implemented virtually in English language, using the platform Teams for the 1-day training. The theoretical assessment together with the feedback survey questionnaire took place one week later and was repeated for those who had no time on the first day or failed the exam in the first attempt. The training being on-line was based on a presentation that was shared with the attendees for them to prepare themselves for the examination. The presentations were based on graphical content information (e.g., images, videos, schemes) to make it more attractive, dynamic and didactic to the trainees. The trainer focused on practical examples and real case scenarios to enable the trainees to make the link between the theory and reality of the content enabling them to understand the importance of the topics being discussed. The registry for the training course was done free of charge, through an on-line form. A total of 25 registries were made, but not all participated in the pilot course ,nor took the exam, which was not mandatory, as detailed on the table that follows. The pilot of the training course was provided by one trainer from EWF, who has been involved in the Certifications and Qualification Systems (Welding and Additive Manufacturing) for at least 3 years. The event banner is show below (please see Figure 8).



Figure 8: Event banner for SAM pilot course on CU63 in 2021

The CU72 pilot event on Metal Binder Jetting Process was piloted on three afternoons in the end of March 2022 using the platform Teams. Trainers from POLIMI and MTC guided through the sessions. Figure 9 shows a screenshot of the piloting course of POLIMI and MTC.

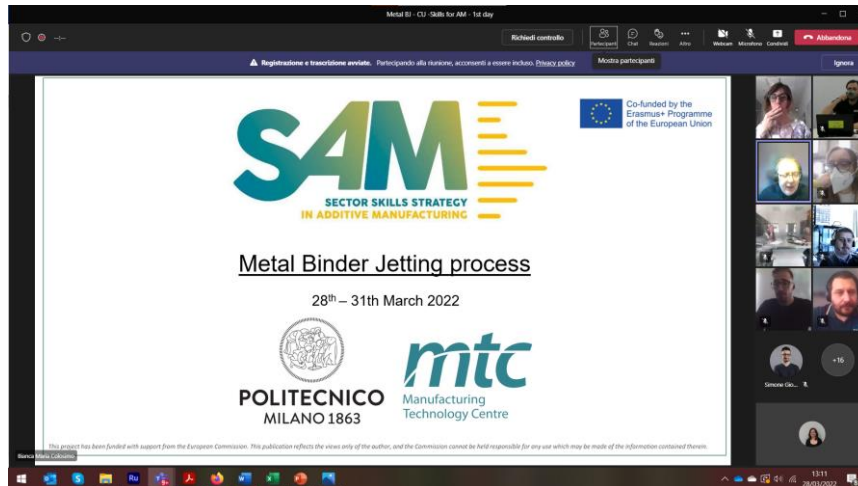


Figure 9: Screenshot of Metal Binder Jetting Process pilot course

CU73 on Sustainability for Additive Manufacturing was piloted by IMR, MTC, LORTEK and IDONIAL. Irish Manufacturing Research (IMR) coordinated the activity, collected the training content for the new CU and managed the training delivery using Zoom. The training was given virtually on 24th, 29th and 31st of March 2022 (please see also the event flyer in Figure 10). In the case of the Competency Unit CU73, a significant effort was put in to attract participants that are not only looking at Additive Manufacturing for industrial use but, also actively engaging in it as part of their daily jobs. The typical attendee was that of someone who was already working or studying in the field of sustainability and operating at an engineer level, which would be representative of the user base in Ireland.

This training course identified the international sustainability policy, standards, and processes relevant to additive manufacturing (AM). It outlined the relationship between these and why they are required and what kind of environmental choices and risks are important to mitigate, along with new legislation and the policies which have driven these legal requirements. The attendees engaged with some case studies to highlight application of product design and lifecycle, applied knowledge for industry needs. Also, each session was interactive with a mix of live delivery using Zoom, interactive group work over the training days, with attendees performing their own studies outside of the sessions in the form of real case studies to solve. A course Guide Handbook outlining the training course details was created as reference materials for the attendees with specific definitions, suggested prerequisite knowledge, IT guides, case study details and examples within it along with attendee notes pages.



Figure 10: Event flyer for SAM pilot course on Sustainability for Additive Manufacturing (CU73)

The CU73 on Sustainability for Additive Manufacturing was piloted by ITECAM (Tomelloso, Ciudad Real) on 30th and 31st of March 2022, an official ATB (authorized training body) of the IAMQS. The virtual course (please see also Figure 11) was held in Spanish by 2 trainers. All attendees were from Spain.

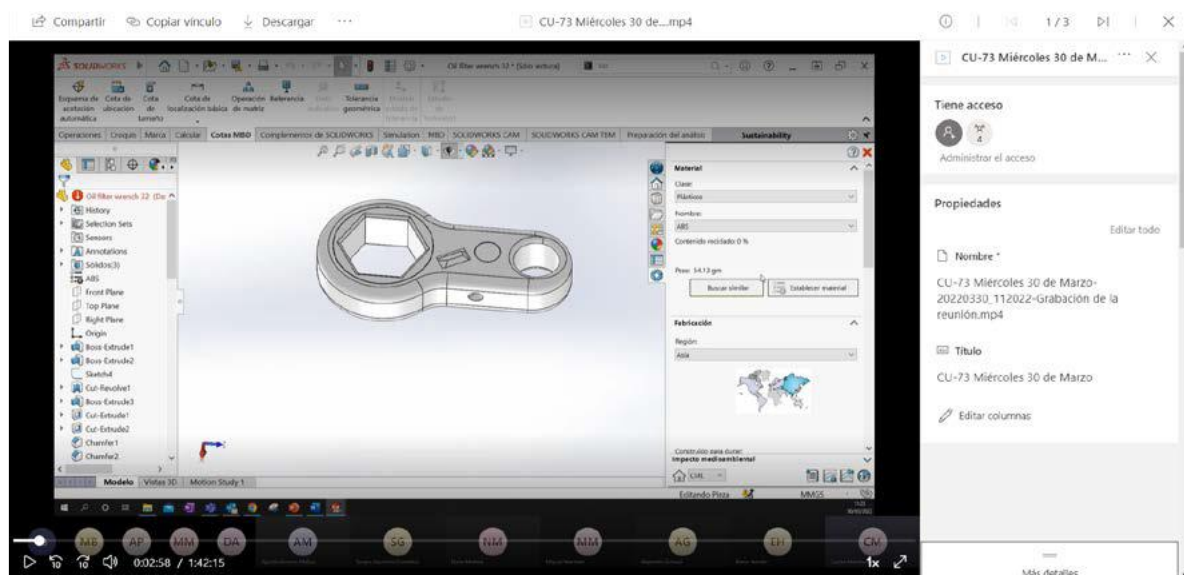


Figure 11: Screenshot of the SolidWorks presentation during the CU73 pilot course of ITECAM

Table 2: Key data on the piloting activities of the CUs Certification, Qualification and Standardization in Additive Manufacturing, Metal Binder Jetting Process and Sustainability for Additive Manufacturing

Number of CU	Period of implementation	Number of trainers	Number of participants*	Results of assessment	Participants replying to feedback survey
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CU63 (FA)	24 th November 2021	1	14 (25 registered, 14 attended the course, only 6 did the assessment and feedback survey)	5 of 6, 83% passed	6
CU72 (POLIMI & MTC)	28 th March, 29 th March and 30 th March 2022	6	27 (27 attended the course, 22 answered to the feedback survey, 11 did the assessment)	11 of 11, 100% passed	22
CU73 (IMR, MTC, IDONIAL, LORTEK)	24 th , 29 th and 31 st March 2022	6	15** (34 registered, about 10 to 15 attended the lectures, 9 did the assessment, the feedback survey was only sent to those who attended the assessment)	9 of 9, 100% passed	9
CU73 (ITECAM)	30 th and 31 st March 2022	2	15 (15 attended the course, 15 answered to the feedback survey, 8 did the assessment)	7 of 8, 88% passed	15

*There were participants that completed the course with feedback survey but did not take the assessment or did the assessment but not the feedback survey. The number of participants gives the number of attendees who completed the whole course with lecture, feedback survey and assessment and could be smaller than the participants who answered to the feedback survey.

**9 participants sat the first round of examination and attended all three days of the training and feedback survey.

All in all, about 15 trainers were engaged in conducting the lectures for the third stage of piloting. All courses were provided virtually using Teams or Zoom platform and except for the Spanish associated partner ITECAM (who conducted the course in Spanish language), all piloting courses were offered in English language.

From the 101 registrations, **71 participants attended the virtual lectures** – by this, at least concerning attendance in the courses, partners met the minimum number of least 15 participants (except the pilot on CU72 (Metal Binder Jetting Process) who had 14 attendees). All in all, 52 participants answered to the feedback survey and 34 attended the theoretic final assessment, which was passed by 32 trainees (only 2 passed the final assessment).

2.5. Piloting activities of the RPL material

Within the 3rd stage of piloting in D5.7, RPL material developed during D5.6 and after WP3 methodology, was tested for four competence units of the professional profile of the Process

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Qualification/Professional Profile: Process Engineer PBF-LB | 2 Competence Units: Metal AM Designer

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Engineer PBF-LB. As the first step, participants with the complying with the criteria for RPL and matching background were chosen for the piloting course. The criteria for enrolment in RPL was to have prior knowledge on the topic of the competence unit to be tested. This was verified by checking the CVs of the candidate. After having scheduled the interview, it was conducted by an expert familiar with the AM topic of the CU. The technical interview was performed through the developed questions, that were read to the candidate who answered orally and directly. After the answer was given, the AM expert decided if the answer was correct, wrong or incomplete, based on the given criteria, and indicated this in the corresponding excel file before continuing with the next question (please see also Figure 12 as example). After the conduction of the technical interview (and the AM demonstration if applicable), the AM expert and the RPL candidate were asked to fill a questionnaire to give feedback on the experience of RPL interview. Key data on the RPL piloting is available in Table 3.

For CU34, the technical interview and the AM demonstration questions of the RPL material were tested virtually with three candidates on 7th of April 2022. David Wimpenny from the MTC conducted the interviews by using the CU34 excel document with the interview questions and the possibility to collect the results as well as the questions for the AM demonstration. All participants passed the RPL process successfully, for the technical interviews results of 75%, 85% and 81% were achieved.

Introduce number "1" on the corresponding cell: > if the answer is CORRECT, introduce "1" on cell "C" > if the answer is WRONG, introduce "1" on cell "W" > if the answer is INCOMPLETE, introduce "1" on cell "IC"						
Authorized Training Body (ATB) identification: MTC						
Date and Place: 07/04/22 on-line						
Participant: Amanda Field						
Competence Unit 34 - Process Selection						
Skills	Question/Answer	Answer			Score	Weighting
	Q11: List 3 factors needs to be considered when choosing a process for a particular part	C	W	IC		
	A1: Part size, part complexity, proposed material, production volume and accuracy/surface finish.	1			2	1
	Q12: How would one make a buy vs make decision? What kind of criteria would one use?					
	A12: IP sensitivity (criticality of info), existing expertise & infrastructure, cost, ROI, how many, ROI, full control, IP	1			2	1
1. Relate supply chain strategies to their effects on the performance of a manufacturing organisation	Q13: What are the factors considered when setting up a supply chain? (buy vs make, local vs distant suppliers)					
	A13: Resilience, control over supply chain (quality?), information, traceability, flexibility, cost, ROI	1			2	1
	Q14: AM offers a set of sustainability benefits, name some of them:					
	A14: low waste, reduced inventory, local manufacturing, ...energy in use	1			2	1
	A14: Less material usage (either through design optimization or less waste generated)					
	Streamline Manufacturing (requires fewer complementary tools/parts)					
	Enable Decentralized Production/Manufacture Locally (less shipping costs/energy consumption/impact)					
	Enable manufacturing on demand (reduced inventories)					
		20	1	1		
					41	85%
					(48 max)	

Figure 12: Detail of the technical interview questions for CU34 piloted with UK Candidate 1

The RPL process for CU35 was conducted face-to-face in Spanish language by José Antonio Dieste by the SAM partner AITIIP between 22nd of March 2022 (date of the first technical interview and AM demonstration) and 25th of March 2022 (date of last interview and demonstration, see also Figure 13). Four candidates did the technical interview with 18 questions and the AM demonstration. The candidates were engineers and had at least 2 years of experience in the use of additive manufacturing technologies. All technical assessments were passed with 78%, 72%, 81% and 78% and all AM demonstrations were passed.

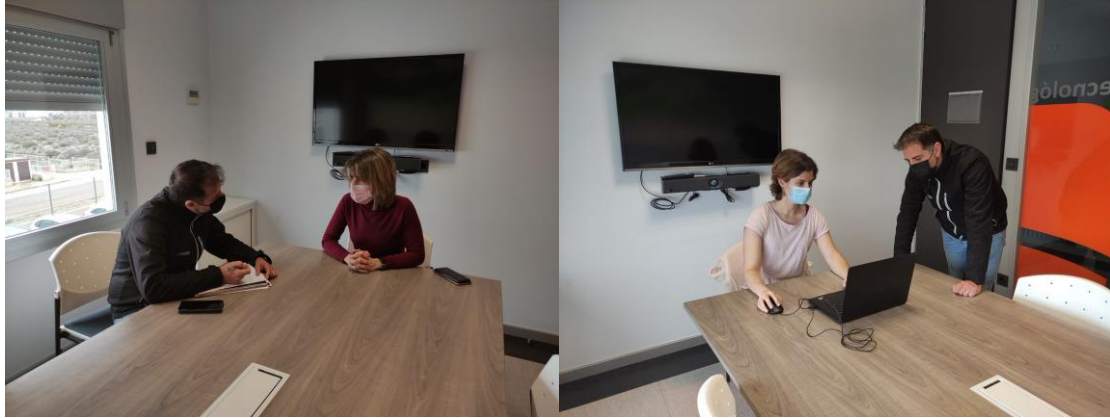


Figure 13: Photos of CU35 RPL testing: technical interview (left) and AM demonstration (photo on the right side)

The technical interviews for CU36 were conducted virtually by the MTC on 7th and 9th of February 2022 with four candidates in total. AM demonstrations were not performed for CU36. All participants passed with 94%, 61%, 94% and 100%. A detail of the technical interview of CU36 can be seen in Figure 14.

Introduce number "1" on the corresponding cell:								
> If the answer is CORRECT, introduce "1" on cell "C"								
> If the answer is WRONG, introduce "1" on cell "W"								
> If the answer is INCOMPLETE, introduce "1" on cell "IC"								
Authorized Training Body (ATB) identification:	N/A - Manufacturing Technology Centre							
Date and Place:	09/02/2022 - Teams							
Participant:	UK Candidate 2							
Competence Unit 36 - Coordination activities	Answer							
Skills	Question/Answer	C	W	IC	Score	Weighting	Weighted score	es/comments
Managing communications across all actors involved in the AM manufacturing chain	Q.List three (3) different actors (people/roles) in the AM manufacturing chain. A. Customer, AM technician or machine operator,AM Designer,Inspection engineer/technician,AM materials or process engineer, AM supervisor or coordinator,Project manager, Customer support, Sales engineer, Application/software engineer	1			1	1	1	Able to provide more than 3 correct answers
		8	0	1	8,5	9	8,5	

Figure 14: Detail of the technical interview questions for CU36 piloted with UK candidate 2

IDONIAL tested the RPL material on CU43 and conducted four technical interviews and three AM demonstrations face-to-face in Spanish language (see also Figure 15). Since one candidate did not pass the technical interview, he did not attend the AM demonstration. The technical interview with a total of 30 questions took place on 8th, 9th, 11th and 28th of March 2022 and lasted about one hour. The AM demonstrations were conducted on 22nd, 23rd and 29th of March 2022. The candidates were engineers or engineering degree students with at least two years of experience in AM. Three technical interviews were passed with 100%, 100% and 95%. One interview was failed with 47%, his knowledge on FDM was not sufficient to pass the RPL on a Competence Unit focussing the PBF-LB process. All three conducted SAM demonstrations were passed with 100%, 100% and 86%.



Figure 15: Photos of CU43 RPL testing: technical interview (left) and AM demonstration (photo on the right side)

The testing of RPL material in the 3rd stage of piloting was performed in English language and virtually for CU34 and CU36. The piloting of CU35 and CU43 was done in Spanish language and face-to-face. All in all, 15 participants attended the piloting process of RPL material in the scope of the 3rd stage of piloting from February to April 2023. All participants filled the feedback survey. 15 technical interviews were performed (14 of 15 were passed successfully). Ten AM demonstrations were tested (10 of 10 passed the AM demonstrations, please see also Table 3).

Table 3: Key data on the piloting activities of the RPL material on CU34 (Process selection), CU35 (Metal AM integration), CU36 (Coordination activities), CU43 (Production of PBF-LB parts)

Number of CU	Period of implementation	Number of participants	Results of technical interview	Results of AM demonstration
CU34 (MTC)	7 th April 2022	3	3 of 3 passed (average result of 80%)	3 of 3 passed
CU35 (AITIIP)	22 nd March – 25 th March 2022	4	4 of 4 passed (average result of 77%)	4 of 4 passed
CU36 (MTC)	7 th February + 9 th February 2022	4	4 of 4 passed (average result of 87%)	Not performed
CU43 (IDONIAL)	8 th March – 29 th March 2022	4	3 of 4 passed (average result of 86%)	3 of 3 passed

3. Final assessment

As part of the implementation of the IAMQS, all participants of the piloting courses had to attend a final assessment, as part of the course, thus in compliance with the system's quality assurance requirements. The final assessment tools were prepared by each partner before the piloting event, then submitted to review and approval process by the International AM Qualification Council (IAMQC), mediated by EWF. The assessment was supervised by EWF or another authorized nominated body, such as, the AM ANB IIS - for Italy and the AM ANB CESOL - for ITECAM in Spain, to ensure the IAMQS Quality Assurance System procedure and a harmonized assessment. In this stage, only theoretical assessments were conducted, there was no practical evaluation. The trainees had 1 minute per single choice question at independent level and 1.5 minute per question at advanced level to answer and needed to have at least 60% of correct answer to pass the final assessment of the Competence Unit.

For CU63, the final assessment was conducted virtually in December 2021 and repeated for attendees that did not take it nor pass it on the first date.. The results from both exams show a success rate of 83% (5 of 6 passed, 1 did not start the exam). The IAMQS supervised the examination process on both occasions. All attendees followed the rules, that were previously explained, turning on their cameras and finalizing the answering of the 7 theoretical questions in less than the 7 minutes established.

For CU72, the assessment on 30th March 2022 was prepared by Istituto Italiano Saldatura, the Italian ANB, and performed on site at Politecnico di Milano. Eleven learners undertook the final exam. All the 11 participants undertaken the final assessment successfully passed and obtained the IAMQS certification for the CU on Metal Binder Jetting Process.

For CU73 on Sustainability for Additive Manufacturing managed by IMR, the assessment was taken by 9 attendees on 31st March 2022– all of them passed. The exam was supervised by the EWF and IMR. Time allowed was 1.5 minutes per question and the exam lasted 10 minutes due to the subject being 7 hours in duration. The virtual assessment was done using the platform Teams.

For CU73, piloted by the associated partner ITECAM, the virtual assessment was supervised by the Spanish ANB CESOL. This exam on 7th April 2022 had 7 questions to be completed in 15 minutes. Of 15 participants, only 8 took the exam with 7 questions to be completed. 7 of 8 participants passed the exam successfully, only one failed.

Also due to the situation caused by the coronavirus, 3 of 4 of the exams were carried out virtually. The results can also be found in Table 2. Some partners saw deviations between the number of attendees in the lectures, the final assessment and the feedback survey. This is the reason why the numbers of participants that are given in the table for the overall participants, the assessment and the feedback survey deviate. Some partners conducted a second final assessment so that participants who failed first could try a second time to pass the exam. The maximum number of attempts for the exam was 2. The attendees who passed the exam received a certificate of completion from SAM project referring to the IAMQS or an official record of achievement of the ANBs as an added value for the participants.

The overall performance in the final assessment was very positive. **From the 34 final assessments carried out, 32 of the participants passed** (corresponding to 94%), while the

remaining 2 participants failed (corresponding to 6%). Thus, it was shown that lectures developed according to the developed guidelines led to successful passed exams that were also developed according to these guidelines. There are various reasons why an attendee fails an exam, e.g. he/she is not paying enough attention, being nervous or unconcentrated or the questions are too difficult or the topic was not presented detailed enough during the course. In one case, one attendee did not show up at the final exam and failed because of this.

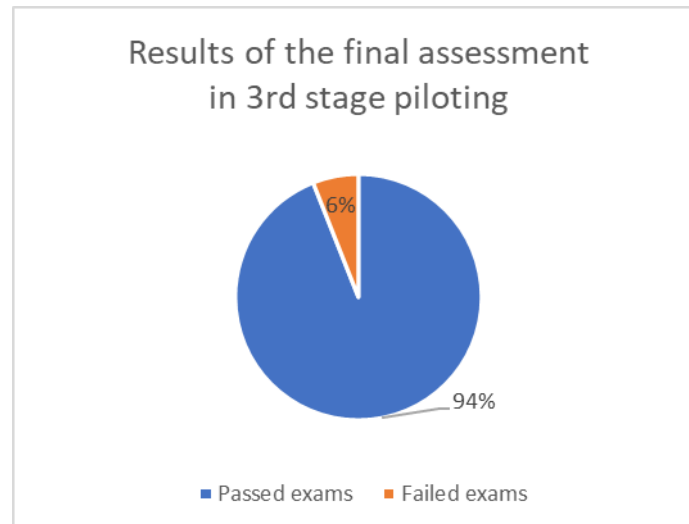


Figure 16: Overall performance in the final assessment of the third stage of CU piloting

For candidates attending the piloting of the RPL (recognition of prior learning) and who did the interview (and the demonstrations), no final assessment was performed in the context of the 3rd stage of piloting in SAM project. The final assessment was only tested with the attendees who attended the lectures. According to the conditions of the IAMQS, the RPL interview (with demonstration if applicable) would only replace the attendance during the lecture course for the CU. If the RPL process is passed, the applicant is allowed to do the final assessment in order to achieve the record of achievements when passing the exam successfully.

4. Feedback results and recommendations

This section provides an overview on the feedback achieved from trainees and trainers about the 3rd stage of piloting. The analysed feedback for CU piloting courses and for RPL process piloting will be evaluated separately.

4.1. Feedback achieved from participants of piloting courses

At the end of the piloting activity, 52 (96%) from 71 attendees in the lectures of the courses filled out the satisfaction/ feedback survey. Not all questions were answered by every participant. The main results are presented below. Regarding the profiles of the attendees, the results show a broad number of different participants and profiles were reached by the pilot course offer.

According to gender balance, **19 participants (37%) identified as female and 33 (63%) of them as male**. Participants from all ages attended the piloting courses of the 3rd stage. **The most attendees (28 of 54 → 54%) of the feedback survey attendees were between 26 and 35 years old**. 15 of 52 (29%) were between 36 and 55 years old. Only 7 (13%) were under 25 years old and only 2 (4%) were over 56 years old. The data is illustrated in Figure 17. Since the piloting courses was done virtually, it was possible to reach people from all around Europe or even the world. Participants were from Spain, the UK, Bulgaria, Greece, Italy, Romania, Portugal, Germany and Mexico.

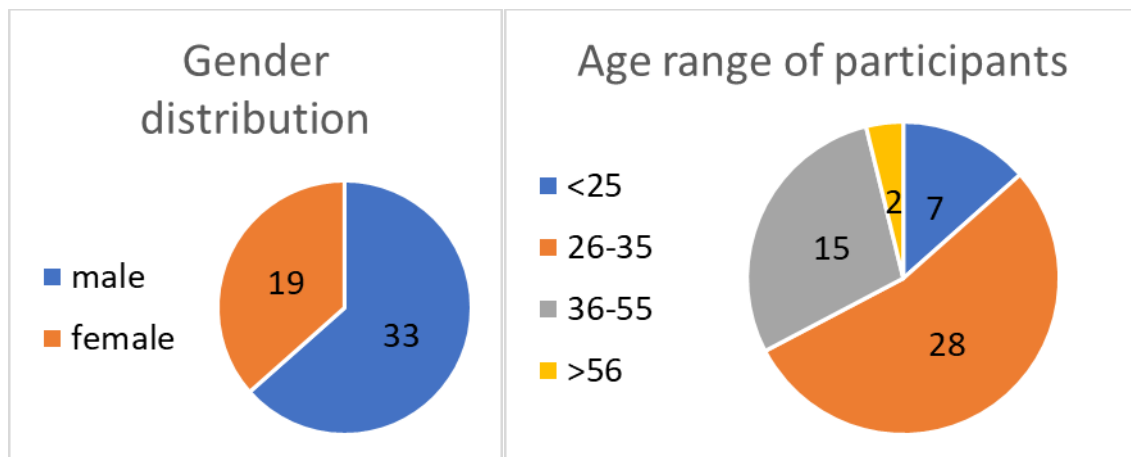


Figure 17: Distribution of Gender and age range of 3rd stage pilot course participants

The majority of the participants were workers (39 of 52, 75%) when attending the pilot course. The other 13 of 52 (25%) answered to be in higher education, whereas no one answered to be in VET or unemployed. Data on background can also be seen in Figure 18.

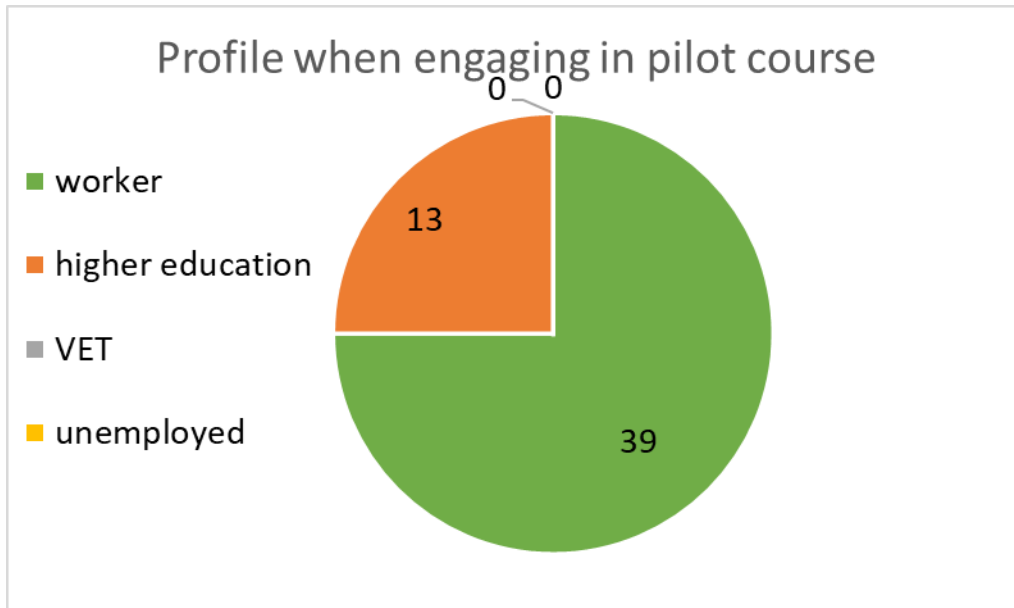


Figure 18: Job profile of participants who attended the piloting courses of the 3rd stage

The data of the profiles matches with the level of education of participants. **The majority of 35 (67%) participants were engineers or had a Master’s degree.** 9 of them had a doctoral degree, 5 of them a Bachelor’s degree, 3 had a school certificate, 2 had a high degree of vocational training and 1 a middle degree of vocational training. 55 answers were achieved, so that some participants ticked more than one option for the profile. Please see also Figure 19 for the results achieved on the level of education.

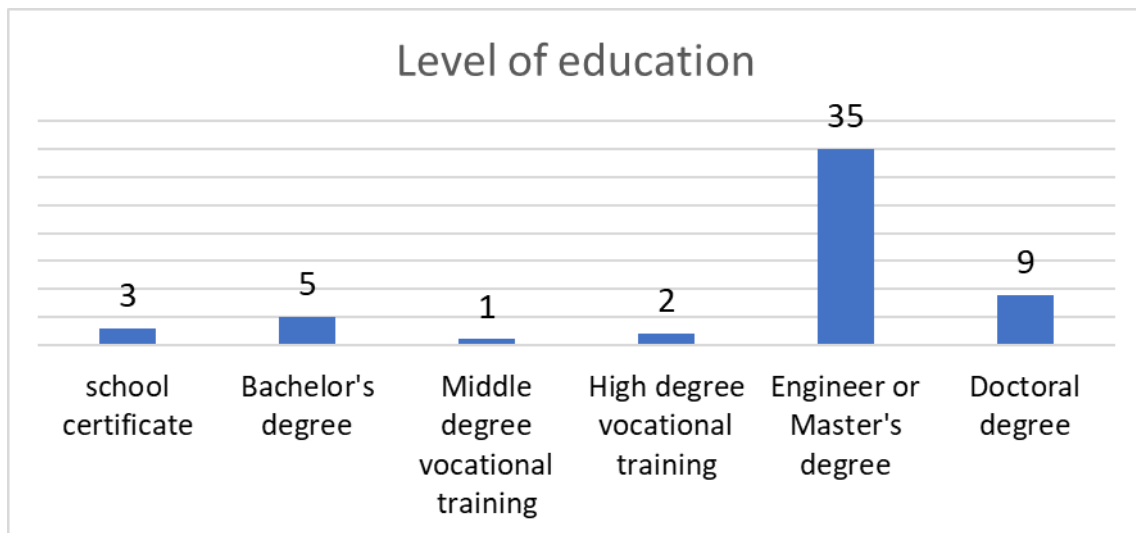


Figure 19: Level of education of participants who attended the piloting courses of the 3rd stage

If the answer was “worker” in a question before, the survey asked for the main sector. More than 54 answers were achieved, so obviously the participants ticked more than one sector for this question, in total, 74 answers were given to this question. Maybe the workers are active in several sectors and / or people who are not workers answered with their field of work or expertise. Most of the answers (21, 28%) could not choose from the given possibilities and ticked

others, they specified: **welding society, research, railway, education, maritime and R&D. 16 were engaged in industrial equipment and tooling, 8 in automotive, 8 in health, 7 in aerospace, 5 in energy, 5 in construction, 3 in defence and 1 in consumer goods.** Overall, the sectors of the participants were very diverse. Figure 20 shows the data on the responses achieved.

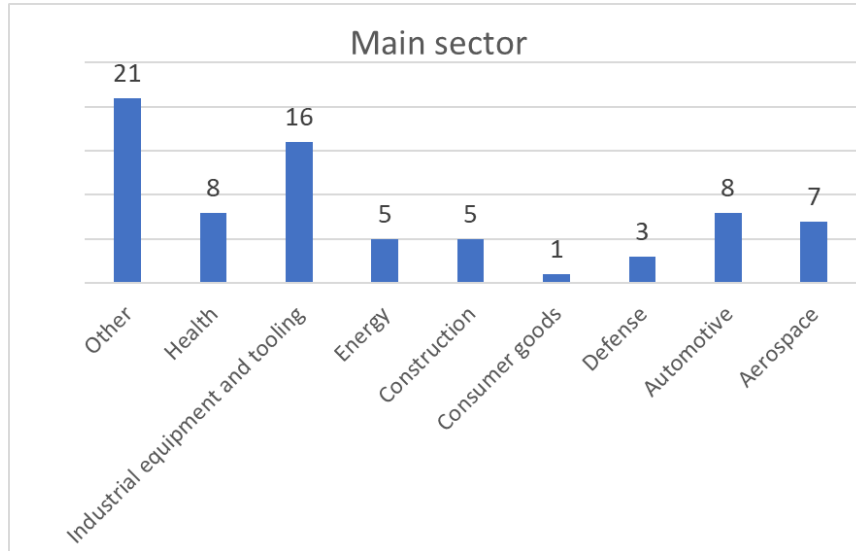


Figure 20: Main sectors of work of participants who attended the piloting courses of the 3rd stage

The opinion of the participants on different aspects of the courses was asked referring to relevance, quality, attractiveness and usability. The overall attitude towards the conduction of piloting was very positive. **When asked about the dynamic and configuration of the course, 30 participants (58%) agreed that the training sessions were quite dynamic instead of just being expositive, 13 agreed strongly (25%).** 6 of 54 attendees (11%) disagreed and 3 (6%) strongly disagreed (see also Figure 37).

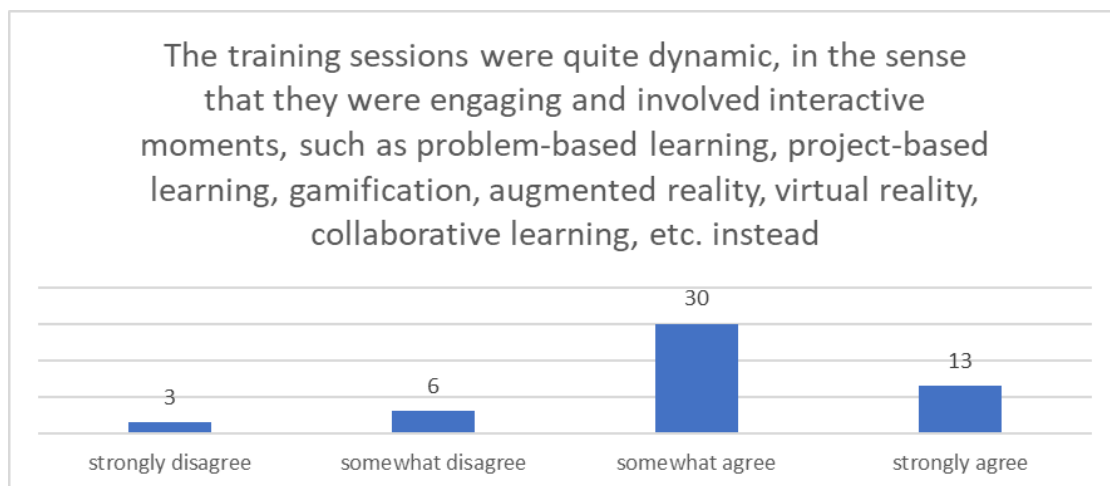


Figure 21: Opinions of attendees on the dynamic and configuration of the piloting courses of the 3rd stage

To check the significance and usability of the implemented content, the participants were asked to assess the relevance of the course to their job activities. The majority of 32 participants **(62%) were very satisfied with the content in relation to their job activities.** 13 of them (25%) say that they are satisfied enough with the relevance (see also Figure 22). This positive result and the

relevance that most of the participants in the AM training course understood for their own work, regardless of the CU attended, shows and underlines the need to offer and expand the range of training on AM. Only 4 participants (8%) rated the relevance as not satisfied enough, none of them said it was poorly satisfied, but 3 (6%) not did not answer to this question.



Figure 22: Relevance of the course

The feedback achieved was very positive since **all participants stated that they are satisfied with the course as it met their expectations (100%)**. The **quality of all courses was also very high**, as all participants (100%) stated that they would recommend the course to others (see also Figure 39).

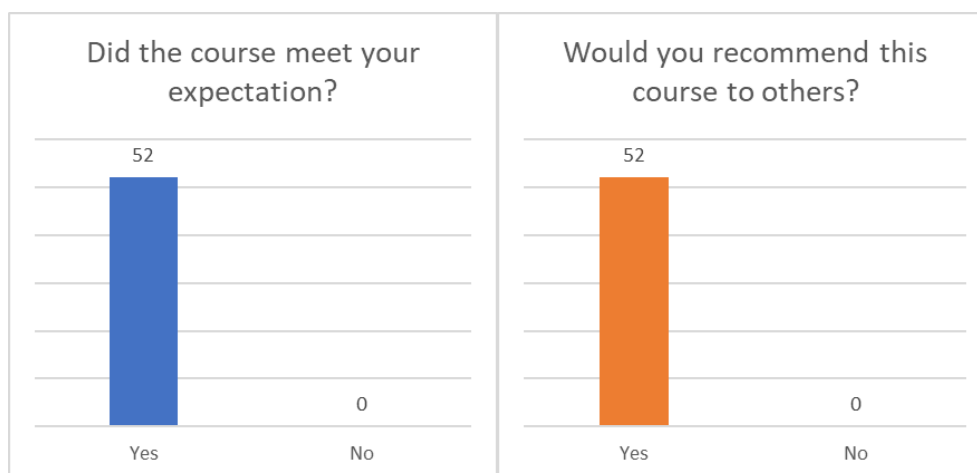


Figure 23: Distribution, if the course met the expectations of attendees (left) and statements if participants would recommend the course to others (right)

4.2. Feedback achieved from trainers of piloting courses

At the end of the piloting activity, also the 15 trainers were asked to fill out a feedback questionnaire. The main conclusions of this feedback are show below.

Trainers were asked to show their satisfaction on different topics and decide between poorly satisfied, not satisfied enough, satisfied enough and very satisfied. Not all trainers answered to all the questions. The feedback on the support provided by the training provider’s staff, the infrastructure conditions provided by the training institution, the structure of the course, contents addressed and the relationship between the contents and the learning outcomes was very positive, either all or all but one of the answers indicated satisfied enough or very satisfied. **Asked on the opinion on the established contact hours, almost all trainers were satisfied enough (9 of 15, 60%) or very satisfied (5 of 15, 33%).** Only one participant said he or she was not satisfied enough with the established contact hours (see also Figure 24).

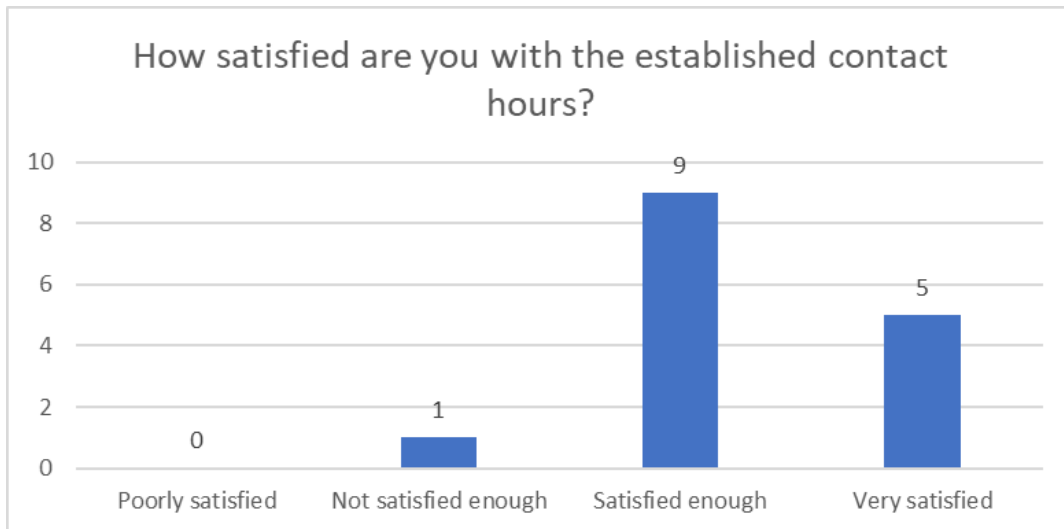


Figure 24: Level of satisfaction of trainers on the established overall contact hours

For the allocated contact hours for the theoretical classes, the feedback was very positive as well. 7 (47%) answers stated to be satisfied enough and 8 (53%) were very satisfied (see also Figure 25). 5 were not satisfied enough and 1 was even poorly satisfied with the allocated contact hours for practical work, the virtual pilot courses may be the reason for this. 3 trainers stated to be satisfied enough and 1 was very satisfied (please see also Figure 26). Similarly distributed feedback was also given on the available equipment and the balance between theoretical and practical training. Also, the majority of trainers **(80%) was satisfied enough or very satisfied with the evaluation methods used (12 of 15).**

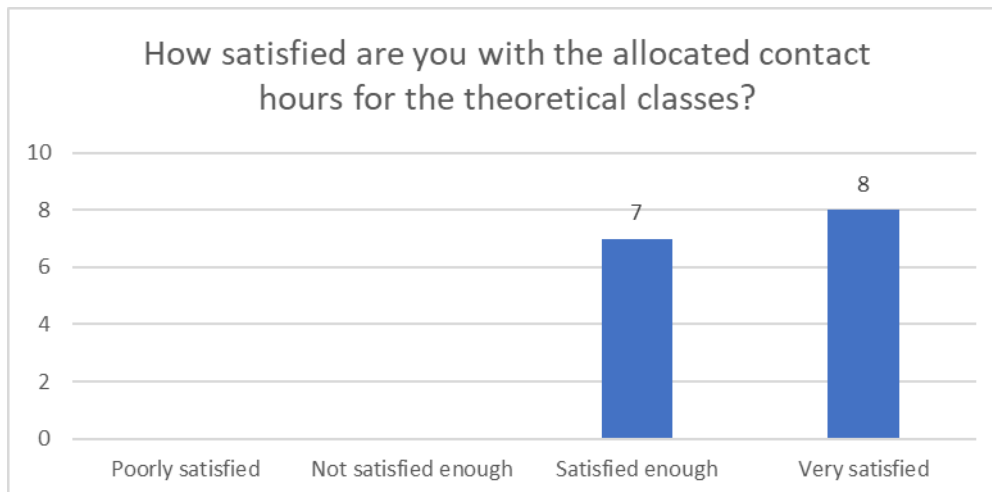


Figure 25: Level of satisfaction with the theoretical contact hours

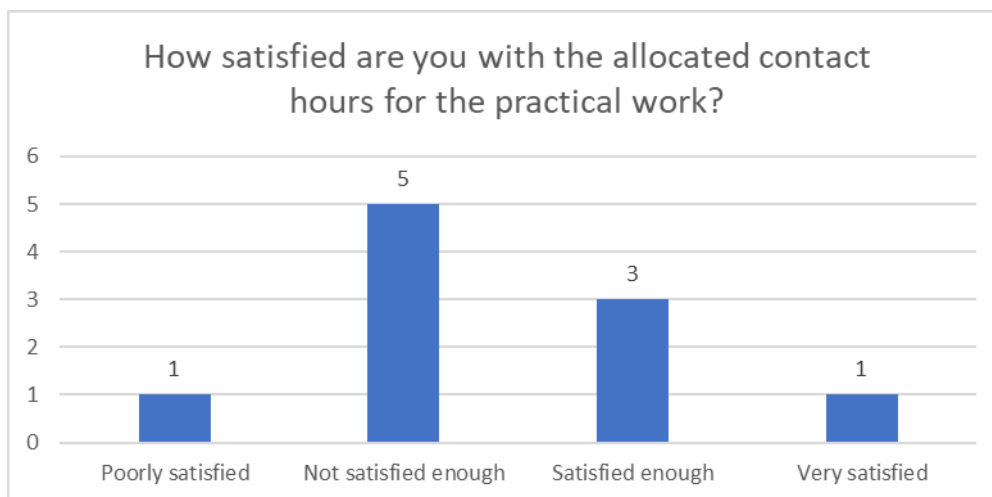


Figure 26: Level of satisfaction with the allocated contact hours for the practical work

4.3. Feedback achieved from candidates of RPL piloting

After the RPL AM demonstration or the technical interview in the 3rd stage of piloting, the candidates of the RPL piloting activity answered to a feedback questionnaire that was especially developed to achieve feedback after the RPL process. All 15 participants answered to the feedback survey but not to all questions. The main results are presented below.

According to gender balance, **4 candidates (27%) identified as female and 11 (73%) of them as male**. Candidates of the RPL interviews already had experience in AM and processes. The most experienced participant had more than 10 years of experience in AM. The candidates were from different organisations with several focusses, they were from RTOs, from the industrial equipment and tooling, the automotive, the aerospace, the defence or another sector. **The most attendees (9 of 15 → 60%) were 36 to 55 years old**. One candidates was younger than 25 years old and 5 of 15 (33%) were between 26 and 35 years old. The data is illustrated in Figure 27. The

candidates were invited by SAM partners conducting the interview (MTC, AITIIP, IDONIAL), therefore they came from the UK or from Spain.

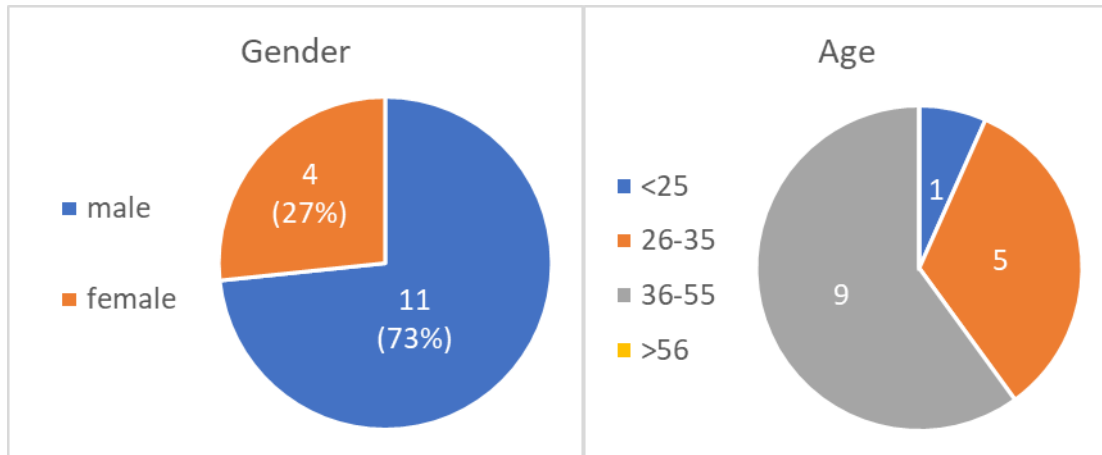


Figure 27: Distribution of Gender and age range of 3rd stage RPL pilot participants

Most of the RPL candidates were workers (13 of 15, 87%), 2 of the candidates were from higher education (13%). No one was unemployed or from VET. Referring to the level of education, 4 of 15 candidates from the RPL interview testing, 4 had a doctoral degree (27%), 1 had a Bachelor's degree and **10 of 15 had an Engineer or Master's degree (67%; see also Figure 28).**

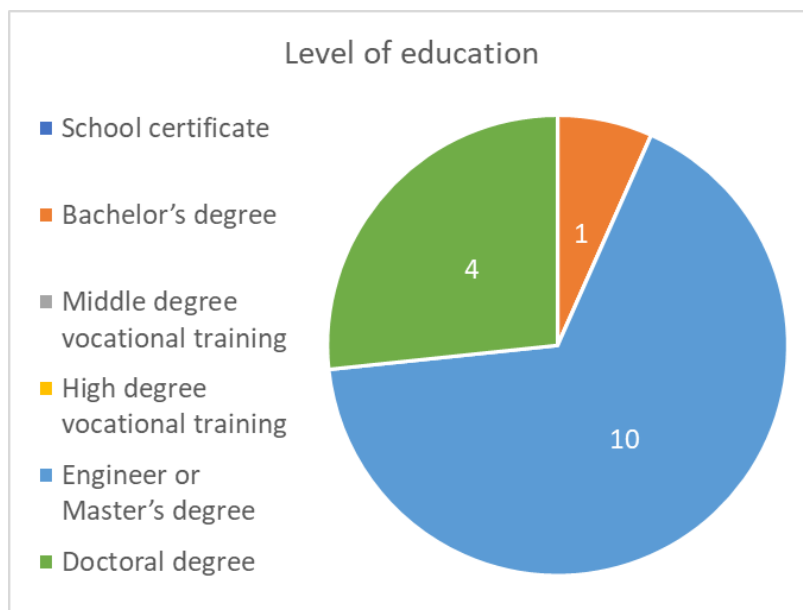


Figure 28: Level of education of participants who attended the PRL piloting of the 3rd stage

The opinion of the candidates on different aspects of the RPL testing process was asked referring to testing conditions and methodology, satisfaction with the interview conditions and satisfaction with the AM demonstration conditions. For the testing conditions and methodology, candidates were asked to answer on the following statements with either “poorly satisfied”, “not satisfied enough”, “satisfied enough”, “very satisfied” or “no answer”: “a) The infrastructure conditions provided by the RPL provider”, “b) The guidance, support and management provided by the interviewer/ trainer”, “c) The equipment used in the AM

demonstration process”, “d) How would you rate the methodology used to identify knowledge” or “e) How would you rate the effort to go through RPL interview and AM demonstration process?”. **The overall feedback on testing conditions and methodology was very positive** (see also Figure 29). All statements achieved agreement with “satisfied enough” or “very satisfied”. 2 participants did not answer questions a) to c), one participant did not answer questions d) and e). Only 1 participant thinks that the methodology used to identify knowledge is not very suitable.

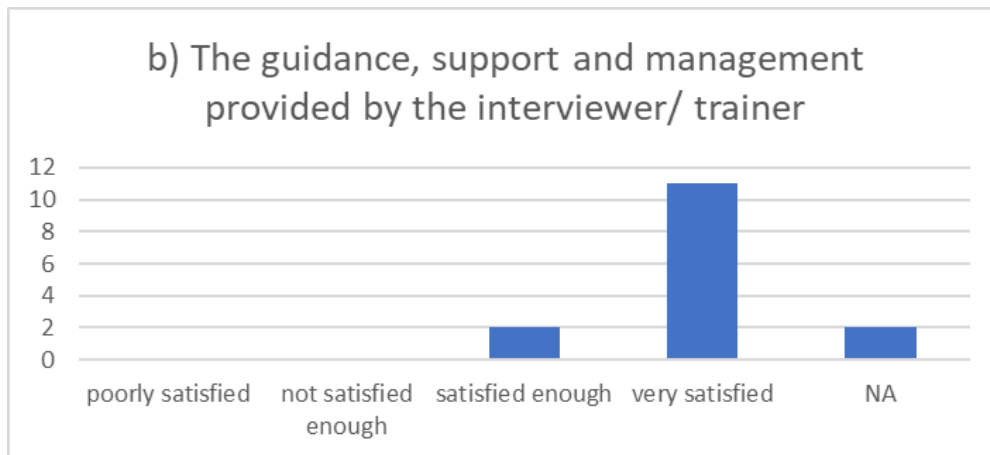


Figure 29: Satisfaction on guidance, support and management provided by the trainer

Candidates were also asked on the satisfaction with the technical interview conditions. 12 of 15 (80%) agreed or strongly agreed that the questions of the technical interview were well comprehensible, 13 of 15 (87%) agreed or strongly agreed that the difficulty of the interview questions was appropriate and 12 of 15 (80%) agreed or strongly agreed that the number of questions was appropriate as well. All the candidates (93%, 14 of 15, 1 did not answer) agreed or agreed strongly that **the questions are suitable to identify candidates with prior knowledge** (see also Figure 30). 3 of 15 (20%) think that the duration of the technical interview was not very suitable, whereas 11 of 15 (73%) candidates think that the duration of the interview was suitable enough or very suitable. 14 of 15 (**93%**) **attendees stated the quality of the technical interview and the relevance and usefulness of the technical interview within the RPL process as suitable enough or very suitable**, 1 did not answer these questions. **On the question whether the RPL technical interview result corresponds with their level of knowledge in the field of AM, 13 of 15 (87%) candidates affirmed** (1 did not answer the question, 1 did not agree).

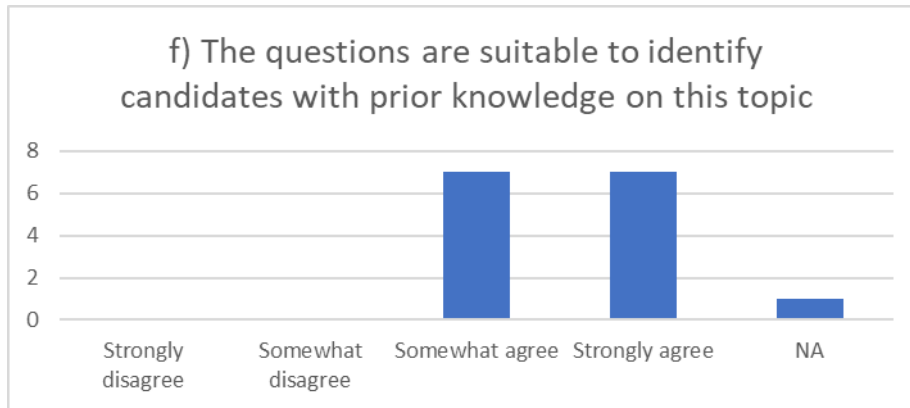


Figure 30: Answers on suitability of RPL technical interview questions to identify prior knowledge

Feedback on the satisfaction with the AM demonstrations was asked as well. **The evaluation of the AM demonstration was also mainly very positive. 7 of 11 (64%) agreed or strongly agreed that the AM demonstration tasks were well comprehensible** (2 did not answer, 2 somewhat disagreed). **9 of 11 (82%) candidates agreed or agreed strongly that the difficulty of the AM demonstration task was appropriate** (2 did not answer the question). **8 of 11 (73%) agreed or strongly agreed that the number of tasks in the AM demonstration was appropriate** (1 did not agree, 2 did not answer the question). **9 of 11 (82%) agreed or strongly agreed that the tasks of the AM demonstration are suitable to identify candidates with prior knowledge on the AM topic** (2 did not answer the question, please see also Figure 31). The duration of the AM demonstration and the **quality of the AM demonstration task were rated “suitable enough” or very suitable by 8 of 11 attendees (73%, 2 did not answer the question, 1 rated it as not very suitable)**. **7 out of 11 (64%) participants stated that the relevance and usefulness of the AM demonstration within the RPL process is suitable enough or very suitable**, the other 4 did not answer this question. In the end, **8 out of 11 (73%) agreed that the result of the AM demonstration corresponds with their level of skills in the field of AM** (2 did not answer the question, 1 had another opinion).

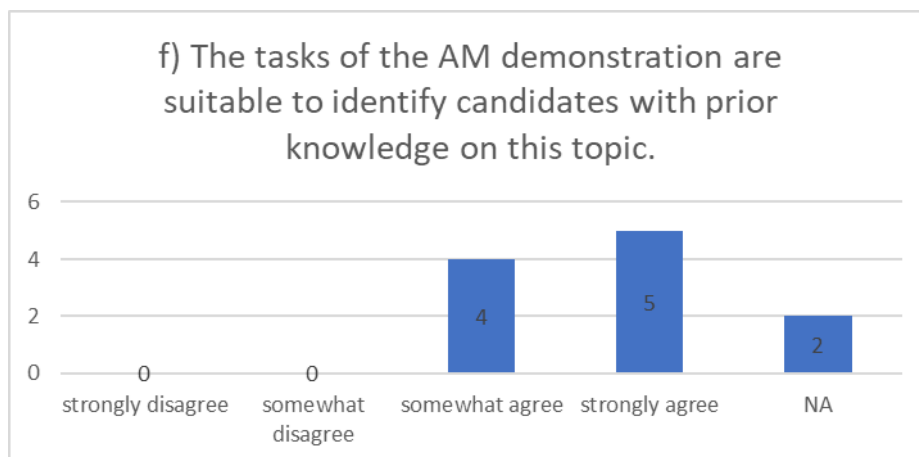


Figure 31: Answers on suitability of RPL AM demonstration to identify prior knowledge

The professionalism and broad knowledge of the RPL experts, who were able to respond to the participants in the interview, were positively highlighted by the candidates. The RPL material tested was found to be suitable for determining whether a person has a certain level of

knowledge on the topic of additive manufacturing. Regarding the less positive aspects or possible suggestions for improvement, it was noted that it would be better not to mix the materials polymer and metal, as candidates usually have advanced knowledge in either one or the other area, but often not in depth in both. In addition, some questions are formulated too vaguely. It is recommended to formulate clear tasks that require fewer assumptions from the candidates

4.4. Feedback achieved from RPL AM experts about the piloting

The RPL expert also provided feedback after conducting the technical interviews and AM demonstrations if applicable. AM Experts from MTC, AITIIP and IDONIAL were engaged in the RPL piloting activities, 15 answered feedback questionnaires (one for every participant) are available. The sections of the feedback surveys were on the satisfaction with the general testing conditions, with the interview conditions and with the AM demonstration conditions. **11 of 15 (73%) experts were satisfied enough or very satisfied with the infrastructure and the guidance, support and management conditions provided by the RPL provider** (4 (27%) did not respond on these questions). When evaluating the equipment for the AM demonstrations, the trainers were not in agreement, 7 (47%) of them were rather dissatisfied, whereas 8 (53%) were satisfied. **All experts rated the methodology used to identify knowledge from prior learning as either suitable enough or as very suitable** (see also Figure 32). 12 of 15 (80%) stated their effort to go through technical interview and AM demonstration was suitable enough or very suitable – 3 of them(20%) said it was not suitable enough.

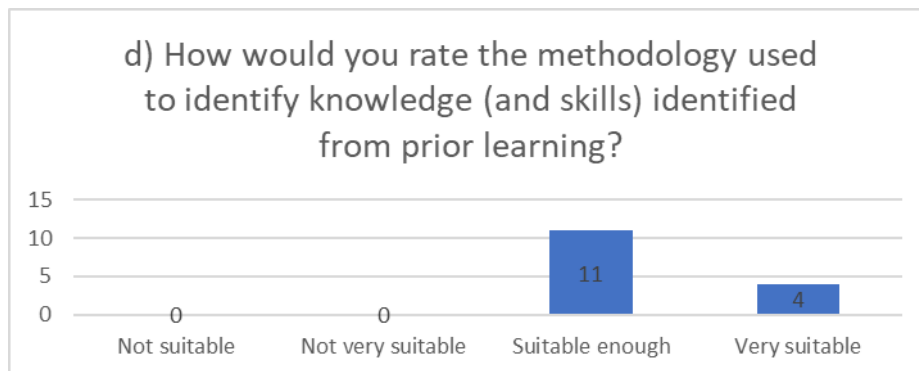


Figure 32: Rating of RPL trainers on the methodology used to identify knowledge from prior learning

AM experts feedback showed that the **difficulty and the number of questions of the technical interview questions was appropriate**. They also agreed that the questions are suitable to identify candidates with prior knowledge on this topic. Since all trainers agreed or strongly agreed on these questions. **The comprehensibility of the questions and the duration of the technical interview achieved agreement by 12 of 15 (80%) answers**. 3 of 15 (20%) experts did not agree on the status referring to these properties. **Good ratings were given to the quality of the technical interview questions and the relevance and usefulness of the technical interview within the RPL process**, since all trainers said this would be suitable enough or very suitable (see Figure 33). 14 of 15 participants (93%) passed the technical interview. **All experts agreed that in their opinion, the result corresponds to the level of knowledge in the field of AM of the candidate.**

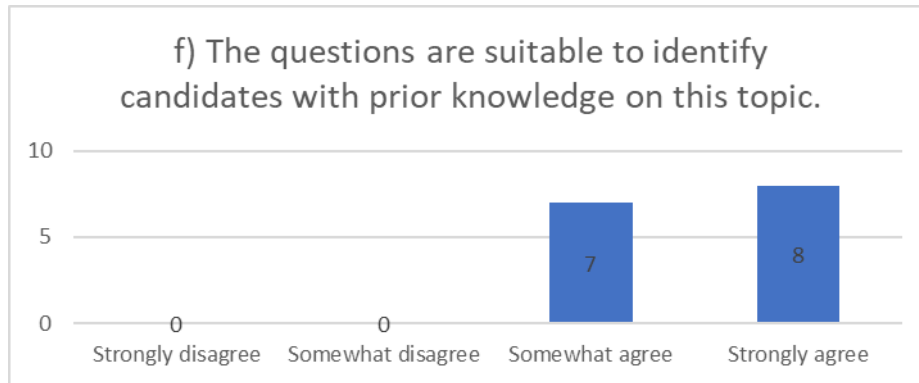


Figure 33: Rating of RPL trainers on the suitability of questions to identify prior knowledge

Since **11 AM demonstrations were conducted**, there is a maximum of 11 answers to the AM demonstration related questions. Related to the RPL AM demonstration, **all experts agreed or strongly agreed that the tasks of the AM demonstration were well comprehensible, that the number of tasks was appropriate and that the tasks of the AM demonstration are suitable to identify candidates with prior knowledge on this topic** (see Figure 34). One part of the answers is ambiguous, as in one question all trainers state that the difficulty of the tasks are appropriate, in another question, 3 of the experts stated that the difficulty of the tasks was too easy.

The experts were not in agreement about the duration of the AM demonstration and also about the quality of the task description. While 8 experts stated that they were satisfied with the duration of the AM demonstration, 3 experts rated the duration as not appropriate. 8 experts rated the quality of the task description as sufficiently appropriate, while 3 experts described it as not very appropriate. It should be remembered that the feedback surveys on RPL were summarised and analysed for all tested competence units. An inspection of the raw data shows that critical evaluation is to be assigned to competence unit CU34. **When asked about the relevance and usability of the AM demonstration in the RPL processes, all indicated that it was sufficient enough.** All 11 conducted AM demonstrations were passed successfully, and **the experts stated that, in their opinion, the result corresponds to the candidate’s level of skills in the field of AM.**

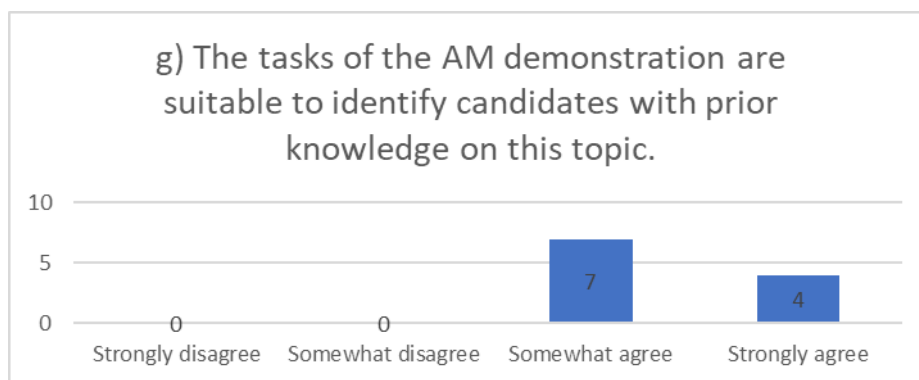


Figure 34: Rating of RPL trainers on the suitability of the AM demonstration tasks to identify prior knowledge

The opportunity to engage directly with candidates was highlighted as particularly positive by the experts. In general, the questions were clear and appropriate, and the technical interview complemented the AM demonstration well. Although the questions in the questionnaire were

assessed as appropriate and suitable, in the section of less positive aspects it is mentioned that the questions were very long and could be revised for better comprehensibility in order to clarify the context. Some content were asked multiple times, here there could be a resolution of the default **of three questions per skill to avoid repetition** and to be able to address the overall concept. It is also noted that it could be useful to **combine the technical interview and the AM demonstration on one day**.

4.5. Recommendations achieved from debrief meeting

All piloting partners wrote national reports on their conducted piloting activity. Further information from each reporting can be seen in the Annex. Partners from LORTEK, EC Nantes, EWF, IDONIAL, the MTC, LMS, ANSYS, AITIIP, IMR, POLIMI and LAK also met on 21st April 2022 via TEAMS and presented the main results and recommendations achieved from the piloting activity. The main input from the debrief meeting is presented below.

Competence Unit	Comments, Feedback, lessons learned, recommendations in discussion of debrief meeting
CU34 – Process Selection (RPL by MTC)	By having participants with 5-10 years of experience in AM, all candidates passed and gave consistent answers to the interview questions. The material was suitable to recognise prior knowledge in AM. Some questions were not clearly formulated in the interview and should be clarified and / or simplified. A revision of questions of the interview would be needed to avoid thematic duplications as well as a shortening of the duration is recommended. In addition, it is advantageous if the AM expert has already had experience with the CU and its content in the context of teaching courses before conducting an RPL process on this process. A revision of the material was suggested for a smoother RPL technical interview.
CU35 – Metal AM integration (RPL by AITIIP)	The possibility of direct interaction of the AM expert with the candidates was highlighted as very positive. Experienced trainers with soft skills such as communication, problem solving and empathy were mentioned by the candidates as very positive and beneficial for the interview process. It is suggested to split the technical interview and the demonstration over different days and to use a blended learning approach (i.e., doing the technical interview online and the AM demonstration on site) to reduce the candidates stress.
CU36 – Coordination activities (RPL by MTC)	Regarding CU36, the questions were found to be well suited to determine the level of existing knowledge of the candidates. It was possible to conduct the technical interview in less than 30 minutes. Since some of the questions were somewhat unclear to the candidates and were labelled as irrelevant, for example, it is

	<p>recommended that the questions be slightly revised. A suggestion for this was presented by the MTC. An additional suggestion is to choose more open questions instead of restricted questions and answers as a basis for a more active interview.</p>
<p>CU43 – Production of PBF-LB parts (RPL by IDONIAL)</p>	<p>The technical interview questions are judged to be well suited for going through the various topics in a structured manner. The duration of the interviews was about 50 to 70 minutes. The specific cases and CAD software provided by IDONIAL added a lot of value and agility to the AM demonstrations. Despite some redundancies, the technical interview and AM demonstration complemented each other well. Suggested areas for improvement include revising the material to eliminate duplication, provide more context to candidates, or provide additional material in graphical representations or printed parts. The available RPL instruments appear to accurately identify whether an candidate has a certain level of knowledge and experience but tend to score high if the examinee demonstrates a minimum level of experience, knowledge, and criteria. Due to the high number of questions, a high score could mask specific and important knowledge/experience deficiencies. Pass/fail should not be based on final score alone.</p>
<p>CU63 – Certification, Qualification and Standardization in Additive Manufacturing (piloted by FA)</p>	<p>All participants were satisfied with the training, stating that the training met their expectations and that they would recommend the training to others. The participants praised especially the preparation and performance of the trainers. They were <i>very satisfied</i> or <i>satisfied enough</i> with the knowledge received during the training and the usefulness of the training materials.</p> <p>Regarding possible improvement, there was a demand for more practical elements in the training, for example through case studies and showing the relevance for different professional activities. According to the trainers, the completion time of the exam questions should be extended. Gamification and interaction during the course would be welcomed as well.</p>
<p>CU72 – Metal Binder Jetting Process (piloted by POLIMI and MTC)</p>	<p>Trainers highlighted that the CU is well balanced in terms of contact hours and contents, they would wish more alignment on teaching material among the trainers to avoid redundant contents; the attendees.</p>
<p>CU73 – Sustainability for AM (piloted by IMR)</p>	<p>Interaction between participants was considered very positive; the training met expectations and participants would recommend the course to others; the relevance of the course and the use of case studies were considered very positive; critical feedback was given on problems with the software; it was recommended to pay more attention to the schedule and to increase the number of exercises and examples used in the course and to avoid redundant content.</p>

**CU73 – Sustainability for
AM (piloted by ITECAM)**

More case studies, practical work with the software, concrete application examples and trying to avoid redundant contents was suggested by the students of the course; the trainers suggested to **integrate the topics product life cycle and AM** within a sustainable production scheme as well as more practical content or hands-on for the participants; they also suggested to check the guideline to possibly avoid redundant contents.

5. Conclusion & Outlook

The objective of this report was to conclude about all piloting events of the 3rd stage of short term scenarios (D5.7) which aimed to test the methodology through the implementation of the IAMQS, which include the new developed or updated competence units (CU63 – Certification, Qualification & Standardization in AM, CU72 – Metal Binder Jetting Process and CU73 – Sustainability for AM) and the RPL material for the competence units: CU34 – Process Selection, CU35 – Metal AM integration, CU36 – Coordination activities and CU43 – Production of PBF-LB parts. Considering the results above, it was concluded that the **methodology applied to designed training programmes for each CU and the RPL technical interview and AM demonstration were suitable for their purposes**. In terms of specific content of the new CUs **no changes will be introduced to the guidelines. A revision of the RPL questions might be useful to avoid redundant contents and to specify the contents required**.

A total of 4 courses and 15 RPL technical interviews with 9 AM demonstrations on 4 different competence units were conducted within the 3rd stage of piloting activities in SAM project between November 2021 and March 2022. All in all, 15 trainers were engaged in the piloting courses of the lectures, 15 attendees did one of the PRL interviews and 71 participants attended in the courses or lectures. 52 participants of the lectures answered to the feedback survey and 34 of them attended in the final assessment.

The feedback achieved in the overall pilots was positive. The dynamic of the sessions and the relevance for own job activities was highlighted by the attendees of the courses. All of them answered that the course met their expectations and that they would recommend it to others. The involvement and support of AM Experts in the RPL was marked as very good by the candidates of the RPL process. They had the opinion that the material is suitable to identify candidates with prior knowledge on a certain topic.

The overall performance of the overall pilots was very positive, since 14 of 15 conducted RPL technical interviews were passed and all 9 AM demonstrations were passed. 32 of the 34 final assessments after the lectures were passed which corresponds to 94% of the attendees. Finally, the results also revealed that the courses developed according to the developed IAMQS guidelines led to successful passed exams that were also developed according to these guidelines. The used methodology for this process was tested successfully and was shown to be suitable.

As an outlook, it can be stated that all findings and outcomes from this stage of piloting will be fed directly into the IAMQS, the follow up survey after 6 months of the pilot course, will be applied to the attendees to identify impacts of their attendance in the course experience. Moreover best practices collected on conducting piloting activities will be used in WP6, where the full profile of the Metal AM coordinator will be implemented.

6. Annex

The following sections provide more detailed information on the feedback achieved from participants and trainers in the national context during the piloting in the 3rd stage of short-term scenarios in SAM project. The sections were provided by the piloting partners. Chapter 6.3 shows the conclusions of the single national reporting on the 3rd stage of piloting in SAM project.

6.1. Feedback achieved from participants' feedback survey

After attending a piloting course and the final assessment or the RPL interview, all participants were asked to answer a feedback survey. The national results are presented below. The feedback questionnaire was developed within WP2 of the SAM project (D2.7 – Kit to collect feedback on the qualifications/ training modules).

6.1.1. Feedback from participants on CU63: Certification, Qualification and Standardization in Additive Manufacturing piloted by FA

The feedback report has shown that 6 participants have responded to the feedback survey. Those that responded to the survey 5 were male and 17% female, spanning the following age range: 33% between 26-35y and 67% between 36-55y.

Out of the responses it is possible to observe that the attendees were, all workers, from different countries including, Spain, Romania, Ireland and one attendant was from Mexico. Moreover, the results show that the sectors of the organization of the attendees were very diverse as shown in the image bellow. The “other” were from Railway, education, Maritime and R&D:

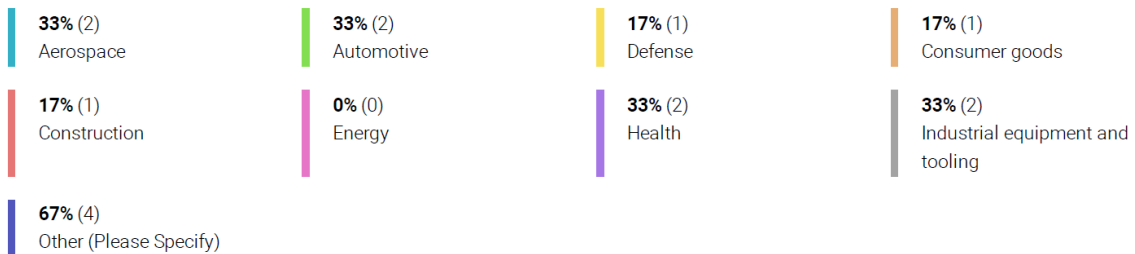
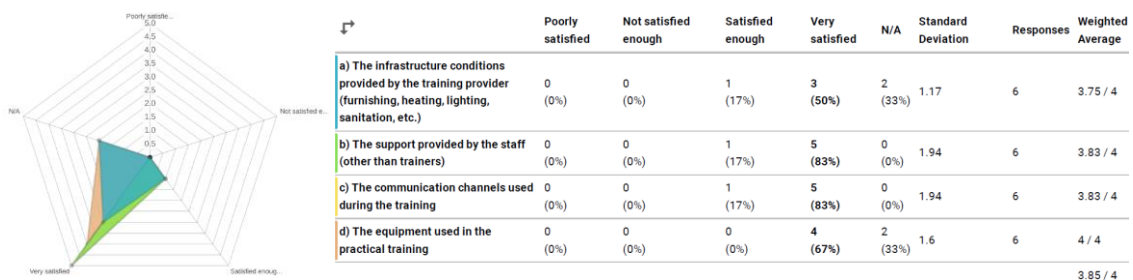


Figure 35 - Sectors from the attendee's organizations

Most of the attendees had a higher education background being 33% with a bachelor's degree, 67% with Engineering or master's degree and 17% with Doctoral degree. The knowledge of the attendees regarding Additive Manufacturing was very high as most of them were actively evolved in the field of AM.

Overall, the level of satisfaction regarding the conditions of the training scored **3,85/4** as shown in image below:



WP5 Pilot Activities Report

Qualification/Professional Profile: Process Engineer PBF-LB | 2 Competence Units: Metal AM Designer

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Figure 36 - Satisfaction stats regarding conditions of the training

Regarding the level of satisfaction of the entire training the score was **3.43/4** as shown in the following image:



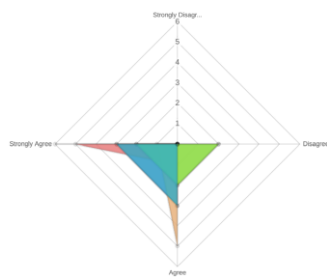
	Poorly satisfied	Not satisfied enough	Satisfied enough	Very satisfied	N/A	Standard Deviation	Responses	Weighted Average
a) The structure of the course	0 (0%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)	1.47	6	3.5 / 4
b) The contents addressed during the course	0 (0%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)	1.47	6	3.5 / 4
c) The coherence of the course with the training programme (did the training provider respect the order of contents established in the training programme?)	0 (0%)	0 (0%)	1 (17%)	5 (83%)	0 (0%)	1.94	6	3.83 / 4
d) The contact hours allocated to the course, considering the amount and nature of the course contents	0 (0%)	0 (0%)	2 (33%)	4 (67%)	0 (0%)	1.6	6	3.67 / 4
e) The balance between theoretical and practical training	0 (0%)	1 (17%)	1 (17%)	1 (17%)	3 (50%)	0.98	6	3 / 4
f) The transparency/communication of the learning outcomes associated to the course	0 (0%)	1 (17%)	2 (33%)	3 (50%)	0 (0%)	1.17	6	3.33 / 4
g) The match between learning outcomes foreseen for the course and what the course covered	0 (0%)	0 (0%)	3 (50%)	2 (33%)	1 (17%)	1.17	6	3.4 / 4
h) The relevance of the course to your job activities	0 (0%)	1 (17%)	3 (50%)	2 (33%)	0 (0%)	1.17	6	3.17 / 4
								3.43 / 4

Figure 37 - Satisfaction scores of the training course

Assessing the feedback of the training course, the results show that the less positive marks are related to the practical content of the training course. Taking into

consideration the content and scope of the Competence Unit it is expected teaching method focusing on more theoretical content, thus, questions addressing practical training fall out of the expected activities off the training. No further comments were provided.

Addressing the training sections, the overall score was **3,43/4** as shown in the image below.



	Strongly Disagree	Disagree	Agree	Strongly Agree	Standard Deviation	Responses	Weighted Average
a) The learning materials (I.e. slide shows, handbooks, videos, samples) were useful	0 (0%)	0 (0%)	3 (50%)	3 (50%)	1.5	6	3.5 / 4
b) The training sessions were quite dynamic, in the sense that they were engaging and involved interactive moments - such as problem-based learning, project-based learning, gamification, augmented reality, virtual reality, collaborative learning, etc. - instead of being just expositive)	0 (0%)	2 (33%)	2 (33%)	2 (33%)	0.87	6	3 / 4
c) The training sessions promoted the use of digital tools	0 (0%)	2 (33%)	2 (33%)	2 (33%)	0.87	6	3 / 4
d) There was a good balance of knowledge among the participants and no big discrepancies in the background knowledge were noticed	0 (0%)	0 (0%)	5 (83%)	1 (17%)	2.06	6	3.17 / 4
e) The trainer(s) showed a good performance (good time management, ability to communicate clearly)	0 (0%)	0 (0%)	1 (17%)	5 (83%)	2.06	6	3.83 / 4
f) The trainer(s) was well prepared and showed a good understanding of the subject	0 (0%)	0 (0%)	0 (0%)	6 (100%)	2.6	6	4 / 4
g) The support provided by the trainer(s) was good and a good management of questions and answers was done	0 (0%)	0 (0%)	3 (50%)	3 (50%)	1.5	6	3.5 / 4
							3.43 / 4

Figure 38 – Satisfaction scores regarding the training section

The marks received are positive and provide an insight of the training sections. The fewer good results are related to the use of digital and dynamic tools and training technics. On an on-line scenario the resources available to provide a more dynamic session diminish and the nature of the Competence Unit also balance the methodology towards a more theoretical and information sharing session. Nevertheless, the feedback regarding the trainers and the way the sections were carried are extremely positive. No further comments were given.

WP5 Pilot Activities Report

Qualification/Professional Profile: Process Engineer PBF-LB | 2 Competence Units: Metal AM Designer

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The last section addressing the overall satisfaction of the efficiency of the course ranked **3,34/4** as shown in the next image.

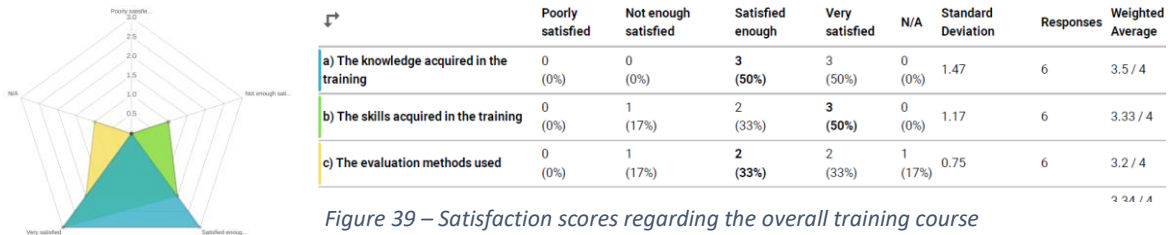


Figure 39 – Satisfaction scores regarding the overall training course

From the results, it is possible to observe that the evaluation method was the one with less positive mark.

Overall, it is important to highlight that the training course have met the expectations of all that responded to the feedback questionnaire and all of them would recommend it to others.

The remarks and comments provided by the trainees about the most positive aspect of the course were:

- Knowledge and expertise of the trainers from prestigious institutions
- Preparation of the trainer for the session
- Structure and sequence followed
- Content and information shared

In terms of things that could be improved the comments were the following:

- Reduce the amount of time spent on the general structure of the standards and standardization at international level
- More engaging on-line activities, where the trainer would invite the trainees to participate, other, game/questions session
- Have breaks throughout the session for this engagement
- The assessment time was too short and very few questions

The last comment was also stressed, externally to the questionnaire and training, by a trainee that contacted FA and during the conversation provided some insights regarding the way the examination was carried out. On in view, more time and more questions should be used when evaluating solo Competence Units.

Overall, the comments were quite positive regarding the training. The knowledge and expertise of the trainer elevated the quality of the training, enabling the delivery of valuable knowledge, content, and information to the trainees.

Upon the feedback received from the trainees and trainer it is possible to identify very few raised points and based on those the following recommendations for future training activities are:

- 1 – Provide more in-depth and practical examples during the training
- 2 – Promote interaction during the training sections. Use questionnaires or games
- 3 – Revise the examination protocol, in order to have more time and questions

6.1.2. Feedback from participants on CU73: Sustainability for Additive Manufacturing by IMR, MTC, IDONIAL and LORTEK

Section 1: General information on the participant

Gender

78% (7) Female

22% (2) Male

Age range

11% (1) 15 - 25

56% (5) 26 - 35

33% (3) 36 - 55

Country

56% (5) Spain, 11% (1), Bulgaria 11% (1), Greece 11% (1), Italy 11% Attendee Profile

Profile

44% (4) Worker, 56% (5) Higher Education Student

Industry

25% (1) Automotive

25% (1) Industrial equipment and Tooling

50% (2) Other (Please Specify) Welding society, Research

Education

11% (1) School certificate

11% (1) Bachelor's degree

0% (0) Middle degree vocational training

0% (0) High degree vocational training

67% (6) **Engineer or master's degree**

33% (3) **Doctoral degree**

Attendees attracted

Many attendees had a broad professional background/ previous additive manufacturing experience and ranged from very basic level knowledge to those working in AM for years, including other examples below:

Attendees were asked: What is your professional background/previous additive manufacturing experience?

- Student of Master of AM.
- Before this master's degree, none.
- 3D Printing start-up co-founder, Ambassador of Women in 3D Printing, Researcher for 3d Printed Fashion.
- 3d printing as a hobby.
- Production of biodegradable polymers that can be used for additive manufacturing during my studies.
- Chemical Engineering, use of AM for research purposes.
- PhD Civil Engineering - experience in LCA but no experience in AM applications
- None.
- Welding.
- We have a WAAM cell with a Kuka Robot and CMT Fronius.

Attendee Feedback

- 100% were either very satisfied or satisfied with the match between learning outcomes foreseen for the course and what the course covered.
- 99% felt that this course related to their job activities.
- 100% were either very satisfied or satisfied with the course structure.
- 100% felt the delivery was dynamic and were either very satisfied or satisfied with the level of interaction during training.
- 100% were either very satisfied or satisfied with the trainer quality, the level of communication and support for questions and answers during the training.

A selection of the feedback comments included:

- *I found out more about sustainability and AM.*
- *I learned more about different methods of AM and tools for sustainability. Meeting people from different backgrounds.*
- *I really enjoyed the case study examples provided during the course work.*
- *Interaction with competent industrial partners.*

100% of attendees were either satisfied or very satisfied with the learning acquired during training and when asked how the attendees might use the learning in their jobs they replied:

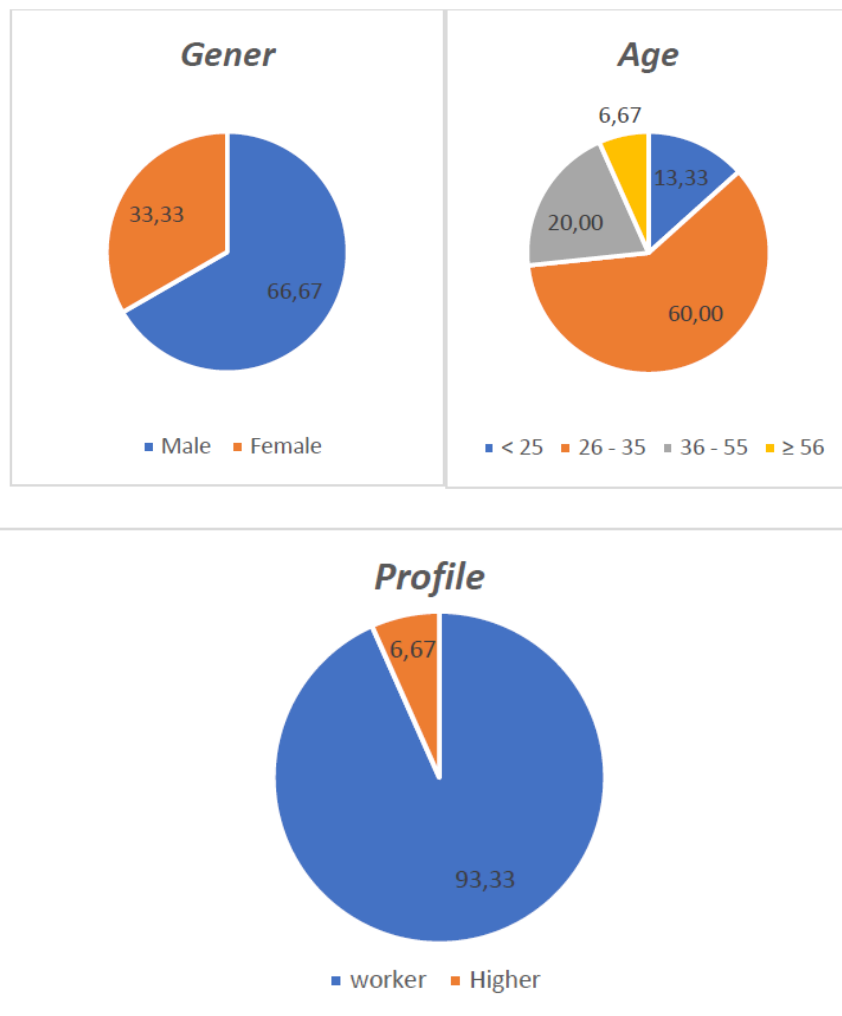
- *Improve the design of some of my products made by additive manufacturing to reduce their environmental impact.*
- *It makes me think about not just AM process, but the whole process from the production of the raw materials to end products life.*
- *In a future job role this may be more relevant.*
- *A slight change in the chain can affects more than meets the eye. If this change is made sustainably, a huge difference can be achieved.*
- *Incorporating sustainability in AM.*
- *Being more consistent with energy waste during manufacturing processes.*
- *Would like to implement the use of more sustainable material and offer more general sustainability knowledge since it is not currently present in the team*

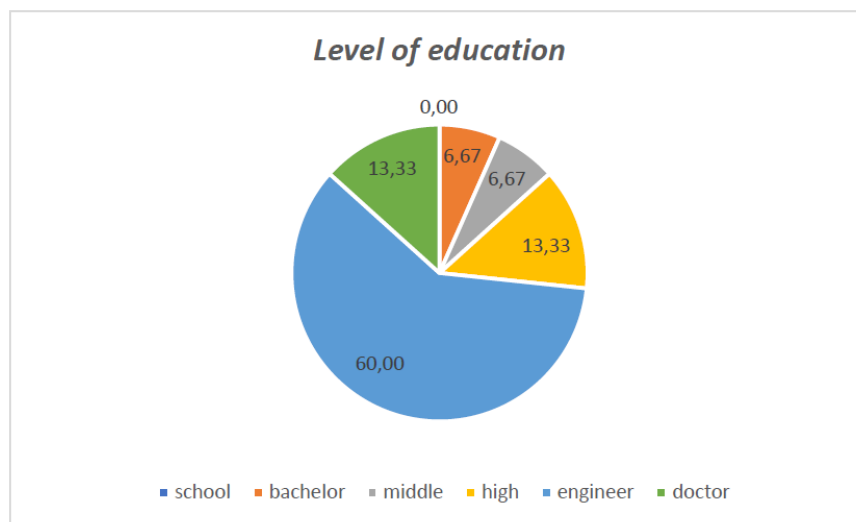
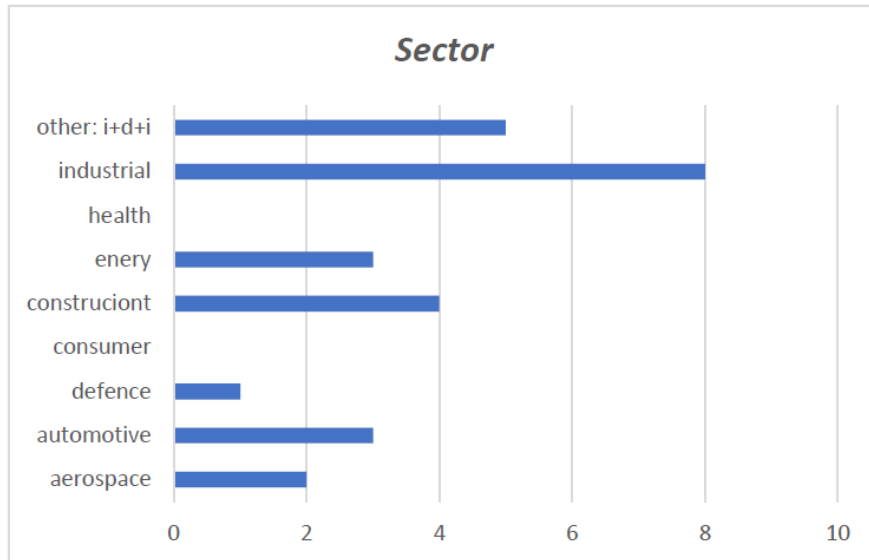
As always there is room for continuous improvement and below attendees outlined how Pilot 3 could be improved:

- *There were technical issues during the examination whereby it took a long time for students to join the exam on the final day – over 30 minutes.*
- *Technical issues Day 1 training with presentation.*
- *Preference for more sessions of training (in other words 7 hours seemed too short for the subject area).*
- *Some repetition between trainers.*
- *More time for case study interaction.*

6.1.3. Feedback from participants on CU73: Sustainability for Additive Manufacturing by ITECAM

15 surveys have been received. The results are as follows:





Professional background/previous additive manufacturing experience:

- Prototyping services
- Participation in R&D&I projects related to Additive Manufacturing
- Trainer in AM course
- Experience in modeling some pieces and some prototypes
- Polymer research
- Working on the synthesis of new materials with a pilot plant for graphene synthesis and the development of new hybrid materials.
- Experience in the chemical and mechanical characterisation of these materials

Satisfaction with the training conditions					
How would you rate your level of satisfaction with...	1. Poorly satisfied	2. Not satisfied enough	3. Satisfied enough	4. Very satisfied	n.a.
The infrastructure conditions provided by the training provider (furnishing, heating, lighting, sanitation, etc.)	0,00	0,00	0,00	80,00	20,00
The support provided by the staff (other than trainers)	0,00	0,00	13,33	73,33	13,33
The communication channels used during the training	0,00	0,00	0,00	100,00	0,00
The equipment used in the practical training	0,00	0,00	6,67	66,67	26,67

Satisfaction with the course					
How would you rate your level of satisfaction with...	1. Poorly satisfied	2. Not satisfied enough	3. Satisfied enough	4. Very satisfied	n.a.
The structure of the course	0,00	0,00	33,33	66,67	0,00
The contents addressed during the course	0,00	0,00	26,67	73,33	0,00
The coherence of the course with the training programme (was the order of contents presentation [foreseen in the ULO/CU] respected by the training provider?)	0,00	0,00	13,33	86,67	0,00
The contact hours allocated to the course, considering the amount and nature of the course contents	0,00	0,00	40,00	60,00	0,00
The balance between theoretical and practical training	0,00	0,00	26,67	53,33	20,00
The relevance of the course to your job activities	0,00	0,00	13,33	86,67	0,00
The transparency/communication of the learning outcomes associated to the course	0,00	0,00	14,29	85,71	0,00
The match between learning outcomes foreseen for the course and what the course covered	0,00	0,00	28,57	57,14	14,29

Satisfaction with the training sessions				
What is your opinion regarding the following statements?	1. Strongly disagree	2. Somewhat disagree	3. Somewhat agree	4. Strongly agree
The learning materials (i.e., slide shows, handbooks, videos, samples) were useful	0,00	0,00	13,33	86,67
The training sessions were quite dynamic, in the sense that they were engaging and involved interactive moments, such as problem-based learning, project-based learning, gamification, augmented reality, virtual reality, collaborative learning, etc., instead of being just expositive	0,00	0,00	80,00	20,00
The training sessions promoted the use of digital tools	0,00	7,14	21,43	71,43
There was a good balance of knowledge among the participants and no big discrepancies in the background knowledge were noticed	0,00	0,00	20,00	80,00
The trainer(s) showed a good performance (good time management, ability to communicate clearly)	0,00	0,00	26,67	73,33
The trainer(s) was well prepared and showed a good understanding of the subject	0,00	6,67	26,67	66,67
The support provided by the trainer(s) was good and a good management of questions and answers was done	0,00	6,67	26,67	66,67

Satisfaction with the course effectiveness					
How would you rate your level of satisfaction with...	1. Poorly satisfied	2. Not enough satisfied	3. Satisfied enough	4. Very satisfied	n.a.
The knowledge acquired in the training	0,00	0,00	13,33	86,67	0,00
The skills acquired in the training	0,00	0,00	33,33	66,67	0,00
The evaluation methods used	0,00	0,00	21,43	78,57	0,00

WP5 Pilot Activities Report

Qualification/Professional Profile: Process Engineer PBF-LB | 2 Competence Units: Metal AM Designer

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Question 13. Closure	YES	NO
Did the course meet your expectations?	100	0
Would you recommend this course to others?	100	0

The main recommendations of the students are:

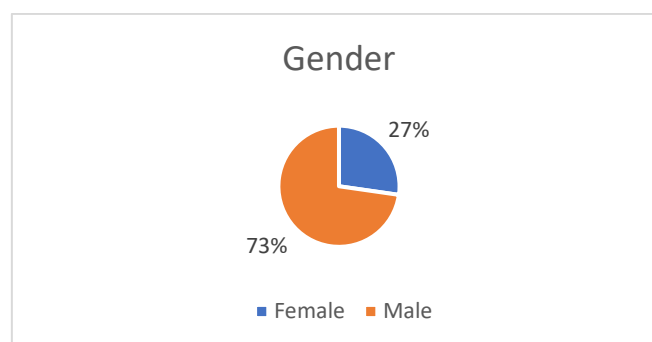
- There are repeated concepts that could perhaps be substituted, complemented with more weight of case studies. In the unit script, it talks about the product life cycle and reducing environmental impact both for AM processes and at a general level. Perhaps it could be somewhat redundant since the basis is the same. Our proposal would be to integrate it a bit more and include more case studies or concrete application examples (only one hour is foreseen at the end of the CU).
- Increase the practical content. We would propose it at the end of: Additive manufacturing within a sustainable production scheme. We believe that it could be good to develop some practical exercise and even use some software to apply what has been discussed during the course.
- This field is very vast and is needed more time to understand all the concepts.
- The less positive aspect to the training course was not being able to interact with the softwares, they were only shown. A practical exercise was carried out using the software SolidWorks.

6.1.4. Feedback from participants on CU72: Metal Binder Jetting Process by POLIMI and MTC

Section 1: General information on the participant

Question 1: Please select the gender you identify better with (for gender balance reporting duties, only):

Options	Female	Male
N of answers	6	16



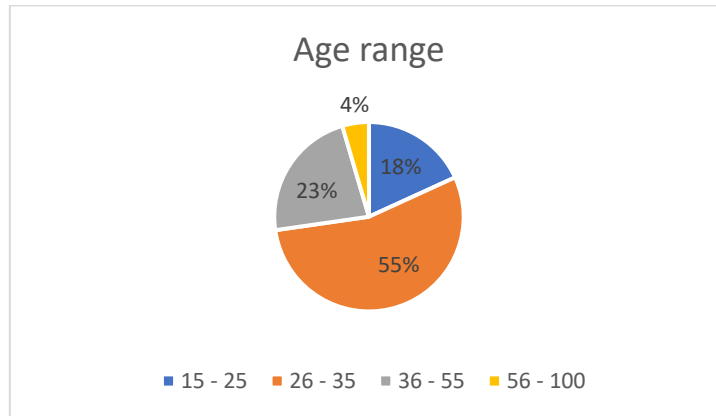
Question 2: Please select the age range you are in:

Options	15 - 25	26 - 35	36 - 55	56 - 100	15 - 25
N of answers	4	12	5	1	4

WP5 Pilot Activities Report

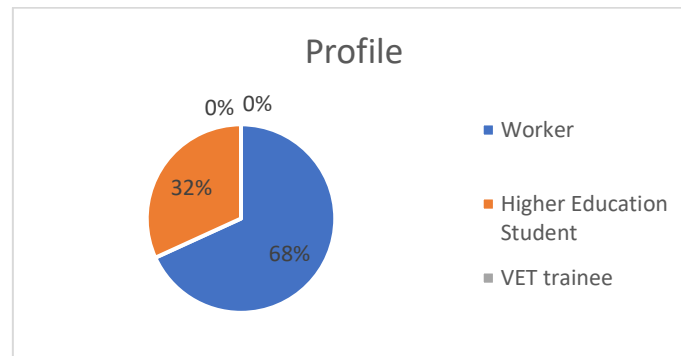
Qualification/Professional Profile: Process Engineer PBF-LB | 2 Competence Units: Metal AM Designer

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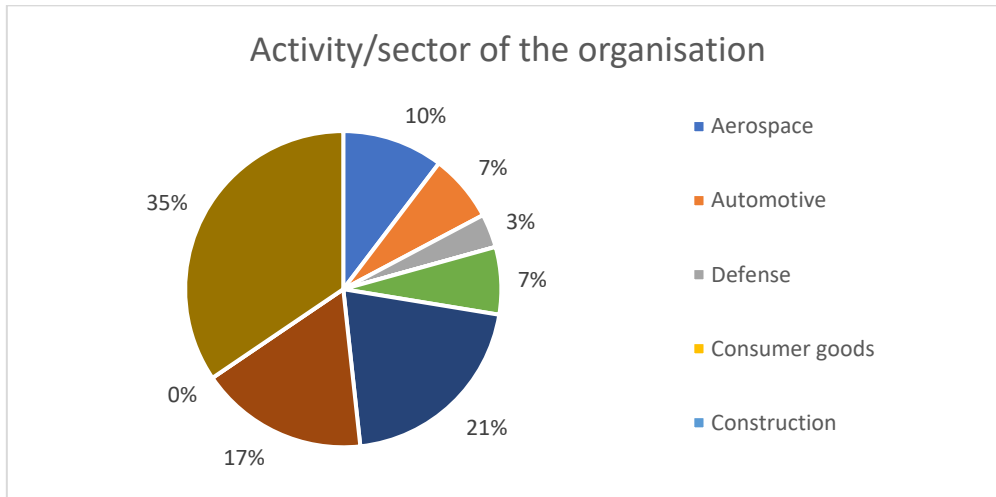
Question 3: What would you say is your profile when engaging in this course?

Options	Worker	Higher Education Student	VET trainee	Unemployed
N of answers	15	7	0	0



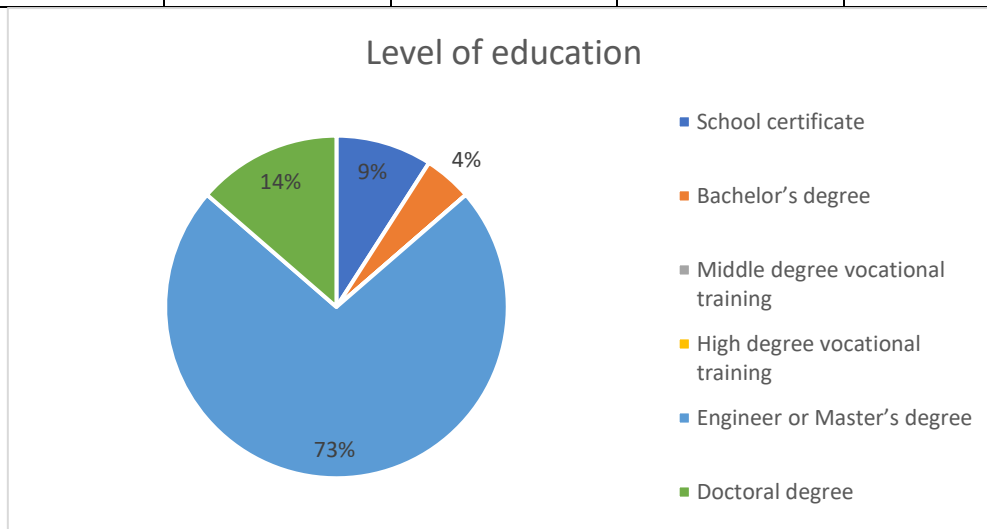
Question 4: What is the main activity/sector of your organisation?

Options	Aerospace	Automotive	Defense	Energy	Health	Industrial equipment and tooling	Other (Please Specify)
N of answers	3	2	1	2	6	5	10



Question 5: What is your level of education?

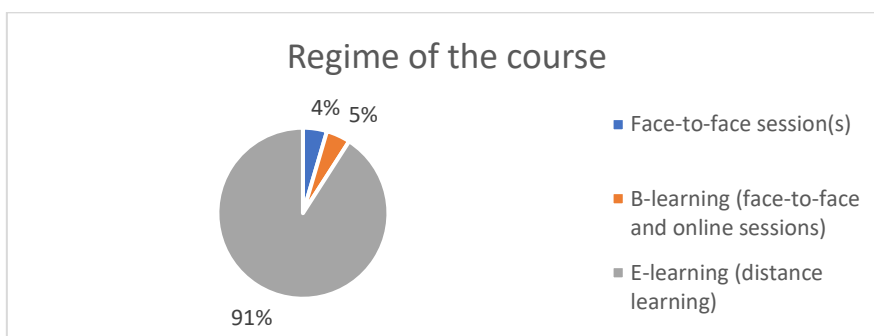
Options	School certificate	Bachelor's degree	Engineer or Master's degree	Doctoral degree
N of answers	2	1	16	3



Section 2: General information on the pilot course

Question 1: What was the regime in your pilot course?

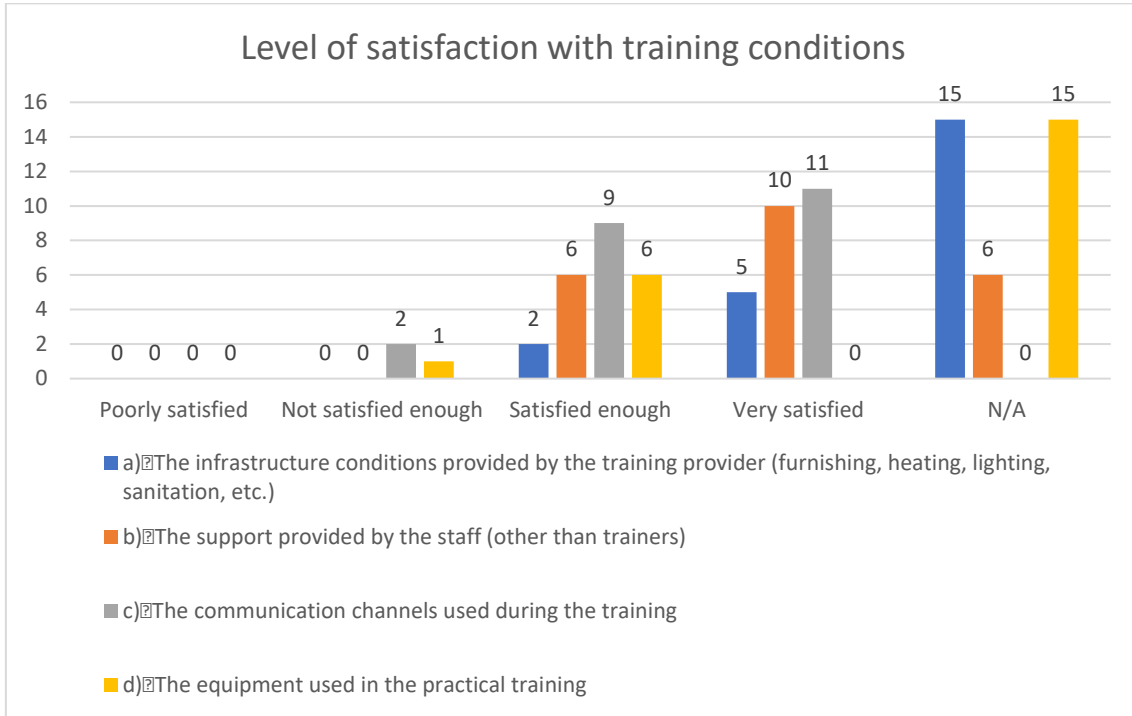
Options	Face-to-face session(s)	B-learning (face-to-face and online sessions)	E-learning (distance learning)
N of answers	1	1	20



Section 3: Information on the level of satisfaction with the training conditions

Question: How would you rate your level of satisfaction with...

	Poorly satisfied	Not satisfied enough	Satisfied enough	Very satisfied	N/A
a) The infrastructure conditions provided by the training provider (furnishing, heating, lighting, sanitation, etc.)	0	0	2	5	15
b) The support provided by the staff (other than trainers)	0	0	6	10	6
c) The communication channels used during the training	0	2	9	11	0
d) The equipment used in the practical training	0	1	6	0	15

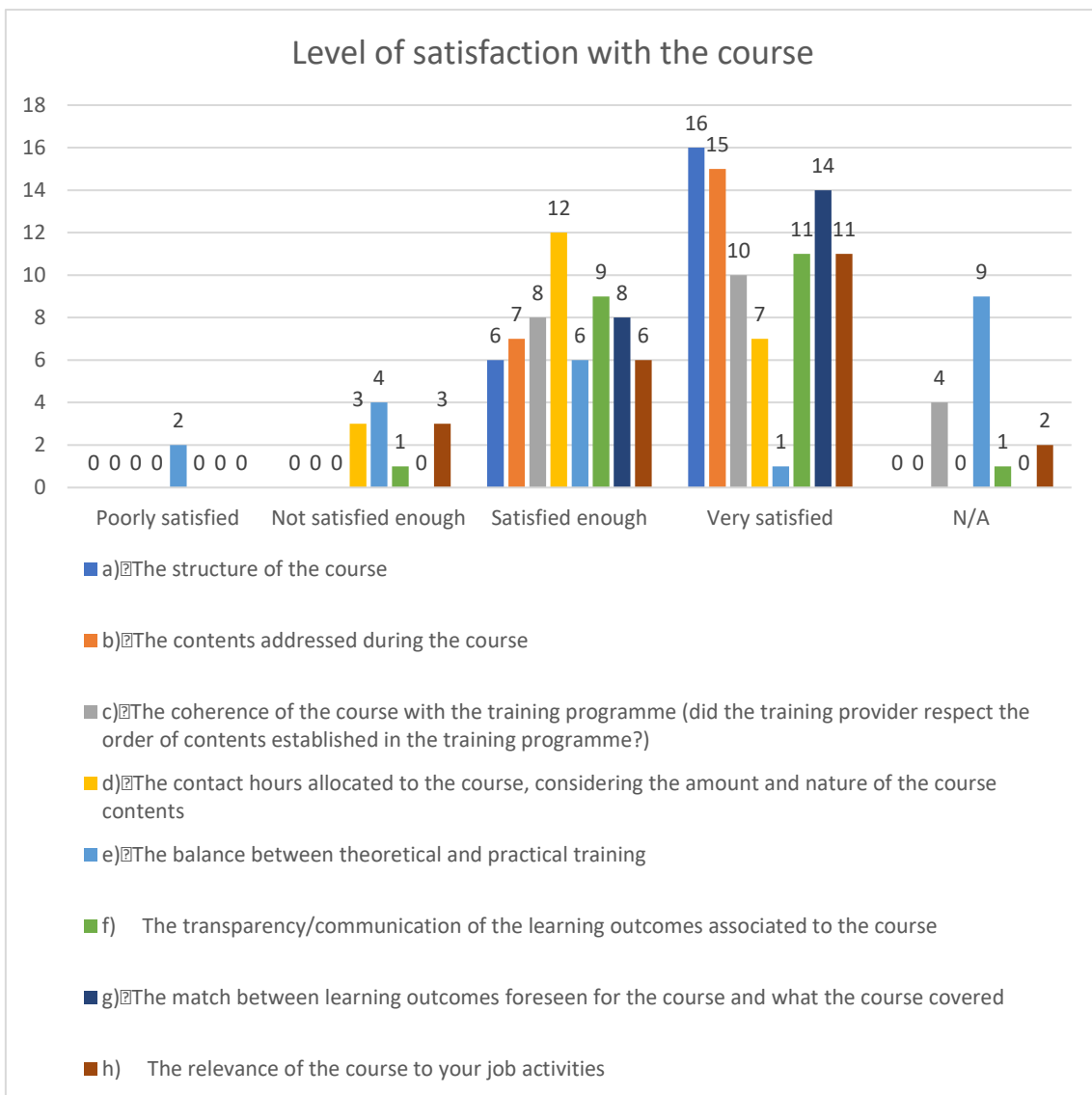


Section 4: Information on the level of satisfaction with the course

Question: How would you rate your level of satisfaction with...

	Poorly satisfied	Not satisfied enough	Satisfied enough	Very satisfied	N/A
a) The structure of the course	0	0	6	16	0
b) The contents addressed during the course	0	0	7	15	0
c) The coherence of the course with the training programme (did the training provider respect the order of contents established in the training programme?)	0	0	8	10	4
d) The contact hours allocated to the course, considering the amount and nature of the course contents	0	3	12	7	0
e) The balance between theoretical and practical training	2	4	6	1	9

f) The transparency/communication of the learning outcomes associated to the course	0	1	9	11	1
g) The match between learning outcomes foreseen for the course and what the course covered	0	0	8	14	0
h) The relevance of the course to your job activities	0	3	6	11	2



Section 5: Information on the level of satisfaction with the training sessions

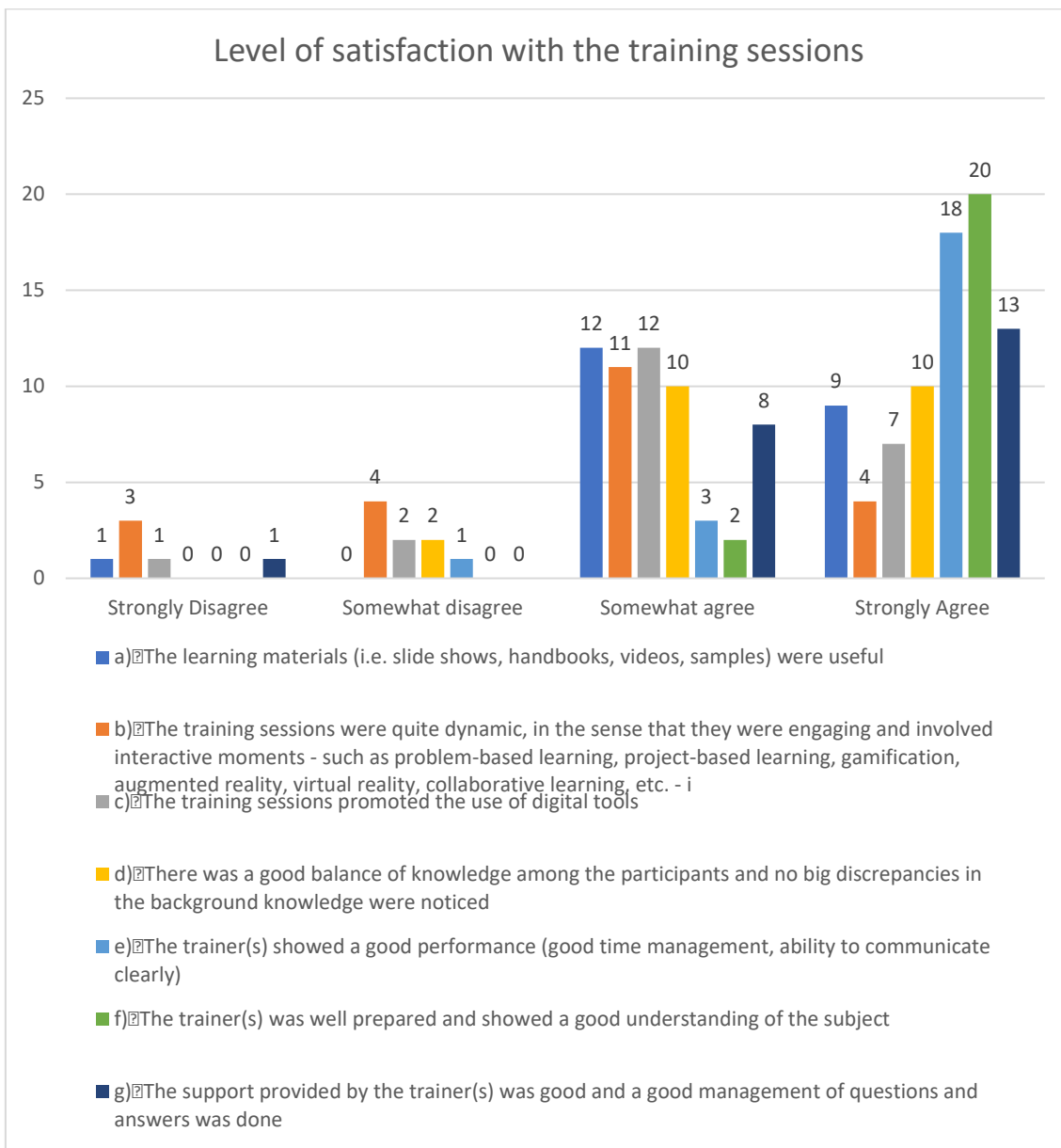
Question: What is your opinion regarding the following statements?

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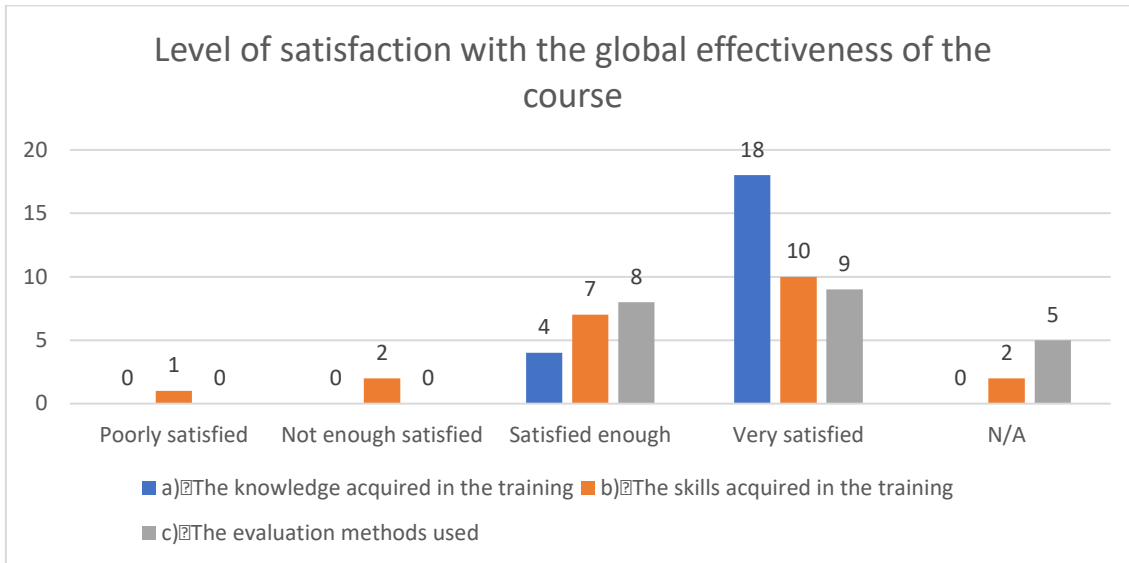
	Strongly Disagree	Somewhat disagree	Somewhat agree	Strongly Agree
a) The learning materials (i.e. slide shows, handbooks, videos, samples) were useful	1	0	12	9
b) The training sessions were quite dynamic, in the sense that they were engaging and involved interactive moments - such as problem-based learning, project-based learning, gamification, augmented reality, virtual reality, collaborative learning, etc. - instead of being just expositive)	3	4	11	4
c) The training sessions promoted the use of digital tools	1	2	12	7
d) There was a good balance of knowledge among the participants and no big discrepancies in the background knowledge were noticed	0	2	10	10
e) The trainer(s) showed a good performance (good time management, ability to communicate clearly)	0	1	3	18
f) The trainer(s) was well prepared and showed a good understanding of the subject	0	0	2	20
g) The support provided by the trainer(s) was good and a good management of questions and answers was done	1	0	8	13



Section 6: Global evaluation of the course effectiveness

Question 1: What is your opinion regarding the following statements?

	Poorly satisfied	Not enough satisfied	Satisfied enough	Very satisfied	N/A
a) The knowledge acquired in the training	0	0	4	18	0
b) The skills acquired in the training	1	2	7	10	2
c) The evaluation methods used	0	0	8	9	5



Question 2: Did the course meet your expectations?

Options	Yes	No
N of answers	22	0

Question 3: Would you recommend this course to others?

Options	Yes	No
N of answers	22	0

What was the most positive aspect of the training course? Why?
Course touched on the fundamentals of the subject and not much noise
The knowledge of the subject matter by the trainers.
The course provided a comprehensive overview of different aspects of metal binder jetting including the process, post-process, and cost and industrialization aspects. Details and fundamental backgrounds were discussed regarding the process itself, debinding and sintering and necessary post processing such as surface finishing.
Aspects in regard to industrialization of MBJ very thought provoking. Technically detailed content in regard to printing and sintering considerations very useful for upskilling in this area very
The delivery of most of the modules were clear, well structured and well delivered. The work pertaining to cost modelling was particularly useful
the organisation and facilitation of the event was well done by Paolo and Bianca, good insights in the process were shown by different speakers, it was positive to split the online event and only have half-day sessions
I learnt a lot about many aspects related to binder jetting
starting with theoretical concepts gives a good base to understand also practical examples. Give lecture not only the engineering/technological aspects but also economical consideration.
The diversity of topics covered

Personally, I really appreciated the practical angle of the courses, in terms of application of the theoretical aspects to the industrialization of the product.
Great theoretical detail
Comprehensive and clear - good possibility for many experts to give a in-depth and general idea about the technology
It covers almost each aspect of the BJ technology
that the course almost cover all the aspects concerning the the BJ and theoretically and experimentally.

What was the less positive aspect of the training course? Why?
I would like to have more interaction during lessons
Repetition of some of the content by different presenters
I was participating in the EST time zone and the hours were a bit inconvenient.
I appreciate that there is a lot of content to go through and breaks were regularly scheduled but some of the content was quite intense, and I think more regular, shorter breaks might be more useful.
The delivery of some of the modules were less passionate and made it a little difficult to follow/focus
practical insights in online sessions are difficult, it would have been nice to see more videos, maybe with audio or to have videos from processes or photos of the systems, e.g. insights; maybe have discussions in smaller groups/break out rooms to consolidate the knowledge; unfortunately, the microphone/ sound quality of some speakers was not optimal
No practical sessions
few more practical cases maybe considering more materials ant how they are printed would have been useful (e.g. the target is to print material A,B, C. here are the parameters here is the results.....
- A lot of information, short time, no learning material/slides/pdfs/manuscripts provided! - Repetition in some presentations. - Limited focus on only metal binder jetting in some presentations
not as many industrial solutions/success achieved
Generally, I prefer live sessions in person, but It is undoubtely easier to be connecting online
No practical expiriences
the course is so compact meaning that in 3 days the lectures where so long and the forth day the exam was held, then, the material is not allowed to attendees in this first version of the course.

Further comments and suggestions
I would recommend having more interaction during lessons, sometimes it felt more like a presentation that a class
Thank you for the great training course! If other certificate options were available it would have been great without the need to be on-site.
While the course was being delivered by Polimi under the SAM project, it would have been nice to be given the opportunity to travel to the MTC to undertake the exam for the UK participants
It would be nice to send a short handbook with important organisational information (e.g. Agenda and topics) and knowledge (e.g. abbreviations used, imporment knowledge, brief

content and main aspects of presentations, as the slides will not be given to the attendees) before the course to all attendees
- Provide learning materials or at least a recap day by day (preferably before session) - Include some practical on site training - Introduce some interactive simulation of the machine parts, operating parameters and their effect on the final part microstructure/properties, some simple exercise for modeling software

6.1.5. Feedback from participants on CU34: Process Selection by MTC

No national report was provided for CU34. All of the three participants answered to the feedback survey. The results are analysed above in the RPL analysis and are also available on the project SharePoint: [05 Evaluation questionnaire-Participants](#).

6.1.6. Feedback from participants on CU35: Metal AM integration by AITIIP

All of the four participants answered to the feedback survey. The number of participants is small, and therefore the results do not have a statistical value. However, they are a reflection of the opinions of the examinees regarding the process developed, which is highly specific and aimed at a very specific field of competence. The complete results are accessible through SAM Sharepoint: [05 Evaluation questionnaire and participants' feedback](#). It is therefore worth reviewing the results that may be more significant, which in view of the survey format can be represented by the following questions:

- Section 2: RPL Process:

Question 9. Testing conditions and methodology					
How would you rate your level of satisfaction with...	1. Poorly satisfied	2. Not satisfied enough	3. Satisfied enough	4. Very satisfied	n.a.
1. The infrastructure conditions provided by the RPL provider (furnishing, heating, lighting, sanitation, virtual platform etc.)				XXXX	
2. The guidance, support and management provided by the interviewer/ trainer				XXXX	
3. The equipment used in the AM demonstration			XX	XX	

Recognition of prior learning – process	1. Not suitable	2. Not very suitable	3. Suitable enough	4. Very suitable
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4. How would you rate the methodology used to identify knowledge (and skills) identified from prior learning?				XXXX
5. How would you rate the effort to go through RPL interview and AM demonstration process?			XX	XX

The general perception of the RPL process by the examinees was positive, as reflected in the previous results.

- Section 3: Technical interview:

Question 10. Satisfaction with the interview conditions				
What is your opinion regarding the following statements?	1. Strongly disagree	2. Somewhat disagree	3. Somewhat agree	4. Strongly agree
1. The questions of the technical interview were well comprehensible.			X	XXX
2. The difficulty of the technical interview questions was appropriate.			XXX	X
3. The difficulty of the technical interview questions was too high.	XX	XX		
4. The number of questions was appropriate.			X	XXX
5. The number of questions was too high.	XX	XX		
6. The questions are suitable to identify candidates with prior knowledge on this topic.			XXX	X

Recognition of prior learning – technical interview	1. Not suitable	2. Not very suitable	3. Suitable enough	4. Very suitable
7. How would you rate the duration of the technical interview?		X	XX	X
8. How would you rate the quality of the technical interview?			XX	XX

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9. How would you rate the relevance and usefulness of the technical interview within the RPL process?			X	XXX
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Question 11. Results	YES	NO	I didn't participate
1. Did you pass the technical interview?	XXXX		
2. In my opinion, the result corresponds to my level of knowledge in the field of AM.	XXXX		

In relation to the technical interview, the respondents positively valued aspects such as the comprehensibility of the questions raised, the duration, quality and usefulness of the interview. They showed a certain disparity in terms of the appreciation of the difficulty of the questions and their number.

- Section 4: AM demonstration

Question 12. Satisfaction with the AM demonstration conditions				
What is your opinion regarding the following statements?	1. Strongly disagree	2. Somewhat disagree	3. Somewhat agree	4. Strongly agree
1. The tasks of the AM demonstration were well comprehensible.			XXX	X
2. The difficulty of the AM demonstration task was appropriate.			X	XXX
3. The difficulty of the AM demonstration task was too high.	XXX	X		
4. The number of tasks was appropriate.			XX	XX
5. The number of tasks was too high.	XXX	X		
6. The tasks of the AM demonstration are suitable to identify candidates with prior knowledge on this topic.			X	XXX

Recognition of prior learning – AM demonstration	1. Not suitable	2. Not very suitable	3. Suitable enough	4. Very suitable
1. How would you rate the duration of the AM demonstration?		X	XX	X
2. How would you rate the quality of the AM demonstration task?			X	XXX
3. How would you rate the relevance and usefulness of the AM demonstration within the RPL process?			X	XXX

Question 13. Results	YES	NO	I didn't participate
1. Did you pass the AM demonstration?	XXXX		
2. In my opinion, the result corresponds to my level of skills in the field of AM.	XXXX		

In a similar way to the technical interview, the respondents positively valued aspects such as the comprehensibility of the proposed tasks and their duration, perceiving as well that this tool is useful and relevant in the context of the RPL process. Some disparities were detected when asked about the difficulty and the number of the proposed tasks.

Comments provided by the examinees to questions 14, 15 and 16 are included below:

- **Question 14. What were the most positive aspects of the technical interview and the AM training? Why?**
- *It is noted that José Antonio has experience as a trainer. He explains clearly and is very patient. The questions are quite clear and the process does not take too long.*
- *With José Antonio there is a relationship of trust and that helps a lot for both parts of the process to be fluid.*
- *The trainer solved all my doubts clearly and quickly*
- *José Antonio is a very good trainer. With him, the questions are clear and understandable and interview doesn't seem long*
- **Question 15. What were the less positive aspects of the RPL technical interview and AM demonstration? Why? Which aspects would you improve?**

- *In my case I did the whole process in one day. Perhaps it would be better to space it out or do it online, at least one part*
- *I do not have much experience in these matters but I have not seen anything negative*
- *The laptop that I used to the AM demonstration must have more memory capacity*
- *I understand that it is necessary to be thorough, but all the process is a bit long.*
- **Question 16. Further comments and suggestions.**
- *In our case it is different because we have followed the whole process in the workplace, but what I see good about this method is that it could also be easily done online.*

6.1.7. Feedback from participants on CU36: Coordination activities by MTC

No national report was provided for CU36. All of the four participants answered to the feedback survey. The results are analysed above in the RPL analysis and are also available on the project SharePoint: [05 Evaluation questionnaire-participants](#)

6.1.8. Feedback from participants on CU43: Production of PBF-LB parts by IDONIAL

The number of four participants is small, and therefore the results do not have a statistical value. However, they are a reflection of the opinions of the examinees regarding the process developed, which is highly specific and aimed at a very specific field of competence. The complete results are accessible through SAM Sharepoint: [05 Evaluation questionnaire and participants' feedback](#). It is therefore worth reviewing the results that may be more significant, which in view of the survey format can be represented by the following questions:

- Section 2: RPL Process:

Question 9. Testing conditions and methodology					
How would you rate your level of satisfaction with...	1. Poorly satisfied	2. Not satisfied enough	3. Satisfied enough	4. Very satisfied	n.a.
1. The infrastructure conditions provided by the RPL provider (furnishing, heating, lighting, sanitation, virtual platform etc.)				XXXX	
2. The guidance, support and management provided by the interviewer/ trainer			X	XXX	
3. The equipment used in the AM demonstration			X	XXX	

Recognition of prior learning – process	1. Not suitable	2. Not very suitable	3. Suitable enough	4. Very suitable
4. How would you rate the methodology used to identify knowledge (and skills) identified from prior learning?			XX	XX
5. How would you rate the effort to go through RPL interview and AM demonstration process?			XXX	X

The general perception of the RPL process by the examinees was positive, as reflected in the previous results.

- Section 3: Technical interview:

Question 10. Satisfaction with the interview conditions				
What is your opinion regarding the following statements?	1. Strongly disagree	2. Somewhat disagree	3. Somewhat agree	4. Strongly agree
1. The questions of the technical interview were well comprehensible.			XX	XX
2. The difficulty of the technical interview questions was appropriate.		X	X	XX
3. The difficulty of the technical interview questions was too high.	X		XX	X
4. The number of questions was appropriate.	X		X	XX
5. The number of questions was too high.	XX	X	X	
6. The questions are suitable to identify candidates with prior knowledge on this topic.			X	XXX

Recognition of prior learning – technical interview	1. Not suitable	2. Not very suitable	3. Suitable enough	4. Very suitable
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7. How would you rate the duration of the technical interview?		X	XX	X
8. How would you rate the quality of the technical interview?			XXX	X
9. How would you rate the relevance and usefulness of the technical interview within the RPL process?			XX	XX

Question 11. Results	YES	NO	I didn't participate
1. Did you pass the technical interview?	XXX	X	
2. In my opinion, the result corresponds to my level of knowledge in the field of AM.	XXXX		

In relation to the technical interview, the respondents positively valued aspects such as the comprehensibility of the questions raised, the duration, quality and usefulness of the interview. They showed a certain disparity in terms of the appreciation of the difficulty of the questions and their number.

- Section 4: AM demonstration

Question 12. Satisfaction with the AM demonstration conditions				
What is your opinion regarding the following statements?	1. Strongly disagree	2. Somewhat disagree	3. Somewhat agree	4. Strongly agree
1. The tasks of the AM demonstration were well comprehensible.			X	XX
2. The difficulty of the AM demonstration task was appropriate.			X	XX
3. The difficulty of the AM demonstration task was too high.	X	X	X	
4. The number of tasks was appropriate.		X		XX
5. The number of tasks was too high.	X	X	X	

6. The tasks of the AM demonstration are suitable to identify candidates with prior knowledge on this topic.			X	XX
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Recognition of prior learning – AM demonstration	1. Not suitable	2. Not very suitable	3. Suitable enough	4. Very suitable
1. How would you rate the duration of the AM demonstration?			XX	X
2. How would you rate the quality of the AM demonstration task?			XX	X
3. How would you rate the relevance and usefulness of the AM demonstration within the RPL process?			X	XX

Question 13. Results	YES	NO	I didn't participate
1. Did you pass the AM demonstration?	XXX		
2. In my opinion, the result corresponds to my level of skills in the field of AM.	XXX		

In a similar way to the technical interview, the respondents positively valued aspects such as the comprehensibility of the proposed tasks and their duration, perceiving as well that this tool is useful and relevant in the context of the RPL process. Some disparities were detected when asked about the difficulty and the number of the proposed tasks.

Comments provided by the examinees to questions 14, 15 and 16 are included below:

- **Question 14. What were the most positive aspects of the technical interview and the AM training? Why?**
 - “Interview was based on additive manufacturing of metals, a really promising technology for the development of industry 4.0. The interviewer had a vast knowledge of the subject. Seeing on site manufacturing of small parts was interesting and the explanations of how technology works was useful”.
 - “ This interview has all aspects of the technical and it’s possible to know if one person has high level knowledge about additive manufacturing.”

- “Highlight, on the one hand, the professionalism of the interviewers and, on the other hand, the comfortable environment in which both tests, theoretical and practical, have been developed.”
- **Question 15. What were the less positive aspects of the RPL technical interview and AM demonstration? Why? Which aspects would you improve?**
 - “Lack of previous educational courses in the subject. Some of the questions were outside the scope of my knowledge, as I hadn’t taken part in courses”.
 - “I will add different exercises for putting supports.”
 - “Probably, for future interviews, someone redundant question can be eliminated. In this way, an even more satisfactory overall experience would be achieved.”
- **Question 16. Further comments and suggestions.**
 - “I would improve some questions, making them more specific, since different responses could be valid, and could lead to misinterpretations.” (this is translation form the main message from Spanish to English by David Santos González).

6.2. Feedback given by trainers after conducting a piloting course

An additional feedback questionnaire for trainers was developed in a former stage to ask for feedback on the given course and possible recommendations or hints on the guideline and contents. The results of the different national partners’ piloting activities in the 3rd stage are given below.

6.2.1. Feedback from trainers on CU63: Certification, Qualification and Standardization in Additive Manufacturing piloted by FA

Only one trainer provided the pilot training for this competence unit and the feedback is presented hereafter:

CU63 – Certification, Qualification and Standardisation in Additive Manufacturing was piloted as a virtual course for all countries. The trainer gave the best rating when being asked for the support provided by the training provider staff, the infrastructure conditions of the training institution, the structure of the course, the contents addressed, the established contact hours and the relationship between the contents and the learning outcomes. A less positive rating was given to the balance between theoretical and practical training. As very positive aspects, the target audience, the learning outcomes and the time assigned are given. The interaction between trainees was seen as an aspect that could be improved. The trainer was very satisfied with the available equipment, the allocated contact hours for the theoretical class and the evaluation method used.

Analysis of results:

Overall, the feedback from the trainer is quite positive with an average mark of 3,80/4,00 taking into consideration the measurable topics. The less positive mark has to do with the balance between theoretical and practical training of the Competence Unit. Also, from the comments it

is possible conclude that there was not much interaction between the trainees, thus this should be addressed and mechanisms to promote these interactions should be considered.

Upon the feedback received from the trainees and trainer it is possible to identify very few raised points and based on those the following recommendations for future training activities are:

- 1 – Provide more in-depth and practical examples during the training
- 2 – Promote interaction during the training sections. Use questionnaires or games
- 3 – Revise the examination protocol, in order to have more time and questions

6.2.2. Feedback from trainers on CU73: Sustainability for Additive Manufacturing piloted by IMR, MTC, IDONIAL and LORTEK

Irish Manufacturing Research (IMR) and partners embraced the agile training design methodology of co-designing with stakeholders included a diverse team of subject experts, managers and attendees who can provide insight and design evaluation on iterations of the training design which was mentioned in IMR's first national report, and which was implemented throughout Pilot 2.

Almost all the cohort's educational backgrounds were either at degree level or beyond and included a high proportion of those who had an engineering degree/background. Gender distribution was majority female which was a noticeable change from Pilots 1 & 2 in first and second stages where the majority were male.

Results:

Internal Trainer Feedback Survey

IMR requested trainer feedback internally, and the results were:

- Zoom worked well for the breakout room than the Teams, but more work needed with the virtual meeting software to be smoother during training sessions. This ties in with more time required for preparation of materials comments received from partners
- Recommend use of pre-assigned breakout room lists. Pre-assigned as people arrive without starting the breakout rooms, for speed of session.
 - More practice using the technology prior to training with all trainers/ organisers to practice.
 - Clarity on responsibilities during the training (who is managing the technology in the background).
- Low levels of interaction from attendees at times, who were slow to answer questions. Could have been a language fluency barrier.
 - Only around 9 people in the final sessions.
- Most of the trainers felt that the sessions were held during working hours and also broken down into 3 separate days (training mode) and that if amalgamated into one full day this may have kept the larger cohort together from Day 1.
 - Low number of cameras on, however bandwidth and internet stability of attendees is unknown., particularly after breaks.

- Three attendees were in the same room, which caused audio feedback and echoes when they tried to speak.
 - If they are in the same venue, encourage sharing computers/screens to reduce this occurring.
 - Introductions not needed in later sessions if trainers are given names & job title.
- More time to prepare the material for the course, to allow review and practice.
- Need more clarity at the initial request for course material on target audience, timings, depth of knowledge (level of knowledge of attendees and depth of course), outline of course material for all parts of the course.
 - Communication between the trainers to avoid overlap or conflicting information.

Recommendations achieved by feedback survey:

Improve the training pilot by increasing time for materials preparation, technical issues and increase learner interaction responses. Increase number of specific case/product studies so that knowledge can be applied and practiced by attendees is the core recommendation.

6.2.3. Feedback from trainers on CU73: Sustainability for Additive Manufacturing piloted by ITECAM

Two professors have participated in the CU-73 pilot program. The results are as follows:

How satisfied are you with the:	1	2	3	4
support provided by the training provider’s staff?				100
infrastructure conditions provided by the training institution (furnishing, heating, lighting, sanitation, etc.)?				100

How satisfied are you with the:	1	2	3	4
structure of the course (Units of Learning Outcomes /Competence Units)?			100	
contents addressed?			50	50
established contact hours?			100	
balance between theoretical and practical training?				100
relationship between the contents and the learning outcomes?			50	50

How satisfied are you with the:	1	2	3	4
available equipment?			50	50
allocated contact hours for the theoretical classes?			50	50
allocated contact hours for the practical work?			50	50
evaluation (tests and examinations) methods used?			50	50

The main recommendations of the teachers are:

- The structure of the themes should be improved. We would propose to integrate the contents of the topics: Product Life Cycle and Additive manufacturing within a sustainable production scheme and include a point in which a practical case is developed in which to apply what has been discussed or include more hours in the Case studies.
- The subject matter of the points indicated in the unit of competence is somewhat repetitive.
- Would also include in the contents a greater weight of practical content.
- The practical part could have been done better but due to the lack of data and information to use different softwares only a small demonstration could be done.

6.2.4. Feedback from trainers on CU72: Metal Binder Jetting Process piloted by POLIMI and MTC

In the following, the answers of the trainers that were engaged in the piloting of CU72 in the 3rd stage of piloting is presented.

Question 2. In which country did the pilot course took place?	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
Italy	X		X			
Latvia						
Lithuania						
Luxembourg						
Malta						
Netherlands						
Poland						
Portugal						
Romania						
Slovakia						
Slovenia						
Spain						
Sweden						
UK						
Other, please specify which:						
virtual course (one country)	X		X			
virtual course (all countries)		X		X	X	X

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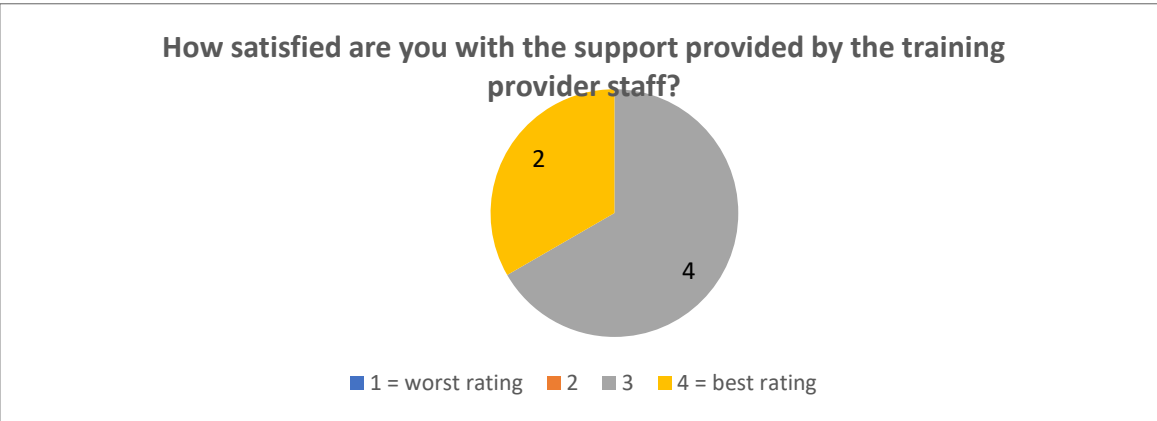
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2) General aspects of the course

Question 3. How satisfied are you with the:

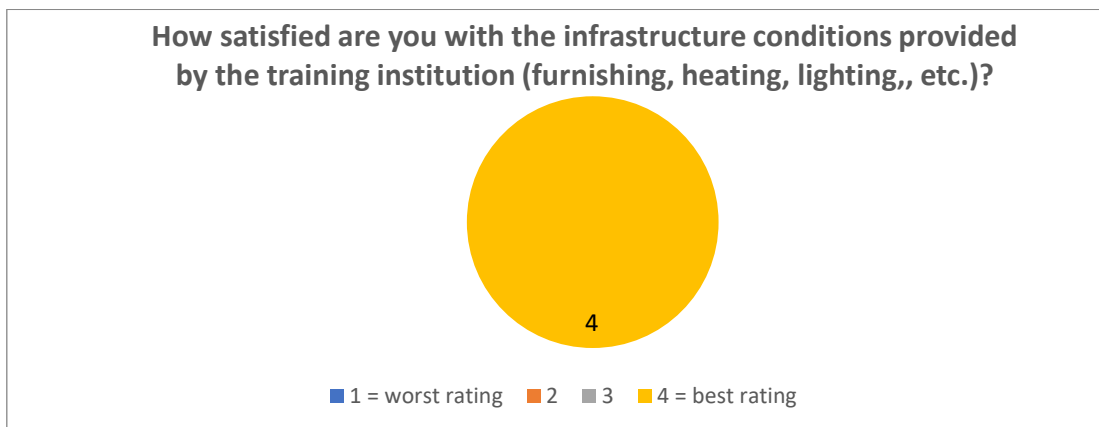
...support provided by the training provider staff?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2						
3	X	X	X		X	
4 = best rating				X		X



2) General aspects of the course

...infrastructure conditions provided by the training institution (furnishing, heating, lighting, sanitation, etc.)?

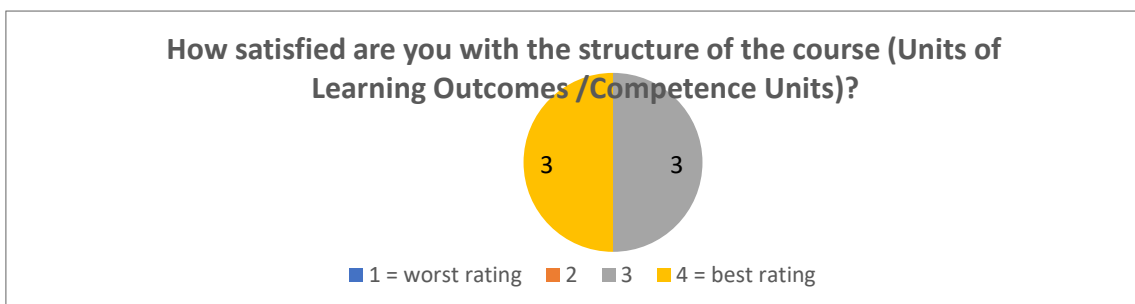
1 = worst rating	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
2						
3						
4 = best rating	X		X	X		X



3) Concerning the training programme

Question 4. How satisfied are you with the:

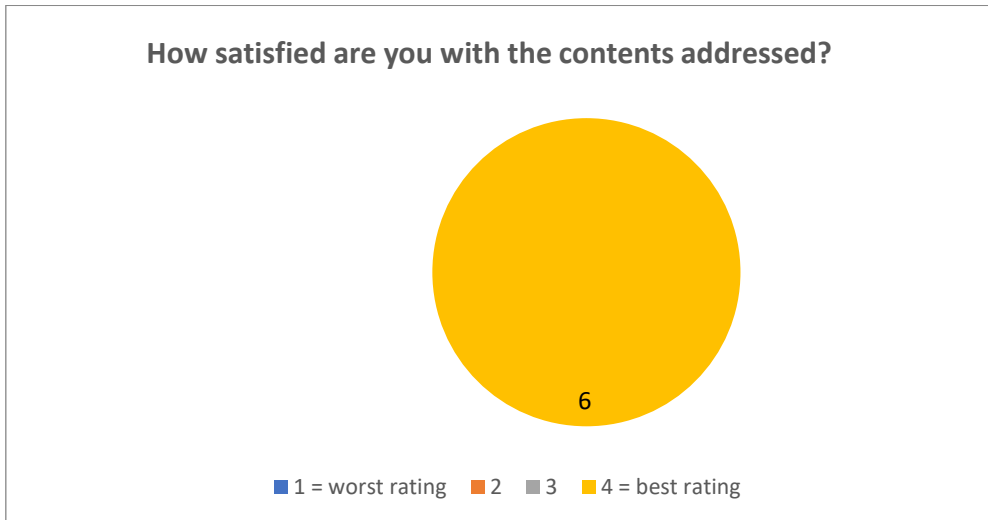
...structure of the course (Units of Learning Outcomes /Competence Units)?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2						
3	X	X	X			
4 = best rating				X	X	X



3) Concerning the training programme

Question 4. How satisfied are you with the:

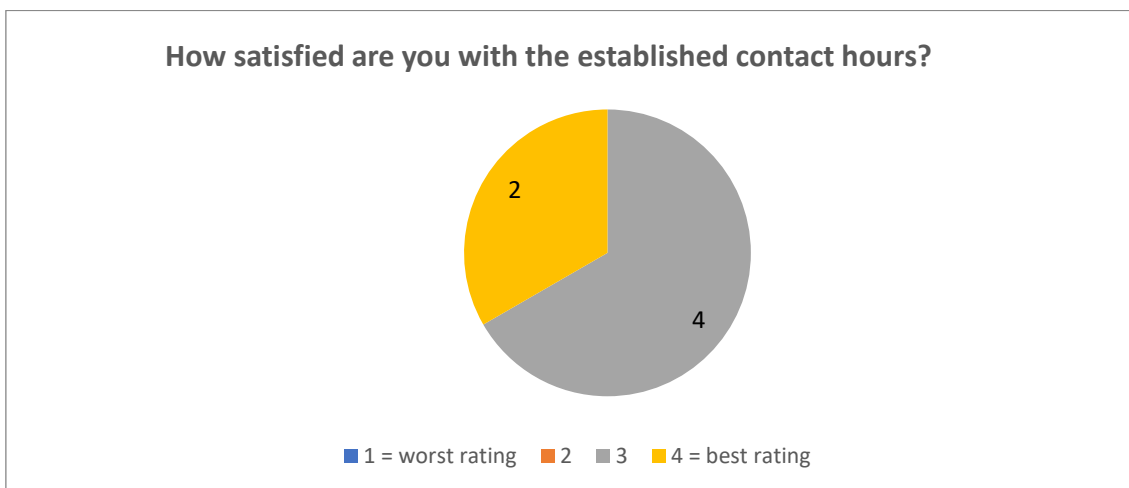
...contents addressed?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2						
3						
4 = best rating	X	X	X	X	X	X



3) Concerning the training programme

Question 4. How satisfied are you with the:

...established contact hours?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2						
3	X	X	X		X	
4 = best rating				X		X



3) Concerning the training programme

WP5 Pilot Activities Report

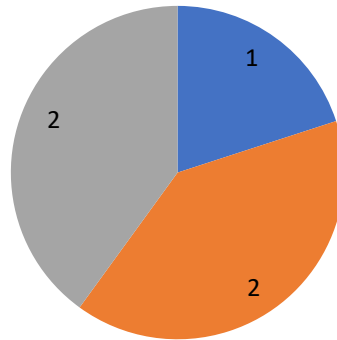
Qualification/Professional Profile: Process Engineer PBF-LB | 2 Competence Units: Metal AM Designer

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

Question 4. How satisfied are you with the:

...balance between theoretical and practical training?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating					X	
2				X		X
3	X		X			
4 = best rating						

How satisfied are you with the balance between theoretical and practical training?



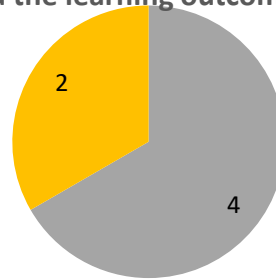
■ 1 = worst rating ■ 2 ■ 3 ■ 4 = best rating

3) Concerning the training programme

Question 4. How satisfied are you with the:

...relationship between the contents and the learning outcomes?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2						
3	X	X	X	X		
4 = best rating					X	X

How satisfied are you with the relationship between the contents and the learning outcomes?



■ 1 = worst rating ■ 2 ■ 3 ■ 4 = best rating

Question 5. Please, remark 3 positive aspects of the training course.
Answers:
Outstanding teaching team
Interested audience
Nice balance of topics
On time
Respectful and positive attendees
Relevant audience to material presented
Organization and delivery of the course worked extremely fine
The material presented was complete and very exhaustive
Virtual sessions worked well
Course content was technically detailed and course material was of high quality
The involvement of more than one organization in preparation and delivery provided audience with wider perspective of the technology and cross-continent technical experts
Good attendee turnout from multiple countries
It addresses all the relevant aspects of binder jetting
It is aimed at both technician and engineers
Trainers have different backgrounds and specialisations

Question 6. What aspects of the course learning programme could be improved?
Answers:
Practice and learning by doing
None from my perspective
More presence of practical training
Some redundance in the presented teaching modules
There was no practical work because the course was fully online. For the future, it is probably worth considering delivering the course on-site, or continue to do it online but with virtual activities to ensure audience engagement, e.g. exercises in virtual break-out rooms etc.
In the future, there should be clarity at the start regarding examination and certification. Having different systems for different attendees makes it confusing and logistically difficult to manage.
Teaching materials should be cross-compared between different trainers to ensure no repetition.

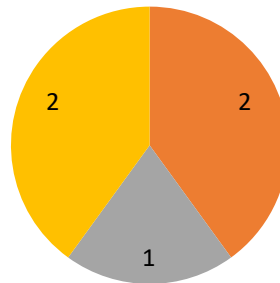
A practical training session should be included

4) Concerning the training sessions and achieved results

Question 7. How satisfied are you:

...available equipment?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2	X		X			
3				X		
4 = best rating					X	X

How satisfied are you with the available equipment?



■ 1 = worst rating ■ 2 ■ 3 ■ 4 = best rating

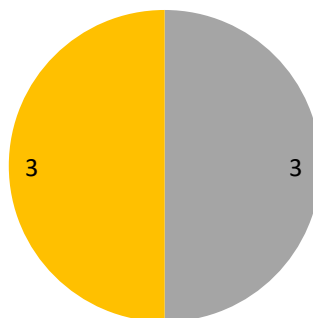
4) Concerning the training sessions and achieved results

Question 7. How satisfied are you with the:

...allocated contact hours for the theoretical classes?

	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2						
3	X	X	X			
4 = best rating				X	X	X

How satisfied are you with the allocated contact hours for the theoretical classes?



■ 1 = worst rating ■ 2 ■ 3 ■ 4 = best rating

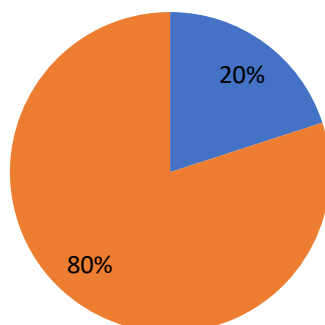
4) Concerning the training sessions and achieved results

Question 7. How satisfied are you with the:

...allocated contact hours for the practical work?

	Reply Trainer 1	Reply Trainer 2	Reply Trainer 3	Reply Trainer 4	Reply Trainer 5	Reply Trainer 6
1 = worst rating					X	
2	X		X	X		X
3						
4 = best rating						

How satisfied are you with the allocated contact hours for the practical work?

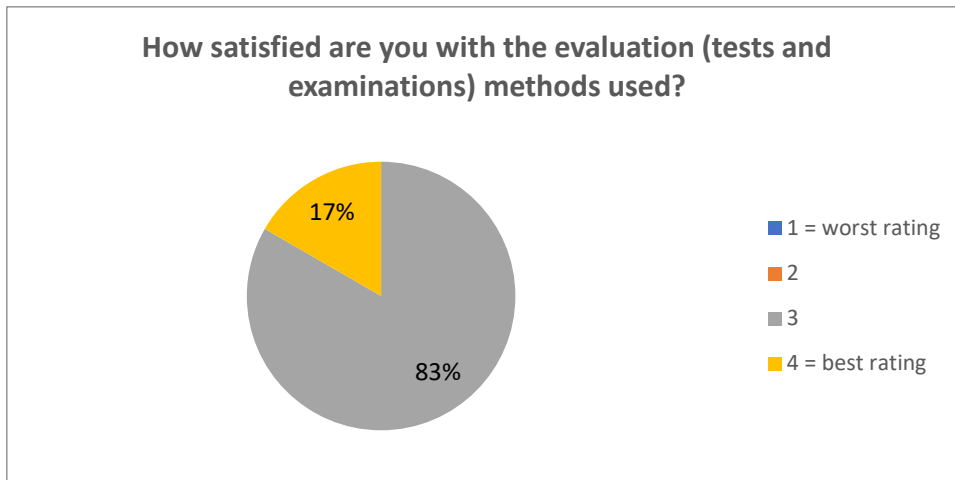


■ 1 = worst rating
 ■ 2
 ■ 3
 ■ 4 = best rating

4) Concerning the training sessions and achieved results

Question 7. How satisfied are you with the:

...evaluation methods used?	Reply	Reply	Reply	Reply	Reply	Reply
	Trainer 1	Trainer 2	Trainer 3	Trainer 4	Trainer 5	Trainer 6
1 = worst rating						
2						
3	X	X	X	X	X	
4 = best rating						X



Question 8. Is there any other aspect(s) you would like to refer?

Answers: Not sure that the balance between the workload and training needs is well respected

6.2.5. Feedback from trainers on CU34: Process Selection by MTC

No national report was provided for CU34. The trainer / interviewer answered to the feedback survey after all interviews. The results are analysed above in the RPL analysis and are also available on the project SharePoint: [05 Evaluation questionnaire-Participants](#).

6.2.6. Feedback from trainers on CU35: Metal AM integration by AITIIP

The pilot as a whole was coordinated by José Antonio Dieste, who also participated in the design of the RPL tools for this competence unit. That is why perhaps the most relevant information from the survey available is that which corresponds to its section 5, the most and least positive aspects detected after testing the tools developed, as well as the assessments regarding potential improvements. These sections are reproduced below:

Section 5: Overall feedback and recommendations

Question 8. What were the most positive aspects of the technical interview and the AM training material? Why?

- *The possibility to interact with the candidates*

Question 9. What were the less positive aspects of the RPL technical interview and AM demonstration? Why? Which aspects would you improve?

- *Some of the questions could be improved to make them easier to understand.*
- *Some of the required classifications for the candidates*

The complete questionnaire is accessible through SAM Sharepoint: [06 Trainers' questionnaire and feedback results](#).

6.2.7. Feedback from trainers on CU36: Coordination activities by MTC

No national report was provided for CU36. The trainer / interviewer answered to the feedback survey after all interviews. The results are analysed above in the RPL analysis and are also available on the project SharePoint: [06 Trainers' questionnaire-feedback](#)

6.2.8. Feedback from trainers on CU43: Production of PBF-LB parts by IDONIAL

The pilot as a whole was coordinated by David Santos González (the same person who is redacts this document), who also participated in the design of the RPL tools for this competence unit. That is why perhaps the most relevant information from the survey available is that which corresponds to its section 5, the most and least positive aspects detected after testing the tools developed, as well as the assessments regarding potential improvements. These sections are reproduced below:

Section 5: Overall feedback and recommendations

Question 8. What were the most positive aspects of the technical interview and the AM training material? Why?

- Regarding the technical interview, the available questions served well when going through the different subjects in a structured way. Although it takes some time to go through all the questions (30), in most cases the interview could be performed in a range between 50 and 70 minutes.
- Regarding the AM demonstrations, and thanks to the development of specific cases (3D files) for the examinees to manipulate through software tools, these sessions developed quite in an agile way, and with a sense of structure to them.

- In spite of some redundancies with questions related to PBF-LB AMPS and PBF-LB work instructions, the two tools performed well, and felt as complementary actions between each other.

Question 9. What were the less positive aspects of the RPL technical interview and AM demonstration? Why? Which aspects would you improve?

- Regarding the Technical Interview:
 - Maybe some questions are redundant, with some sense of repetition between some of them. This is due to the necessity of asking three questions for each skill. Some skills are maybe more about assuring that the examinee has a good understanding of the global concept and capabilities behind a skill (e.g: finite element analysis, scanning strategies), so a more general question could be enough instead of three, on those cases.
 - Some questions would require providing the examinee with more context and/or detail, if a specific answer is hoped to be correct one. For example, questions related to proposing specific parts for considering the most correct way for its manufacturing, material selection, etc. These kinds of questions could be then simplified or refocused.
Another option when asking said questions could be providing additional contents, as for example some graphical (drawings), or physical information (models, 3D printed parts), that could help when answering or doing considerations by the examinee.
 - Questions related to skills 9 and 10 (PBF-LM AMPS and PBF-LB work instructions) could benefit from a practical approach, in the way that the examinee could write down or sketch in paper the different stages and sub-processes involved in the implementation of the technology. In this sense, there is some kind of duplication between the technical interview and the AM demonstration, as long as the approach for both the questions and the potential responses are conceptually the same.
- Regarding the AM demonstration
 - The AM demonstration involves using tools for 3D files manipulation, that could be different than the ones previously known and used by the examinee. This can pose a limitation when designing the AM demonstration, as long as examinees could have or not experience with the tools used during the AM demonstration. This has not been a problem during the pilot, as long as all the examinees were people currently employed by IDONIAL, so they previously knew the tools used for the AM demonstration.

- Again, questions related to PBF-LM AMPS and PBF-LB work instructions were in some ways redundant with the approach to those same subjects during the technical interview, creating a sense of repetition.

Both of the tools make up a good combination when trying to identify if a person has (or not) the required skills and knowledge for giving them a “pass” in terms of the RPL process. However, taking into account that the people that could use this path for accessing an AM accreditation would in principle have a previous background on PBF-LB, a possibility for defining and implementing a “one-step/one tool” RPL assessment (that would be theory and practice in one single session) could be proposed, instead of the current “two-step/two tools” approach.

The complete questionnaire is accessible through SAM Sharepoint: [06 Trainers' questionnaire and feedback results](#).

6.3. Conclusions drawn in national reporting

Every partner that conducted a piloting activity (guideline piloting in a course or a RPL interview) was asked to collect evidence on the piloting activities. The evidence, results and conclusions are reported in national reports per competence unit and partner and is available at the project SharePoint: [09 Pilot Activities Reports-3rd Stage](#). Below, the conclusions from the national reporting are presented.

6.3.1. Conclusion of CU 63 report: Certification, Qualification and Standardization in Additive Manufacturing piloted by FA

The pilot training course of the Competence Unit 63 – Certification, Qualification & Standardisation in AM, developed on-line, in English, had a total of 14 attendees. Out of those, 6 attendees registered for the examination and 5 successfully completed the course. The one that did not complete the course, was due to the fact that did not show up to the examination. In general, the feedback was positive and constructive, the performance and knowledge of the trainer was extremely valuable for the success of the course. Nevertheless, there were some raised points that should be taken into consideration for future activities. The comments were towards the managing of the timesteps and approach of the training in regard to the need to involve the trainees in discussions and have them more engaged and participative. Thus, more activities such as questionnaires and practical discussions on the training should be considered in future similar activities.

The examination was done in with two exams at different dates. This was due to the fact that some of the trainees failed to achieve the minimum score and others were not able to be present in the first one.

Overall, the feedback from the satisfactory questionnaire was extremely positive and the data gathered of utmost importance to update and improve the teaching methods of the CU 63 – Certification, Qualification & Standardisation in AM.

6.3.2. Conclusions of CU 73 report: Sustainability for Additive Manufacturing piloted by IMR, MTC, IDONIAL and LORTEK

Attendee/ Trainer preparation and interaction is highly valued by participants

Learning from Pilots 1 and 2 meant that the design of the learning would take a Learner Centric Model approach. Attendee feedback has shown how highly interactive training sessions are valued by learners and that some wanted more basic information on Additive Manufacturing during the training. Learners indicated that the use of Zoom with a facilitation session on was a positive experience. Learners stated that they had a positive learning experience means the attendee is more likely to learn and return.

From the comments above it is evident that the project pilot delivered thought provoking learning experiences which create change in behaviour or thinking. That is the acid test of training.

6.3.3. Conclusions of CU 73 report: Sustainability for Additive Manufacturing piloted by ITECAM

- The structure of the themes should be improved.
- The subject matter of the points indicated in the unit of competence is somewhat repetitive.
- Would also include in the contents a greater weight of practical content.

6.3.4. Conclusion of CU 75 report: Metal Binder Jetting Process by POLIMI and MTC

In conclusion, the pilot of the new CU72 on Metal Binder Jetting Process, organized by Politecnico di Milano in cooperation with MTC and with the support of Istituto Italiano Saldatura, achieved good results and was very appreciated by participants. The main positive aspects and suggestions for improvement that were highlighted by trainers from Politecnico di Milano and MTC in the trainers' feedback survey can be summarized in the following points:

- + CU72 is well balanced in terms of contacts hours and contents for engineering and operators
- + Attendees from multiple countries and with different backgrounds
- Coordination of teaching material and among trainers can be improved
- Practical session missing

In addition, the main positive feedback and suggestions for future delivery of the training received from the pilot attendees can be summarized in the following points:

- + High quality teaching material
- + Organization and delivery of the course worked fine
- + Trainers with different expertise provided multiple perspectives on the technology and its applications

- Practical session missing
- More interaction during virtual session would have helped

The main improvement suggested both by trainers and trainees is related to the inclusion of a hands-on session to apply the theoretical knowledge acquired during the lectures. Unfortunately, due to the on-going covid pandemic, it was not possible to include a practical session in the pilot, but the plan is to add it in future iterations of the training as soon as the pandemic situation allows it.

6.3.5. Conclusion of CU 34 report: Process Selection piloted by MTC

There is no national report available for CU34. The results, conclusion and recommendations resulting from CU34 RPL piloting were provided in the debrief session after the piloting of the RPL material and is considered in the report above.

6.3.6. Conclusion of CU35 report: Metal AM integration piloted by AITIIP

As a summary of the information contained in this document, these are the main conclusions and recommendations:

- The exercise was carried out with the participation of 3 people currently working at AITIIP and other in Tecnopackaging, all of them coming from technical backgrounds, with variable knowledge and experience in additive manufacturing technologies.
- All of them passed both the technical interview and the AM demonstration, achieving high scores.
- Surveyed about the pilot activity, the examinees gave positive feedback, especially in terms of perceiving the tools and procedure useful and accurate.

Thus, the application of both RPL tools was performed in an agile way, in a process that was developed in a structured and logical way, thanks to the structure and "script" provided by them.

- The participants valued positively the role of the trainer in the process, that it is essential to guarantee that this process is fluid and agile.
- In any case, some potential improvements have been detected:
 - We did all the process in one day (morning for interview and afternoon for AM demonstration) for each participant and this process is long for them. It is better to separate the process or combined with online.
 - In our case, the software demands a computer with strong capacity. It is important to guarantee this.

6.3.7. Conclusion of CU36 report: Coordination activities piloted by MTC

There is no national report available for CU36. The results, conclusion and recommendations resulting from CU36 RPL piloting were provided in the debrief session after piloting of the RPL material and is considered in the report above.

6.3.8. Conclusion of CU43 report: Production of PBF-LB parts piloted by IDONIAL

As a summary of the information contained in this document, these are the main conclusions and recommendations:

- The exercise was carried out with the participation of 4 people currently working at IDONIAL, all of them coming from technical backgrounds, with variable knowledge and experience in additive manufacturing technologies. Three of the participants had previous experience in the specific use of PBF-LB technologies, while the remaining person came from the field of fused filament deposition technologies, not having prior experience or in-depth knowledge of PBF-LB technologies.
- The 3 people with previous experience in the use of PBF-LB technologies passed both the technical interview and the AM demonstration, achieving high scores. The person with no prior experience in PBF-LB technology did not pass the technical interview and therefore did not continue through the AM demonstration.
- Surveyed about the pilot activity, the examinees gave a positive feedback, especially in terms of perceiving the tools and procedure useful and accurate when assessing PBF-LB capabilities, as well as agile in terms of time spent in its application.

Thus, the application of both RPL tools was performed in an agile way, in a process that was developed in a structured and logical way, thanks to the structure and "script" provided by them.

- In any case, some potential improvements have been detected:
 - PBF-LM AMPS and PBF-LB related work instructions questions (technical interview) and tasks (AM demonstration) were in some ways redundant between each other, creating a sense of repetition. As long as we are talking about a specific subject were all possible approaches are basically theoretical, an option to consider would be to restrict related questions/tasks to the technical interview. This way, the examiner could even ask the examinee to outline in paper the main stages and concepts to consider when developing general procedures and more specific instructions.
 - Some questions from the technical interview could require providing the examinee with more context and/or detail, if a specific and only one answer is hoped to be correct one.
 - Again regarding the technical interview, the requirements of defining three questions for each skill may lead to a certain sense

of redundancy between some questions. On these cases, it may be possible to reduce the number of questions.

- As a possibility during the technical interview, some graphical or even physical information (models, 3D printed parts) could be in place, that would act as a support for both the examiners and examinees when making or answering the questions.
- Due to the high number of questions, a high score could be masking specific and important lacks of knowledge/experience. Thus a “pass/not pass” result should not be only based on a final score obtained by the direct application of these tools.