O2/A1Definition of training paths, modules, units and learning outcomes

SKILLS IN ADDITIVE FOR THE TOOLMAKING MANUFACTURING AND HABITAT SECTORS

SAMANTHA

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SAMANTHA SKILLS IN ADDITIVE MANUFACTURING FOR THE TOOLMAKING AND HABITAT SECTORS

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Content

Aim of the IO2 'SAMANTHA Joint Curriculum and Training Content'

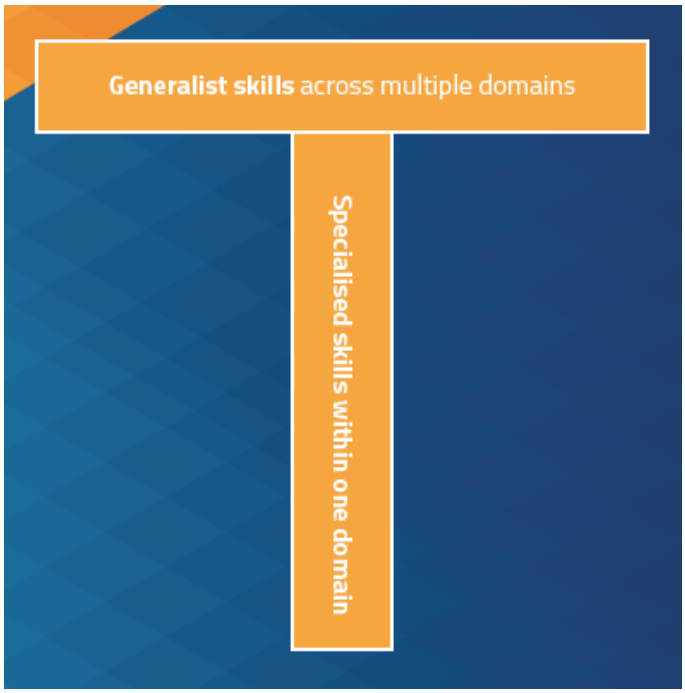

Figure 1. T-shaped skills, graphic definition

The main objective of this output is to obtain the most suitable curriculum and, therefore, the offline training content taking into account the real needs of the target groups (previously identified in IO1).

The concept of T-shaped skills will be placed in the centre of our vision as those needed abilities by the workforce in the Toolmaking and Habitat sectors. The vertical bar on the T represents the depth of related skills and expertise in a single field, whereas the horizontal bar is the ability to collaborate across disciplines with experts in other areas and to apply knowledge in areas of expertise other than one's own.

The offline training materials will comprise different formats: Text documents, slides, articles and other supporting materials, assessment methods, etc.

Due to the features of the SAMANTHA initiative, this output will define and analyse the most suitable training paths, modules and units in order to ease the learning process. Future students will have different levels of knowledge and areas of expertise and they will want to choose those subject matters in which they are more interested in. For this reason, partners designed the training pathways in terms of the necessary areas of training adapted to fit the variety of high-tech T-shaped skills and competences.

O2/A1. Definition of training paths, modules, units and learning outcomes

The SAMANTHA Curriculum was prepared bearing in mind the necessary areas of technical knowledge and transversal skills desired and needed in the Toolmaking industry and Habitat sector for a proper use of AM. The answers of the target users consulted in OI and the final reports gave to the partnership the clues for identifying the modules, the suitable learning outcomes that are required as well as the units. As a result, partners designed and developed the SAMANTHA high-tech- T-shaped Curriculum. Each partner defined the modules, learning outcomes and units closely related to its area of expertise and taking into consideration the results of O1.

The SAMANTHA training course foresees nine modules which are divided in two groups: technical or hard skills, representing the vertical bar of the T; and transversal skills, also called soft competences, showing the horizontal bar. This combination is the result of the T-shaped training curriculum.

Under the umbrella of Advanced Manufacturing Technologies (AMT) has been recognised as one of the technologies that are expected to be decisive in tomorrow´s economy, identified by the European Commission as KETs. Besides, KETs have huge potential to fuel economic growth, can

lead to a great number of technical and economic advantages and provide jobs in creative sectors such as the Toolmaking and Habitat. However, this revolutionary technology is still at an early stage in the addressed industries. On the one hand, Toolmaking industry mainly involved AM for product development and the production of low-cost tools. On the other hand, the consumer market for AM in Habitat represents less than 0,1% of conventional manufacturing and the total services and products made is still a niche.

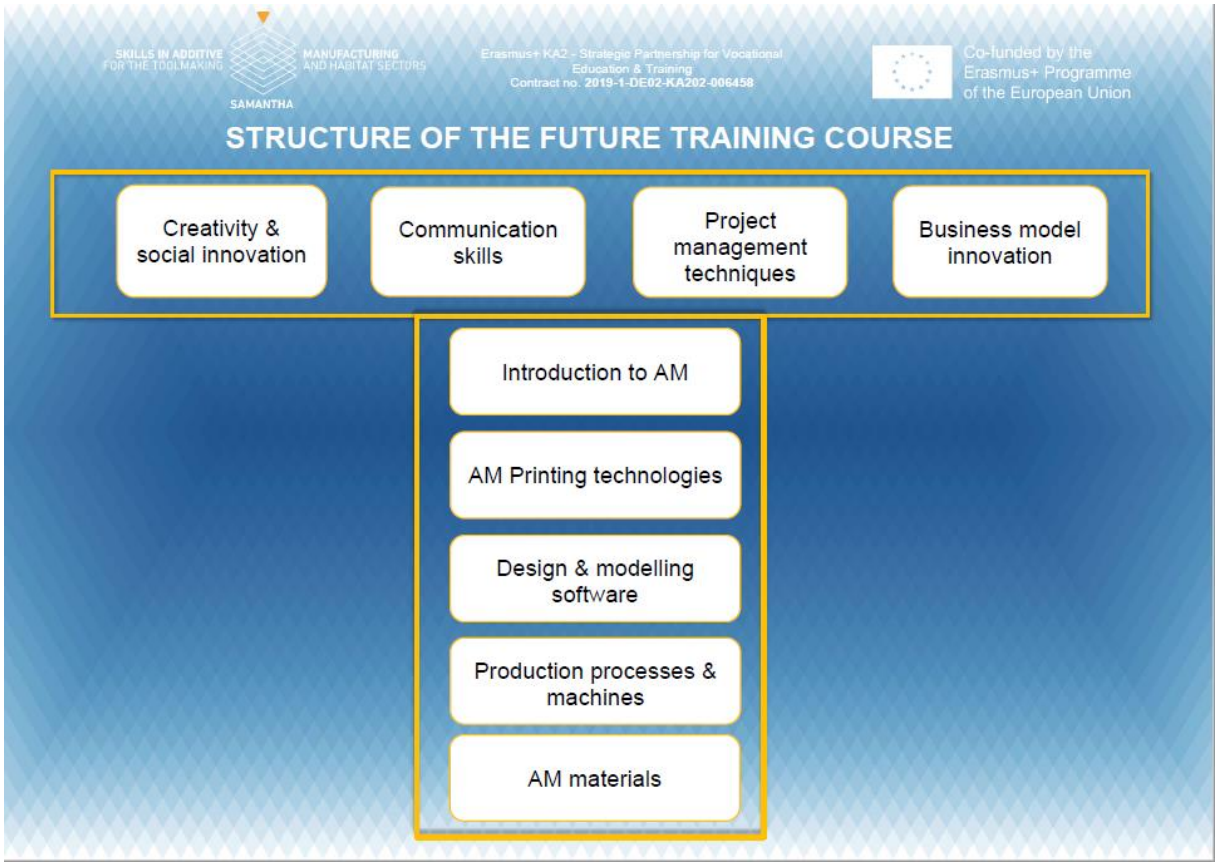

Figure 2. Distribution of the SAMANTHA T-Shaped Curriculum

Otherwise, the competitiveness of the industry is highly dependent on the knowledge, skills, competences and creativity of its workforce. However, the skills requested by industry are not only technical. Over the last decade, the notion of T-shaped skills has appeared, referring to an individual worker having a combination of general skills across multiple domains and specialist skills within one domain. Regarding to that, the concept of high-tech T-shaped skills has emerged.

The Fourth Industrial Revolution brings a higher division to the scale at which upskilling and reskilling efforts currently happen and is likely to increase these potential gaps. Moreover, advanced economies, such as the European Union (EU), will be confronted with the highest skills mismatches so high-tech T-shaped skills are an imperative for the EU. What is needed is to design and implement new educational curricula and teaching methods at all levels. SAMANTHA project wants to anticipate with this strategy, especially in VET field because the current European VET offer has to respond to such challenges and take advantage of great opportunities ahead as the gap that exists in the Toolmaking and Habitat sector in order to foster its DT and IS.

Therefore, the main objective of the project is to develop a novel training program addressing the mismatched high-tech T-Shaped skills in the Toolmaking industry and Habitat sector for proper implementation of AM.

Partners address these target groups:

- Initial VET students. People with no practical expertise who are willing to learn about AM and find a job.
- Continuing VET students. Workers coming from the Toolmaking industry and Habitat sector with experience in AM who want to acquire high-tech T-shaped skills or upgrade their knowledge to find new labour opportunities or even professionals from other sectors or unemployed people aiming to reroute their careers.
- VET providers interested in increasing or improving their training offer.
- SME's, clusters, development agencies, sector experts' associations and unions that wish to be involved.
- Key stakeholders, policy formulators and decision makers wishing to support the development of an aligned curriculum with the current necessities of the industry.
- The general public, mainly acting as consumers, who will benefit from more personalized attention and products.

Standardisation and harmonisation of learning outcomes

The designed curricula include some EU tools for transparency, recording and recognition to facilitate employability and mobility of workers in the Toolmaking industry and Habitat sector:

- ECVET (European Credit system for Vocational Educational and Training). Each of the units in the curricula will be allocated the corresponding ECVET points which will make it easier to transfer, to have recognised and to accumulate assessed learning outcomes.

- European Quality Reference in Vocational Education and Training (EQAVET) Framework will be taken into account for the development of projects results.

Moreover, the partners analysed the EQF system in its own country.

Harmonised Unit Description Template

Partners created two templates in order to comply with the requirements for the descriptions of Units and Learning Outcomes of each participant country along with the specifications that the ECVET approach requires:

-the "Harmonized Learning Outcome Template", this will use the terms of Knowledge, Skills and Competences.

-The "Harmonized Unit Description Template", this will contain at least: The generic title of the unit and the qualification, its reference to the EQF and NQF levels, the Learning Outcomes contained in the unit and the procedures and criteria their assessment, the ECVET points associated with the unit and, if relevant, the validity in time of the unit.

Title of the Qualification

EQF Level	4	**Procedures and Criteria for Learning outcomes assessment**	Multiple or blank choice, test - Online quizzes	**ECVET Point associated**	*Depending on the total hours of the training

Brief description of the qualification

	Knowledge	Skills	Responsability and autonomy (competences)
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

https://ec.europa.eu/ploteus/de/node/1440

SAMANTHA T-Shaped Curriculum

TECHNICAL MODULES:

1. Introduction to AM
2. AM printing technologies
3. Design & modelling software
4. Production Processes & Machines for the Toolmaking & Habitat Sectors
5. AM materials

TRANSVERSAL MODULES:

1. Creativity and social innovation
2. Communication skills and competences
3. Project management techniques for continuous innovation through AM
4. Business model innovation

Module 1 - Technical Competences: Introduction to AM

No. Unit	Title	Learning outcomes	Knowledge	Skills	Competences	Procedures and Criteria for Unit assessment
1	History	To know what additive manufacturing is	Origin about AM and important events	• Expand knowledge	Ability to relate events from the past to those of the present	Multiple choice
		Difference between AM and Traditional Manufacturing	How AM developed out of traditional manufacturing	• Comparative view on the two processes	Assimilate the advances of AM for further development	Multiple choice
		To know application of Rapid Prototyping for AM	Areas of application with different technologies	• Creativity	Broaden the general vision of AM	Multiple choice
		To know the Pros and Cons of AM	Acquire knowledge about advantages & disadvantages	• Differentiate aspects of AM • Critical thinking • Problem solving	Identify when AM is suitable for the design of certain parts	Multiple choice
		To know different & exotic AM applications	Unexpected & unusual approaches apart from the already known applications	• Creativity of applying AM to unusual fields of work	Sharpen the view for niches of application	Case-based exam Question exam
		Case Study: What is RepRap?	How to transfer theory into practical examples	• Transversal thinking • Practical understanding	Transfer knowledge to practical approaches	Case-based exam Essay/written answer exam
2	How does AM Work?	To know principles of AM technologies		• logical understanding	• Identify when AM is suitable for the	Multiple choice

		To know different 3D Printers	Acquire knowledge about the concepts of Additive Manufacturing	• differentiate 3D Printer types • Analysis of workflow styles & approaches	design of certain parts • Adjust one's own workflow more effectively	Matching Answers Short answer questions
		Have an overview of Production process workflows				
		Case Study: Video example of a real process. How to transfer theory into practical examples	How to transfer theory into practical examples	• Transversal thinking • Practical understanding	Transfer knowledge to practical approaches	Case-based exam Essay/written answer exam

Module 2 - Technical Competences: AM Printing Technologies

No. Unit	Title	Learning outcomes	Knowledge	Skills	Competences	Procedures and Criteria for Unit assessment
1	Introduction about main technologies	Have an overview of the so far main existing technologies	Factual knowledge of existing technologies	• Cognitive skills	Recognize possible ways of AM Printing	Multiple choice Short answer questions
2	Fused Deposition Modeling (FDM)	To know properties (Resolution, Accuracy, Size)	FDM properties	• Analysis • Problem solving • Creative thinking	• To identify the right material for a specific use • To identify and process the right material for a specific 3D printing technology	Multiple choice Matching Answers Short answer questions
		To know fields of application	Specific application of FDM			
		To know relevant machinery & materials	Relevant machinery for FDM			

3	Selective Laser Sintering (SLS)	To know properties (Resolution, Accuracy, Size)	SLS properties	• Analysis • Problem solving • Creative thinking	• To identify the right material for a specific use • To identify and process the right material for a specific 3D printing technology	Multiple choice Matching Answers Short answer questions
		To know fields of application	Specific application of SLS			
		To know relevant machinery & materials	Relevant machinery for SLS			
4	Stereolithography (SLA)	To know properties (Resolution, Accuracy, Size)	SLA properties	• Analysis • Problem solving • Creative thinking	• To identify the right material for a specific use • To identify and process the right material for a specific 3D printing technology	Multiple choice Matching Answers Short answer questions
		To know fields of application	Specific application of SLA			
		To know relevant machinery & materials	Relevant machinery for SLA			
5	Direct Metal Sintering (DMLS)	To know properties (Resolution, Accuracy, Size)	DMLS properties	• Analysis • Problem solving • Creative thinking	• To identify the right material for a specific use • To identify and process the right material for a specific 3D printing technology	Multiple choice Matching Answers Short answer questions
		To know fields of application	Specific application of DMLS			
		To know relevant machinery & materials	Relevant machinery for DMLS			

Module 3 - Technical Competences: Design & Modelling Software

No. Unit	Title	Learning outcomes	Knowledge	Skills	Competences	Procedures and Criteria for Unit assessment
1	Software that you need for 3D Printing	To know programs for Designing	Get an overview of the different software that are needed to get a 3D model from the design until the part is printed	Be able to identify types of Software used in 3D printing	Know how to identify, what kind of program is needed for each step of the 3D printing process	Short answer questions Multiple Choice
		To know programs for testing, orienting & repairing				
		To know programs for generating the G-Code				
		To know programs for 3D printing Workflow				

Module 4 – Technical Competences: Production Processes & Machines for the Toolmaking & Habitat Sectors

No. Unit	Title	Learning outcomes	Knowledge	Skills	Competences	Procedures and Criteria for Unit assessment
1	Description of Production Process	Know how to: model with CAD software/ Obtain digital model	Steps to follow since you get the 3D model up to the printed piece	• Technical analysis • Problem solving • Creative thinking • Know when a support structure is needed	• Application of the learned steps of 3D Printing • Ability to make decisions within the printing process • Analyze the part before printing • Solve printing problems	Short essay Matching
		…build support structures, rafts & other features				
		…export and repair the STL File				
		…test, orient, distribute the model				
		…generate the G-Code				
		…3D-print				
		Know the extraction process methods				
		Know the post-processing of 3D printed parts				

2	Complex Geometries	Know how to deal with complex geometry	What are complex geometries and how to simplify them for the printing process	• Be able to identify what is printable or not	• Ability to assess complexity • Courage to take on complex designs	Multiple Choice
3	Focus on Toolmaking + Habitat Sectors	AM Process peculiarities of Toolmaking Sector	possibilities to customize the AM process	• Differentiate between sector-specific applications	Apply 3D printing process steps depending on the Toolmaking Sector	Case-based exam
		AM Process peculiarities of Habitat Sector	possibilities to customize the AM process	• Differentiate between sector-specific applications	Apply 3D printing process steps depending on the Habitat Sector	
		Different criteria for choosing the best 3D printing technology	Have a set of criteria to assess possible technologies depending on the final object	• Recognize sector-specific features and requirements	Identify the most suitable 3D printing technology depending on the sector the final object is referred to.	
		Know exotic/ unusual approaches of AM	Broaden knowledge beyond the limits of typical AM approaches	• customize common methods & technologies to suit the project	Ability to “think big”, more creatively and innovatively	Short answer questions

Module 5 – Technical Competences: AM Materials

No. Unit	Title	Learning outcomes	Knowledge	Skills	Competences	Procedures and Criteria for Unit assessment
1	Introduction – properties, performance, pros & cons	Know FDM materials	FDM materials properties, performances, processability, pros and cons	• Analysis • Problem solving • Product Design • Process Design	• To identify the right material for a specific use • To identify and process the right material for a specific 3D printing technology	Multiple choice test Matching
		Know SLS materials	SLS materials properties, performances, processability, pros and cons			
		Know SLA materials	SLA materials properties, performances, processability, pros and cons			
		Know DMLS materials	DMLS materials properties, performances, processability, pros and cons			
2	New emerging materials	Know about Lifecycle assessment of 3D Printing Materials (re-use, recycle etc.)	What is LCA focused on 3D printing materials	• Analysis • Problem solving • Product Design • Process Design	Understand LCA principles	Multiple choice test Matching
		Know materials with eco-friendly properties, e.g. bio-based polymers, natural fillers)	Eco-friendly materials properties, performances, processability, pros and cons		o identify alternative material solutions	

		Know high performance and innovative materials, e.g. graphene, thermochromic, thermal & electrical high conductivity, flexibles, antibacterial etc.)	Innovative materials properties, performances, processability, pros and cons		To design innovative products/solutions	
3	Focus on toolmaking + Habitat Sectors	Know the relevant peculiarities for Toolmaking Sector, e.g. high mechanical performance	Materials, properties and performances for toolmaking applications	• Analysis • Problem solving • Product Design • Process Design	• To identify the right material for a specific for toolmaking applications	Multiple choice test
		Know the relevant peculiarities for Habitat Sector	Materials, properties and performances for Habitat Sector applications		• To identify the right material for a specific for Habitat Sector applications	

Module 1 – Transversal skills: Creativity and Social Innovation

No. Unit	Title	Learning outcomes	The programme provides with… (knowledge)	The Programme prepares for… (Skills)	The Programme develops… (Competences)	Procedures and Criteria for Unit assessment
1	Creativity and innovation	To know in a general way what creativity is.	Definition of creativity, historical and theoretical recognition of the concept, if it is a competence or a talent, creativity nowadays in different work and life fields.	Analysis Open-Mindedness Organization Communication	-Understanding these two aspects in general and the relationship between them.	Multiple or blank choice, test - Online quizzes
	To know in a general way what innovation is.	General aspect of innovation, why it is so important and explanation of the different approaches to innovation.				
	To know in a general way the relation between creativity and innovation is.	General aspect about the relation between creativity and innovation and differences between them.				
2	What is creativity and its process?	To know in a deep way what is creativity and how to create and to generate an idea in each step of its process.	How to: define a problem, gather information, select a concept, combine and reorganise a concept, generate an idea, evaluate an idea, plan and implement and idea, identify the barriers to creativity, plan solution and adaptation, monitoring them, identify sources of	Analysis Open-Mindedness Organization Communication Curiosity Problem solving Teamwork	- Capturing and preserve ideas when they come in mind in relation to creativity -Recognising failures and turn them into challenges in relation to creativity -Be curious and experiment with the different skills you	Multiple or blank choice, test - Online quizzes

			new ideas, transform ideas into opportunity.	Leadership Imagination Analysis and attention to detail Creativity Goal and / or result orientation Customer orientation Flexibility and adaptability Stress tolerance Self-esteem and self-confidence Adaptability Keep up to date Working for goals Manage information Resourcefulness	already have in relation to creativity -Considering the surrounding environment to generate creative stimuli in relation to creativity	
3	Creativity and AM Technology	To know some case study around Europe of using creativity in the Additive manufacturing sector related both with Habitat and Toolmaking fields.	Difference between the past and presents about production tools, which are the new opportunities thanks to the AM in terms of creativity both in toolmaking and Habitat sectors. Some relevant case studies to understand more in dept the differences.	Analysis Open-Mindedness Organization Communication Curiosity Problem solving Teamwork	-Analysing previous and current examples relating to AM manufacturing -Extending knowledge -Reinforcing what is known	Multiple or blank choice, test - Online quizzes

				Leadership Imagination Analysis and attention to detail Creativity Goal and / or result orientation Customer orientation Flexibility and adaptability Stress tolerance Self-esteem and self-confidence Adaptability Keep up to date Working for goals Manage information Resourcefulness		

4	What's Innovation & Innovation Strategy?	To know the differences between social and technical innovation.	Definition of radical innovation, how new ideas born, personal creativity and innovation, the social and cultural context, Successes and failures in innovation, risk management (psychological, cognitive, financial), economic exploitation of innovation economic and socio-cultural aspects, Definition of incremental innovation, what are the continuous marginal improvements in the quality of existing products or in the efficiency of production processes.	Analysis Open-Mindedness Organization Communication Curiosity Problem solving Teamwork Leadership Imagination Analysis and attention to detail Creativity Goal and / or result orientation Customer orientation Flexibility and adaptability Stress tolerance Self-esteem and self-confidence Adaptability Keep up to date Working for goals Manage information Resourcefulness	-Capturing and preserving ideas when they come in mind in relation to innovation -Recognising failures and turn them into challenges in mind in relation to innovation -Be curious and experiment with the different skills you already have in mind in relation to innovation -Considering the surrounding environment to generate creative stimuli in mind in relation to innovation -Realising a clear sense of purpose -Be dynamic in different contexts	Multiple or blank choice, test - Online quizzes

	To know who the innovator is, and which sources of opportunities has for making innovation real.	How and who innovate, innovation as a process, sources of innovation and opportunities, commercialization and diffusion of innovations, manage Innovation				
5	Innovation and AM Technology	To know some case study around Europe of using innovation in the Additive manufacturing sectors related both with Habitat and Toolmaking fields.	Which are new opportunities thanks to the AM in terms of innovation both in toolmaking and Habitat sectors. Some relevant case studies to understand more in dept the differences. New forms of innovation lab: FabLab. New kind of technology related to AM sectors that produce innovation.	Analysis Open-Mindedness Organization Communication Curiosity Problem solving Teamwork Leadership Imagination Analysis and attention to detail Creativity Goal and / or result orientation Customer orientation Flexibility and adaptability Stress tolerance	-Analysing previous and current examples relating to AM manufacturing -Extending knowledge -Reinforcing what is known -Knowing how to search for new opportunities	Multiple or blank choice, test - Online quizzes

				Self-esteem and self-confidence Adaptability Keep up to date Working for goals Manage information Resourcefulness		
6	Creative and innovative techniques and methodologies	To know which kind of techniques or methodologies exist both in creativity and in innovation, and the relation and not between them.	Definition of methodology and definition of techniques. Differences and relation between them.	Analysis Open-Mindedness Organization Communication Curiosity Problem solving Teamwork Leadership Imagination Analysis and attention to detail Creativity Goal and / or result orientation Customer orientation Flexibility and adaptability Stress tolerance	-Understanding these two aspects in general and the relationship between them.	Multiple or blank choice, test - Online quizzes

				Self-esteem and self-confidence Adaptability Keep up to date Working for goals Manage information Resourcefulness		
7	Convergence and divergence techniques	To know what divergence techniques are and some example of them useful in the AM technology both in Habitat and Toolmaking sectors.	Definition of divergence techniques. Some example of them: attribute listing, biomimicry, brainwriting 6-3-5, challenge assumptions, Osborn checklist, classical brainstorming, excursion technique, Harvey Cards, imaginary brainstorming, lotus Blossom Technique, more Inspiration, personal Analogy, random Input, redefinition, reverse Brainstorming, SIT (Systematic Inventive Thinking) and Wishing.	Analysis Open-Mindedness Organization Communication Curiosity Problem solving Teamwork Leadership Imagination Analysis and attention to detail Creativity Goal and / or result orientation	-Be mentally open for new experience -Knowing 2 different ways of thinking -Using methods to select, order and re-arrange knowledge -Analysing opportunities for different sources of inspiration -Knowing and practicing non-conformist and unconventional ways of thinking	Multiple or blank choice, test - Online quizzes

	To know what convergence techniques are and some example of them useful in the AM technology both in Habitat and Toolmaking sectors.	Definition of convergence techniques. Some example of them: COCD-Box, enhancement checklist, force-field analysis, hundred-euro test, idea advocate, negative Selection, NUF (New Useful Feasible) test, PINC filter, six thinking hats and weighted selection.		Customer orientation Flexibility and adaptability Stress tolerance Self-esteem and self-confidence Adaptability Keep up to date Working for goals Manage information Resourcefulness		
8	Other methodologies and techniques	To know other useful techniques to generate creativity and innovation that can be useful in using AM technology in Habitat and Toolmaking sectors.	Design thinking, customer journey, creative conversation, human centered design, collaborative prototyping, remote cocreation tools / codesign around the world.	Analysis Open-Mindedness Organization Communication Curiosity Problem solving Teamwork Leadership Imagination Analysis and attention to detail	-Knowing different ways of thinking -Knowing how to innovation inspired by people -Identifying the knowns and unknowns via observation -Gaining a deeper insight into what customers want, need, and value, as well as what brings them joy	Multiple or blank choice, test - Online quizzes

				Creativity Goal and / or result orientation Customer orientation Flexibility and adaptability Stress tolerance Self-esteem and self-confidence Adaptability Keep up to date Working for goals Manage information Resourcefulness	-Knowing how to design a usability testing -Knowing how to observate the customer -Knowing how to organize insights through group -Knowing how to identify opportunities is the ability to discover strengths, weaknesses, and potentialities -Knowing how to develop insights and opportunity statements to act as a springboard for ideation -Knowing a general way of prototyping -Knowing to review and pitch the idea	

Module 2 – Transversal skills: Communication Skills and Competences

No. Unit	Title	Learning outcomes	The programme provides with… (knowledge)	The Programme prepares for… (Skills)	The Programme develops… (Competences)	Procedures and Criteria for Unit assessment
1	Introduction	Raising awareness about communicative competence	The learner knows a definition of communicative competence	The learner is able to distinguish between skills and competences	The learner develops and understanding of communication competence and skills and is able to describe own examples of typical professional communication situations	Questions for self-reflection Matching tasks
		Raising awareness about important communication skills	The learner knows the range of communication skills The learner knows the relation of communication skills to communicative competence			
		Raising awareness about typical professional communication situations	The learner knows some examples of successful and unsuccessful communication	Using the given examples, the learner is able to recall own communication examples and to reflect upon successful and unsuccessful communication aspects		
2	The whole process of communication	Awareness about communication happening always and everywhere	The learner gets to know that communication is happening even in situations where “no”	The learner develops an understanding for communication happening even in situations where “no” communication is	The learner identifies own professional communication situations and is able	Training activities with sample solutions and self-assessment questions

			communication is intended The learner gets to know what successful communication in the context of work means	intended and is able to conclude what that fact means for the context of professional communication	to reflect upon them analyses them	Mix and match tasks Multiple Choice Tasks
		Knowledge about encoding and decoding	The learner gets to know the theoretical model of encoding and decoding	The learner is able to describe exemplary communication situations with this concept	The learner is able to reflect on the concept and its meaning for potential misunderstandings	
		Knowledge about communication as interaction	The learner gets to know the different dimensions of communication as interaction: • Interaction • Feedback • Neutral wording • Active Listening • Neutral understanding • 'Flexible' messages Verifying assumptions	The learner is able to describe exemplary communication situations with this concept	The learner is able to apply the concept on own examples give a weighing-up of positive and negative experiences	
		Knowledge about Communication channels	The learner gets to know a choice of relevant communication channels • From direct conversation to media-mediated communication	The learner understands that is necessary to reflect on appropriate communication channels	The learner is able to select communication channels appropriate to the situation	

			• Dependence on technology What channel to use?			
		Knowledge about multimodality of communication	The learner gets to know the concept of multimodality of communication and its dimensions • Spoken versus Written Communication • Formal versus Informal • Synchronous versus Asynchronous • Recorded versus Unrecorded Benefits of Spoken Communication	The learner is able keep in mind the different aspects of communication modalities	The learner is able to balance the choice of different communication modalities according to the situation	
		Knowledge about nonverbal communication	The learner gets some information on selected aspects of the concept of nonverbal communication • Types of non-verbal communication (facial expressions, gestures, proximity, touch, eye contact, appearances) • Caution: the effect of nonverbal communication is very individual	The learner is aware that non-verbal communication is more difficult to interpret than popular literature claims The learner is able to apply recommendations for non-verbal communication aspects in e-mail communication	The learner develops an understanding attitude towards non-verbal aspects of communication and does not draw hasty conclusions when interpreting perceived communication signals	

			Non-verbal communication in computer-mediated communication (e-mails)			
		Application of the concepts	-	The learner is able to demonstrate his or her knowledge by labeling an illustrated communication model	The learner is able to explain the model to another person	
3	How to understand a message?	Knowledge about the “Four Sides of a message”	The learner gets an introduction into the Model “Four Sides of a message” by Friedemann Schulz von Thun	The learner understands the relevance of the model	The learner is able to analyze a message according to the model	Training activities with sample solutions and self-assessment questions Mix and match tasks Multiple Choice Tasks
		Awareness about preferred sending sides and preferred ears	The learner gets to know that different communication partners have individual styles of “sending” and “hearing” a message	The learner raises his/her awareness about different styles of hearing/sending messages	The learner is able to reflect upon own examples	
		Understanding the benefits of the model	The learner learns about the relevance of that model for professional communication situations	The learner becomes aware of the effect of a message and searches for the cause	The learner can carry out his/her analysis in a way that is appropriate to the situation (without exaggerating)	
		Application of the concepts	-	The learner applies the knowledge about the “Four Sides of a message” on a given example	The learner reflects upon given examples and develops own ideas	

4	Shaping Communication or Conversation Techniques	Awareness about the usefulness of techniques	The learner gets to know that communication techniques can promote business success	The learner understands how communication techniques contribute to an improved communication culture	The learner develops a constructive attitude towards communication techniques	Training activities with sample solutions and self-assessment questions Mix and match tasks Multiple Choice Tasks
		Knowledge about goal-oriented communication	The learner is informed about the importance of goal-oriented communication	The learner can find his/her own examples using the given examples	The learner is able to check given criteria for measuring success The learner is able to define a schedule for reaching goals	
		Awareness about reciprocity	The learner receives introductory knowledge about reciprocity in communication	The learner is able to examine given examples on reciprocity	The learner is able to pay attention to reciprocity in his/her own communications	
		Understanding the importance of first-person formulations	The learner gets to know the importance of first-person formulations and its dimensions	The learner is able to examine given examples first-person formulations	The learner is able to apply first-person formulations appropriately	
		Reflection upon the importance of feedback and knowledge of rules for feedback	The learner gets to know rules for feedback	The learner applies the rules on given examples	The learner reflects upon his/her own behavior with regard to giving and receiving feedback	
		Application of the concepts	-	The learner reflects upon communication examples with regard to goal-orientation, use	The learner reflects about open questions and develops own answers	

				of first-person message and feedback		
5	Presentation Skills	Knowledge about the communication dimensions of a presentation	The learner gets to know the application field of presentation as part of communication	The learner reflects about the application field of presentation	The learner is able to transfer the concept “Four sides of a message” to the application field of “presentation”	Training activities with sample solutions and self-assessment questions Mix and match tasks
		Reflection upon having a “set of slides” and/or “something to say”	The learner gets an insight into the critical discussion of presentation slides	The learner reflects on given examples	The learner is able to select the appropriate presentation medium for the particular situation and objective	
		Knowledge about how to visualize contents	The learner gets to know different possibilities of visualization • Images • Figures • Tables • Diagrams • Relations • Process	The learner can name the individual possibilities correctly	The learner is able to decide which content is suitable for which form of display	
		Knowledge about rules for a good layout of slides and handout	The learner gets to know rules for creating good slides and a good handout • Number of slides and files names • Manageable amount of information • Keywords instead of sentences	The learner can memorize the rules correctly	The learner is able to create own materials according to these rules	

			• Clear Structure • Font size • Thoughtful use of colour, font and characters • Using animations and sound correctly • Use of media			
6	Networking Skills	Knowledge about terms and relevance	The learner is learning about the definition of networking skills	The learner understands the relevance of networking	The learner develops a constructive attitude towards networking	Training activities with sample solutions and self-assessment questions Mix and match tasks
		Knowledge about methods to improve networking capabilities	The learners is introduced to several methods supporting networking: • 6-nodes model/ small world phenomenon • Pareto principle • Strokes balance and Transaction Analysis Techniques	The learner can understand the concepts on the basis of examples	The learner is able to find own examples and reflect about them	
		Reflection upon the advantages of networking capabilities	The learner gets to know the advantages of networking capability	The raises his/her awareness on networking	The learner deepens his/her constructive attitude towards networking	
		Application of the concepts		The learner is able to remember the concepts correctly	The learner is able to reflect on own examples	

Module 3 – Transversal skills: Project management techniques for continuous innovation through Additive Manufacturing

No. Unit	Title	Learning outcomes	The programme provides with… (knowledge)	The Programme prepares for… (Skills)	The Programme develops… (Competences)	Procedures and Criteria for Unit assessment
1	Project management – an introduction	Understand the role of project management and the importance of the project appraisal, planning and determining the feasibility of the project prior to implementation. Specifically, to be able to identify these elements in the habitat and toolmaking sectors	Define and analyse Project management techniques as a way to introduce innovation in companies	Understand the importance of Project Management to know the relevant environment	Analyse how to establish needs and establish customer requirements	Multiple or blank choice, test - Online quizzes
			Get closer to the reality of project management through readings and current cases	Identify the critical points of all the phases of its life cycle	Being able to work in situations of maximum pressure due to deviations in terms, cost and quality	
			Learn the procedures, techniques and tools necessary to work in a project management environment	Implement general business concepts, practices, and tools to facilitate project success	Practise the concept of success in project management and the criteria for achieving it	

2	The project manager	Understand the importance of Project Management, who is designated as the Project Manager and what qualifications they should have	Appraise the role of project management in organization change	Align the project to the organization's strategic plans and business justification throughout its lifecycle	Develop confidence and self-confidence, resilience and work capacity based on teamwork and an open and flexible mind	Multiple or blank choice, test - Online quizzes
			Apply project management practices to the launch of new programs, initiatives, products, services, and events relative to the needs of stakeholders	Utilize technology tools for communication, collaboration, information management, and decision support	Interact with team and stakeholders in a professional manner, respecting differences, to ensure a collaborative project environment	
3	Project management lifecycle	Apply the Project Cycle structure and analysis to a Habitat or Toolmaking project	Define the project objectives and the scope of Work	Know the most common techniques and tools to plan and control project deadlines and resource	Manage the supplies necessary for the development of the project	Multiple or blank choice, test - Online quizzes
			Describe the life cycle of a project, the characteristics and the basic agents involved in it	Manage the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders	Identify project goals, constraints, deliverables, performance criteria, control needs and resource requirements	

					in consultation with stakeholders	
			Apply project management practices to launch of new programs, initiatives, products, services and events relative to the needs of stakeholders	Adapt projects in response to issues that arise internally and externally	Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success	
4	Online tools for project management	Provide the necessary relationship between the design and management of projects and their contextualization in a technological and social field marked by an incipient need for telework	Know different Project Management tools	Learn how to use and manage different tools successfully to achieve objectives	Utilize technology tools for communication, collaboration, information management and decision support	Multiple or blank choice, test - Online quizzes
			Apply social technologies and media tools	Perform Virtual collaboration	Prepare for Interconnectivity and online teamwork	
5	Information management strategies for project management	Introduction to the methodology and tools of Watch and Competitive Intelligence and its usefulness for	Control the strategic intelligence tools and methods	Operate information management and transfer	Challenge the typologies of modern sources of information: patents, databases.	Multiple or blank choice, test - Online quizzes

		managing innovation and projects through information	Define Watch in general and Technology Watch and Competitive Intelligence according to the UNE 166000 standard	Adapt the main components of the process of acquiring and processing information about the company's competitive environment	Be aware of the applications of the Watch/Intelligence form real cases and studies developed in habitat or toolmaking industries	
6	Strategic Intelligence and Technological Watch systems and tools	Basic and advanced techniques for the identification, systematic collection and analysis of critical information of the environment in order to achieve the development and innovation of existing products or processes to diversify towards new products or markets and make strategic business decisions	Learn about the data and text mining and its role in the Watch / Intelligence process	Define and characterise the function of intelligence in the company	Perform the basic and advanced techniques that allow defining and anticipating the events of the competitive environment, critical for the success of the company	Multiple or blank choice, test - Online quizzes
			Learn the Technology Watch Systems and Competitive Intelligence usefulness as an essential aspect for continuous innovation	Learn the method to respond correctly to strategic, business and operational intelligence requests from decision makers	Follow the methodology for its implementation in an organisation.	

Module 4 – Transversal skills: Business model innovation

No. Unit	Title	Learning outcomes	The programme provides with… (knowledge)	The Programme prepares for… (Skills)	The Programme develops… (Competences)	Procedures and Criteria for Unit assessment
1	Business Model Innovation Process	Understand basic concepts on business model innovation and its connections with current mainstream entrepreneurial methods to be able to recognize general types of innovation and develop the appropriate mindset to manage the process of business model innovation.	Business model definition, the process of creating business models	Know diverse interpretations and definitions of business models in different application contexts.	Determine when it is necessary to define the business model behind a certain activity or project.	Multiple choice or blank choice tests, and/or online tests.
			Business model innovation methodology, main categories of business model innovation	Identify the main steps for business model innovation and classify major types of innovation.	Learn a systematic approach to apply different categories of innovation around new business ideas.	
			Skills and mindset for business model innovation, connections with lean start-up and customer development practices	Understand basic concepts of entrepreneurial methods when moving to business model innovation.	Develop self-confidence and a new entrepreneurial mindset to manage the process of business model innovation in the current context.	
2	Business Discovery	Use specific methods and tools to formulate business challenges, scan the environment and depict a business model to support the	Purpose definition, design challenges, SMART objectives	Identify and formulate main business challenges and goals in a creative and clear manner.	Find opportunities for design and set empathy with other collaborators around a common rationale.	Multiple choice or blank choice tests, and/or online tests.

		design of innovation and set a common ground with collaborators around the same purpose.	Scanning the environment, resource identification, trends watch	Conceptualizing the environment of a business model.	Scan the environment to identify possible opportunities, existing key players and available resources to be employed in a project.	
			Business model mechanics, business model tools	Understand the importance of having a shared language around the business model definition and using tools to depict business models.	Learn to map the business model behind any project or product using global standard business model tools.	
3	Impact Assessment	Gain a deeper understanding of demand-side, societal and environmental dynamics of business to internalize people-centered and sustainable perspectives when creating impact by using business model innovation.	Human-centered design, user problem exploration, user requirements	Use different approaches to gain a deeper understanding of target customers and end-users.	Develop a customer-centric view to uncover existing gaps as an essential way to foster business model innovation.	Multiple choice or blank choice tests, and/or online tests.
			Social and environmental impact, sustainability factors	Understand practical pathways to recognize society and environmental aspects impacting a project.	Leverage social and environmental factors to enable new sources of innovation in	

					business models for habitat sector.	
4	Generation of New Business Options / Solutions	Learn to evaluate different business options and align reasoning skills with business model mapping to spread collaboration and raise interest around a project, product or activity.	Solution fit, value proposition design, co-creation	Map ideas and try out different potential business scenarios.	Ideate multiple business models and evaluate collaboratively the viability of each model to manage a portfolio of business ideas around the same product.	Multiple choice or blank choice tests, and/or online tests.
			Entrepreneurial communication, creative elevator pitch	Align the project communication to the logical structure of a business model.	Being able to improve the narrative and spark the interest in a project, idea or product.	
			Network based business models	Use alternative business model visualization tools according to the collaborative nature of business.	Change the focus of business modeling and communication to highlight specific attributes or get different perspectives of the business model.	

5	Learning and Validation	Understand the importance of business model validation and experimentation to reduce the risk of failure and increase impact based on evidences.	Market fit, experimentation process, prototypes	Generate experiments as a source of continuous innovation for business model novelty and impact.	Test new business ideas systematically to reduce the risk of failure, engage stakeholders, promote collective learning and refine business model based on feedback.	Multiple choice or blank choice tests, and/or online tests.
			Key performance indicators, business model metrics	Define indicators and metrics aligned to overarching goals to increase the business model efficiency.	Measure progress in de-risking new business ideas with innovation metrics.	
6	Tactics for a Sustainable Growth	Learn to explore and discover useful business model patterns in the habitat sector to keep a business model updated, competitive, and sustainable.	Tactics, business model patterns	Understand repeatable business tactics that strengthen sustainability and scalability of business models in the habitat sector.	Update and change the business model to create better, more resilient solutions according to day to day business and growth needs.	Multiple choice or blank choice tests, and/or online tests.