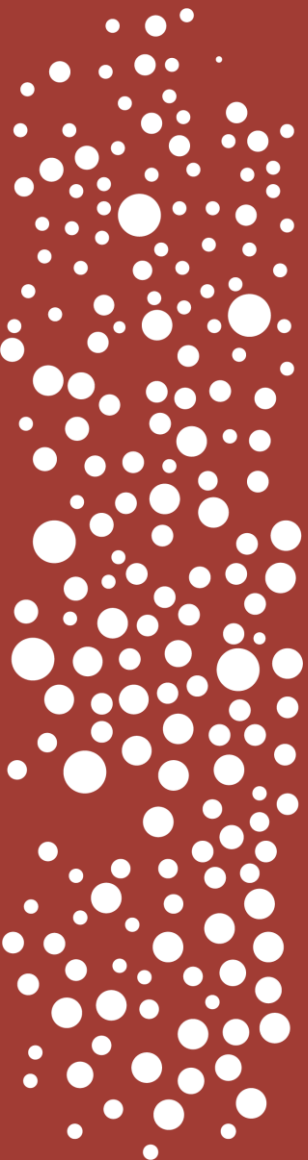# intride

D4.2
Definition of training methodologies and tools

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PARTNERS:

UNIVERSITÀ DEGLI STUDI FIRENZE

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UNIVERSITY OF ART AND DESIGN CLUJ-NAPOCA

WSB University

TRANSYLVANIAN FURNITURE CLUSTER

zamek cieszyn

dID
distretto
INTERNI DESIGN

D4.2 DEFINITION OF TRAINING METHODOLOGY AND TOOLS

Deliverable Number	D4.2
Deliverable Title	Definition of training methodology and tools
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Work Package	WP4
Work Package Leader	DIDA
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Acronym	INTRIDE
Title	Soft, Digital and Green Skills for Smart Designers: Designers as Innovative TRIggers for SMEs in the manufacturing sector
Programme	Erasmus+
Strand	Knowledge Alliances
Starting date	01/01/2020
Duration	36 months

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Module 1 – Design and Sustainability
METHODOLOGY AND TOOLS

Learning Module (partner country)	**DIDA - UNIFI**
Title of the Learning Module	**Design and Sustainability** Postgraduate 1 - Module 1
Learning Module and Units Description (including: main contents, key skills, addressed target groups, elements of innovation of the topics addressed)	Units and main contents • ***Design between digital and green transformation: the green perspective*** (8 hours, frontal lessons combined with case studies) Key contents: introduction to the main meanings of digital and green transformation, with reference to the recent European guidelines. Particular attention to the green perspective with an overview of the connected issues. Principles of design-driven innovation approach in relation to the complexity and issues of the 5.0 scenario. Emerging trends and topics concerning digital and green transformation, with specific focus on a new green perspective. • ***Systemic design for innovative ecosystems*** (8 hours, frontal lessons combined with case studies) Key contents: principles of strategic design methodologies and tools in relation to creativity (creative thinking approach). • ***Strategic design and creativity*** (8 hours, frontal lessons combined with case studies) Key contents: principles of system thinking and systemic design methodologies and tools, in order to collaborate in innovative ecosystems. • ***Sustainability for manufacturing sector companies***

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(8 hours, frontal lessons combined with case studies)

Key contents: principles of design for sustainability (environmental, socio-cultural, economic) and case studies concerning methods and tools applied.

- **Collaborative networks: Design as catalyst agent**
  (8 hours, frontal lessons combined with case studies)
  Key contents: principles of project management methods and tools in relation to collaborative networks (link with territories and communities, local productive systems, etc.).

- **Design thinking for social innovation**
  (8 hours, frontal lessons combined with case studies)
  Key contents: principles of design sustainability (environmental, socio-cultural, economic) and case studies concerning methods and tools applied.

- **Final workshop "Design&Sustainability. Experiments and Practices"**
  (16 hours, practical workshops)
  Key Contents: full immersion in the theoretical contributions addressed in the previous learning units, together with more intensive insights into the practical laboratory activity.

Key skills

Soft: strategic planning, communication, innovation, teamwork, creativity, adaptability/flexibility, leadership, ethics, responsibility, crisis management.

Digital: social media, data literacy, digital marketing, networking & IT systems

Green: consumption reduction, sustainable product management,

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resource management, circular economy, social responsibility, environmental awareness

Target groups

Design students, Design postgraduate students, SMEs employees, Cluster professionals

Elements of Innovation

Considering the presence of very few master programs that include the integration of soft, digital and green skills, it emerges that INTRIDE JMD programme has several innovative elements in terms of contents addressed, methodologies and tools, learning outcomes and outputs.

Specifically, this learning module aims to provide innovative elements on the interconnection between Design and Sustainability, addressing all the main topics related (SDGs, circular design approach, restorative design approach, etc.).

| **Learning Module and Units Methodology**

 (*indicate which learning methods will be used, whether in participatory form or through individual work, any disciplinary approaches followed, etc.*) | The module is structured into 6 theoretical units + final workshops, for a total of 64 hours (48 hours between frontal lessons, case studies and presentation + 16 hours of practical work).

 The learning module and units' methodology is based on an alternation between theoretical lessons and short practical workshops, possibly involving some stakeholders above all companies connected with INTRIDE project.

 The structure will consist in frontal lessons mixed with focus groups and teamwork, specially when presenting case studies. Participants will be actively involved in order to |

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develop a direct approach with good practices examples presented during the learning units.

Going into more detail, the methodological overview presents:

- **design-driven approach** (strategy-development tools, etc.);
- **codesign and participative approach** (participatory tools, collaborative design framework, probes, etc.) will be used.
- **strategic design process** for business innovation
- **systemic design approach** with methods and tools for supply chain management, SME's competitiveness, etc.
- **design thinking process** (Double-Diamond framework, design process diagrams, etc.)

Participants will also be taught how important it is to "manipulate" methods and tools according to the reference design context (including target groups, main objectives and goals, design challenges, etc.)

Media(s) (indicate the tools that will be used, whether physical or virtual, etc.)	To develop this methodology, there will be utilized innovative interdisciplinary tools such as: - short workshops among students, entrepreneurs and business people - work-based learning - collaborative learning tools (e.g. collaborative design framework) - desk analysis (e.g. State of the art mapping) - field analysis (interviews, surveys, etc.) - data collecting and analyzing tools - interactive digital tools, such as Google Jamboard, MIRO, etc.
Activity Leading Organisation	DIDA-UNIFI With support from DID (cluster partner)
Expected Learning Outputs	• Interdisciplinary tools/competencies for the designer, useful to activate a design-driven innovation mindset in order to work in collaborative contexts

	• Toolbox (i.e. skills map, networking map, scenarios, mapping and storytelling tools) • Contacts and experiences with the business world of SMEs of the manufacturing sector (data base)
Learning Module Duration	8 ECTS Total (7 weeks) 1 ECTS = (8 hours Class Work) + (17 Hours Autonomous Work) 64 Academic Hours 6 (1ECTS Units) + 1 (2ECTS Final Workshop)

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Module 2 – Economics, business model and circular economy
METHODOLOGY AND TOOLS

Learning Module (partner country)	**WSB**
Title of the Learning Module	**Economics, business model and circular economy** Postgraduate 1 - Module 2
Learning Module and Units Description (including: main contents, key skills, addressed target groups, elements of innovation of the topics addressed)	<u>Units and main contents</u> • ***Circular Economy*** (8 hours, frontal lessons combined with case studies) <u>Key contents:</u> The course on Circular Economy is concentrated on state-of-the-arts solutions related to extension of life of products by introduction of sustainable sourcing. During the course the students will get theoretical background in management of reverse supply chains and the rationale for development of closed-loop economy. In the practical part the students will be required to prepare bill of materials or similar design documentation for products invented by them, with the condition that the materials used for its manufacturing should be supplied from reverse or sustainable sources. • ***Sustainable Logistics*** 8 hours, frontal lessons combined with case studies) <u>Key contents:</u> The objective of the course is to familiarize the students with the basics of logistics and the concepts of forward and reverse logistics, as well as managing and improving of performance of respective supply chains. • ***Heuristic methods*** (8 hours, frontal lessons combined with case studies) <u>Key contents:</u> The course of heuristic methods is designed for students who

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want and need to increase their creativity and innovations. It will allow students to familiarize themselves with the general outline of example heuristics methods. During course they will get theoretical knowledge about specific methods and later they will do some practical exercises connected with those methods (they will solve example problems and will search for innovative solutions of those problems using heuristic methods). It will allow them to apply those methods during later activities connected with design and manufacturing. Example methods given during course: brainstorm, superposition method, 635 method etc.

- ***Strategic partnerships and alliances in creative industries***
(8 hours, frontal lessons combined with case studies)
<u>Key contents:</u> The first part of the course will be devoted to recognition of the sense of collaboration in general, especially networking, in the frame of design issues in connection with common learning process and problem solving.
Creative industries will be introduced as a branch where various types of formal and informal relations could be used as a very efficient tool to extend the business relations, strengthen the competitive position, increase the margin profit and improve the brand recognition.
The goal of this course stage is to recognize the specific features of various types of collaboration and to learn how to create / develop them and how to join them.

- ***Service design as a tool for innovations***
(8 hours, frontal lessons combined with case studies)

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Key contents: The workshop will be dedicated to ways of facing the challenges connected to the service design and implementation. The course will get an overview on the most important methods and tools of customer experience innovation. It will be focused on the issues connected to the ways of effective improvements of public and business services. Service design tools will be introduced. Students will practice the real process in the city life, they will work with citizens and local entrepreneurs. They will learn to use rapid ethnography, service safari and observations in order to discover the needs of the users. During the two days long workshop students will be provided with theoretical knowledge about the role and stages of service design process and they will practice team work, co-creation and prototyping to find the best solutions for the discovered people's needs. The workshop applies to the skills which should be possessed by the smart designers and innovation leaders in the upcoming era of Industry 5.0.

- ***Innovations by design. Design management in business***
(8 hours, frontal lessons combined with case studies)
Key contents: The course will be focused on the issues connected to the role of design in the business organization. Design will be introduced as a tool for business development and creation of not only products, but services, customer's experiences and company's branding. Students will learn how to adopt management and design perspectives to lead innovation as a design manager. During the course students will be provided with theoretical knowledge about implementation of

design at different levels of organization: operational, tactical and strategic. They will do some practical exercises and work on the real life examples in order to solve the company's challenges with the use of design. They will practice design thinking method which will allow them to cooperate with both designers and end users in their future professional life. The course is designed for students who will act as smart designer and innovation leaders in the upcoming era of Industry 5.0.

- **Final workshop *"Service design as a tool for innovation"***
  (16 hours, practical workshop)
  <u>Key contents:</u> Students will get familiar with the process of designing services. They will practice the process in the real life of the city and with its citizens and entrepreneurs.

<u>Key skills</u>

<u>Soft:</u> strategic planning, communication, innovation, teamwork, creativity, flexibility, responsibility, crisis management, positive attitude

<u>Digital:</u> digital marketing

<u>Green:</u> sustainable product management, resource management, circular economy, social responsibility, environmental awareness

<u>Target groups</u>

Design students, SMEs employees, Cluster professionals

<u>Elements of Innovation</u>

Considering the presence of very few master programs that include the integration of soft, digital and green skills,

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it emerges that INTRIDE JMD programme has several innovative elements in terms of contents addressed, methodologies and tools, learning outcomes and outputs.

Specifically, this learning module aims to provide innovative elements on the interconnection between economics, business model and circular economy addressing all the main topics related.

Learning Module and Units Methodology *(indicate which learning methods will be used, whether in participatory form or through individual work, any disciplinary approaches followed, etc.)*	<u>Circular Economy</u> Practical and activating methods (ex. situational method) will be applied, in the form of individual exercises as well as group work on specific examples prepared in advance (ex. Case studies etc.), which will be preceded by a short presentation lecture with an explanation. <u>Sustainable Logistics</u> As the result of own work the students will be obliged to deliver a concept (design) or case study of practice related to forward and reverse supply chains in selected organisation, including preparation of potential material requirements for redesigned products utilizing refabricated or recycled materials. <u>Heuristic methods</u> Practical and activating methods (ex. situational method) will be applied, in the form of individual exercises as well as group work on specific examples prepared in advance (ex. Case studies etc.), which will be preceded by a short presentation lecture with an explanation <u>Strategic partnerships and alliances in creative industries</u> Lectures with presentation of best practices will be used. Case studies based learning will be applied. Participatory workshop elements including team work will be conducted.

	Student individual work will be implemented based on the materials will be gathered on the e-learning platform. Individual preparation, literature studies will be also recommended.
	<u>Service design as a tool for innovations</u> Practice based learning will be applied. Lecture with presentation of service design method, it's stages and tools will be used. Students will work on specific case important for Cieszyn city citizens, prepared in advance. They will create teams and use participatory methods to find the best service solutions. Individual work and preparation, literature studies will be also applied. <u>Innovations by design. Design management in business</u> Practice-based learning will be applied. Lecture with presentation of best practices and participatory workshop elements including teamwork will be used. Students will work on specific case studies prepared in advance, their work will be based on the design thinking methodology. Individual work and preparation, literature studies will be also applied.
Media(s) (indicate the tools that will be used, whether physical or virtual, etc.)	To develop this methodology, there will be utilized innovative interdisciplinary tools such as: - multimedia presentation - flipchart - post-it notes - digital common working environment - cloud - sheets of paper - blackboard - films and movie references - different prototyping tools
Activity Leading Organisation	WSB With support from ZC (cluster partner)

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Expected Learning Outputs	The expected learning outputs will concern the composition of conceptual mock-ups, methodological kits and scenario/context mapping tools related to the following learning outcomes of each unit:

Circular Economy
Increase of knowledge and awareness concerning sustainable sourcing and reverse logistics. Ability to prepare bills of materials comprising sustainable, used and recycled materials.

Sustainable Logistics
Knowledge about Sustainable Logistics and they role in economy and business strategic and skills related with this activities

Heuristic methods
Raising knowledge about heuristic methods. Increasing creativity and unconventional thinking among participants. Ability to create or propose solutions for given or found problem/task, also not obvious solutions.

Strategic partnerships and alliances in creative industries
The learning output is the increase of knowledge about the role of collaboration for organizations involved in the creative industries and the awareness of the various types of collaboration, as well as their advantages and disadvantages.
The students will get familiar with the practical ways of the collaboration designing and extending.
The students will train the soft skills: team working, creativity, communication, problem solving, leadership, flexibility etc.

Service design as a tool for innovations
The learning output of the workshop is the increase of knowledge about the role of service design in organizations, both in business and in public administration. The important output is

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the increase of the ability of team work and participation of end users in finding the tailored solutions. Also increase of awareness about role of design in the social life will increase. Students will practice the ability of service design tools use.

Innovations by design. Design management in business
The learning output is the increase of knowledge about the role of design in organizations and in creation of innovations. Also increase of awareness of the modern trends in planning company's development is expected. Students will get familiar with the practical ways of implementing design methods in company's activity. Ability to use methods and tools of cooperation with designers and end users will increase.

Learning Module Duration	8 ECTS Total (7 weeks)
	1 ECTS = (8 hours Class Work) + (17 Hours Autonomous Work)
	64 Academic Hours
	6 (1ECTS Units) + 1 (2ECTS Final Workshop)

Module 3 – Product & Service Design
METHODOLOGY AND TOOLS

Learning Module (partner country)	**ELISAVA**
Title of the Learning Module	**Product & Service Design** Postgraduate 1 - Module 3
Learning Module and Units Description (including: main contents, key skills, addressed target groups, elements of innovation of the topics addressed)	This learning module is focused on understanding the current and future contexts and challenges of the Product&Services Industry, with a focus on new materials, emerging contexts, trends and possible design outcomes. Units and main contents • ***Service & Product Design: Future Sustainable Trends Research & Analysis*** (8 hours, frontal lessons combined with case studies) Key contents: What is product & service design? Future trends analysis with a focus on sustainability. • ***Design & Creative Methods II*** (8 hours, frontal lessons combined with case studies) Key contents: What is an advanced design method? Build Applied Design toolkits; Research methods; Generative methods; Validation methods. • ***Design Stage: New Paradigms for Creative Processes & New Trends in Project Culture*** (8 hours, frontal lessons combined with case studies) Key contents: New paradigms for research and creative processes; Additive Manufacturing Possibilities and Limitations; Applied design praxis and Project culture. • ***Product & Service Systems*** (8 hours, frontal lessons combined with case studies)

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Key contents: What is a product-service system strategy? Contextual analysis regarding innovation as a process and sustainability as a strategy.

- ***Technology as a Strategic force for Change: New Materials, Paradigms, Manufacturing Methods & Artisans***
  (8 hours, frontal lessons combined with case studies)
  Key contents: New technologies and materials for sustainability; New paradigms & manufacturing methods; New artisans.

- ***Design Stage: New Strategies for Products & Services***
  (8 hours, frontal lessons combined with case studies)
  Key contents: Future Creative strategies; Applied design methods for developing sustainable Products & Services; Future Materials & Technologies.

- **Final workshop *"Product & Service Design Praxis. Applied Design & Strategic Challenge"***
  (16 hours, practical workshops)
  Key contents: Applied Methods, Materials, Technologies and new paradigms for creative approaches on Project Culture; Interaction with real industry contexts

Key skills

Soft: Time management, strategic planning, communication, innovation, teamwork, creativity, adaptability / flexibility, leadership, self-management, responsibility, aesthetic sensibility, critical thinking

Green: social responsibility, sustainable product development advanced / eco

materials, environmental awareness, ecological sensitivity

Target Groups:

Students
Designers / Professionals
Employees of the Furniture / Living Manufacturing Sector

Elements of innovation

The learning module aims to provide innovative elements on the interconnection between Product and Service Design, addressing all the main topics related. This is done by studying the relationships between the two disciplines within Design in terms of correlated methods, tools and media; then putting it into practice with reference to the trends of the contemporary scenario.

| **Learning Module and Units Methodology**

(*indicate which learning methods will be used, whether in participatory form or through individual work, any disciplinary approaches followed, etc.*) | Frontal lessons
Students will attend to tailored theoretical lectures where the key topics of each module will be addressed by the relevant teaching staff.

Case study
Students will be asked to perform in-depth analysis of relevant source materials, bibliography and specific instances or projects relevant to the topics of the module, provided to them by the teachers. Individual or group work will be set depending on the Unit.

Discussion/Forums
Students will be asked to prepare arguments and actively participate in debates stemming from the topics given in the lessons and case studies. Individual or group work will be set depending on the Unit. |

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	Guided Demonstrations / Workshops Students will participate in active demonstrations, such a specific use of machinery, hardware or software in order to replicate it and achieve certain results. Individual or group work will be set depending on the Unit. Stakeholders such as SME's, Clusters and Technological Centres will also be involved. Specific Design methods: industrial product design, creative thinking, visualization, Design methods, User centered Design, modelling, market research.
Media(s) (indicate the tools that will be used, whether physical or virtual, etc.)	Physical: Work-Based Learning Basic Design/Prototyping Tools and Materials 3D Machinery & Special Equipment Specific Software Research and Knowledge Sharing Platforms Digital Learning Platforms: Microsoft Teams Virtual Campus Interactive Digital Tools (ie Miro) INTRIDE community platform
Activity Leading Organisation	ELISAVA With support from CENFIM (cluster partner)
Expected Learning Outputs	Product & Service Design ToolKit - Design Methods Contacts & Networking from subject Matters Experts, SME's, Clusters and Technological Centres.
Learning Module Duration	8 ECTS Total (7 weeks) 1 ECTS = (8 hours Class Work) + (17 Hours Autonomous Work) 64 Academic Hours 6 (1ECTS Units) + 1 (2ECTS Final Workshop)

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Module 4 – Creative explorations of traditional and digital techniques for product design
METHODOLOGY AND TOOLS

Learning Module (partner country)	**CLUJ - NAPOCA**
Title of the Learning Module	**Creative explorations of traditional and digital techniques for product design** Postgraduate 2 - Module 1
Learning Module and Units Description (including: main contents, key skills, addressed target groups, elements of innovation of the topics addressed)	Units and main contents: • ***Design between digital and green transformation: the digital perspective*** (8 hours, frontal lessons combined with case studies) Key contents: introduction to the main meanings of digital and green transformation, with reference to the recent European guidelines. Particular attention to the digital perspective with an overview of the connected issues. Art and technology linked and integrated continuously in design projects development, furniture industry between traditional and digital technologies; fine arts and furniture design intersection with digital tools and processes. Emerging trends and topics concerning digital and green transformation, with specific focus on a new digital perspective. • ***New computational tools and infrastructures which could be introduced into "traditional" processes of artistic and craft-based production*** (8 hours, frontal lessons combined with case studies) Key contents: artistic techniques for product design and technology available at the time of the creation process; systemic methodology of approaching the product design.

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- ***The dynamics of integration of new technological systems and practices into craft and creative design***
(8 hours, frontal lessons combined with case studies)
<u>Key contents</u>: art forms for broader approaches in the field of craft and design.

- ***Digital technologies impact into artistic design***
(8 hours, frontal lessons combined with case studies)
<u>Key contents</u>: digital revolution in product design and manufacturing; design ideas adaptation to production technologies in order to release all potential of new modern technologies.

- ***Innovative thinking through digital media in the field of product design***
(8 hours, frontal lessons combined with case studies)
<u>Key contents</u>: design and digital media; efficiency and comprehensiveness in product design.

- ***Optimal ideas and practically applied ideas for finding the best solutions in the field of product design using accessible technologies***
(8 hours, frontal lessons combined with case studies)
<u>Key contents:</u> meaningful ways of using technologies in the field of product design; managing digital assets in the field of product design.

- **Final workshop *"Furniture design for quality and sustainability"***
(16 hours, practical workshop)
<u>Key contents</u>: Introduction to product testing and certification processes based on valid standards and regulations; On-

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site tests of furniture; Introduction to life cycle analysis based on the SimaPro software; Modeling and analyzing product life cycles, determination of environmental impact of products; Introduction to rapid prototyping; On-site 3D printing of models, parts or full-scale prototypes.

Key skills:

Soft: communication, strategic planning, teamwork, creativity

Digital: networks and IT systems, social media

Green: sustainable product development

Elements of innovation:

Considering the presence of very few master programs that include the integration of soft, digital and green skills, it emerges that INTRIDE JMD programme has several innovative elements in terms of contents addressed, methodologies and tools, learning outcomes and outputs.

Specifically, this learning module aims to provide innovative elements on:
- making intersemiotic connections between design and other fields: visual arts, geology, mathematics, psychophysiology, environmental sciences
- regarding the history of the Design of objects (form and function), the aim is to promote and develop the search for interconnections between the past repertoire and the contemporary scenario.

Learning Module and Units Methodology *(indicate which learning methods will be used, whether in participatory form or through individual work, any disciplinary approaches followed, etc.)*	<u>Methodology for unit 1 till unit 6:</u> lectures based on presentation on computer, individual exercises under supervision, conversation, using the resources, critical analysis of the students' exercises. Presentations offer the students the visual documentary material and the practical experience of analytical review of the main concepts and ideas within the learning unit. The student's personal investigations are aiming at improving the systemic methodology of approaching the product design (independent exercises outside the classroom). Corrections are vital for the design proposition's development, evaluating the quality and the efficiency of the student's work, the capacity to study and monitoring the projects' objectives and results. Monitoring the results is made by critical individual and group analysis, the compatibility between the concept and the practical solutions, consulting the professors who teach correlated disciplines. <u>Methodology for the final workshop</u>: workshop organized for validation of the knowledge and abilities provided by the learning units.
Media(s) (indicate the tools that will be used, whether physical or virtual, etc.)	Physical tools and media: - research on bibliographic references - computer - desk analysis and research softwares (ie Mandalay, etc.) - Adobe Creative Suite (Illustrator, Photoshop) - Drawing traditional tools + digital tools
Activity Leading Organisation	CLUJ-NAPOCA With support from TFC (cluster partner)
Expected Learning Outputs	The expected outputs will concern the composition of conceptual mock-ups, methodological kits and scenario mapping tools related to the following outcomes: • Use of specific elements related to visual language's grammar, syntaxis and semiotics.

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	• Use of certain specialized visual analysis methods, within digital media context, connected to the field of product design. • Defining the paradigm and the methodologies connected with the theoretical-experimental research in the field of the visual arts (frameworks, design models, etc.). • Adapting the language and the communication means to digital media (specific tools). • Analysis, synthesis and interpretation of data and information from the professional context.
Learning Module Duration	8 ECTS Total (7 weeks) 1 ECTS = (8 hours Class Work) + (17 Hours Autonomous Work) 64 Academic Hours 6 (1ECTS Units) + 1 (2ECTS Final Workshop)

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Module 5 – IoT, cloud computing and cyber physical systems
METHODOLOGY AND TOOLS

Learning Module (partner country)	**DIEF-UNIFI**
Title of the Learning Module	**IoT, cloud computing and cyber physical systems** Postgraduate 2 - Module 2
Learning Module and Units Description (including: main contents, key skills, addressed target groups, elements of innovation of the topics addressed)	This module aims to provide basic knowledge and methodology for the design and implementation of advanced technological solutions for digital transformation in innovative industrial applications. It will present the main fundamental topics related to the description of embedded systems, IoT and Cloud architecture, Cyber Physical System, Artificial intelligence and Digital Communication and marketing. Units and main contents • ***Internet of Things*** (8 hours, frontal lessons combined with case studies) Key contents: Internet of Things (IoT) overview and fundamental concepts; IoT framework and applications; Sensors and actuators; Embedded systems; Networking protocols; Security and privacy; Domains and Connected Ecosystems; Blockchain in IoT; Standards and interoperability. • ***Cloud Technologies and architectures*** (8 hours, frontal lessons combined with case studies) Key contents: Definition of cloud computing and concepts; Virtualization and containers; Main properties and features of Cloud based system; IoT Services Platform, functions and requirements; Integration of IoT with Cloud Computing. • ***Fundamentals and vision of Artificial Intelligence***

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(8 hours, frontal lessons combined with case studies)

Key contents: Introduction to AI and short history; Machine learning techniques; Data mining; Statistical pattern recognition.

- ***Cyber Physical Systems***
(8 hours, frontal lessons combined with case studies)
Key contents: Cyber Physical System overview and fundamental concepts; Application in Industry 5.0; Advanced robotic capabilities; internet of robotic things; robot development in ROS.

- ***Designing in the IoT scenario***
(8 hours, frontal lessons combined with case studies)
Key contents: What are the actors involved in the IoT scenario? And what is the contribution of the discipline of Design and, consequently, the role of the designer? State of the art of theories, experiences, practices on product/service design linked to the reference scenario.

- ***Digital communication and digital marketing***
(8 hours, frontal lessons combined with case studies)
Key contents: business strategies; digital techniques; social media metrics; digital and multichannel communication; brand Manager; organization and promotion of events; Communication Design; Basic elements of marketing.

- **Final workshop *"Digital sense for Design"***
(16 hours, practical workshops)
Key Contents: Practical experiences in creating applications with sensors and connected devices using Arm

microcontroller and communication modules.

Key skills

Soft: Strategic planning, communication, innovation

Digital: E-commerce; social media; digital marketing; Networking & IT systems; Cybersecurity; Data literacy

Target groups

Design students, SMEs employees, Cluster professionals

Elements of Innovation

Considering the presence of very few master programs that include the integration of soft, digital and green skills, it emerges that INTRIDE JMD programme has several innovative elements in terms of contents addressed, methodologies and tools, learning outcomes and outputs.

Specifically, this learning module provides a comprehensive vision and approach to digital transformation with a real design and developmental learning process that makes attendees more focused in the contents.
It makes participants understanding the convergence of digital technologies for standardize processes and make interoperable solutions.

Learning Module and Units Methodology *(indicate which learning methods will be used, whether in participatory form or through individual*	The module is structured into 6 theoretical units + final workshops, for a total of 64 hours (48 hours between frontal lessons, case studies and presentation + 16 hours of practical work). The learning module and units' methodology is based on an alternation between theoretical lessons and short practical workshops, possibly

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work, any disciplinary approaches followed, etc.)	involving some stakeholders above all companies connected with INTRIDE project.

The structure will consist in frontal lessons mixed with focus groups and teamwork, specially when presenting case studies. Always involving participants to develop a direct approach with good practices examples presented during the learning units.

The final workshop will provide practical basic competencies to program devices based on microcontroller and create IoT-like applications for digital sensing. |
| **Media(s)**

(indicate the tools that will be used, whether physical or virtual, etc.) | Participants will be provided with lecture slides and additional in-depth information worksheets in all units. Slides could include video.
In unit seventh, participants will be provided with embedded system boards and a free platform for implementing solutions of digital sensing. In case of online lessons, instead of embedded system boards, it will be used appropriate simulators of the boards. |
| **Activity Leading Organisation** | DIEF-UNIFI
With support from DiD (cluster partner) |
| **Expected Learning Outputs** | • The expected learning outputs will concern the composition of small prototypes, working samples and demos and / or conceptual mock-ups concerning the following learning outcomes:
• Understand the main concepts of digital transformation, the methods and implications
• Describe the key components and functions of complex systems for industry 4.0
• Identify different system architectures with standardization and interoperability aspects
• |
| **Learning Module Duration** | 8 ECTS Total (7 weeks)

1 ECTS = (8 hours Class Work) + (17 Hours Autonomous Work) |

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64 Academic Hours

6 (1ECTS Units) + 1 (2ECTS Final Workshop)

Module 6 – Advanced fabrication module
METHODOLOGY AND TOOLS

Learning Module (partner country)	**LEITAT**
Title of the Learning Module	**Advanced fabrication module** Postgraduate 2 - Module 3
Learning Module and Units Description (including: main contents, key skills, addressed target groups, elements of innovation of the topics addressed)	Units and main contents: • ***Additive manufacturing introduction*** (8 hours, frontal lessons combined with case studies) Key contents: Digital product development framework; Open design; Collaborative Networks; Social Manufacturing; Co-creation; Digital Tools; Additive Manufacturing technologies overview; Mass customization; Cloud Manufacturing. • ***Additive manufacturing implementation*** (8 hours, frontal lessons combined with case studies) Key contents: AM materials analysis and selection; AM technology analysis and selection; Benchmark (Test and validation); End to end solutions. • ***Additive manufacturing technologies*** (8 hours, frontal lessons combined with case studies) Key contents: Material extrusion technology: Fused Deposition Modelling (FDM). VAT photopolymerization technology: Stereolithography (SLA), Digital Light Processing (DLP), and Liquid-crystal display (LCD-AM). • ***Design for additive manufacturing*** (8 hours, frontal lessons combined with case studies) Key contents: introduction to the emerging core design principles and skills necessary to fully exploit the benefits of

additive manufacturing. Overview of design for additive manufacturing (DfAM) fundamentals. Latest trends in additive manufacturing such as optimising parts with generative design, minimising material with lattices and simplifying assemblies with part consolidation.

- ***Additive manufacturing technologies – Metals & Polymers***
  (8 hours, frontal lessons combined with case studies)
  <u>Key contents:</u> Knowledge in AM technology to manufacture polymers, specifically with polymers with UV polymerization (resins). Powder Bed Fusion (PBF): Multi Jet Fusion (MJF), Selective Laser Melting (SLM), and Selective Laser Sintering (SLS); Direct Energy Deposition (DED): Laser Engineering Net Shape (LENS); Electron Beam Additive Manufacturing (EBAM).

- ***Additive manufacturing technologies – Others***
  (8 hours, frontal lessons combined with case studies)
  <u>Key contents:</u> knowledge in AM technology to manufacture other materials apart from metals and polymers. Binder Jetting (BJ); Material Jetting (MJ).

- **Final workshop *"Product development"***
  (16 hours, practical workshops)
  <u>Key contents:</u> Industrial sector selection; AM Technology assessment; Design for AM; Prototyping.; Comparative and economic study.

<u>Key skills</u>

<u>Soft:</u> innovation, teamwork, creativity, adaptability/flexibility, self-management

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Digital: e-commerce, networking & IT systems

Green: sustainable product development, advanced/eco materials

Target groups

Design students, SMEs employees, Cluster professionals

Elements of Innovation

Considering the presence of very few master programs that include the integration of soft, digital and green skills, it emerges that INTRIDE JMD programme has several innovative elements in terms of contents addressed, methodologies and tools, learning outcomes and outputs.

Specifically, this learning module aims to provide innovative elements related to: Industry 4.0; New design methods; Innovative manufacturing routes; Digital manufacturing; Innovative product development; AM value chain.

| **Learning Module and Units Methodology**

(indicate which learning methods will be used, whether in participatory form or through individual work, any disciplinary approaches followed, etc.) | The module is structured into 6 theoretical units + final workshops, for a total of 64 hours (48 hours between frontal lessons, case studies and presentation + 16 hours of practical work).

The learning module and units' methodology is based on an alternation between theoretical lessons and short practical workshops, possibly involving some stakeholders above all companies connected with INTRIDE project.

The structure will consist in frontal lessons mixed with focus groups and teamwork, specially when presenting case studies. Always involving participants to develop a direct approach with good practices examples presented during the learning units. |

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	Great importance will be given to teaching the methods necessary for learning advance manufacturing, obviously in relation to the tools and media that will be used by the participants.

Media(s)
 	
(indicate the tools that will be used, whether physical or virtual, etc.)
	To develop this methodology, there will be utilized innovative interdisciplinary tools such as:
	
	- CAD tools
	- Possibility to use these AM machines:
	    o Fused Deposition Modelling (FDM)
	    o Stereolithography (SLA)
	    o Liquid-crystal display (LCD-AM)
	    o Multi Jet Fusion (MJF)
	    o Selective Laser Melting (SLM)
	    o Binder Jetting (BJ).

Activity Leading Organisation	LEITAT With support from CENFIM (cluster partner)
Expected Learning Outputs	• Practical applications of AM in the real industrial scenarios (prototypes and working samples). • Conceptual applications of AM for product innovation (mock-ups, etc.)
Learning Module Duration	8 ECTS Total (7 weeks) 1 ECTS = (8 hours Class Work) + (17 Hours Autonomous Work) 64 Academic Hours 6 (1ECTS Units) + 1 (2ECTS Final Workshop)

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Methods and Tools Ecosystem
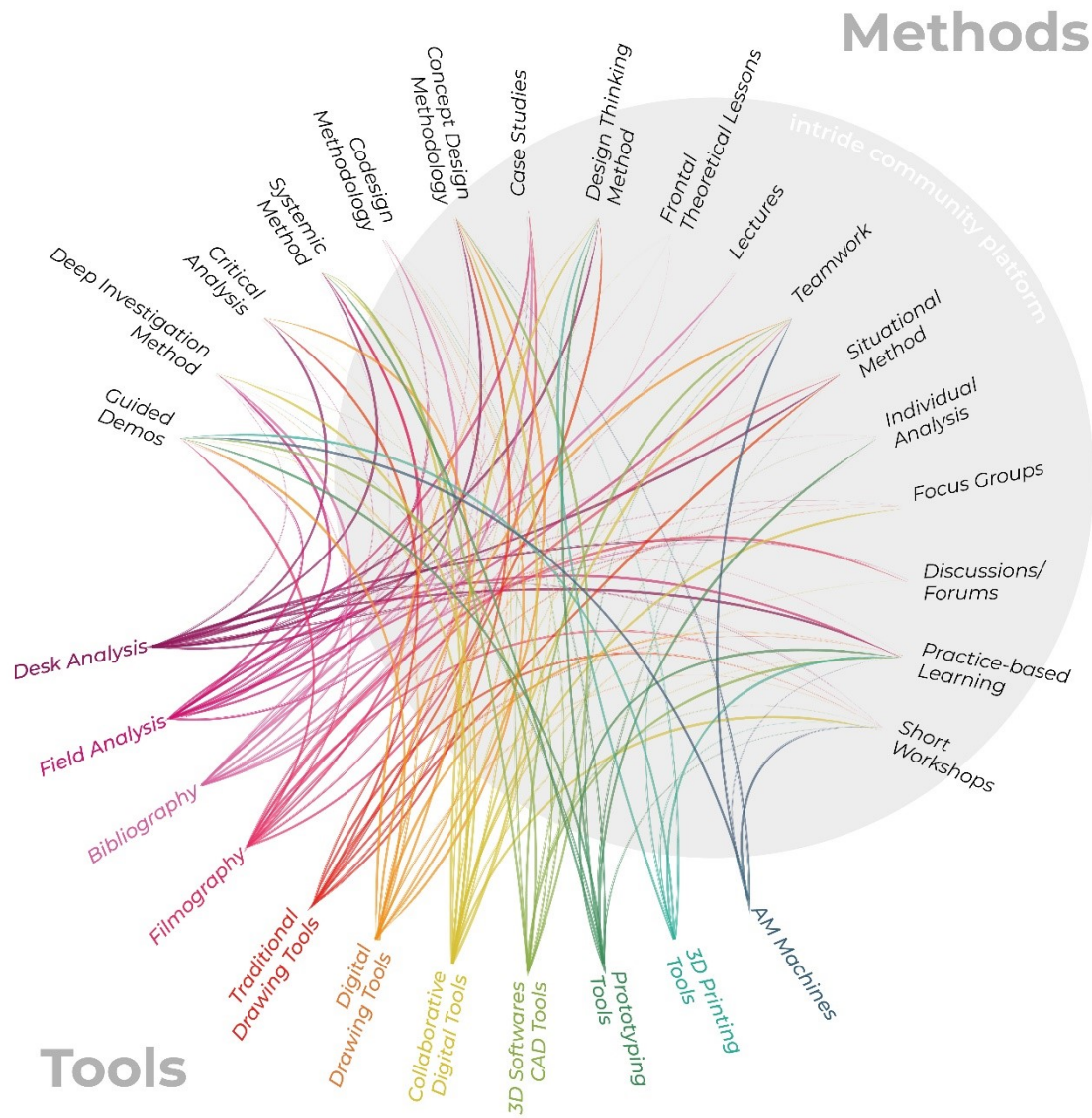
Methods

Tools

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for SMEs in the manufacturing sector

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