2.2 Real Case Scenarios' Kit M34

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1. Introduction

The current kit is produced in the framework of WP2, which covers SAM's Forecast Methodology: assessment of current and future skills in AM. SAM's Forecast Methodology is structured into three main time-based scenarios, this kit relates to the identification of the immediate skills needs (Scenario 1, ie. timeframe of one year). Different tools will be used for data collection, such as surveys and interviews, that will be applied to identify the professional profiles, general core activities and the required skills to operate AM Technology, covering the AM value chain.

D2.2 encompasses guidelines for the collection of Real Case Scenarios and details the following information:

- To whom is each tool targeted at;
- Inputs and outputs of the tools;
- Steps to be implemented and resources
- Timeframe to use the tool;
- Expected number of stakeholders and targets involved.

The implementation of the current kit for real case scenario will serve as input to the methodology for revising, creating professional profiles and developing skills (WP3) and for the workshops conducted in the AM Observatory (WP4).

In summary:

D.2.2 Real Case Scenarios Kit	
AIM	Identify the immediate skills to be addressed by AM Observatory through the Qualification Council
TOOLS USED	Surveys and Interviews
TO WHOM	Industry (working or aiming to work in AM) Training Centers AM workers / professionals
INDICATOR/LEVEL OF IMPACT	250 answers per target group each year
INPUT	Literature review and job offers Previous background and answers to surveys; Analysis of the contents coming from previous Interviews and surveys applied to current needs (less than 1 year)
OUTPUT	Review and/or development of Qualification or Competence units Data on AM skills needs and need for updating or re-skilling existing Professionals
TIMELINE	Every 1 year

In addition, the current kit also includes templates and tools. The purpose of the templates is to facilitate the use directly by those that will implement the surveys and interviews.

2. Methodology

Figure 1 summarises the methodology to be followed in the real case scenario in order to identify the immediate skills to be addressed.
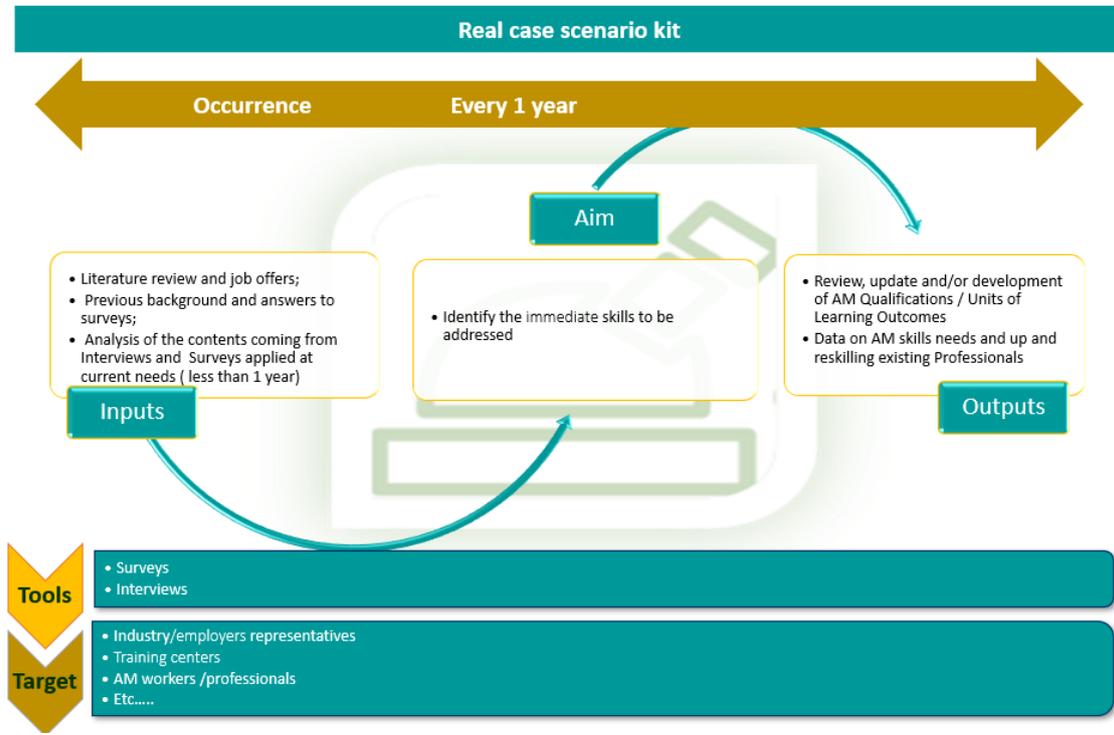

Figure 1 - Methodology applied for the Real Case scenario

During the data collection and feedback phase, the gathered skills' gaps and shortages are framed according to different scenarios established in SAM project (1, 3 and 10 years respectively).

In terms of Scenario 1 (1 year), specific groups are selected as targets for "Real Case Scenarios" with the aim of understanding how and to which extent skills applied/need to be addressed in less than 1 year. The involvement of these groups is explained in Table 1 below.

WHO?	WHY?
INDUSTRY/EMPLOYERS	To find out their needs with regards to AM skills and identify possible existing gaps at present
CURRENT WORKFORCE/ PROFESSIONALS	To find out the needs with regards to technological, green, digital and entrepreneurial skills at present
TRAINING CENTERS	To map and identify the current training offer and educational practices, which combined with Industry/ employers /workforce needs to determine skills gaps

Table 1 -Target groups in scenario 1 (real case, 1 year)

3.Tools and templates

The tools used to gather the information on the Real Case scenario are surveys and interviews. Below the tools developed for the different target groups in Scenario 1 are detailed.

3.1 Surveys

3.1.1 Survey to Industry/ Employers

The survey targets AM current and potential industrial employers with AM profiles/skills to find out their needs with regard to AM skills and identify the possible existing gaps in Scenario 1. The targeted industry includes both large companies and SMEs, from several key sectors for AM deployment in Europe[1] (Figure 2) covering all value chain segments (Figure 3). Industrial associations are also welcomed to reply as entities reflecting employers' needs. Replies by other profiles (e.g., RTOs, students) will not be considered.
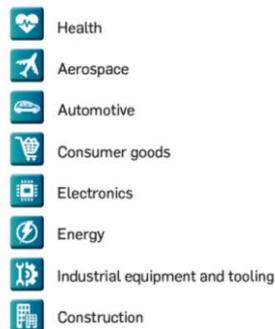
Figure 2 - Example of key sectors for AM deployment in Europe

Figure 3 - Value chains segments as defined in AM-motion project

Moreover, a prioritisation exercise has been carried out in order to select key questions to produce a shorter version of the survey. This short version will be applied in internal or external events addressing Industry/AM employers and take profit of their presence to get more replies. Tools as *Slido* or *Mentimeter* or other of the same kind can be used for this purpose.

The survey template to be used with companies involved or willing to be involved with AM in less than one year is provided below:

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[1]   Key   AM   sectors   for   Europe   (AM-motion   deliverable   D2.1,   2018)   http://www.am-motion.eu/images/D2.1_Key_AM_Sectors_for_Europe_.pdf

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SECTOR SKILLS STRATEGY
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Survey introductory text:

Welcome to our survey on Additive Manufacturing Skills!

SAM is a European initiative addressing workforce development for Additive Manufacturing (AM) by developing a common vision and collaborative learning solutions for the sector at European level.

We would like to know what kind of AM skills you look for in a candidate taking into account the current needs of your company.

The survey lasts for 5 to 10 min approx. It is split into two sections:

- *Section 1: General info and background*
- *Section 2: Skills and profiles needs*

Please take into account that some questions admit multiple choices, as indicated in the specific question.

Thank you for helping us in designing the future of Europe's AM workforce!

Participation in this survey is anonymous and voluntary. By replying to it, you are consenting that SAM project partners process the data collected in conformity with the Contract Agreement signed with the EACEA. For any additional clarification, please contact ewf@ewf.be

Survey:

Section 1: General info and background

Question 1. What type of organisation do you work for?
(only 1 can be chosen): ●Start-up ● Small and Medium-sized enterprise ● Large enterprise ●Industrial association ●Other (please specify which)

Question 2. In which country is your organisation based? (dropdown question)
Austria Belgium Bulgaria Croatia Republic of Cyprus Czech Republic Denmark Estonia Finland France Germany Greece Hungary Ireland Italy Latvia

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Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
UK
Other (please specify which)

Question 3. Indicate the name of your organisation

Question 4. What is your role within your organisation?

Question 5. What is the main activity/sector of your organisation?

(Several answers can be chosen)
- Aerospace
- Automotive
- Defence
- Consumer goods
- Construction
- Energy
- Health and Medical
- Industrial equipment and tooling
- Other (please specify)

Question 6. Is your organisation currently using AM?

(*only 1 can be chosen*):
- Yes
- No

ROUTE 1: If answering **YES to Question 6**

Question 7 (6.1) Indicate the AM Supply position in which your organisation is involved in?

(Several answers can be chosen)
- R&D
- Service bureau
- Original Equipment Manufacturer (OEM)
- Materials Provider

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- Software Provider
- Design
- End-user
- Other (please specify)

Question 8 (6.2): Which AM material/s do you mainly use?
(Several answers can be chosen) • Metal • Plastic • Ceramic • Composite • Biomaterials • Other (please specify)

Question 9 (6.3): Which AM process(es) do you mainly use in your company?
(Several answers can be chosen) • Powder Bed Fusion • Vat Photopolymerization • Material Jetting • Material extrusion • Sheet lamination • Directed Energy Deposition • Binder Jetting • Other (please specify)

Section 2: AM Profiles and Skills needs

Question 10 (6.4) - Which professionals in your company need to attend a skills development programme?	In the coming 1 year
• Designer • Process Engineer • Inspector • Inspector Technician • Non Destructive Testing Technician • Supervisor • Coordinator at the Engineer level • Metrology Engineer • Materials Engineer • Operator/Technician • Digital expert • Data manager • Quality Manager • Business Manager • Human Resources Technician • Other (please specify the AM profile)	

Question 11 (6.6). In which domain do the professionals need to attend a training programme	In the coming 1 year
(Several answers can be chosen) • AM processes • Numerical modelling /Topology optimisation • Design • Structural integrity • Metallurgical analysis and characterisation • Pre-processing & material handling • Post-processing • Non-destructive testing • Certification and validation • Testing/Quality control • Standards • Costs/business models • Environment, health, safety (EHS) • Marketing and sales • Communication • Resource efficiency/sustainability • Other (please specify)	

Question 12 (6.7). Which AM task(s) below would you need qualified professionals for? *(Several answers can be chosen)*	In the coming 1 year
• Performing AM Machines operations • Developing and building AM Machines • Developing solutions for AM processes • Development of AM materials • Characterization of AM materials • Designing AM solutions • Performing post-processing operations • Coordinating AM tasks distribution • Performing AM product life cycle • Assessing technical and financial viability of AM implementation • Performing AM business strategies implementation • Other (please specify)	

Question 13 (6.8). Which entrepreneurial skills will be needed by the AM Professionals? *(Several answers can be chosen)*	In the coming 1 year

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- Learn through experience
- Work with others
- Visualise future scenarios to help guide effort and action
- Identify needs and challenging opportunities to create value
- Develop creative and purposeful ideas /solutions
- Develop financial and economic know-how
- Other (please specify)

Question 14 (6.9). Which digital skills will be needed by the AM Professionals? *(Several answers can be chosen)*	In the coming 1 year
• Digital data analysis (Artificial intelligence/ machine learning...) • Digital data management (big data, statistics,) • Ability to think in 3D • Other (please specify)	

Question 15 (6.10). Which green skills will be needed by the AM Professionals? *(Several answers can be chosen)*	In the coming 1 year
• Resource efficiency management • Life cycle analysis (LCA) • Reuse/recycling AM materials and products • Other (please specify)	

<u>*ROUTE 2: If answering **NO to Question 6**</u>

Question 7: Do you plan to use / implement AM technologies in your organisation within this coming year?	In the coming 1 year
Options (*only 1 can be chosen*): •Yes •Likely •No	

*If answering **NOT to Question 7**- Please explain why. (END of survey)*

* if answering to Question 7 **"yes" or "likely"**

Question 7a: How do you plan to use and implement AM Technology?
• By reskilling/upskilling existing staff on AM technology   • By hiring new staff specialized in AM   • Investing in new AM technology and machines   • Other (please specify)

* if answering "by reskilling/upskilling "in question 7.a

Question 7b. In which domain do you need to reskill/upskill current professionals? *(Several answers can be chosen)*	In the coming 1 year
• AM processes • Numerical modelling /Topology optimisation • Design • Structural integrity • Metallurgical analysis and characterisation • Pre-processing & material handling • Post-processing • Non-destructive testing • Certification and Validation • Testing/Quality control • Standards • Costs • Environment, health, safety (EHS) • Marketing and sales • Communication • Resource Efficiency/sustainability • Other (please specify)	

* if answering "by hiring new staff specialized in AM in question 7.a

Question 7c. - Which AM professionals' profiles do you plan to hire? *(Several answers can be chosen)*	In the coming 1 year
• Designer • Process Engineer • Inspector • Inspector Technician • NDT Technician • Supervisor • Coordinator at the Engineer level • Metrology Engineer • Materials Engineer • Operator/Technician • Digital Expert • Data Manager • Quality Manager • Business Manager • Other (please specify the AM profile)	

Your Survey is now completed!

Thank you for helping us in designing Europe's AM workforce future!

For further information visit our website www.skills4am.eu

17. Please indicate your email address to be informed about the survey results.

Survey short version

Question 1. What is the main activity/sector of your organisation?

(Several answers can be chosen)
- Aerospace
- Automotive
- Defence
- Consumer goods
- Construction
- Energy
- Health
- Industrial equipment and tooling
- Other (please specify)

Question 2: Which AM material/s do you mainly use?

(Several answers can be chosen)
- Metal
- Plastic
- Ceramic
- Composite
- Biomaterials
- Other (please specify)

Question 3: Which AM process(es) do you use in your company?

(Several answers can be chosen)
- Powder Bed Fusion
- Vat Photopolymerization
- Material Jetting
- Material extrusion
- Sheet lamination
- Directed Energy Deposition
- Binder Jetting
- Other (please specify)

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Question 4: Which professionals in your company need to attend a skills development programme? *(Several answers can be chosen)*	In the coming 1 year
• Designer • Process Engineer • Inspector • Inspector Technician • Non Destructive Technician • Supervisor • Coordinator at the Engineer level • Metrology Engineer • Materials Engineer • Operator/Technician • Digital Expert • Data Manager • Quality Manager • Business Manager • Human Resources Technician • Other (please specify the AM profile)	

Question 5. In which domain do the professionals need to attend a training programme	In the coming 1 year
(Several answers can be chosen) • AM processes • Numerical modelling /Topology optimisation • Design • Structural integrity • Metallurgical analysis and characterisation • Pre-processing & material handling • Post-processing • Non-destructive testing • Certification and Validation • Quality control • Standards • Costs • Environment, health, safety (EHS) • Marketing and sales • Communication • Resource efficiency/sustainability • Other (please specify)	

Question 6. Is there any specific need on AM skills development related to your sector in the coming year? Please if so, provide more info

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17. Please indicate your email address to be informed about the survey results.

[   ]

3.1.2 Survey to Training Centers

The survey targets at training centers to map and identify the current and future training offer, which combined with Industry/employers and Research Centers' needs identified, enables to determine skills gaps.

The Survey template to be used with education and training centres is provided below.

As with the previous survey, a prioritisation exercise was carried out to select the key questions to produce a shorter version of the survey. The idea is to use this short version in internal or external events addressing training centres and take profit of their presence to get more replies.

Survey introductory text:

Welcome to our survey on Additive Manufacturing Skills for Training Centres!

SAM is a European initiative addressing the workforce development for Additive Manufacturing (AM) by developing a shared skills vision and collaborative learning solutions for the sector at European level.

We would like to understand and characterize the educational practices concerning Additive Manufacturing training in Europe.

The survey lasts for 8 to 10 mins approx. It is split into three sections:

- *Section 1: General info and background*
- *Section 2: Existing training practices*
- *Section 3: Training needs*

Please take into account that some questions admit multiple choices, as indicated in the specific question text.

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Survey on AM Training Practices

Section 1: General info and background

Question 1. To which type of organisation do you belong?
Options (*only 1 can be chosen*): - University - VET school - Research Center - Technology center - Private Training Centre - Other (please specify)

Question 2. In which country is your organisation based? (dropdown question)

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Austria
Belgium
Bulgaria
Croatia
Canada
China
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Japan
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Republic of Cyprus
Romania
Slovakia
Slovenia
Spain
Sweden
Turkey
United Kingdom
Other (please specify which)

Question 3. Indicate the name of your organisation

Question 4. What is your role within your organisation?

Section 2: Existing training practices

Question 5. How does your organization provide training?

(Several answers can be chosen)
- Online
- At the company site
- In an education center
- Blended learning (e.g online and presential)
- Other (please specify)

Question 6. Which of the following sectors do you target?

(Several answers can be chosen)
- Aerospace
- Automotive
- Health and Medical
- Consumer goods
- Electronics
- Energy
- Industrial equipment and tooling
- Construction
- Other (please specify)

Question 7. Do you currently offer courses specifically related to AM?

(*only one can be chosen*):
- Yes
- No
- AM is not our main focus, but there are courses related to AM

If *YES* or *AM* is not the main focus (but it is related to) in *question 7*

Question 8. What type of AM Courses is your institution currently offering? What is the targeted level?

(Several answers can be chosen)
Type of programme:
- Short term, focusing on specific competencies or AM topics (i.e. summer school, seminar, workshop)
- Long term, focusing on a set of learning modules and leading to a qualification)
- Both short- and long-term courses

Targeted EQF level:
- 8 – Corresponds to PHD degree
- 7 – Corresponds to Master's degree
- 6 – Corresponds to Bachelor diploma or certificate
- 5- Corresponds to Post Upper secondary /Non tertiary national diploma
- 4- Corresponds to Upper Secondary national diploma
- N.A

Modes of delivery:
- Presential learning / classroom lectures
- Blended Learning (i.e. Presential and distant learning)
- Distant learning (i.e. online)
- Both distant and presential
- All options
- **Duration**:
- Part time
- Full time
- Short / intensive courses
- Both Part and full time
- Both Part time and intensive modules
- Both full time and intensive modules
- All duration options

Question 9. Please list and/or include a link the main AM related courses offered by your organization

Free space

Question 10. From the number of students, you train every year, how many correspond to AM specifically?

(*only one answer can be chosen*):
- None
- Less than 100
- 100-300
- 300-600
- 600-1000
- More than 1000

Question 11. What is the background of the students attending the AM courses?

(Several answers can be chosen)
- Just graduated without prior experience in AM
- Unemployed without experience, belonging to a different area
- Unemployed with AM experience (1 to 5 years)
- Employed without experience, belonging to a different area
- Employed with AM experience (1 to 5 years)
- Other (please specify which)

Question 12. Which technological domains do your AM courses address?

(Several answers can be chosen)
- AM processes
- Simulation
- Topology optimisation
- CAPP (Computer Aided Process Planning)
- Design (CAD Modelling)
- Structural integrity
- Metallurgical analysis and characterisation
- Pre-processing & material handling
- Post-processing
- Destructive and non-destructive testing
- Certification and validation
- Tolerance/Testing/quality control/metrology
- Standardisation
- Environment, health and safety (EHS)
- Robotics/automation
- Sensing
- AM applications
- AM equipment acquisition
- AM machine handling and feedstock handling
- Other (please specify)

Question 13. Which Entrepreneurial skills do your AM courses address?

(Several answers can be chosen)
- Course does not address any entrepreneurial skills
- Develop of creative and purposeful ideas /solutions
- Visualise future scenarios to help guide effort and action
- Identify needs and challenging opportunities to create value
- Develop financial and economic know-how
- Work with others
- Learn through experience
- Other (please specify)

Question 14. Which digital skills are addressed in your AM Courses?

(Several answers can be chosen)
- Course does not address any digital skills
- Digital data analysis (e.g. Artificial intelligence/ machine learning..)
- Digital data management (e.g. big data, statistics,…)
- Ability to think in 3D
- Cybersecurity
- Other (please specify)

Question 15. Which green skills are addressed in your AM courses?

(Several answers can be chosen)
- Course does not address any green skills
- Resource efficiency management
- Green awareness
- Life cycle analysis (LCA)
- Eco-design
- Reuse /recycling AM Materials and products
- Other (please specify)

Question 16. Select the training method(s) you use to address each skill category

SKILLS	Lectures	Tutorials	Case studies	Working groups	Problem based learning	Practical activities in Laboratory	Visits on Site	Videos	Other (specify which)
Technological									
Entrepreneurial									
Digital									
Green									
Other (please indicate which)									

Question 17. Relate each skill category with the assessment methods used

SKILLS	Oral exams	Written exams	Case studies	Working groups	Thesis	Report	Problem Based learning	Practical activities in Laboratory
Technological								
Entrepreneurial								

Digital							
Green							
Other (please indicate which)							

Section 3: Training needs

Question 18. What are the main AM-related courses requested by companies and workers?

- AM processes
- Simulation
- Topology optimisation
- CAPP (Computer Aided Process Planning) for AM
- Design (CAD Modelling)
- AM Materials
- Structural integrity
- Material analysis and characterisation
- Pre-processing & material handling
- Post-processing
- Destructive and non-destructive testing
- Certification and validation
- Tolerances/Testing/quality control/metrology
- Standardisation
- Robotics/automation
- Environment, health and safety (EHS)
- Sensing AM applications
- AM equipment acquisition
- AM machine handling and feedstock handling
- Other (please specify)

Question 19. Do you keep track on trainees after the end of the course?

- Yes
- No
- Depends on the course

If *Yes* to Q.19

Question 20. What mechanisms do you use to keep track?

the answers to these questions will allow to pass directly to the last question.

Options (*More than one can be chosen*):
- Follow up questionnaires
- Follow up interviews
- Follow up meetings
- Other (please specify)
- No mechanisms are used

Your survey is now completed!

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23. Please indicate your email address to be informed about the survey results.

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If answering *NO* to Q7

Question 21. What is the main reason for not providing AM courses?
Options (*More than one can be chosen*): • Lack of trainers • Lack of equipment • Lack of need/request from market • Other (please specify)

Question 22. Please indicate if you plan to offer AM specific courses in the following periods

1 year
    • Yes
    • No

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23. Please indicate your email address to be informed about the survey results.

<div style="border:1px solid black; height:2em;"></div>

Survey short version

Question 1. Which technological domains do your AM courses address?
(*Several answers can be chosen*) • AM processes • Simulation • Topology optimisation • CAPP (Computer Aided Process Planning) • Design (CAD Modelling) • Structural integrity • Metallurgical analysis and characterisation • Pre-processing & material handling • Post-processing • Destructive and non-destructive testing • Certification and validation • Tolerance/testing/quality control/metrology • Standardisation • Environment, health and safety (EHS)

- Robotics/automation
- Sensing
- AM applications
- AM equipment acquisition
- AM machine handling and feedstock handling
- Other (please specify)

Question 2. Which Entrepreneurial skills do your AM courses address?

(Several answers can be chosen)
- Course does not address any entrepreneurial skills
- Develop of creative and purposeful ideas /solutions
- Visualise future scenarios to help guide effort and action
- Identify needs and challenging opportunities to create value
- Develop financial and economic know-how
- Work with others
- Learn through experience
- Other (please specify)

Question 3. Which digital skills are addressed in your AM Courses?

(Several answers can be chosen)
- Course does not address any digital skills
- Digital data analysis (e.g. Artificial intelligence/ machine learning..)
- Digital data management (e.g. big data, statistics,…)
- Ability to think 3D
- Cybersecurity
- Other (please specify)

Question 4. Which green skills are addressed in your AM courses?

(Several answers can be chosen)
- Course does not address any specific green skills
- Resource efficiency management
- Green awareness
- Life cycle analysis (LCA)
- Eco-design
- Reuse/ recycling AM Materials and products
- Other (please specify)

Question 5. Which are the main AM-related course domains requested by companies and workers?

- AM processes
- Simulation
- Topology optimisation
- CAPP (Computer Aided Process Planning) for AM
- Design (CAD Modelling)
- AM materials
- Structural integrity

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- Material analysis and characterisation
- Pre-processing & material handling
- Post-processing
- Destructive and non-destructive testing
- Certification and validation
- Tolerances/testing/quality control/metrology
- Standardisation
- Robotics/automation
- Environment, health and safety (EHS)
- Sensing AM applications
- AM equipment acquisition
- AM machine handling and feedstock handling
- Other (please specify)

Your Survey is now completed!

Thank you for helping us designing Europe's AM workforce future!

For further information visit our website www.skills4am.eu

17. Please indicate your email address to be informed about the survey results.

3.1.3 Survey to current workforce/ professionals

Survey addressing AM related professionals from different sectors to find out the needs with regards technical skills needs in scenario 1. The survey template to be used with professionals working in AM is provided below.

Survey introductory text:

Welcome to our survey on Additive Manufacturing Skills for AM professionals!

SAM is a European initiative addressing the workforce development for Additive Manufacturing (AM) by developing a shared skills vision and collaborative learning solutions for the sector at European level.

We would like to identify relevant AM skills and new job demanded profiles, which will be translate in future education and training requirements.

The survey aims to identify AM skills needs as well as related entrepreneurial, green and digital skills needs. It last for 10 min approx. It is split into three sections:

- *Section 1: General information*
- *Section 2: Professional background*
- *Section 3: AM skills Needs*

Please take into account that some questions admit multiple choices as indicated in the specific question text.

Thank you for helping us in designing Europe's AM workforce future!

The participation in this survey is anonymous and voluntary. By replying to it, you are consenting that SAM project partners process the data collected in conformity with the Contract Agreement signed with the EACEA. For any additional clarification, please contact ewf@ewf.be

Section 1: General info

Question 1. To which type of organisation do you belong?

Options (*only 1 can be chosen*):
- Start-up
- Small and Medium-sized enterprise
- Large enterprise
- Industrial association
- University
- Training Centre
- Research Center
- Technology center
- Other (please specify which)

Question 2. In which country is your organisation bases? (dropdown question)

- Austria
- Belgium
- Bulgaria
- Croatia
- Canada
- China
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Ireland
- Italy
- Japan
- Latvia
- Lithuania
- Luxembourg
- Malta
- Netherlands
- Poland
- Portugal
- Republic of Cyprus
- Romania
- Slovakia
- Slovenia
- Spain
- Sweden
- Turkey
- United Kingdom
- Other (please specify which)

Question 3. Indicate the name of your organisation

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

Options (*more than one answer is possible*):
- Aerospace
- Automotive
- Defence
- Consumer goods
- Construction
- Energy
- Health
- Industrial equipment and tooling
- Other (please specify)

Section 2: Professional Background

Question 5. What is your current role within your organisation?

Question 5a. Accordingly, which of the following profiles fits better with your current role?

Options (*only 1 can be chosen*):
- Designer
- Process Engineer
- Inspector
- Inspector Technician
- NDT Technician
- Supervisor
- Specialist at the Engineer level
- Metrology Engineer
- Materials Engineer
- Operator/Technician
- Other (please specify)

Question 6. What is your education level ?

Options (*only 1 can be chosen*):
- Professional/technical course
- Bachelor degree
- Master's degree
- Doctoral degree
- Other (please specify)

Question 6a. Please provide details on your educational level (e.g. Dr. in Physics, Engineering…)

Free text

Question 7. -Rate from 1 to 4, your expertise on the	1 (low)	2 (regular)	3 (high)	4 (very high)

different AM value chain position.				
• Modelling/simulation				
• Design				
• Materials				
• Process				
• Post-processing				
• End of life				
• Other (please specify)				

Question 8. -Rate from 1 to 4, your expertise on the different AM materials.	1 (low)	2 (regular)	3 (high)	4 (very high)
• Metal				
• Polymer				
• Ceramic				
• Bio-material				
• Composite				
• Other (please specify)				

Question 9. -Rate from 1 to 4, your expertise on the different AM process types.	1 (low)	2 (regular)	3 (high)	4 (very high)
• Powder Bed Fusion (PBF)				
• Vat Photopolymerization (VP)				
• Material Jetting (MJ)				
• Material extrusion (ME)				
• Sheet lamination				
• Directed Energy Deposition (DED)				
• Binder Jetting (BJ)				
• Other (please specify)				

Question 10. How have you acquired your AM knowledge and skills?

Options (*more than one answer is possible*):
- Through formal education (e.g. VET, University...)
- Through online courses (e.g. self-study)
- Through classroom (e.g., at University, VET...)
- On the job training by external
- On the job training by internal (mentoring)
- Other (please specify)

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Question 10a. Have you been reskilled?

Options (*more than one answer is possible*):
- Yes
- No

If yes, please let us know your previous job position

Section 3: AM skills needs

Question 11- Which technological domains you estimate you will need to develop /improve?	In the coming 1 year
• AM processes • Simulation • Topology optimisation • Design (CAD modelling) • Structural integrity • Material analysis and characterisation • Pre-processing & material handling • Process control • Post-processing • Destructive and non-destructive testing • Certification and qualification • Quality monitoring and control • Standards • Environment Health and Safety (HSE) • Marketing and sales • Research and innovation • Other (please specify)	

Question 12- Which entrepreneurial skills you estimate you will need to develop /improve? *(Several answers can be chosen)*	In the coming 1 year
• Learn through experience • Work with others • Visualize future scenarios to help guide effort and action • Identify needs and challenging opportunities to create value • Develop creative and purposeful ideas /solutions • Develop financial and economic know-how • Other (please specify)	

Question 13. Which digital skills you estimate you will need to develop /improve?	In the coming 1 year

(Several answers can be chosen)
   • Digital data analysis (e.g. Artificial intelligence/ machine learning...)
   • Digital data management (e.g. big data, statistics,)
   • Ability to think in 3D
   • Other (please specify)	

Question 14. Which green skills you estimate you will need to develop / improve?	In the coming 1 year
Several answers can be chosen) • Resource efficiency management • Life cycle analysis (LCA) • Reuse/recycling AM materials and products • Other (please specify)	

Question 15 According to your experience/opinion, which of the following training approaches you think will be most effective to overcome your skills needs?
• Short term courses, focusing on specific competencies or AM topics   • Long term courses, focusing on a set of learning modules and leading to a qualification   • Presential learning / classroom lectures   • Distant learning (e.g. Online courses, Tutorials)   • Case studies   • Working group   • Problem based learning   • Practical activities   • Virtual reality   • On the job training   • Other (please specify)

Your survey is now completed!

Thank you for helping us designing Europe's AM workforce future!

For further information, visit our website: https://www.skills4am.eu/

18. Please indicate your email address to be informed about the survey results.

Survey short version for AM professionals

Question 1. What is the main activity/sector of your organisation?
(Several answers can be chosen)   • Aerospace   • Automotive   • Defence   • Consumer goods   • Construction   • Energy   • Health and Medical   • Industrial equipment and tooling   • Other (please specify)

Question 2. Accordingly, which of the following profiles fits better to your current role?

(*only 1 can be chosen*):
- Designer
- Process Engineer
- Inspector
- Inspector Technician
- NDT Technician
- Supervisor
- Specialist at the Engineer level
- Metrology Engineer
- Materials Engineer
- Operator/Technician
- Other (please specify)

Question 3. Which technological domains you estimate you will need to develop /improve? *(Several answers can be chosen)*	**In the coming 1 year?**

- AM processes
- Simulation
- Topology optimisation
- Design (CAD modelling)
- Structural integrity
- Material analysis and characterisation
- Pre-processing & material handling
- Process control
- Post-processing
- Destructive and non-destructive testing
- Certification and qualification
- Quality monitoring and control
- Standards
- Environment, health, safety (EHS)
- Marketing and sales
- Research and innovation
- Other (please specify)

Question 4- Which entrepreneurial kills you estimate you will need to develop /improve ? *(Several answers can be chosen)*	**In the coming 1 year**

- Learn through experience
- Work with others
- Visualize future scenarios to help guide effort and action
- Identify needs and challenging opportunities to create value
- Develop creative and purposeful ideas /solutions
- Develop financial and economic know-how
- Other (please specify)

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Question 5. Which digital skills you estimate you will need to develop /improve?	In the coming 1 year
(Several answers can be chosen) • Digital data analysis (e.g. Artificial intelligence/ machine learning…) • Digital data management (e.g. big data, statistics,) • Ability to think 3D • Other (please specify)	

Question 6. Which green skills you estimate you will need to develop / improve?	In the coming 1 year
Several answers can be chosen) • Resource efficiency management • Life cycle analysis (LCA) • Reuse/recycling AM materials and products • Other (please specify)	

Question 7 According to your experience/opinion, which of the following training approaches you think will be most effective to overcome your skills needs?
(Several answers can be chosen) • Short term courses, focusing on specific competencies or AM topics • Long term courses, focusing on a set of learning modules and leading to a qualification • Presential learning / classroom lectures • Distant learning (e.g. Online courses, tutorials) • Case studies • Working group • Problem based learning • Practical activities • Virtual reality • On the job training • Other (please specify)

3.2 Interviews

In the context of real case scenarios and identification of skills to be addressed in less than one year, interviews are used as complementary tools to the surveys, therefore they are not mandatory.

3.2.1 Interview to industry/ Employers

The interview is designed to explore relevant information in order to support the understanding and analysis of the AM related sector's skills agenda and needs.

People to be interviewed will be mainly selected from the companies' representatives who previously answered the employers' survey. The interview intends to build upon this preliminary data provided and will be applied to different AM employers' profiles.

After checking the companies replying to the survey and analysing the info to select whom to interview, the next step is to send the invitations to the selected stakeholders. This is done via email, addressing the person and/or the entity he/she represents.

Below is the text that can be used for inviting stakeholders.

Invitation text for the interview

You are being invited to be interviewed. Before you decide about your participation, it is important for you to understand the purpose and what it will involve. Please take time to read the following information carefully.

You have been selected as a key stakeholder from those who replied to our Industry skills survey/ as an associated partner (to select one option) under the framework of SAM project. SAM is a four years Sector Skills Strategy in Additive Manufacturing Project, funded by the European Commission through its Erasmus+ Programme, tackling the current European need of developing an effective system to identify and anticipate the right skills for the Additive Manufacturing sector (http://www.skills4am.eu.)
The objective of this interview is to further explore and analyse skills gaps and the real industrial needs with regards to professionals working in AM

The participation in this interview is anonymous and voluntary. You will be engaged in a phone, online or face-to-face interview and will be asked 11 questions. Estimated duration of the interview is from 30 minutes to 1 hour.

By participating, you are consenting that SAM project partners will be able to process the data collected in conformity with the Contract Agreement signed with the EACEA. The project Coordinator, EWF, commits to adopt all necessary measures to guarantee the safe keeping of data against any possible abuse or against unauthorized access. For any additional clarification, please contact ewf@ewf.be.

Kindly let us know whether or not you wish to take part. If you do decide to take part please sign the consent form attached and send it back.

Consent form

An interview consent form needs to be sent together with the invitation, to the person who is going to be interviewed and get it back signed prior to the interview. Printable version can be found in annex A.

Employers' interview template

*Interview to stakeholders that have previously participated into the survey:
Q1: How many+ workers in your company are involved in Additive Manufacturing?

Q2. In your opinion what are the current challenges regarding AM skills? In general, and in your company, in particular.

Q2a. Do you think your company is prepared to meet those challenges? (Yes / No)

If answering YES:	If answering NO:
Q Why do you think that your company is well prepared to meet those challenges? What was your strategy, so far?	**Q** Why do you think that your company is not well prepared to meet those challenges? What is your company's strategy to address this issue?
	Q What are the main difficulties in implementing AM within your company? Is this related to the lack of skills or lack of AM professionals, or other reasons?
Q Although you feel your company is prepared, what do you think may be needed to improve the skills and knowledge in AM within your company? (e.g., new qualification system more adapted to industry needs, practical training, short and intensive training courses….)?	**Q** In general, what do you think is needed to improve the skills and knowledge in AM within your company (e.g. new qualification system more adapted to industry needs, practical training, short and intensive training courses ….)?

Q3. Have you experienced any difficulties to find AM skilled professionals you were searching for? (Yes / No)

If answering YES:	If answering NO:
Q If so, which particular profile were you searching for?	**Q** How did you find this profile: internal recruitment, external recruitment, recruiting agency, etc.?
Q What kind of problems did this difficulty cause?	

Q4. Regarding the 10 professional profiles*, how do you see their relationship with materials and processes: i.e., is there any profile that will be material /process related?

Q5. AM metrology and inspector were found, by the majority of respondents, not so relevant ones. What is your opinion on that?

Q6. Which of the following entrepreneurial, digital and green skills do you think are relevant or not relevant for current AM professionals in your sector?

Skills	Relevant	Not relevant

Digital		
-Digital data analysis (Artificial intelligence/ machine learning...) -Digital data management (big data, statistics,…) -Ability to think in 3D		
Green		
-Resource efficiency management -Life cycle analysis (LCA) -Reuse/recycling AM materials and products		
Entrepreneurial		
-Learn through experience -Work with others -Visualize future scenarios to help guide effort and action -Identify needs and challenging opportunities to create value -Develop creative and purposeful ideas /solutions -Develop financial and economic know-how		
Other(s) please specify		

Q7. How do you expect to increase the use of AM technologies?

	YES
By increasing the number of applications	
By testing new AM technologies*	
By using new materials**	
By moving from prototyping to industrial production***	
By hiring new staff specialized in AM****	
By reskilling and upskilling existing staff on AM technology*****	
Other (please specify)	

Ask more about the answer selected: e.g. if increasing the use of AM – Ask how?
Options depending on reply:
*Which Technologies?
** Which materials
*** In which volume (prototyping versus series production)
**** Which profiles?

*****Which professional profiles working in your company would benefit from upskilling/reskilling in AM and why?
On which subjects? Which skills are lacking?

Q8. In your opinion what is the relevance of the following training approach to address skills development in AM: for the next 1 year?

	Not relevant	Relevant	Very relevant
Classroom type (e.g. at University, VET centre...)*			
On the job training by external *			
On the job training by internal (mentoring) *			
Online courses			
Virtual reality courses			
Blended Learning' (i.e. combination of online and face-to-face)			
Apprenticeships*			
Doctorate			
Other (please specify)			

to ask about the time, e.g. intensive courses or other type?

Q9. Do you think "Maker spaces and fab labs" can help students to get familiar with the technology and to develop green, digital and entrepreneurial skills?

And what about possible "Industrial experience accelerators" that offer raining? Can they be helpful at industrial level?

Any other thoughts / ideas/comments?

SAM professional profiles as defined can be found in Annex B

For those stakeholders that have not participated in the survey, the starting point will be its survey's section 1

- What type of organisation do work for?

- In which country is your organisation based?

-What is the main activity/sector of your organisation?

-What is your role within your organisation?

-Indicate the AM Supply position in which your organisation is involved

-Which AM materials do your company mainly use?

-Which AM processes do your company mainly use?

ANNEX A: Interviews' Consent form

	CONSENT FORM: Sector Skills Strategy in Additive Manufacturing **(SAM) :** The participant should complete the whole form
Please tick the appropriate box	

Have you read the Interview invitation /Information text?	
YES	NO

Do you have a clear understanding about the goal and outcomes of the interview?	
YES	NO

Do you understand that you will not be referred to by name in any report concerning this interview?	
YES	NO

(Where relevant) I agree with having my interview being recorded.	
YES	NO

(Where relevant) I agree with the use of non-attributable direct quotes when the study is written up or published.	
YES	NO

Do you agree to take part in this interview study?	
YES	NO

Signature of Interviewee:
Date:
Name in capitals:

I am satisfied that the above-named has given informed consent.	
Interviewer name:	Signature:
Project Partner name:	Signature:

Professional Profile (Roles)	Description
AM Designer (Professionals that are able to **design parts optimised for function, cost and manufacture.**)	Design AM solutions for specific AM process, ensuring and validating that parts can be made cost-effective and efficiently. Validate specific AM process design projects by verifying requirements for production with engineer as well as process requirements, ensuring liaison with other technical areas to sign of drawings.
AM Process Engineer (Professionals that are able to **create the manufacturing process** for the efficient production and post-processing of additively manufactured parts.)	Develop and execute Specific AM Process plans including validation of design, implementation, pre and post processing operations, assurance of parts conformity and identification of the causes and the corrective actions of technical production problems; Coordinate the tasks distribution between the operators according to the workplan as well as manage the link between them and the management.
AM Inspector (Professionals that are able to define and carry out **inspection of** additively manufactured parts)	Carry out quality assessments and inspection of AM parts. Interpret DT and NDT reports
Inspection Technician	Carry out the **dimensional inspection of complex geometries** of additively manufactured parts to the clients' requirements
NDT Technician	**Carry out the** safe and reliable non-destructive testing **of complex geometry additively manufactured parts**.
AM Supervisor	Supervise AM production on shop floor ensuring quality and HSE procedures
AM Coordinator – at the Engineer level	Evaluate manufacturing suitability for customers' requests defining which processes are fit for the request, based on the application, material, design and cost of the part. Coordinate the work with AM team.
Metrology Engineer	Use their comprehensive knowledge of metrology to **specify the optimal measurement method** to meet the functional and manufacturing requirements of the part
Materials Engineer	Use their comprehensive knowledge of materials to **specify the optimal material** to meet the functional and manufacturing requirements of the part and **implement material handling processes** for the entire material life cycle
AM Operator / Technician (Professionals that are able to carry out the safe and reliable production and simple post-processing of additively manufactured parts.)	Operate AM machines, including fitting and setting up, maintenance and specific repairs.