Deliverable 2.5 - Definition of iPRODUCE Demonstration Framework

Prepared by **MATERALIA**

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Abstract	Report D2.5 Definition of iPRODUCE demonstration framework is the result of T2.4 Defining the Local Collaborative MDFs, Use-Cases, Innovation Challenges and KPIs. The aim of this task is to provide the identification and general definition of the different Use Cases that will be used as validation scenarios of the iPRODUCE project.

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PP	Restricted to other programme participants (including the EC services)	
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Executive Summary

Report D2.5 *Definition of iPRODUCE demonstration framework* is the result of T2.4 *Defining the Local Collaborative MDFs, Use-Cases, Innovation Challenges and KPIs*. The aim of this task is to provide the identification and general definition of the different Use Cases that will be used as validation scenarios of the iPRODUCE project.

The initial part describes the six cMDF (collaborative Manufacturing Demonstration Facilities) pilots; What their purposes are, their scope of actions, which services they are entitled to offer. This information will be summarized under a “cMDF identity Card”.

The second part is devoted to Use Cases. Each of the pilot cMDFs participating in the iPRODUCE project had the task of defining 2 to 4 Use Cases, which will serve as a baseline for the evaluation of the iPRODUCE platform and its effectiveness. We will then go into detail by presenting both a current situation and a future situation that will allow us to imagine the improvement brought by a co-creation platform. Based on their knowledge of local actors and the reticence generally encountered, the cMDFs have listed the main doubts expressed by users, which will have to be overcome in order to ensure a good adoption of the platform. The objectives that must be achieved for each of the Use Cases in order to be successful will also be included, as well as the KPIs (Key Performance Indicator) to be monitored.

In the last part, we will discuss the most common problems encountered in co-creation projects. Based on the feedback and experience of the Materalia competitiveness cluster as well as the great deal of collaborative projects it has been exposed to, we will propose different ways of improvement, in order to limit inconvenience and maximise a project's chances of success.

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1. Introduction

1.1. Scope and objectives of the deliverable

The purpose of this document is to first present the objectives of the iPRODUCE project, as well as the different pilot structures taking part in it, highlighting their scope of action, their composition and their development strategy. Secondly, we will present the Uses Cases that the different pilot teams have set up, in relation to their ecosystems. From these Uses Cases, the teams have drawn the various KPIs that will be used to evaluate the success of the pilots and the specifications that will be used to build the platform.

1.2. Structure of the deliverable

Some basic background information about the methodology will first be provided. In a second section, information about the six iPRODUCE pilots will be provided, in order to give a broader understanding of their scope, needs and challenges in the context of iPRODUCE. Then, we will focus on the scenarios and Use Cases developed in close cooperation with the iPRODUCE pilots in order to ensure that the scenarios and Use Cases reflect the needs and challenges of their ecosystems.

1.3. Relation to other tasks and deliverable

T2.4 is closely linked to the following tasks: T2.3 Mapping and Assessment of Co-creation and Open Innovation Methods, Tools and Practices, T2.5 Social Manufacturing Reference Model and Framework Evolution, T3.1 Lean Operational Models for Local collaborative manufacturing demonstration facilities cMDFs and their Federation, T3.2 Mapping and Reinforcing the Manufacturing Capacity of the cMDFs, T3.3 Setup the Network of local cMDFs, T4.1 Architecture and Design of the Open Innovation Platform, and T9.4 Realisation of Local cMDF Pilots and Open Innovation Missions.

2. Description of Pilots

The outcomes of the iPRODUCE project will be validated in six pilot cMDFs, located in different countries, namely Spain, Germany, France, Italy, Denmark and Greece.

A wide applicability of iPRODUCE technologies and methodologies to a broad number of areas remains critical. This is why the six pilots have been selected from distinct consumer-goods industrial sectors: furniture, automotive, microelectronics, medical, electronics. The six cMDFs present an evident need for adaptation to address industrial challenges related to co-creation of products in both ends of the value chain involving customers and coupling design, creativity and knowledge.

In spite of the differences of the industrial environments, they all share common challenges related to co-creation approaches and strategies, as well as data exchange and cooperative technologies' testing, to which iPRODUCE will provide solutions. These solutions will be demonstrated and validated in real world scenarios within the cMDF settings.

2.1. Spanish cMDF : Collaborative Engineering in Customer-Driven Home Furnishing Products

2.1.1. Scope of the cMDF

The objective of this pilot is to enable collaborative engineering between the furniture manufacturing companies, the cMDF and the FabLab jointly with the community of experts/makers, allowing them to develop customer-driven products with complex specifications that the furniture producer cannot tackle on his own.

The work process for the development of a customer-driven product with complex specifications has three complementary and collaborative stages:

1. Initial prototyping of the product in the FabLab VLC. This step consists in incorporating digital manufacturing technologies (3D printing and CNC router), which allow to - technically and dimensionally- check the construction of a custom design, based on a digital 2D design made in a simple way. It will also incorporate the development of an open source technology and electronic components.
2. Once the first prototyping process has been completed, AIDIMME will design the most appropriate process to industrialize this furniture design (advanced product development).
3. Validation of the process and final documentation of the elements will be carried out, which will constitute the design of the furniture project.

In summary, within this pilot case physical products design and co-production will be introduced in the furniture sector. Specific needs for new products will be part of the demonstration on how iPRODUCE can address and improve the needs of product development such as new materials or tailor-made shapes or functionalities.

2.1.2. cMDF's Identity Card

cMDF identity Card	
cMDF's Country	Spain

Scope and purpose of the cMDF	The Scope of the Spanish cMDF is first to provide a physical space for MMC´s communities to stimulate, promote, and develop innovative customer-driven product ideas in a collaborative way. It will also act to transform ideas into real furniture products in order to be commercialized.	
Entities and their role in the cMDF (Actual situation)	*AIDIMME*	• Research Partner • Technology Institute • Facility Party • Product Engineering activities • Contact to manufacturing SMEs (Small Medium Entreprises) (mainly associated members) • Support for dissemination actions
	Lagrama	• Furniture Manufacturer • Representing the manufacturing companies who can approach to a cMDF • Product requirements definition
	Océano Naranja (ON)	• Facility Party • FabLab • Product Design activities • Contact to Fablabs, Makers, Consumers • Support for dissemination actions
Expansion strategy for the cMDF	The Spanish cMDF is supported by three very influential members from the furniture sector and additionally by various associates. For instance, AIDIMME has over 700 associates and disseminates through their social media a great deal of news related to the furniture sector. In addition, ON is connected to many FabLabs and makerspaces through the FabLab network. All these factors could yield large audiences for any event to be celebrated. All entities will actively conduct and promote iPRODUCE activities, events and services using their large existing networks and public relations channels.	
Services offered by the cMDF	Digitized training process for equipment	
	Generative design processes	
	Product prototyping workshops	
	Ideation workshops	
	3D-Printing	
	Woodworking / DIY services	
	Engineering processes	

2.2. German cMDF : Open Consultation, Collaborative Product Development, Collaborative Learning

2.2.1. Scope of the cMDF

The objective of the German pilot is to enhance the co-creation capacity of manufacturing SMEs for consumer product innovation, introduce SMEs to the Maker scene and capitalize the FabLab mentality and working processes to stakeholders in the area.

MakerSpace Bonn (MSB) is a non-profit organisation offering workshops, courses, jam sessions and various events dealing with topics such as electronics development, microcontrollers (Arduino, etc.), programming, creation of IoT devices, 3D printing, rapid prototyping of physical devices, CNC machining, CAD design and technology in general. Besides these, handcrafting with wood, metal and paper are possible. MSB has completed many collaborative projects with SMEs and industry partners, and many local SMEs act as a sponsor for MSB. Using the contact network of local SME's from ZENIT further broadens the reach of the German CMDF. Consumers and end-users will be involved by both using the maker scene contacts provided by MSB and the SMEs contacts provided by ZENIT. Workshops and co-creation sessions will be promoted using various communication channels, such as MSB's website, newsletters, social media etc, ZENITs contact database and FITs professional communication channels. The consumers were and further will be involved as participants in workshops conducted and organized by FIT and the MSB. In specific cases, a workshop could also be organised based on specific needs from customers.

2.2.2. cMDF's Identity Card

<table>
<tr><th colspan="3">cMDF identity Card</th></tr>
<tr><td>cMDF's Country</td><td colspan="2">Germany</td></tr>
<tr><td>Purpose of the cMDF</td><td colspan="2">The German cMDF envisions multiple purposes. First it aims at understanding and determining the relationship between SMEs and MakerSpaces. Then it aims to establish a concise list of services that are of interest and could be beneficial for SMEs. After this, mechanisms to facilitate initial equipment usage for new machine users and corresponding processes and tools to support iterative prototyping with electronics will be developed.</td></tr>
<tr><td rowspan="3">Entities and their role in the cMDF

(Actual situation)</td><td><i>Fraunhofer FIT</i></td><td>• Research Partner
• Responsible for methodology</td></tr>
<tr><td><i>Zenit GmbH</i></td><td>• Networking Partner
• Provides Contact to SMEs
• Organizational support for organizing events</td></tr>
<tr><td><i>MakerSpace Bonn</i></td><td>• Facility Partner
• Production capacity
• Hosting workshop and machinery
• Support for dissemination actions</td></tr>
<tr><td>Expansion strategy for the cMDF</td><td colspan="2">The German cMDF has organized, and will organize in the future, face-to-face and remote events for local SMEs and citizens at MSB. After learning about SMEs interests, topics will be selected in order to support community building and understand related barriers.

If prototyping sessions with start-ups (providing ideas) are successful, maturation of the prototypes will be followed as a co-creation activity.

All entities will actively conduct and promote iPRODUCE activities, events and services by using their existing networks</td></tr>
</table>

	and public relations channels. The business development of Bonn Municipality also supports and promotes iPRODUCE activities.
Services offered by the cMDF	Beginners in Software-Coding classes (MSB branded hardware kit)
	Consulting for Start-Up companies (to build first hardware-prototype)
	Rapid prototyping workshops
	Ideation workshops
	3D-Printing
	Woodworking / Bricolage services
	Cost-calculation service
	Digitized training process for equipment

2.3. French cMDF: Establishment of cMDF in the French industrial ecosystem for developing collaborative projects in the automotive/mobility area and associated consumer goods sectors

2.3.1. Scope of the cMDF

The pilot will demonstrate the use of co-creation and co-design in the mobility, automotive and robotics sectors, and its extension to other sectors in which Excelcar and Materalia have already worked with (agriculture, health and maritime). The main challenge of this demonstration will be to embed the iPRODUCE tools and methods in the FabLab of Excelcar for upscaling the use of collaborative production. Initial physical products that are considered are related to new vehicles (design of cockpits, seats, ergonomics of autonomous vehicles) and mobility devices (i.e. from four to 1 wheelers), addressing a number of stakeholders from large OEMs, SMEs, start-ups and end-users. The actual physical products to be co-designed and validated for this Use Case through iPRODUCE will be further analysed during WP2 (requirements) and WP9 (pilot planning).

Several tools will be used to ensure customers' engagement like workshops for end users, promoted by local government, regional press and the students community, engagement via Social Media, Our facilities to co-design and co-produce and simulation tools:

<table>
<tr><th colspan="3">cMDF FR identity Card</th></tr>
<tr><td>cMDF’s Country</td><td colspan="2">France</td></tr>
<tr><td>Purpose of the cMDF</td><td colspan="2">The French cMDF will focus on 2 main purposes: Firstly, it will work on making the FabLabs equipment, tools and machines more accessible to potential users or products developers by creating virtual and digital trainings, tutorials and courses. By doing so, the public users will become more familiar with prototyping and CNC machines, including their respective software. Secondly, the French cMDF will aim at supporting entrepreneurs’ and SMEs’ projects, especially in the mobility and electro-mobility sectors, by introducing and encouraging them to involve social and collaborative manufacturing in their product design and development processes.

In order to encourage SME’s and entrepreneurs the social manufacturing approach will be highlighted and collaborative projects will be promoted by dedicated product designing workshops and trainings</td></tr>
<tr><td rowspan="3">Entities and their role in the cMDF (Actual situation)</td><td>Excelcar</td><td>• Detection of entrepreneurial projects related to micro-mobilities
• Provision of prototyping equipment for cMDF projects
• Organisation of open-innovation challenges
• Experimentation of training modules dedicated to the use of prototyping equipment</td></tr>
<tr><td><i>FabLab Vosges</i></td><td>• Running and organizing product design, co-creation and prototyping workshops.
• Disseminating the local production and making capabilities through the participation in a set of local projects as well as organizing trainings related to the available equipment (such as 3D printing, laser engraving, programming, IoT application).
• Providing prototyping machines and equipment for user project purposes.</td></tr>
<tr><td><i>Materalia</i></td><td>• Identification of new project opportunities
• Elaboration of a financing strategy
• Organisation of co-creation/Open innovation workshops
• Detection of partners or end users.</td></tr>
</table>

Expansion strategy for the cMDF	The cMDF development strategy will aim to strengthen its production and coaching capacities while anchoring it in its local ecosystem. The long-term objective is to benefit from the know-how of local actors empowered by the iPRODUCE platform, which will accelerate and fluidify its members' interactions. For this purpose, the cMDF will invite members with complementary skills to join the cMDF. The objective is to allow to easily go from an idea to a product by accompanying the creator throughout the development. To this end, structures with varied profiles will be required as following: *Actors:* ● Fablabs ● Startups & Entrepreneurs networks ● Manufacturing companies *Users:* ● Entrepreneurs and SMEs ● General public & consumer
Services offered by the cMDF	Open innovation challenge
	Provision of design tools and prototyping equipment
	Prototyping of system
	Funding strategy
	Partners matchmaking
	Training additive manufacturing

2.4. Italian cMDF: Collaborative manufacturing environment with cross-competences sharing for product development/enhancement in the microelectronics consumer sector.

2.4.1. Scope of the cMDF

The objective of this pilot is to enable collaborative engineering between the microelectronics manufacturing companies, the cMDF and the FabLabs, involving the community of experts/makers, local start-ups and SMEs to address the development/enhancement.

The Italian cMDF will experiment new open-innovation schemes through the involvement of industries and makers communities in the product development value chain. In particular, an SME on Silicon components and smart optical sensors (Optoi, able to develop and produce tailored solutions) will collaborate with Trentino Sviluppo (TS) in order to test the innovative approaches developed in iPRODUCE, setting up a test case which will involve cMDF facilities, engineers and local community. The challenge here is to engage community and makers to develop new products or enhance existing ones, using both tools and methods coming from iPRODUCE (i.e. the Agile Analytics tool, or a lean operational model). In that prospective, the cMDF facility will be the optimal ground to set-up a collaborative environment to implement and share cross-competences focused on new ideas coming from the community, enabling the company to become more responsive to consumer needs. Thus, in this Use Case, next generation of photography equipment (i.e. x-ray tomography, high-speed digital image scanners) will be part of the co-design and collaborative environment that will be delivered by the project. Moreover, as a result of the iPRODUCE driven collaboration between the Autonomous Province of Trento, TS, Bruno Kessler Foundation, University of Trento and Confindustria Trento, the objective is to provide companies operating in the mechatronics sector with an integrated platform for the co-production, rapid prototyping and qualification of mechatronic systems.

2.4.2. cMDF's Identity Card

<table>
<tr><th colspan="3">cMDF IT identity Card</th></tr>
<tr><td>cMDF's Country</td><td colspan="2">Italy</td></tr>
<tr><td>Scope and purpose of the cMDF</td><td colspan="2">Italian cMDF purpose is to serve as a partner for companies and professionals, mainly, in the design and realization of mechatronics and microelectronics appliances. Competences span from mechanical and electronic design, electronics, through cybersecurity, metallic and polymeric 3D printing and measurement services to quality control.
Our purpose is to support companies and professionals, -especially SMEs -to design and build up components, devices with innovative technologies, which are not available to them regionally.</td></tr>
<tr><td rowspan="3">Entities and their role in the cMDF
(Actual situation)</td><td><i>ProM Facility</i></td><td>• Manufacturing partner
• Electronics design
Prom Facility is the Manufacturing Facility of Trentino Sviluppo (ProM is not a legal entity, it is a lab owned by Trentino Sviluppo). ProM is the reference lab of the Italian cMDF.</td></tr>
<tr><td><i>MUSE FabLab</i></td><td>• FabLabPartner
• Training on additive manufacturing
• 3D printing
• Realisation of goods
MUSE FabLab is the FabLab of the Trentino regional Science Museum, working with students, researchers and companies.
MUSE Fablab will cooperate in the realization of some parts of the objects made by ProM.</td></tr>
<tr><td><i>Noitech Makerspace</i></td><td>• Maker Space
• 3D printing
• Realisation of good
400m^2 makerspace, mainly targeting companies. Noitech Makerspace will cooperate in the realisation of some parts of the objects made by ProM.</td></tr>
<tr><td>Expansion strategy for the cMDF</td><td colspan="2">Until now, Noitech Makerspace and MUSE FabLab represent the extension of initial cMDF core (ProM). Other industrial makerspaces/Manufacturing Facilities have been identified, especially in the Northern Italy Area. They could be added to the iPRODUCE, after the pilot in order to enlarge the national geographical coverage area.</td></tr>
<tr><td rowspan="4">Services offered by the cMDF</td><td colspan="2">Design (mechanical and microelectronics)</td></tr>
<tr><td colspan="2">Realization of goods (3D printing, drilling, etc.)</td></tr>
<tr><td colspan="2">Quality check, measurement</td></tr>
<tr><td colspan="2">Technical consultancy services</td></tr>
</table>

	Training on additive basics (for students, technicians, professionals…)

2.5. Danish cMDF: Establishment of a mobile BetaFactory Unit

2.5.1. Scope of the cMDF

The objective of this pilot is to deploy the Mobile BetaFactory Unit in real Use Case scenarios in at least 10 Danish cities to evaluate the requirements for a sustainable long-lasting business case. The results will help to best scale up the open innovation concept and understand consumer market. They will also be used to better cater to actual needs, as well as to understand how future trends could impact the concept.

The pilot cuscuses on the realisation of a Mobile BetaFactory unit that can travel throughout the country, making the resources available beyond Copenhagen. Consumers can interact and download drawings/schematics, execute them in the mobile lab and assemble it close to their homes. Due to the close proximity, consumers can adapt and customize the goods according to their specific needs. One example would be to take the Mobile BetaFactory unit to public schools across the country to co-create, co-develop and co-produce their own furniture assets, customizing them according to their needs. A wide-spread campaign will be carried out, making use of social media outlets and in close contact with municipalities across the country. This, together with the organisation of local events, can provide valuable data towards understanding consumers' needs and wishes, and also understand which set of consumer skills are available, guiding how the service can develop and better fit with the market.

The establishment of cMDF in Denmark focuses on further developing customer-oriented goods manufacturing by incorporating co-creation and design thinking tools earlier in the process as well as guiding how to better design interfaces to accommodate a wider population. Furthermore, this Use Case will push the boundaries of urban production by deploying a mobile unit where a range of designs can be customized, manufactured and delivered on-site across the country. Building on the expertise and resources of BetaFactory, assisted by Copenhagen Business School (CBS) knowledge of methods, tools and business models to develop sustainable solutions, this pilot will demonstrate how we can apply customization to mass-manufacturing towards sustainable urban production.

2.5.2. cMDF's Identity Card

DK cMDF identity Card		
cMDF's Country	Denmark	
Scope and purpose of the cMDF	The Danish cMDF focuses on democratizing 'making' by expanding the knowledge and expertise about possibilities to local production through partnerships with distinct sets of stakeholders, including educational institutions (schools and universities), SMEs and businesses. Among the activities of the cMDF, a mobile lab unit containing a set of machines has been created and equipped to provide a mobile production facility that can be deployed to various locations, linked to specific 'maker'/on site production workshops and activities.	
Entities and their role in the cMDF	BetaFactory (BF)	• Responsible for local production on site, equipment and development of the mobile unit,

(Actual situation)		- Running workshops, - Disseminates local production capabilities through events and partnerships with potential partners from educational institutions (schools and universities), SMEs and businesses.
	CBS	- Supports and co-develops with BetaFactory workshops and project-related activities. - Identifies and develops sustainable business models, based on BF's vision and goals, aligned with market opportunities. - Helps BF to solidify and expand its business towards a healthy and sound development.
Expansion strategy for the cMDF	The initial plan includes reaching out a great deal of businesses, educational institutions and public sector institutions in order to raise the awareness of the possibilities and opportunities, thanks to local production (with different materials provided by BF). Besides, running co-creation activities during these events can create opportunities to learn about needs, wishes and existing impediments that affect how makerspaces and FabLabs are currently used. As part of the plan, the cMDF will run a number of initial workshops focused on specific groups (schools, women, architecture studios/designers, etc.) to gather key insights regarding different groups' specific needs. This knowledge will help inform the cMDF's expansion. Partners, can help the growth and further development of the space operational functionality, helping cMDF stay on the forefront of innovation and research, while also helping cMDF to create educational and production-related materials, that could be used in other collaborations. The cMDF has already reached out to educational institutions (schools and universities), SMEs and businesses, promoting local workshops to introduce the space and capabilities (first workshop was on August 27th, 2020). An internal workshop (Sept 16th) has held, in order to identify which key types of institutions can contribute and benefit from cMDF's expansion, as well as contribute to its positive impact in society. Besides the initial workshop, a couple of meetings have taken place to help further establish the initial partnerships. Another workshop focused on women, concretely on understanding the existing constrains behind their low demographic in Danish spaces, is happening on October 7th. A follow-up workshop with schools has also been planned and will take place on October 22nd – which will focus on establishing the plan to co-develop materials with the teachers and identifying which types of machines can be most useful towards the planned activities.	

Services offered by the cMDF	Fully equipped wood workshop
	Metal workshop
	Electronics workstation
	Full size CNC-routers
	3D-printers
	Laser cutter
	Loading dock
	Mobile Unit (under development)

2.6. Greek cMDF : Upgrade of the design of a 3D printed medical equipment including IoT sensors integration

2.6.1. Scope of the cMDF

The pilot objectives are to leverage expert opinion and experimental feedback to feed the design process supported by community makers and result in an innovative medical equipment that outperforms current solutions in terms of comfort and efficiency, offering patients a chance to increase their quality of life.

This pilot examines the role of consumer engagement in the development of orthopaedic back brace solutions of AidPlex with the aim of higher comfort levels. In order to retrofit the resulted design will be extended with IoT sensors, capable of monitoring the progress of a patient’s spinal condition (e.g. scoliosis, kyphosis etc), whilst gamifying the process to achieve higher rates of adherence in back brace usage, introduction of waterproof and recyclable material will be part of the co-design and collaboration towards improving the management of orthopaedic injuries.

In order to achieve that, AidPlex aims at using the facilities and network of OK!Thess to host co-creation workshops, leveraging design thinking and generative design frameworks, and reach out to makers and designers that could translate patients’ feedback into actionable insights. Moreover, physicians and patients will be contacted and invited to participate in order for the design process to include skilled as well as experimental feedback. Participants will be divided into teams with similar skillsets, informed about the goals of the workshops and asked to provide their initial design thoughts and suggestions. These will be put under a Delphi process of elimination resulting in two prevalent designs, which will be printed, equipped with basic sensors (e.g. pressure sensors) and subsequently tested by patients, leading to the design of choice.

2.6.2. cMDF’s Identity Card

cMDF GE identity Card	
cMDF’s Country	Greece
Scope and purpose of the cMDF	Greek cMDF mission is to bridge the gap between SME’s and Makerspaces. AidPlex, with expertise in medical sector, is going to help any company or customer to achieve better treatment experience.

<table>
<tr><td></td><td colspan="2">Greek cMDF apart from being focused only on medical sector, expands its services on micro-manufacturing and rapid prototyping to other sectors like robotics, agile tools, electronics and consumer lifestyle goods.

To introduce and highlight the importance and the advantages of social manufacturing, Greek cMDF is going to engage SMEs, entrepreneurs, makers, industrials and potential customers in many collaborative product development projects by organizing innovative and product designing workshops.</td></tr>
<tr><td rowspan="3">Entities and their role in the cMDF
(Actual situation)</td><td><i>AidPlex</i></td><td>• Research & Facility Partner
• Responsible for methodology</td></tr>
<tr><td><i>CERTH</i></td><td>• Research and Facility Partner
CERTH open its facilities to MMCs for
o a) prototyping using 3D printing technologies at its Additive Manufacturing Unit (AMU) and for
o b) demonstration of the final products at its nZEB Smart Home infrastructures that works as Digital Innovation Hub.
o CERTH also provides to MMCs a demo room which acts as a virtual presentation room and a testing facility (test lab) with related equipment.

• Training activities on 3D printing & micromanufacturing by open access to AMU/CERTH facilities
o MMCs can be trained on different 3D printing technologies as Fused Filament Fabrication (FFF), Selective Laser Sintering (SLS), Selective Laser Melting (SLM), Stereolithography (SLA), MultiJet Printing (MJ), Inkjet-based Bio-Printing (BIO), 3D Printed Ciruit Boards (PCB) and CNC milling.
• Technical consultation</td></tr>
<tr><td><i>OK!Thess</i></td><td>• Networking Partner
• Provides Contact to SME’s
• (Makerspace of PoPMachina)</td></tr>
<tr><td>Expansion strategy for the cMDF</td><td colspan="2">The greek cMDF has organized and will continue organizing remote and physical events (if Covid-19 Outbreak is going to stop) events for local SME’s and the public (citizens) at OK!Thess.

Expansion to Start-ups:

Preliminary interest has already been gathered from start-ups and makers, which wanted to expand their network of customers. They also wanted to have better reach to contacts, which could lead to future partnerships.
If prototyping sessions with start-ups (providing ideas) are successful, maturation of the prototypes will be followed as a co-creation activity.

Expansion to Customers:</td></tr>
</table>

	After learning about the interests of SMEs, these topics will be deepened. Involved SMEs will also promote Greek cMDF's activities and projects into their existing networks and public relations channels, sharing to all Greece the values of social manufacturing and iPRODUCE.
Services offered by the cMDF	Rapid Prototyping Roadmap Design
	3D Design
	3D Scanning
	3D Printing (biopolymers, thermoplastics, polymers, resins, ceramics, metals etc)
	PCB Design and Manufacturing
	Electronics Assembly, Miniaturized surface mount devices (SMD), firmware development and debugging
	Electronics Enclosure Design
	Sensor development and embedded systems with IoT functionalities
	Ideation workshops
	Characterization and Quality control by inspection cameras, spectrometers, FTIR, Stereoscope Microscopy

3. IProduce Use Cases Definition

3.1. Use Cases: Introduction & Methodology

This section gathers all scenario Use Cases of the 6 pilots of the IPRODUCE project. Each pilot is focused on a specific theme (mobility, electronics, furniture, collaborative learning, health) and brings together different entities - such as FabLabs, companies or research centres. Hence, these entities know their customers, their habits and their special theme first-hand. Each pilot individually developed their Use Cases, in order to best meet the needs of their local ecosystem. In this section, the idea was not to find all of the iPRODUCE Use Cases, but rather to identify meaningful Use Cases per pilot. Thus, next to the Use Cases a good overview of the iPRODUCE achievable goals is provided.

Each of the Use Cases starts with the "as is" situation, which highlights the difficulties and the need for improvement in the processes to reach the "to be" situation. A scenario-driven approach is used to determine the next steps in the Use Cases. By interviewing the future participants - and based on their experiences - the different pilots were then able to determine the doubts, obstacles and motivations of key stakeholders. The next important step was to set the limits of each Use Case, in other words, where does it start and where does it end. The scope specification was achieved by using specific fields for this information namely the preconditions, the flow and post condition. These fields are used to show what should have happened before the Use Case, what happened in the Use Case and what will the next steps be.

Each pilot has then determined what conditions are necessary for a Use Case to be successful, which have been listed and determined in the form of KPIs. These KPIs will allow to validate or not the objectives of the Use Cases in the next steps. Finally, in order to facilitate the understanding and coordination with the platform modules, Use Case diagrams have been built in an iterative way, involving both the cMDF pilots and platform developers.

3.2. Spanish Use Cases

3.2.1. cMDF_ES_UC1 SMART BED HEADBOARD

Name of Use Case:	cMDF_ES_UC1 SMART BED HEADBOARD		
Created By:	AIDIMME	**cMDF Involved**	Spanish
Date Created:	16/04/2020	**Last Revision Date:**	02/11/2020
Description:	AS-IS situation: A furniture manufacturing company is involved in an innovation process and has detected new trends and needs that fall under their target consumers. Therefore, the company starts looking on the Internet for maker groups and FabLabs in order to get support to carry out the idea. Through a thorough search process, involving phone calls, emails exchanges, google searches, etc, the company has found out that their idea is not currently being tackled by any of their competitors. The idea is a bed headboard with lighting, sound, and sensor engineering, all customizable by the user. Nevertheless, the company is currently unable to manufacture the product, since they do not possess the manufacturing processes or the machinery. It is therefore necessary to work on the idea. However, they encounter great difficulties in finding the right partners. Plus, the way information is being exchanged is not optimal to follow different versions of the product design,		

	according to the different people working on the same sketch. TO-BE situation: The furniture producer can use the iPRODUCE OpIS to look for the cMDF profiles, so that the company can find a suitable cMDF, in order to share their idea. In fact, this new market-driven idea has complex specifications that the furniture producer is not able to challenge alone. Thanks to iPRODUCE, the company is able to contact the cMDF in order to co-design and materialize (design, prototype, and implement) the concept into a prototype through the open collaboration space by being tested in a virtual way with a focus group (consumers). Thus, iPRODUCE will help to validate if the new bed headboard satisfies the original detected need.
Actors:	PRIMARY: ● USER: Furniture Manufacturer (Lagrama). ● cMDF: Océano Naranja (ON) and AIDIMME. SECONDARY: ● Consumers (focus group)
User doubts:	The furniture company It can be reluctant, especially at the beginning of the process. Main doubts can range from: ● Exploitation rights ● Confidentiality reassurance that no competitors are going to be aware of my idea ● Trust ● Can I carry this out, and incorporate it into my industrial processes? The company will also be willing to have total control of the process and be sure that the totality of the concept can be addressed by the cMDF with no other providers involved. The company aims at having a complete solution, and eventually everything must be integrated in their industrial processes.
User motivation:	The manufacturing company is involved in an innovation process whose main driving force is to come up with the latest and most advanced customizable products that can differentiate them from their competitors.
Preconditions:	The furniture company can design and manufacture furniture products. However, it is not able to attend the complex engineering of it (industrial, electrical, IT, etc.). So the first question is: can I do this alone? Design thinking sessions can be established with users and Lagrama in order to identify new uses of the headboard. The cMDF must be able to carry this forward and needs to have a total understanding of the goals of the company in terms of design and manufacturing of the prototype, but also its exploitation.
Post conditions:	At case completion, the manufacturing company must ensure that all requirements were addressed, that the doubts stated before were all solved, and that the products developed were added to the normal flow of the company, as any other existing products. Collaboration with the cMDF can end here or continue for as long as the two

parties consider (design of more products, enhancements, new trends awareness, etc.)

For an unsuccessful case, failing reasons must be identified and corrected, and it is up to the parties to decide about the viability of the product and whether or not it should be discarded, changed, or implemented again, applying the changes detected.

Flow:

The flow for the ideation process through the OpIS platform can be structured in 4 main phases.

1. IDEATION INITIAL PROCESS

The furniture company, in this Use Case Lagrama is involved in an innovation process in which a new product design must be identified in order to address the needs of their target clients.

Through the cMDF profiling Marketplace component, Lagrama requests cMDF profiles that can adapt to its needs and the system returns a list of them. Then, Lagrama request specific cMDF services to the Matchmaking & Agile Network component which selects the most adequate cMDF.

After the acceptance of the cMDF to work collaboratively in the manufacturer´s idea there will be a request for an IPR contract to be accepted by both parties using the Ricardian Toolkit.

2. DESIGN THINKING (DEFINE WHAT TO DO, INFORMATION ANALYSIS)

A co-creation design process starts when the cMDF requests the product requirements (description, target, dimensions, materials, constraints, drawings, budget, technical specifications,…) to the Generative Design Platform which are provided by the Manufacturer asking for support. During the ideation process, the cMDF provides the design and detailed technical specifications (functional specifications, material characteristics, packaging design,…) getting feedback at all times from the Manufacturer. Finally a design brief is elaborated with all needed specifications and entered into the Generative Design Platform.

3. DESIGN, PROTOTYPING AND INDUSTRIALIZATION

The brief is a document composed by six sub-processes that contains all specifications related to environmental aspects, regulations about health and safety, ergonomics, aesthetics, etc.

DESIGN BRIEFING SUBPROCESS	***INPUT NEEDED (information sources)***
Requirements and specifications of the prototype	
Environmental aspects to consider	ENVIRONMENTAL REGULATIONS
Manufacturing specifications to be taken into account	PRODUCTION DATA
Analysis of quality levels and Regulations	QUALITY STANDARDS
Define price thresholds (price the company wants to pay for the design)	

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<table><tr><td>Conclusions, market research related to product evolution analysis, trends analysis, interaction product-environment, etc.</td><td></td></tr></table>
The cMDF provides the 3D model to the 3D Configurator and the manufacturer provides feedback. Once both parties have agreed, the manufacturing process modelling step takes place with the cMDF requesting the manufacturing model to the Digital FabLab Kit.

4. PLANNING AND PROTOTYPE CREATION (VALIDATION)
The cMDF and the manufacturer both send a request to the AR/VR tool in order to obtain a preview of how the headboard will look in a specified Lagrama’s bedroom in which the headboard is thought to be located and to have a joint vision to continue configuring the new product.

A selected FOCUS GROUP targeting Lagrama’s clients validates the virtual prototype to see if it fills the consumers’ needs that started the initial product ideation. This is done through the Mobile App, with both the manufacturer and the consumers (FOCUS GROUP) providing validation feedback in order to provide input for the prototype.

The cMDF then sends a request to the Matchmaking & Agile Network component in order to access the validation feedback specified before. After that, the cMDF and the manufacturer request an AR visualization to the AR/VR tool to see the impact of the product in a real enviroment.

All information must be accessible to all parties, therefore, cMDF and manufacturer request all project data to date to the OpIS Data Repository component in order to have the latest and start production of the prototype.

Finally, the cMDF provides the resource planning of all the tasks and processes to the Matchmaking & Agile Network component to be conducted in order to manufacture the prototype, receiving the scheduling of all needed tasks taking into account all stakeholders in the working group (from the manufacturer’s company and from the cMDF), even externals if needed. This is very helpful for instance, to receive alerts (deadlines, etc.) and to keep all stakeholders informed. This tool would set and monitor deadlines for each step, sending deadline reminders for users, so bottlenecks within the working group are avoided.

Then, the first prototype will be produced based in all project data.

Once the physical prototype is manufactured, another validation occurs. The same selected FOCUS GROUP as before validates now the physical prototype. Again, the Mobile App, with both the manufacturer and the consumers (FOCUS GROUP) provides validation feedback and as before, the cMDF sends a request to the Matchmaking & Agile Network component in order to access the validation feedback.

To conclude all information is sent to the OpIS Data Repository component to have the system updated.
</td>
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<td>Alternative Flows:</td>
<td>Different options can occur here. Third parties can be brought in to collaborate with the cMDF and the furniture company to offer totally customized solutions to the predicament in place. The main product can change during the course of the engineering phase, and result in altering the initial idea.</td>
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Exceptions:	• Timing or planning errors, the system will warn the user and provide a correction path should a delay occur. • Execution errors. For instance, if the system detects that a user is not executing an assigned task that was due on a specific date. The system reacts and tries to correct it, giving higher priority.
Requirements:	**LEGAL AND REGULATORY REQUIREMENTS:** Collaboration agreement needs to be put in place, so that all tasks and responsibilities are correctly identified. • A confidentiality agreement must be signed between the parties. • Exploitation rights must be settled. • Compliance of this new product with the quality and safety standards and regulations. • **ORGANIZATIONAL REQUIREMENTS:** • Elaborate a planning of each of the phases. The system controls and monitors them, and warns should a deviation occur. Then the system offers possible corrections according to plan.
Objectives to achieve:	• Reducing the time finding the right partners to materialize the product idea • Increasing the ratio of ideas related to new innovative products brought to market • Reducing the product development´s cost • Increasing the company’s portfolio of innovative products • Improving the adequacy of the idea from its original state due to the focus group feedback • Motivating co-creation practices between the industry and users
KPI:	• Number of manufacturers involved in different ideation processes (at least 5). • Reduction of the time spent searching for the right partner (cMDF). • Reduction of the time validating the virtual prototype. • Number of opinions from consumers (focus group) to validate a virtual prototype. • Time between the manufacturer/cMDF first contact and the final prototype planning (less than 60 days).

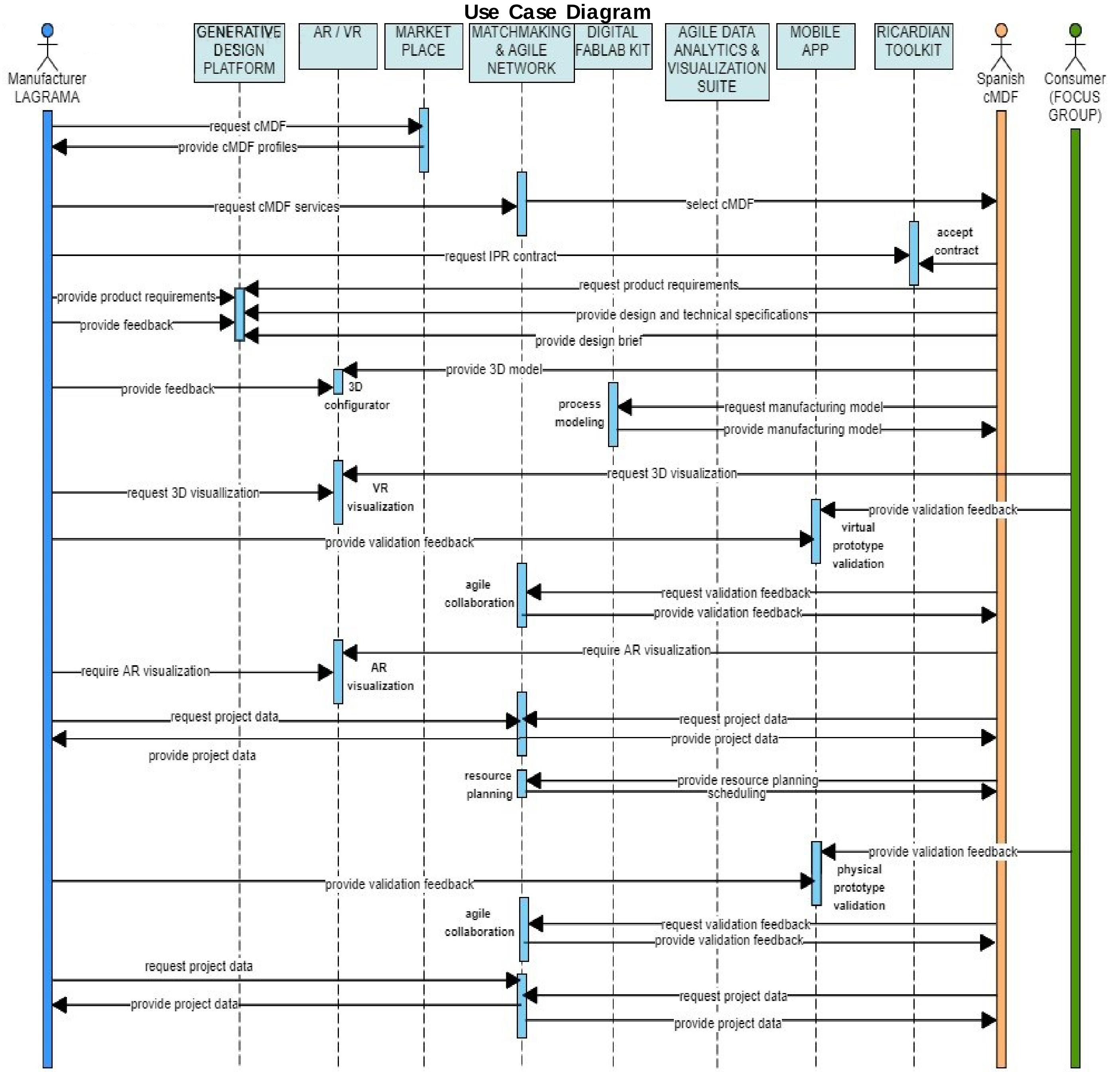


Figure 1 : Spanish Use Case Diagram 1

3.2.2. cMDF_ES_UC2 SMART ADJUSTABLE GAMER CHAIR

Name of Use Case:	cMDF_ES_UC2 SMART ADJUSTABLE GAMER CHAIR		
Created By:	AIDIMME	**cMDF Involved**	Spanish
Date Created:	16/04/2020	**Last Revision Date:**	02/11/2020
Description:	INTRODUCTION: There is an ample group of young people that are into gaming. Most of them lack the necessary furniture equipment in youth bedrooms that can address important questions such as aesthetics, ergonomics, and health and safety issues. For instance, a gaming chair which can adapt to the game that the user is playing, would provide with proper ergonomics and, at the same time, would ensure that the user is not seated for long periods of time, correcting/teaching good posture habits, all by issuing proper warnings and doing proper adequate ways of gaming or using technology. AS-IS situation: The furniture manufacturer gets ideas from potential consumers through online surveys, internet searches, customer satisfaction questionnaires, etc. This is a tedious process that sometimes ends up with abandoning the idea due to a lack of credibility of the source. At the same time, a gamer has an idea of a new piece of furniture for youth bedroom. As stated above, this person may represent a large group of people with similar interests and potential customers of the furniture company. The individual would like to combine his two passions and at same time, provide fellow gamers with a proper tool that could bring gaming to a next level by dealing with health, something that gamers may not be aware of due to the nature of their hobby. However, the individual may be completely lost, since he does not know who to contact. In this scenario, both furniture manufacturer and the client gamer are not connected and do not know each other. TO-BE situation: The furniture manufacturer can use iPRODUCE OpIS to get ideas from potential consumers and find a suitable cMDF. Meanwhile, the gamer can approach the cMDF. In this scenario, both stakeholders are put in contact through the cMDF and can start collaborating along with the cMDF spectrum to co-design and materialize (design, prototype, and implement) the concept (idea) into a prototype through the open collaboration space being tested in a virtual way with a focus group of gamers, thus validating if the chair satisfies the original detected needs.		
Actors:	PRIMARY: ● USER: Gamer, Furniture Manufacturer (Lagrama) ● cMDF: ON and AIDIMME SECONDARY: ● Consumers (Focus group)		
User doubts:	The consumer does not know how to put it in practice his/her idea and bring it to life. The cMDF can tell apart between a good idea and a bad one. A product like this entails a series of issues that must be carefully addressed before turning the		

	idea into a real prototype. Consumer: ● How to put it into practice The cMDF: ● Materials ● Industrial processes integrating engineering (electronics, IoT, IT, …) ● Safety and health regulations
User motivation:	Motivation and customization are key in this use case as well as user ergonomics and health. User(consumer) is totally engaged in the idea, and eagerly wants to make a reality. However, it's up to the cMDF to see the viability of it and try to make it happen. Customization is key.
Preconditions:	The cMDF must be able to carry this idea forward and must have total understanding of: ● Feasibility of the idea ● Functionality of the product (i.e. easy to assemble for the user) ● Materials involved, ● Safety concerns (ergonomics and health)
Post conditions:	At case completion, we have a prototype of a new piece of furniture for young people. The cMDF must ensure that: ● All requirements are addressed, ● The product can be safely used, ● The product complies with the current safety and sector related regulations, ● The product can potentially be produced by a furniture company as part of their catalogue. For an unsuccessful case, failing reasons could vary, but mainly fall under the unviability of the original idea which should be changed in order to make it successful.
Flow:	**1. IDEATION INITIAL PROCESS** A gamer visits a nearby cMDF which is in the network of iPRODUCE makers communities in order to tell them about the gaming chair idea. The cMDF finds the idea very interesting and enters it into the system via the Generative Design Platform along with all requirements. After some determined time, the cMDF contacts the gamer and the manufaturer since the needs of both latter can be aligned with the needs of the gamer. Once all parties are brought together several talks take place and a working collaboration starts. Therefore, a request for an IPR contract to be accepted by both parties using the Ricardian Contract Toolkit component is performed.. **2. DESIGN THINKING (DEFINE WHAT TO DO, INFORMATION ANALYSIS)** A co-creation design process starts maturing the idea into a game chair with an intelligent system of sensors which will detect bad postural hygiene, long seated periods and correct them, and at the same time, it will provide full comfort thanks to its materials and design. Then the cMDF requests the product requirements (description, target, dimensions, materials, constraints, drawings, budget, technical specifications,…) to the Generative Design Platform which are provided by the Manufacturer asking for support. During the ideation process, the cMDF provides the design and detailed technical specifications (functional specifications, material characteristics, packaging design,…) getting feedback at all times from the

Manufacturer and the gamer. Finally a design brief is elaborated with all needed specifications and entered into the Generative Design Platform.

3. DESIGN, PROTOTYPING AND INDUSTRIALIZATION

The brief is a document composed by six sub-processes which contains all specifications related to environmental aspects, regulations about health and safety, ergonomics, aesthetics, etc.

DESIGN BRIEFING SUBPROCESS	***INPUT NEEDED (information sources)***
Requirements and specifications of the prototype	
Environmental aspects to consider	ENVIRONMENTAL REGULATIONS
Manufacturing specifications to be taken into account	PRODUCTION DATA
Analysis of quality levels and Regulations	QUALITY STANDARDS
Define price thresholds (price company wants to pay for the design)	
Conclusions market research related to product evolution analysis, trends analysis, interaction product-environment, etc.	

The cMDF provides the 3D model to the 3D Configurator and the manufacturer and gamer provides feedback. Once all parties have agreed, the manufacturing process modelling step takes place with the cMDF requesting the manufacturing model to the Digital FabLab Kit.

4. PLANNING AND PROTOTYPE CREATION

The cMDF, the manufacturer and the gamer send a request to the AR/VR tool in order to obtain a preview of how the headboard will look in a specified Lagrama’s bedroom in which the chair can have a fit and to have a joint vision to continue co-creating the new product.

A selected FOCUS GROUP targeting LAGRAMA´s clients validates the virtual prototype to see if it fills the consumers’ needs. This is done through the Mobile App, with the manufacturer, the gamer and the consumers (FOCUS GROUP) providing validation feedback in order to provide input for the first prototype.

The cMDF then sends a request to the Matchmaking & Agile Network component in order to access the validation feedback specified before. After that, the cMDF, the gamer and the manufacturer request an AR visualization to the AR/VR tool to see the impact of the product in a real environment.

All information must be accessible to all parties, therefore, cMDF and manufacturer request all project data to date to the OpIS Data Repository component in order to have the latest and start production of the prototype.

	Finally, the cMDF provides the resource planning of all the tasks and processes to the Matchmaking & Agile Network component to be conducted in order to manufacture the prototype, receiving the scheduling of all needed tasks taking into account all stakeholders in the working group (from the manufacturer's company and from the cMDF), even externals if needed. This is very helpful for instance, to receive alerts (deadlines, etc.) and to keep all stakeholders informed. This tool would set and monitor deadlines for each step, sending deadline reminders for users, so bottlenecks within the working group are avoided. Then, the first prototype will be produced based in all project data. Once the physical prototype is manufactured, another validation occurs. The same selected FOCUS GROUP as before validates now the physical prototype. Again, the Mobile App, with the manufacturer, gamer and the consumers (FOCUS GROUP) provides validation feedback and as before, the cMDF sends a request to the Matchmaking & Agile Network component in order to access the validation feedback. To conclude all information is sent to the OpIS Data Repository component to have the system updated.
Alternative Flows:	Different options can occur here. Third parties can be brought in to collaborate with the cMDF… For example, other gamers that are expert in the fields needed to create the product, etc. In addition, the furniture product/s could change during the engineering phase, and result in altering the initial idea.
Exceptions:	• Timing or planning errors, the system will warn the user and provide a correction path should a delay occur. • Execution errors, the system detects that a user is not executing an assigned task that was due on a specific date. The system reacts and tries to correct, giving higher priority.
Requirements:	**REQUIREMENTS:** • Collaboration agreement needs to be put in place so all tasks and responsibilities are correctly identified. • A confidentiality agreement must be signed between the parties. • Exploitation rights must be settled. • Compliance of this new product with the quality and safety standards and regulations. • **ORGANIZATIONAL REQUIREMENTS:** • Elaborate a planning of each of the phases. The system controls and monitors them, and warns us if a deviation occurs. Then the system offers possible corrections according to plan.
Objectives to achieve:	• Filling the gap of products of this category for young people. • Improving overall well-being of gamers while spending countless hours playing games.
KPI:	• Increasing the number of ideas for new furniture product design addressing young people (target). • Improving product innovation and co-creation activities (around 20%). • Improving consumer satisfaction (more than 50%)

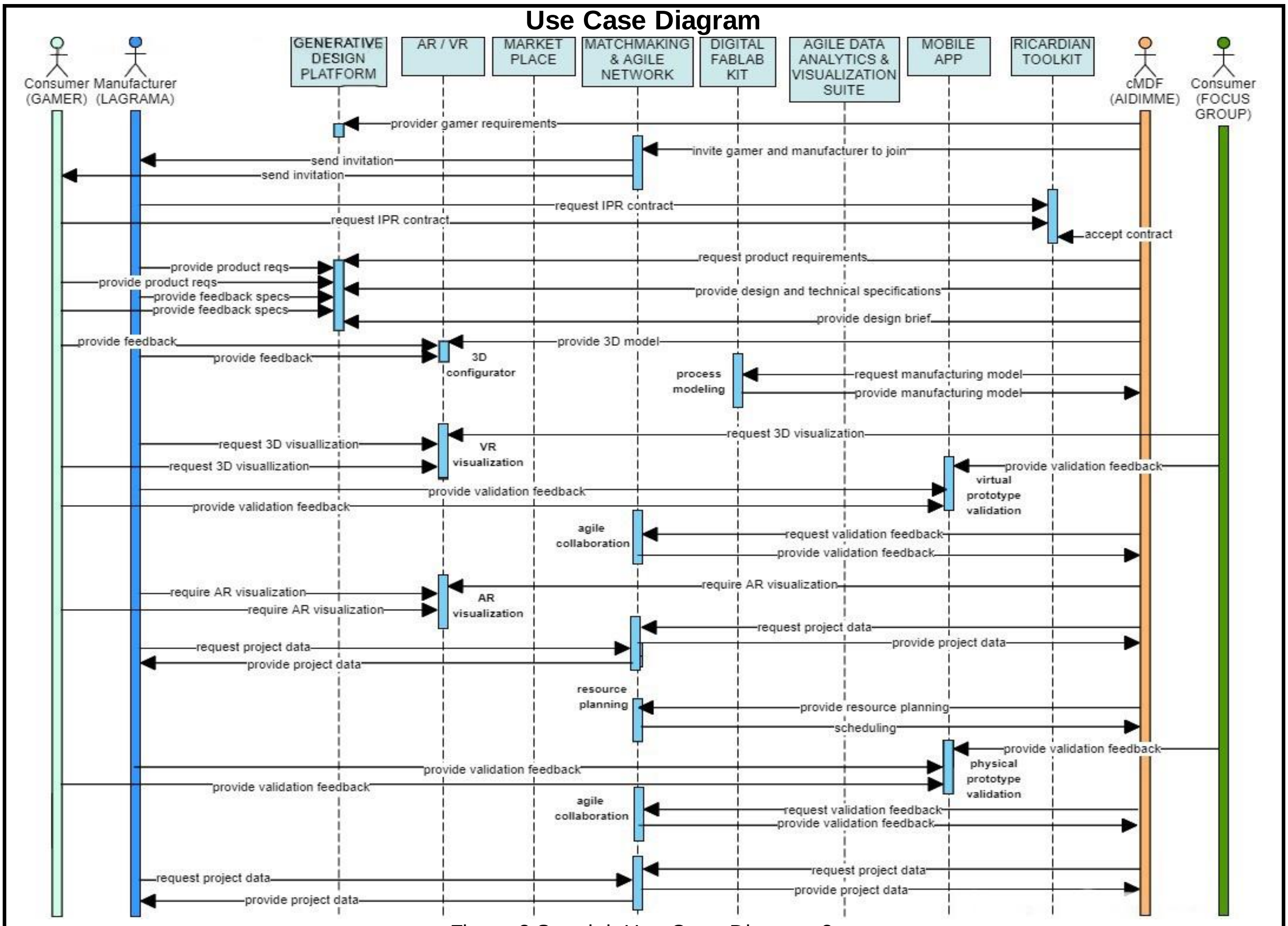


Figure 2 Spanish Use Case Diagram 2

3.2.3. cMDF_ES_UC3

Name of Use Case:	cMDF_ES_UC3		
Created By:	FABLAB VLC	**cMDF Involved**	Spanish
Date Created:	22/04/2020	**Last Revision Date:**	03/11/2020
Description:	AS-IS situation: A maker entrepreneur has an initiative or a design idea that evolves around the manufacture of furniture, identifying a need for innovation around design and considers it could be interesting, either to start his initiative or propose it to a manufacturer or groups of manufacturers. This profile starts looking in Internet for manufacturers and maker spaces in order to obtain support to carry out the idea. This idea is not defined technically or commercially yet. It needs a new design which incorporate innovations based in programming and in an open source electronic system. This maker entrepreneur has big problems to find partners, because he is not used to industrialization. On the other hand he has digital fabrication skills, so it wouldn't be difficult for him to solve some prototyping needs in a cMDF. He also has no problems to share benefits or partnership to produce or commercialize this idea with. this innovation.		

	TO-BE situation: The “maker” profile is an entrepreneurial profile and a profile of a person interested in the digital manufacturing technologies, who develops a component, design or element that can be put into practice with the help of a cMDF or in collaboration with the industry. The professional profile of a maker is diverse. Knowledge usually comes from experience and learning by doing, rather than from work or academic title. Skills vary from electronics, electro mechanics, programming, and general computing, favouring open source and freeware (Linux, Arduino, etc.). Some of them have knowledge in general engineering while others come from creative jobs such as architecture and design. We can also find specialist in different areas that have a technological hobby or suggest conceptually to the community some solution in need of a technology (e.g. a medical doctor with a professional solution which needs an engineering component to fit that need).
Actors:	PRIMARY: ● Maker entrepreneur ● cMDF SECONDARY: ● Maker no entrepreneur ● Industrial partners ● Ecosystem of experts and makers within the umbrella of the cMDF
User doubts:	The profile of a maker user that can use the cMDF can be found in a similar situation to the one of the rest of entrepreneurs in incubation processes. This is more tangible when a centered model is suggested where ideas can be developed and necessary support can be found, both prototyping resources, investment and alliances before an industrialization or business occurs (the first question will be if the cMDF can find what it is seeking). The user model finds personal and economic benefits, but above all, feeling satisfied that its idea can be materialized and can find someone that will believe in it. Once cMDF contact is established, the main doubts can be summarized in the contracts to be established, authorship, or project exploitation and the economic percentage subscribed.
User motivation:	Main motivation of the entrepreneur makers is that his ideas can become a business reality. This is because the cMDF has a series of resources that are necessary for the maker to get his idea forward, getting support, from inception until prototype validation and potential contractual relationships.
Preconditions:	The maker who will be the user of the cMDF must know where and whom he needs to contact to. Answers have to be clear and concise (a service offer with examples). The maker seeing the possibility of working with the cMDF, will want to know what can be done with his/her idea and how much is it going to cost (contract, estimate, conditions). The maker needs can technical, economical or incubation ones.
Postconditions:	To analyze the post, an evaluation of the obtained results has to be made from the maker side (of the service received). It would be useful to also have a follow up of the satisfaction given an adequate time margin in order to get the obtained benefits settled of the service or incubation in the cMDF
Flow:	The flow for the ideation process through the OpIS platform can be structured in 4 main phases, as in the other Use Cases. **1. IDEATION INITIAL PROCESS**

A maker entrepreneur visits a nearby cMDF. This maker can fit any of these maker profiles:

- Comes with an idea that the maker wants the cMDF to develop (may not be a “true” maker, it is more someone that has an idea and thinks that somebody can develop it for him).
- Comes with an idea which is willing to help to convert it into a business model (is a longer-term model since he/she doesn’t want just a development, but also an incubation. It is a natural entrepreneur).
- Comes with a first development that he/she wants to get improved (will be a regular, if we take the conventional maker profile into account).
- Comes with a development and the maker wants it to be prototyped (a maker sure of himself that comes to get his design prototyped).

The cMDF sends an invitation to the maker to join OpIS using the Matchmaking & Agile Network. Then the maker registers into the iPRODUCE platform via the Marketplace component. After several talks, a working collaboration starts. Therefore, a request for an IPR contract to be accepted by both parties using the Ricardian Toolkit is performed.

2. DESIGN THINKING (DEFINE WHAT TO DO, INFORMATION ANALYSIS)

A co-creation design process starts and the cMDF requests the product requirements and specifications (description, target, dimensions, materials, constraints, drawings, budget, technical specifications…) to the Generative Design Platform, which are provided by the maker. After the ideation process, the cMDF provides a design briefing with all needed specifications and entered into the Generative Design Platform. This brief is then checked by the maker reaching an agreed final briefing.

3. DESIGN, PROTOTYPING AND INDUSTRIALIZATION

The briefing is a document composed by six sub processes that contains all required specifications related to environmental aspects, regulations about health and safety, ergonomics, aesthetics, etc.

DESIGN BRIEFING SUBPROCESS	***INPUT NEEDED (information sources)***
Requirements and specifications of the prototype	
Environmental aspects to consider	ENVIRONMENTAL REGULATIONS
Manufacturing specifications to be taken into account	PRODUCTION DATA
Analysis of quality levels and Regulations	QUALITY STANDARDS
Define price thresholds (price company wants to pay for the design)	
Conclusions market research related to product evolution analysis, trends analysis, interaction product-environnement, etc.	

The cMDF provides the 3D model to the 3D Configurator and the maker provides feedback. Once all parties have agreed, the manufacturing process modelling step

	takes place with the cMDF requesting the manufacturing model to the *Digital FabLab Kit*. Finally, the maker checks the model. **4. PLANNING AND PROTOTYPE CREATION** The cMDF and the gamer send a request to the AR/VR tool in order to obtain a preview of how the product will look in and to have a joint vision to continue co-creating the new product. Both maker and cMDF validates the virtual prototype to see if it fits the original needs. This is done through the Mobile App, with the maker and the cMDF providing validation feedback. The cMDF then sends a request to the Matchmaking & Agile Network component in order to access the validation feedback specified before. After that, the cMDF and the maker as well request an AR visualization to the AR/VR tool to see the impact of the product in a real environment. All information must be accessible to all parties, therefore, cMDF and maker request all project data to date to the OpIS Data Repository component in order to have the latest and start production of the prototype. Afterwards, the cMDF provides the resource planning of all the tasks and processes to the Matchmaking & Agile Network component to be conducted in order to produce the prototype, receiving the scheduling of all needed tasks. This is very helpful for instance, to receive alerts (deadlines, etc.) and to keep all stakeholders informed. This tool would set and monitor deadlines for each step, sending deadline reminders for users, so bottlenecks within the working group are avoided. The maker provides feedback about the planning. Then, the first prototype can be produced based in all project data. Once the physical prototype is manufactured, another validation occurs. The maker and the cMDF validate now the physical prototype. Again, the Mobile App is used to provide validation feedback and as before, the cMDF and the maker send a request to the Matchmaking & Agile Network component in order to access the validation feedback. All information is sent to the OpIS Data Repositorycomponent to have the system updated. It is possible that the maker may want to inquire into searching for partners to industrialize his/her product. To achieve this, a request is sent to the Marketplace component to look for partners for industrial alliances. The system then, provides with a set of alternatives..
Alternative Flows:	The cMDF can provide with two alternative options for the maker beyond a FabLab or beyond a company's incubator, maybe a hybrid process. On the one hand, we find partners and have a technical functionality focused in the development of a prototype that can be validated. On the other hand, incubation oriented to acceleration where a prototype is developed and validated at technical level, but also at the business model level (looking for investors or strategic alliances) and industrialization (industrial partners in the home furnishing sector).
Exceptions:	Main obstacles are that this type of user won't understand the concept (collaborative language, benefits of open design, etc). In addition, once started, the user will not be able to appreciate changes or an innovative model compared to other traditional incubation models. This advanced maker profile is an important ally in future development, as an example of what is intended to be done in

	iPRODUCE if we want the model of cMDF to continue.
Requirements:	New considerations must be raised in the different participation formats, exploitation, registries, patents or authorships, considering the maker taking as a reference the EU framework: legislation, norms, copyrights, etc, and also the possible industrial and commercial exploitation between all parties. In this section, the cMDF model for Spain must be defined, therefore, the model among the partners will have to be established (FabLab and AIDIMME)
Objectives to achieve:	• The prototype • The resources used (economical, technical and human like), obtaining a final report that describes the process • Copy of de contract models (development services and prototype validation) or business development (from incubation) and include estimates
KPI:	• Improvement in the decision-making process (more than 20%) • Reduction of the time spent searching for the right partner (maker) to industrialize the prototype (more than 50%) • Improvement with respect to the traditional innovation model (more than 50%)

Use Case Diagram

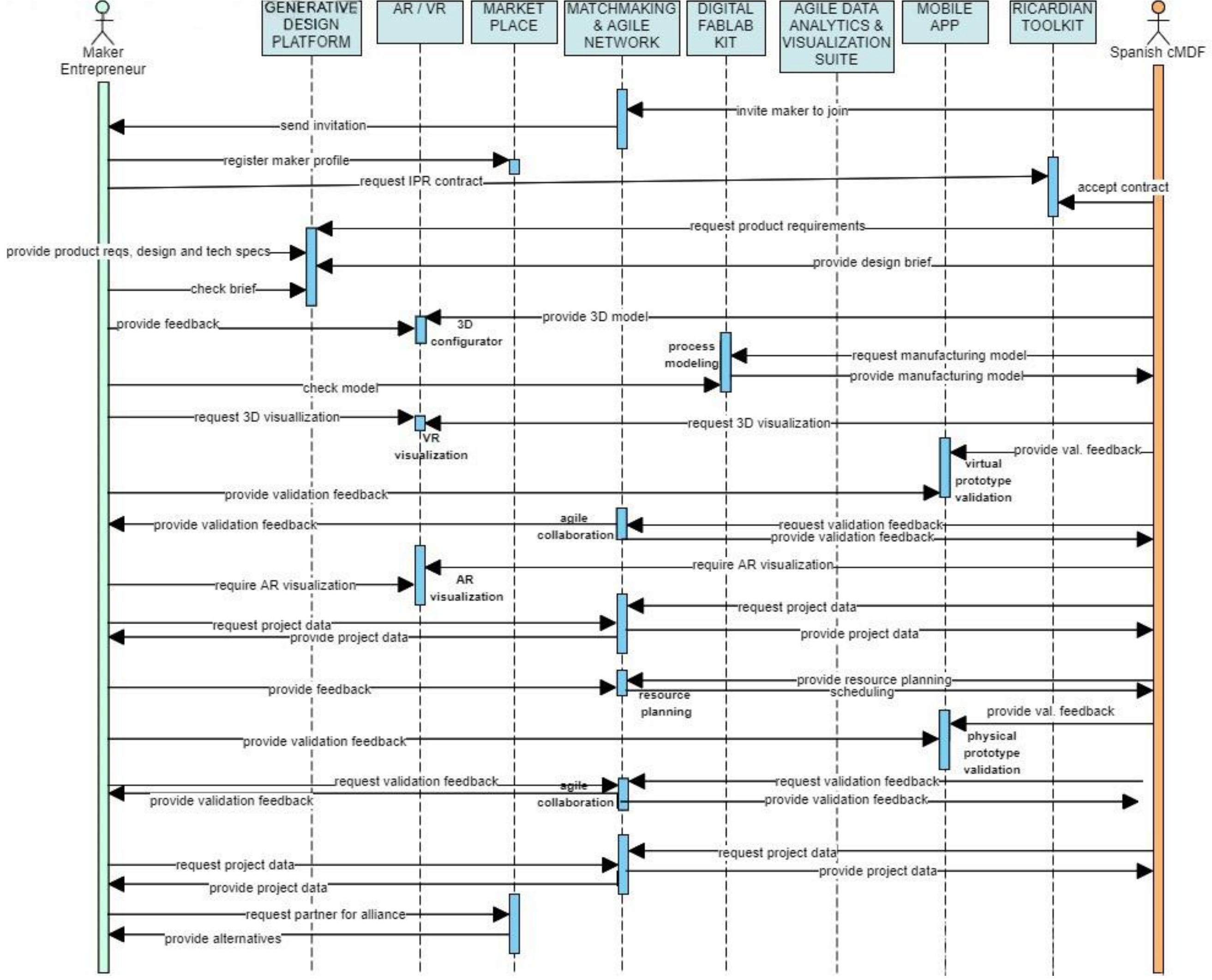


Figure 3 Spanish Use Case Diagram 3

3.3. German Use Cases

3.3.1. cMDF_GER_UC1

Name of Use Case:	cMDF_GER_UC1		
Created By:	Marc Jentsch	**cMDF Involved**	German cMDF
Date Created:	25/05/2020	**Last Revision Date:**	13/08/2020
Description:	INTRODUCTION: A company (small-medium enterprise) wants to renew their approach towards innovation. Their goal is to get from idea to prototype in less time and to make sure that product development is more user-centered, effective and modern. AS-IS-Situation: The company does not currently follow a defined process or methodology for innovating. The company's products are based on innovation created by the owner (or a small group of experts) and are rarely updated. The owner /expert group creates prototypes using their private tools and simple bricolage methods. TO-BE-Situation: The company is looking for training and/or prototyping facilities within their region as they want to renew their approach towards innovation. They search online and find the iPRODUCE digital (OpIS). Via OpIS they get in touch with the German cMDF and submit their request for learning about innovation processes, such as design thinking (Matchmaking). The company may send their employees to trainings about ideation or prototyping methodologies, which are offered by the German cMDF. The company may also decide to engage into a consulting process to co-create on the company's products. The training lets the employees get a first grasp on the taught methods and the connected mindset. And the consulting process can accompany their first implementation steps, in order to be able to apply what has been taught. The German cMDF would further support the company's innovation process in a concrete innovation project if desired.		
Actors:	PRIMARY: • Industrial company • German cMDF: Fraunhofer Institute for Applied Information Technology (FIT), MSB, ZENIT – Networking Agency for regional SME's		
User doubts:	Company: • Is a "modern innovation process" needed at all? • Will iPRODUCE OpIS protect intellectual property on my innovative ideas? • How much will I have to pay if I engage with iPRODUCE OpIS ?		
User motivation:	Company: The company (SME) wants to renew their approach towards innovation. Their goal is to get from idea to prototype is less time and to make sure that product development is more user-centered, effective and modern. cMDF: The members of the cMDF want to apply their expertise in commercial contexts.		

Health and Safety Issues:	No health and safety issues
Preconditions:	The cMDF must have expertise about innovation processes. The company must know about the cMDF services and cost model. The company must have a concrete product to innovate on. The company must have a need for learning on co-creation and Innovation.
Postconditions:	• Successful: The company has implemented a modernized innovation process. The company reduced the time required from idea to prototype compared to the previous situation (without modernized innovation process) • Unsuccessful: The customer decided to not make use of the consulted content of the cMDF
Flow:	• The company is searching online for training and/ or prototyping facilities within their region. The company finds the iPRODUCE digital Open Innovation Space (OpIS) and submits their request for learning about innovation processes, such as design thinking using the *Matchmaking & Agile Network* creation tool. • Then, they get in touch with the German cMDF and learn about the services offered by them. • The company sends their employees to trainings about ideation and prototyping methodologies, which are offered by the German cMDF. • The trained employees implement the taught strategies and are informed about the prototyping facilities offered by the cMDF. • The German cMDF may also come to the company for consulting about how to apply the innovation process in a concrete innovation project example. This is repeated until the customer feels comfortable enough for applying the learned and adapted process on their own.
Alternative Flows:	The company may involve other third parties, that they used to collaborate with previously to produce prototypes, for example. The company may come to the conclusion that the innovative product is not cost-effectively producible with current technologies.
Exceptions:	The company concludes that the offered methodologies are not what they need. If the German cMDF disagrees with that point of view, they will adapt the process and try to convince the company. If that does not work out or the German cMDF agrees that the conveyed processes are not applicable to this company, the activity is stopped.
Requirements:	The Company must be a legal entity that exists. The cMDF and the company need to consider signing contractual agreements like a collaboration agreement (tasks, roles and responsibilities), a confidentiality agreement, a document to define exploitation rights and / or product compliance with general quality and safety standards and regulations.
Objectives to achieve:	• Reducing Time to Market: get from idea to prototype is less time • Deploying User-Centered Innovation Process: make sure that product development is more user-centered. • Improving Innovation Quality • Improving Number of Innovation Ideas
KPI:	• The number of innovations in the first year after having applied the new process is 15% higher compared to the year before the new process. What counts as innovation has to be defined on individual company level. • The average time of generating an idea in the first year after having applied the new process is 10% shorter than in the year before the new process. What counts as idea has to be defined on individual company level. • In the first year after having applied the new process, the 5% more innovations find their way into products, compared to the year before the new process. What counts as innovation has to be defined on individual company level.

Use Case Diagram

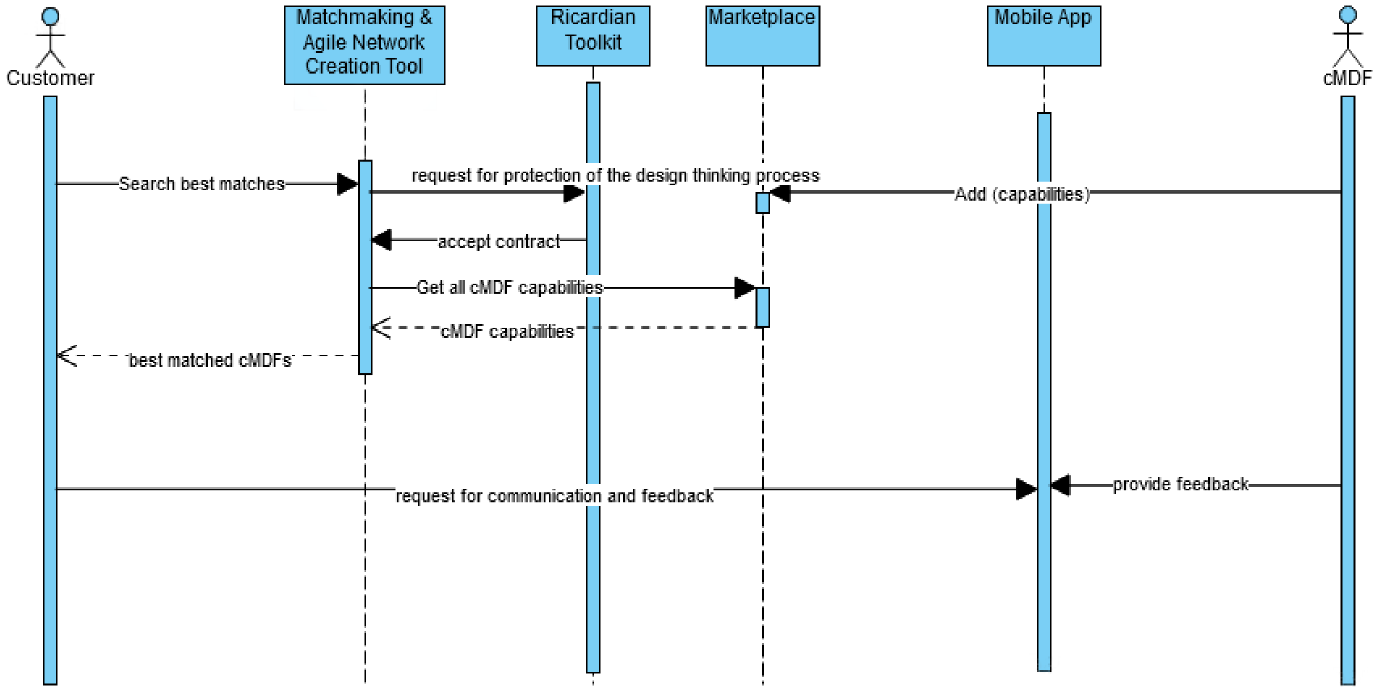


Figure 4 German Use Case Diagram 1

3.3.2. cMDF_GER_UC2

Name of Use Case:	cMDF_GER_UC2		
Created By:	Veronika Krauß	**cMDF Involved**	Probably all cMDFs (this is a use case for conceptual work)
Date Created:	03/06/2020	**Last Revision Date:**	21/07/2020
Description:	INTRODUCTION: Maker Space Bonn bought a new machinery for prototyping and printing circuit boards. Now, many people need to learn about the operation of this machinery as well as its capabilities for projects and how printed circuit boards can be designed / included in projects. The FabLab wants to establish virtual tutorials and sample projects to teach and train inexperienced makers about machinery, material and processing steps in a fun and immersive way – also to reduce the time spent on explaining repetitive information. They provide sample projects as well as learning material for inexperienced users.		
Actors:	PRIMARY: • Maker • Workshop Conductor, head of FabLab		
User doubts:	Maker:		

	Feels insecure about using equipment and is inexperienced in which steps to take; is insecure if documentation is usable and does not know much about how to include the potential of the new machine it their projects Workshop Conductor: Is unsure if digitized training material is up-to-date
User motivation:	Maker: Wants to broaden their skill sets and realize their ideas, wants to enhance their skills with machinery and tools, wants to build sample projects Workshop Conductor: Wants to preserve knowledge, wants to reduce repetitive explanations, wants to enable makers to build things
Health and Safety Issues:	Misuse of equipment can lead to major / fatal injuries and damage of machinery and material
Preconditions:	The makers need to have access to equipment and tutorials. The workshop conductor must have a digital version of equipment and training.
Postconditions:	Successful: The maker was able to complete a tutorial or training and advance with their project The workshop conductor had less repetitive tasks Unsuccessful: The maker dumped the project The workshop conductor did not feel positive impact
Flow:	**Creation, maintenance and sharing of tutorials** The workshop conductor digitizes their knowledge about material and machinery as virtual sample projects using the *Digital FabLab Kit*. The virtual version of those sample projects is defined and updated as an immersive experience, involving physical material, tools and machinery as well as virtual trainings, explanations and step-by-step guides. Since the tutorial involves multiple steps that are both, intertwined and independent, the workshop conductor records the steps taken during building the creation of the sample project using for example the *Video Intelligence* tool. Other content such as workflows, techniques for prototyping etc. can be authored with tools that still need to be defined or existing tools that need to adapt this functionality. If available, the Digital Twin of machinery might be included to create a better understanding of the positioning and size of parts, how the machine works internally and how the circuit board is being produced. The workshop conductor can review and adapt the tutorials any time before publishing and sharing it. The tutorials and digital twins can be shared using the OpIS platform for FabLab-overarching use, in case other FabLabs have the same machinery or want to try out the applicability of their ideas before buying a similar machine.

	Other experienced makers can maintain and update the guides and tutorials based on their experiences. Workshop conductors and experienced makers can quickly prototype new sample projects and iteratively enhance them until it is fit to be published for inexperienced makers by using the *Digital FabLab Kit* (*Video Intelligence* tool or other software). **Application of tutorials** The inexperienced maker has an idea about a project and wants to gain experience in working with material and machinery. They can either work individually or create the sample project in a group. The FabLab has established virtual tutorials and sample projects to teach and train inexperienced workers. The makers follow the tutorial either on sequential or parallel tracks and increase their knowledge about the machinery, tools, material and working methods.
Alternative Flows:	NA
Exceptions:	• Machinery mentioned in the tutorial is moved or working differently than the one explained in the training • Tutorials are not well formed and contain difficult expressions or unfamiliar vocabulary • Tutorials are not maintained or difficult to maintain • Tools and material are missing, a trainee can therefore not complete a tutorial • The tutorial increases the amount of repetitive explanations
Requirements:	• Machinery and workshop material need to be accessible • Authoring and display tools should be easy to use • Tutorials should be easy to share and maintain (across FabLab maintenance and sharing) • Tutorials should be immersive • Tutorials should cause a learning effect
Objectives to achieve:	Inexperienced makers should be able to learn at least the basics handling of tools, machinery and material and should be able to complete a simple project on their own. The repetitive explanation of the same things should be reduced for the workshop conductors
KPI:	• The number of available virtual workshops should reach 5 sample projects for beginners, involving different material and tools. The sample projects as well as the tutorials etc. should be defined, created and maintained by the maker spaces themselves. • At least 10 makers should be able to complete the envisioned sample projects as a training with material, machinery or tools they have not used before. • The collaborative digitization of training material should increase by 5% compared to the existing digital material.

Use Case Diagram

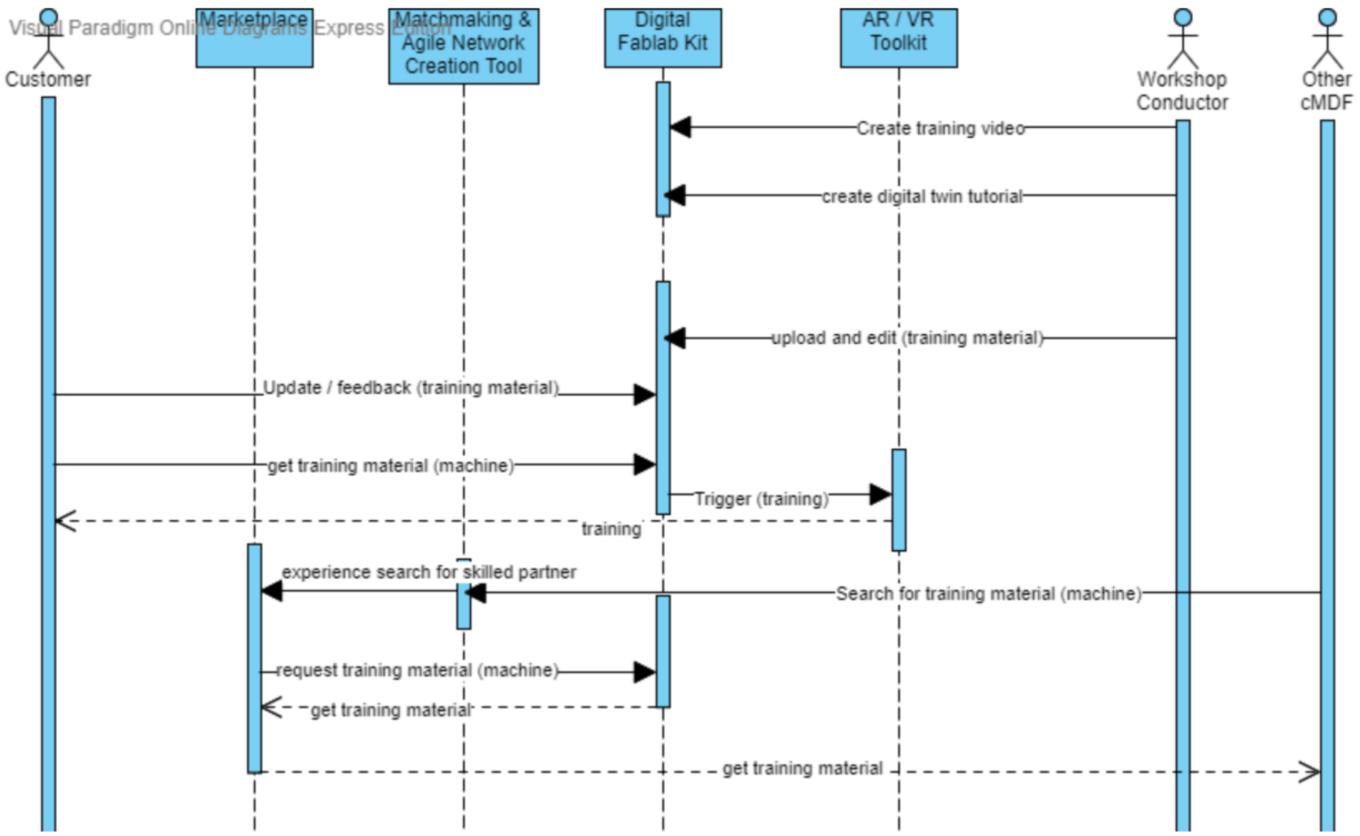


Figure 5 German Use Case Diagram 2

3.3.3. cMDF_Ger_UC3

Name of Use Case:	cMDF_Ger_UC3 - Guided Product Development as a Service (GPDaaS)		
Created By:	Salim Deeb	cMDF Involved	Ger
Date Created:	20/09/16	Last Revision Date:	
Description:	INTRODUCTION: MSB will offer Guided Product Development as a Service (GPDaaS) for start-ups. MSB experts will challenge the start-up to carve out the unique selling point of their product idea. Furthermore, MSB experts will support and consult with regards to cost calculation, ramp-up and production. If needed, consulting regarding certification, etc. can be given by subject matter experts internally or externally (matchmaking).		
Actors:	PRIMARY: • Start-ups with a product (idea) • Makers/experts from MSB SECONDARY: • (External) subject matter experts/consultants		
User doubts:	• Start-ups might be afraid because of intellectual property regards.		

	• Qualification of MSB makers • "Openness" of process - fear of competitors
User motivation:	• Start-ups and MSB share the same DNA (fast action, short time to market, same "community"), which leads to trust • MSB is much more "agile" than traditional consultants • Success stories of previous start-ups that took that route
Health and Safety Issues:	• If machines are used by start-up personnel, a proper introduction needs to be ensured
Preconditions:	• The start-up has a new product idea and wants to get this out to the market • MSB has "subject matter experts" in the startup's field of operation
Postconditions:	The start-up went from idea via prototype to (ramp-up of) production inside the projected budget.
Flow:	• The start-up requests an appointment at MSB. They are naming their needed fields of expertise. • MSB is suggesting possible dates where people with the needed expertise are present in MSB. MSB uses a calendar / know-how availability system from OpIS in order to give this reply (*Resource analysis* tool) • The start-up pitches the idea to MSB and gets challenged on various aspects (use, production, cost, market, IPR and legal issues, suppliers, QA) • MSB uses OpIS as knowledge base for calculating the service price(s) using the *Matchmaking & Agile Network* creation tool. This includes experience exchanges with other makers about similar services and considers regional differences • If the idea is valid, the start-up works together with MSB experts on the various phases of market entrance. • MSB experts mentor the start-up and recommend third party consultancy, if necessary • The start-up gets the product to market
Alternative Flows:	Process is highly individual and tailored to the start-up's needs. Networking with other star-ups, MakerSpaces or players might be necessary
Exceptions:	• The start-up decides to cease business • MSB experts have no or not enough expertise in the field of the start-ups • Special machines/equipment not available at MSB might be needed for prototyping the product
Requirements:	• Subject matter experts available (freelance, etc.) • Overview when which knowledge expert is present at MSB • The start-up needs to have funds • Pricing for machine use and consulting has to be determined
Objectives to achieve:	• The start-up knows obstacles it has to overcome • The start-up launches product to market • Fair calculation/price determination of the consultancy services (possibly via OPIS platform)
KPI:	• Number of start-ups that have been consulted • Number of released products • Number of workshops • Average turnaround time of prototypes • Number of prototypes • Number of consultancy hours

Use Case Diagram

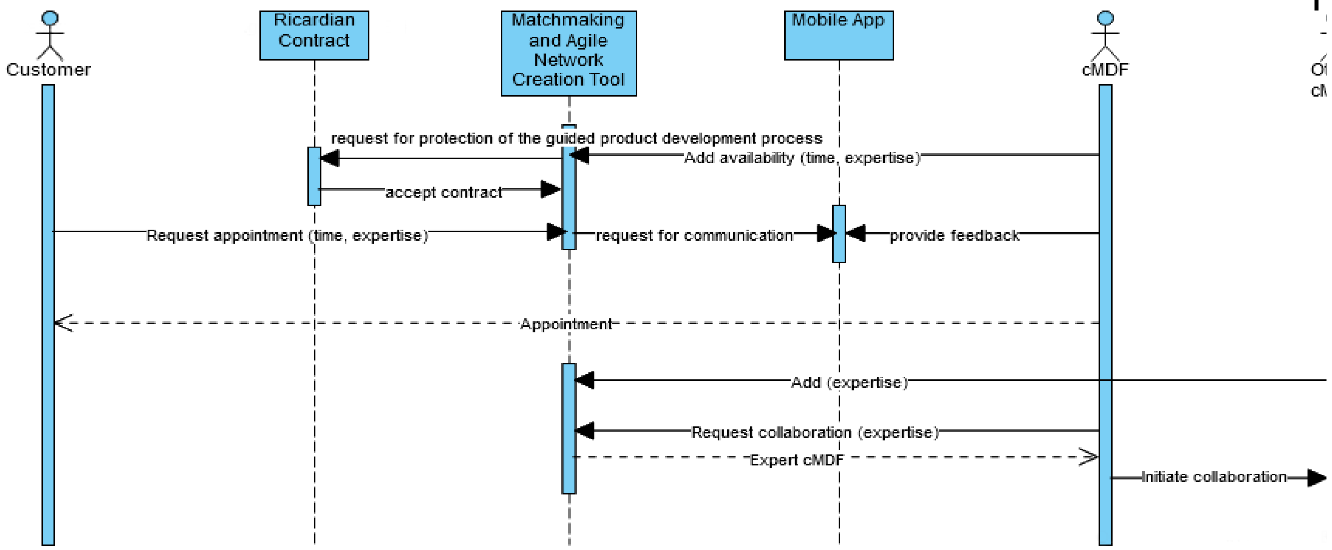


Figure 6 German Use Case Diagram 3

3.3.4. cMDF_Ger_UC4

Name of Use Case:	cMDF_Ger_UC4 - New Skilling/MSB IoT Education Kit		
Created By:	Salim Deeb	cMDF Involved	Ger
Date Created:	20/09/16	Last Revision Date:	
Description:	"New-Skilling" - Cookbooks, recipes and workshops for coding and electronics development. Get your product ready for the digital world with the MakerSpace Bonn IoT Education Kit.		
Actors:	SMEs and developers will learn how to integrate electronics, networking and software into their products to make them internet aware (IoT) MSB will offer courses, workshops, best practices Experts (makers or external) will support the SMEs with the challenges to get their prototypes production ready and connected in our digital world.		
User doubts:	• SMEs might be afraid to integrate connectivity into their products ("We never did this and it always sold, nevertheless") • SMEs might think, the hurdle of integrating connectivity into their products is high • SMEs might have reservations regarding coding/electronics • Security concerns		
User motivation:	Customers expect products to be digitally connected and companies that fail to cope with the "digital transformation" might run out of business.		
Health and Safety Issues:	General risks in electronics production (contact with chemicals, heat, machine operation, etc.)		
Preconditions:	• The SME has a new product idea that involves connectivity to the internet		

<table>
<tr><td></td><td>OR
- The SME has an existing product that needs to be connected to the internet</td></tr>
<tr><td>Postconditions:</td><td>The SME has a prototype for a (connected) electronic device</td></tr>
<tr><td>Flow:</td><td>- The SME gathers ideas/requirements/use-cases
- The SME discusses the above with experts from MSB, gets feedback and orders the tailored “new-skill” workshop
- The SME gets the MSB IoT Education Kit as part of the <i>Digital Fablab Kit</i> and implements the product prototypically in the workshop setting. If needed, the SME is also introduced to programming and/or other needed skills.
- SME can get further consulting, either by MSB or external consultants (matchmaking).</td></tr>
<tr><td>Alternative Flows:</td><td>Workshop contents and support can be adopted, based on the actual need of the SME and the project.
If needed, the SME can generate custom electronics derived from the MSB IoT Education kit.</td></tr>
<tr><td>Exceptions:</td><td>Products and ideas generated during the workshops are not certified for production (CE, conformity).
Based on negotiations with the SMEs, MSB might support the SMEs in that phase as well, or point it to other specialists (match making)</td></tr>
<tr><td>Requirements:</td><td>For quick turnaround times when developing customs electronics, e.g. component placement, additional machinery, like a Pick-and-Place machine, needs to be acquired by MSB. Backup via commercial/3rd party services is always possible, but slower.</td></tr>
<tr><td>Objectives to achieve:</td><td>- The SME has a general understanding of the skills and requirements needed for electronics/IoT development
- The SME has a prototype
- The SME knows how to proceed to get the product to market
- Matchmaking and know-how transfer if needed.</td></tr>
<tr><td>KPI:</td><td>- Number of held workshops
- Number of MSB IoT Education Kits distributed to SMEs
- Number of products in the market</td></tr>
<tr><td colspan="2">Use Case Diagram

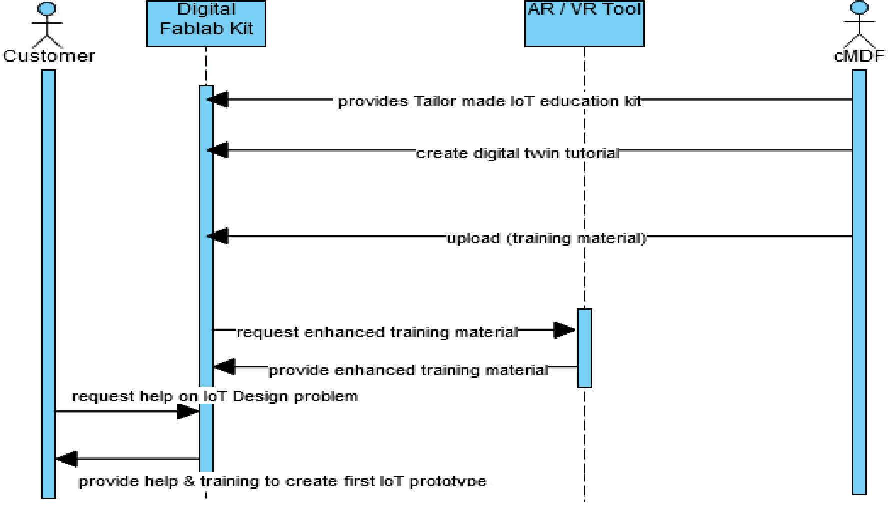


Figure 7 German Use Case Diagram 4</td></tr>
</table>

3.4. French Use Cases

3.4.1. cMDF_FR_UC1

<table>
<tr><td>Name of Use Case:</td><td colspan="3">cMDF_FR_UC1</td></tr>
<tr><td>Created By:</td><td>Jérémy Keller</td><td>cMDF Involved</td><td>French cMDF</td></tr>
<tr><td>Date Created:</td><td>18/05/2020</td><td>Last Revision Date:</td><td>13/072020</td></tr>
<tr><td>Description:</td><td colspan="3">INTRODUCTION:
The FabLabs want to facilitate access to their machines and their methods.
Today, workshops and courses are mainly face-to-face with a member of the FabLab in charge of transmitting their knowledge and training in the use of the machines.
At the end of the iPRODUCE project, we want to have facilitated the access to the FabLab to any person; a consumer who wants to learn how to modify his products, a beginner maker who wants to learn more, a project leader or industrialist who wants to be able to make a first prototype alone.
For this purpose, virtual training modules/tutorials will be designed and made available.</td></tr>
<tr><td>Actors:</td><td colspan="3">• FabLab
• Makers, Consumer, Industrial</td></tr>
<tr><td>User doubts:</td><td colspan="3">FabLab:
Is not very comfortable with digitalizing educational material and keeping it up to date.
Maker/ Consumer/ Industrial:
They are not reassured about using machines they are not used to, and they are afraid of not having the necessary support to progress.</td></tr>
<tr><td>User motivation:</td><td colspan="3">FabLab:
Wishes to facilitate access to their machines, and reach a wider audience. Wants to reduce repetitive work with low-added value
Maker/ Consumer/ Industrial:
Wants to learn how to prototype their ideas. Wants to learn at their own pace on subjects that interest them.</td></tr>
<tr><td>Health and Safety Issues:</td><td colspan="3">Particular attention must be paid to the use of machinery and equipment which, if misused, can cause serious injury.</td></tr>
<tr><td>Preconditions:</td><td colspan="3">The Maker/ Consumer/ Industrial will have to be registered on the iPRODUCE platform to have access to the pedagogical material. For some tutorials, they will also need to have access to the machines.</td></tr>
</table>

	The FabLab will need to have up-to-date educational materials and tutorials.
Postconditions:	Success: Maker/ Consumer/ Industrial have gained knowledge through the use of the teaching materials made available to them. They were able to produce a prototype of their project. The FabLab has widened its audience, seeing the positive impact in terms of increased attendance. The FabLab will also spend less time doing repetitive tasks, especially on equipment training. Fail: Maker/ Consumer/ Industrial failed to complete the tutorials or dropped out of class. Explanations are unclear, leading to little progress. Users are not autonomous and unable to prototype their ideas. The FabLab has not seen an increase in attendance; it spends more time creating teaching materials while continuing to provide strong support to learners. It has therefore not saved time and has not gained any new members.
Flow:	The user wants to know which FabLabs are close to his home, in which he could develop his skills and know-how. The user connects to the iPRODUCE platform and through the MarketPlace will have access to FabLabs and structures offering courses and learning tutorials. He will also have the information on the equipment available in these structures. Among a panel of tutorials made available by the FabLabs, the user will choose his interests. For instance, it could be an introduction to the use of the FabLab machines, a programming exercise, a course on design and a brick on design thinking. The user will have access to the course which will be available in video format (via YouTube), in a downloadable pdf or any other format chosen by the FabLab. The user will therefore be able to complete the training at his own pace and go to the associated FabLabs to put into practice his new knowledge, whether on a personal project or via projects proposed by the FabLab. The FabLab will be able to offer its training courses free of charge or for a fee. The user will be able to pay the FabLab directly through the platform.
Alternative Flows:	The user can be a company that wants to know more about open innovation and collaboration with FabLabs. It will be able to follow modules more adapted to its needs.
Requirements:	FabLabs need to be up to the standards of hygiene quality and safety to be integrated into the platform. FabLabs must be declared and legally exist. FabLabs must have or produce their own content to add it to the platform. User must sign in the iPRODUCE platform to access the learning material.

Objectives to achieve:	• Having between 3 and 5 tutorials / Lesson for each FabLab joining the Fench Pilot. • 80% of the users must complete/finish the Lesson they start. • FabLab must see an increase of participants/attendants. • Improvement in makers’ and consumers’ perceived readiness to participate in collaborative manufacturing
KPI:	• Improvement in the perceived ability of manufacturing SMEs to apply open innovation methods: >20% increase • Improvement in makers’ and consumers’ perceived readiness to participate in collaborative manufacturing: >20% • Increased in the attendance of the FabLab and training attendance.

Use Case Diagram

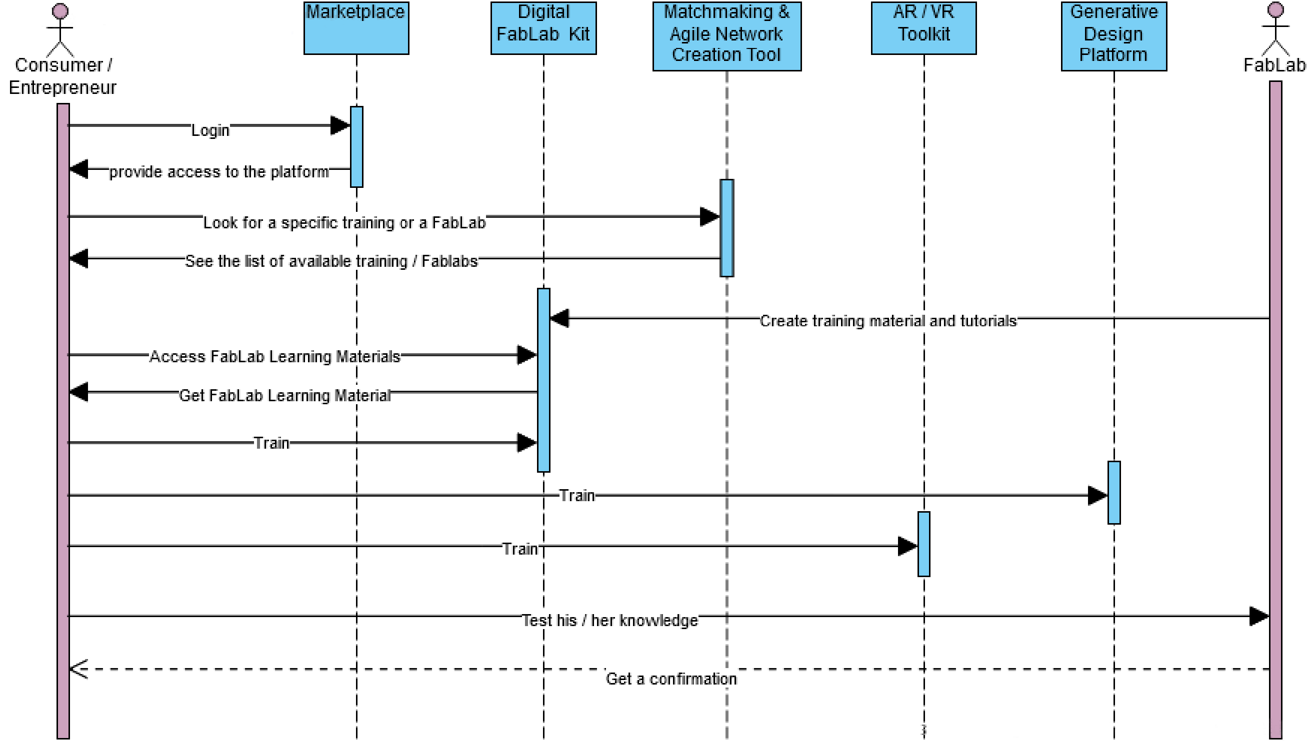


Figure 8 French Use Case Diagram 1

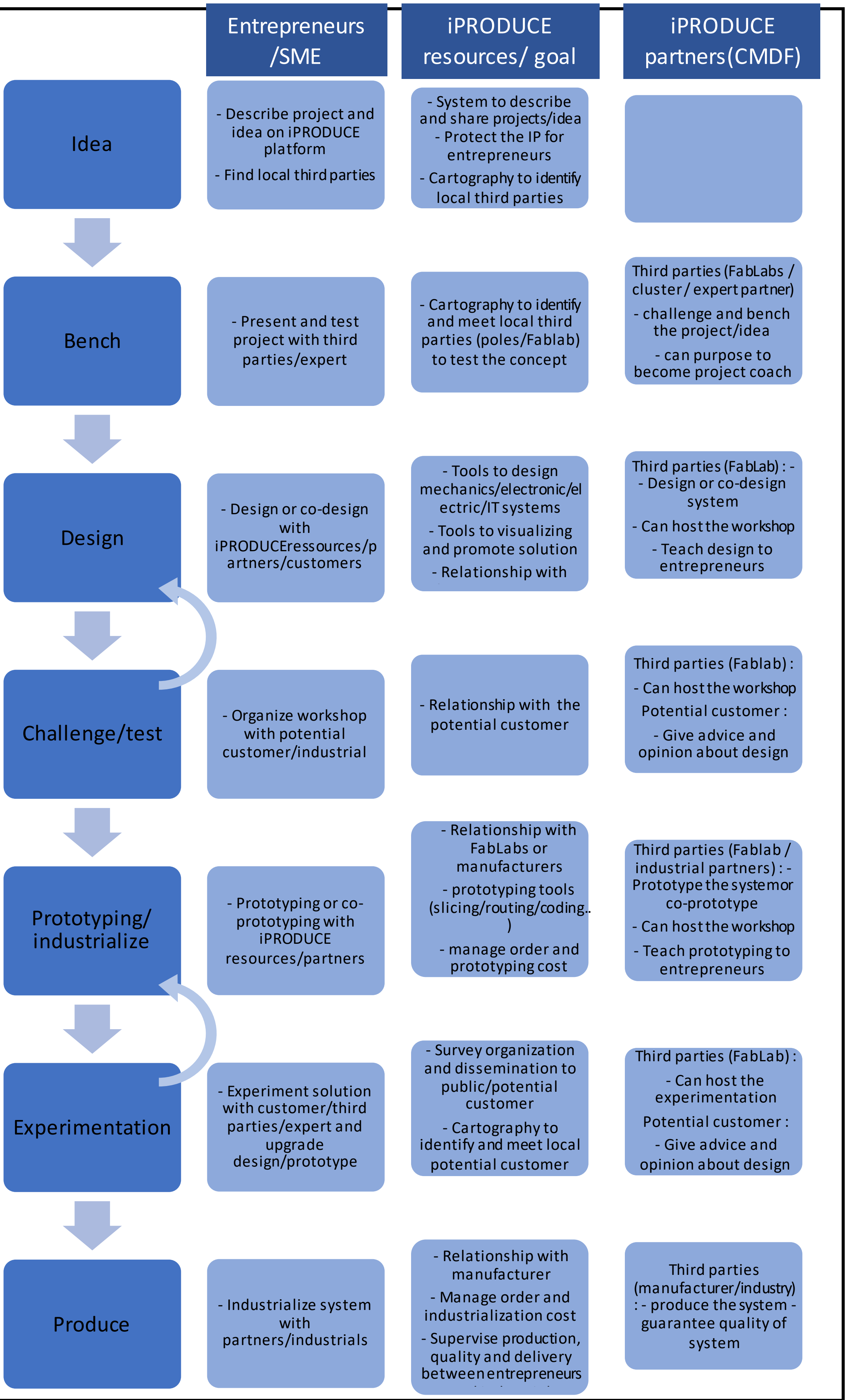
3.4.2. cMDF_FR_UC2

Name of Use Case:	cMDF_FR_UC2		
Created By:	Simon ALBERT	**cMDF Involved**	French cMDF
Date Created:	03/06/2020	**Last Revision Date:**	30/06/2020
Description:	**<u>INTRODUCTION:</u>** Entrepreneurs and SMEs want to develop urban solutions for soft or electric mobility adapted to the needs of users. However, there are many specific needs which have very few solutions, such as urban logistics, last mile delivery or mobility for people with disabilities. By using the iPRODUCE project and the installed ecosystem, entrepreneurs will be able to: • Design their systems with groups of potential users • Prototyping the system with shared machines • Experimenting with the system with consumers in urban areas • Produce the first series of the system		

	Today, an entrepreneur or SME may encounter several problems: • Difficulty to obtain expert advice on a draft from a neutral party. • Difficulty to obtain feedback from future users. • Difficulty to find partners. • Difficulty to go from the idea to the prototype, without having an already built network. • Administrative tasks, which bring slowness, and slowing down the development of the project. • Problem with the notions of intellectual property. • Difficulty to get help on what does not fall within its field of expertise (marketing, etc ...). • Difficulty working with people outside his network or geographical area. • Significant investment in a specific equipment or dependence on producers who do not offer room for manoeuvre on product customization. There is no single solution or network that addresses all of these issues. The project will therefore take a long time to develop. With iPRODUCE, entrepreneurs and SMEs will be able to: • Have a market place where it will be easier to identify partners. • Have IPR and contractualization management tools to reduce exchanges and therefore the time of contractualization between partners. • Have design support tools to accelerate product development. • Access visualization tools that facilitate collaborative work with partners and the promotion of the system • Benefit from pedagogical resources and methodologies to introduce entrepreneurs to rapid prototyping and innovation techniques. • Connect the project leader with a community equipped / having the skills to prototype his idea. • Connect the project leader with a community of end users.
Actors:	**PRIMARY:** • Entrepreneurs and SMEs who wish to develop new urban mobility devices. **SECONDARY:** • Makers, Fablabs or production/industrial companies associated with the iPRODUCE network present on the platform will be the co-producers of the system. • The general public (or potential customers) who will be involved in User Experience design, test and experimentation • The customer who wants a mobility device product
User doubts:	**Entrepreneurs and SMEs want to:** • Keep control over the quality of the products • Have a good understanding on the prototype's finances • Be sure to understand and agree to the financial terms of the construction of the use case and the products • Maintain the liberty to change manufacturers • Keep control on confidence and intellectual property because of the co-design with users, FabLab, makers and company **Makers/FabLabs/production companies want to:** • Stay neutral and do not become a classic and unique supplier for the entrepreneur or SMEs (customer / supplier relationship) • Being a manufacturer and do not waste time on the commercial aspects **The general public wants to:** • Be free to participate in creativity and co-construction sessions when he wants to

	• Have a consideration for his involvement in the project **<u>The customer wants to:</u>** • Do not waste too much time if the product doesn't fit with his requirements • Be sure about the delay for the design and production of the system. He also has doubts about the final quality of the product and the delay between the finalization of the order and the reception of the final product. • Be sure to have good warranty (After sales service) if he has an issue with the system
User motivation:	**<u>Entrepreneurs and SMEs want to:</u>** • Produce specific mobility devices or/and at a lower price or/and high quality in order to create a new market • Limit invests in production equipment • Have technical support from FabLabs, makers and manufacturers • Learn design and prototyping • Have flexibility in its production capacity **<u>Makers:</u>** • Share their knowledge in the service of an entrepreneurship project • Reflect on a concrete project • Move from maker to entrepreneur **<u>FabLabs/production companies:</u>** • Find alternative sources of revenue for machines or personnel that are underutilized. FabLab/manufacturer) • Support new projects (FabLab) • Find new business (FabLab/manufacturer) **<u>The general public:</u>** • Participate in an innovative project on the concepts of soft mobility **<u>The customer:</u>** • Be provided with mobility devices adapted to their specific needs.
Health and Safety Issues:	There should be no problem, as long as the customer only uses iPRODUCE digital interface, and producers/FabLabs/Makers use their own machines. They are therefore supposed to have received the appropriate training and to use them. Pedagogical resources and rules of use will be made available via the Digital *FabLab* module, in order to accompany users in their training in the use of the equipment.
Preconditions:	• The company must have been already created • All entities must be members of the iPRODUCE network and have informed their production capacity, their machine and be up to date with legal obligations (specially in terms of health and safety). • All parties must have signed a non-disclosure agreement.
Postconditions:	**<u>Success:</u>** • Entrepreneur/SME succeeded in designing his solution with iPRODUCE tools and cMDF partners • Entrepreneur/SME succeeded in prototyping his solution with iPRODUCE tools and cMDF partners • Entrepreneur/SME succeeded in producing his solution with iPRODUCE tools and cMDF partners • The entrepreneur/SME saves time between the idea and the production of his idea. • The customer is satisfied with the product developed with the entrepreneur and iPRODUCE cMDF use case. • The entrepreneur masters technique, production and quality of the product he has

	developed. **Fail:** • The entrepreneur wasted his time, he did not succeed in designing, prototyping and producing his products because the tools, methodologies and contact were difficult. • Customer satisfaction is not good because the product developed does not suit his needs. • The entrepreneur does not master the technique, production and quality of the product he has developed
Flow:	The entrepreneurs go to the iPRODUCE module/ iPRODUCE platform to introduce and describe their idea or project. The platform protects the entrepreneurs’ concept and put them in contact with third parties in the territory. Third parties carry out an initial analysis of the project/concept and viability with entrepreneurs. These third parties may offer to become project coaches. Entrepreneurs and third parties design system with iPRODUCE tools or resources of FabLab/designer. Entrepreneurs organize workshops to challenge the design of the system with potential customers. Entrepreneurs and third parties prototype systems with iPRODUCE tools and resources of FabLabs/manufacturers. Entrepreneurs organize a workshop to test the prototype with potential customers in order to improve or validate it. iPRODUCE tools or resources of FabLabs/manufacturers can be used to upgrade the prototype into an industrialize system. Entrepreneurs can use the iPRODUCE platform to identify an industrial manufacturer able to produce the system, manage order, production and delivery. The customer can order and personalize the product on the platform and receive his custom-made product directly at home.



	Entrepreneurs /SME	iPRODUCE resources/ goal	iPRODUCE partners(CMDF)
Idea	- Describe project and idea on iPRODUCE platform - Find local third parties	- System to describe and share projects/idea - Protect the IP for entrepreneurs - Cartography to identify local third parties	
Bench	- Present and test project with third parties/expert	- Cartography to identify and meet local third parties (poles/Fablab) to test the concept	Third parties (FabLabs / cluster/ expert partner) - challenge and bench the project/idea - can purpose to become project coach
Design	- Design or co-design with iPRODUCEressources/partners/customers	- Tools to design mechanics/electronic/electric/IT systems - Tools to visualizing and promote solution - Relationship with	Third parties (FabLab) : - - Design or co-design system - Can host the workshop - Teach design to entrepreneurs
Challenge/test	- Organize workshop with potential customer/industrial	- Relationship with the potential customer	Third parties (Fablab) : - Can host the workshop Potential customer : - Give advice and opinion about design
Prototyping/ industrialize	- Prototyping or co-prototyping with iPRODUCE resources/partners	- Relationship with FabLabs or manufacturers - prototyping tools (slicing/routing/coding..) - manage order and prototyping cost	Third parties (Fablab / industrial partners) : -Prototype the systemor co-prototype - Can host the workshop - Teach prototyping to entrepreneurs
Experimentation	- Experiment solution with customer/third parties/expert and upgrade design/prototype	- Survey organization and dissemination to public/potential customer - Cartography to identify and meet local potential customer	Third parties (FabLab) : - Can host the experimentation Potential customer : - Give advice and opinion about design
Produce	- Industrialize system with partners/industrials	- Relationship with manufacturer - Manage order and industrialization cost - Supervise production, quality and delivery between entrepreneurs	Third parties (manufacturer/industry) : - produce the system - guarantee quality of system

Alternative Flows:	The process can be divided according to the entrepreneurs/SME needs. For example, the entrepreneurs/SME can use the platform only to design the system or he can use it to find the best company to produce his system. The entrepreneur can dispose of the production capacity and manufacture the system directly. In this case, contact with a supplier is not necessary. The challenge / test stage can improve the system design stage (create a loop in the flow). The experimentation stage can improve and industrialize the prototype (create a loop in the flow).
Exceptions:	The customer may have a problem and want to contact the furniture company directly. In this case the contact should be possible. The company can't find any manufacturer who can produce close to home. In this case the platform can communicate the offer to other European CMFs or the company can propose a more interesting offer for the producers.
Requirements:	Companies must be declared and exist legally. Intellectual property issues must be settled and set out in a contract. Standard models must be proposed. In exceptional cases, tailor-made conditions can be set up if all parties agree.
Objectives to achieve:	This section should describe the objectives that the use case will have to achieve in order to validate the Use case. The entrepreneur/SME will be able to: • Design his solution • Prototype his solution • Produce his solution The entrepreneur will be able to co-develop a solution according to the needs of his clients. The entrepreneur/SME will be able to improve his skills in design, prototyping and industrialization. The entrepreneur will be satisfied about iPRODUCE experience.
KPI:	• Number of design support by Use Case. • Number of prototype support by Use Case. • Number of industrialize product support by Use Case. • The entrepreneur/SME will be able to develop and industrialize his solution 20% faster. • The entrepreneur/SME will be able to reduce development cost of 20%.

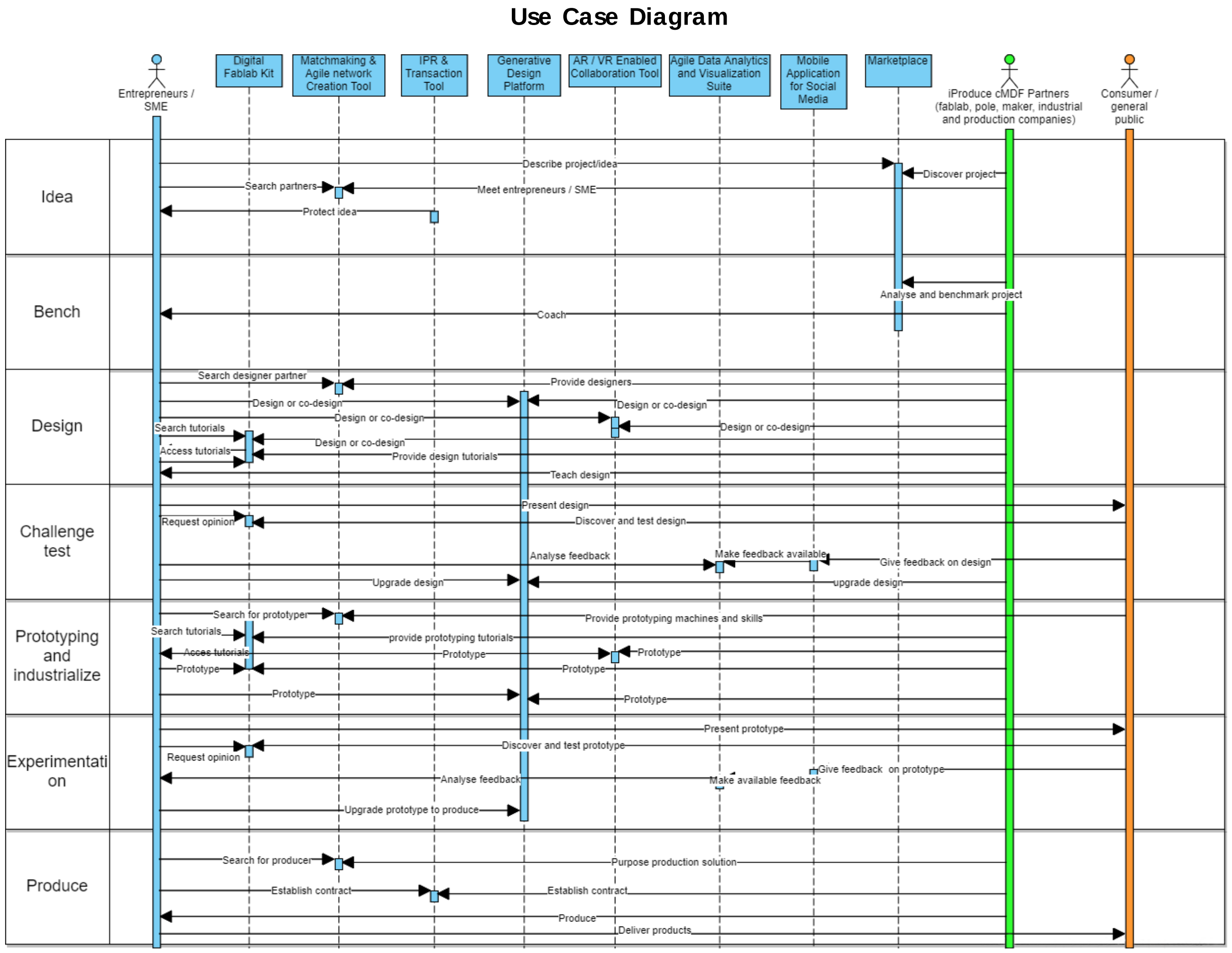


Figure 9 French Use Case Diagram 2

3.5. Italian Use Cases

3.5.1. cMDF_IT_UC1

Name of Use Case:	cMDF_IT_UC1		
Created By:	Luca Capra	**cMDF Involved**	Italian cMDF
Date Created:	22/06/2020	**Last Revision Date:**	02/07/2020
Description:	INTRODUCTION: A user wants to build a simple and customized mechatronic aid to automate, for instance, the moving back and forth of a fan or of a rocking chair or whichever may need an oscillating movement. The mechatronic device must become an input slow-rotational movement, created by a motor, in a linear movement. The user can be a professional trained person but also a tech-newbie, as well a company that wants to create a new B2B product. In all cases the ProM-iProduce services can help.		

Actors:	• CMDF node ("ProM"/cMDF engineer) • Other CMDF's/cMDF local member • User (professional, newbie)
User doubts:	In case of tech-newbie: He/she feels insecure about design, creation and other tools provided by the iPRODUCE platform and is inexperienced about which steps to take. Furthermore, he/she is uncertain about defining the technical requirements of the final product. In case of professional: He/she feels insecure about design, creation and other tools provided by the iPRODUCE platform and is inexperienced about which steps to take. He/she must interpret the final user requirements and translate it into the specifications for the iPRODUCE platform. In case of company: It is not acquainted with the use of co-creation and other tools of iPRODUCE platform.
User motivation:	In case of tech-newbie He/she - feeling him/herself as a DIY fellow - wants to improve his/her basic knowledge and skills about design, creation, etc. Furthermore, he/she wants to create his/her own customized object for personal use. In case of professional: He/she wants to provide with an efficient, cost-effective, and aesthetically valid appliance for his/her client. In case of company: They need a new device in order to sell it to the hobbyist GDO.
Health and Safety Issues:	Misuse of equipment can lead to major/fatal injuries. Nevertheless, the machining is carried out by ProM and other cMDF, that respect safety and health rules established by local laws. The final product must be safe for the final user, being compliant with quality and safety standards (for instance CE certification).
Preconditions:	The user/professional needs to have access to tutorials installed into the iPRODUCE platform. The user/professional must be able to provide as much information as possible to let the cMDF engineer design and size properly both electronic/microelectronic and mechanical parts. The user/professional is capable of designing part of the product, but is not experienced and skilled enough to perform the complex design of it (microelectronics, mechanical, electrical, etc.). The cMDF local network shall be established and running. The cMDF must be able to carry out their work and need to have a total understanding of the goals of the user in terms of design and manufacturing of the prototype, but also its exploitation.
Postconditions:	The professional was able to relate both to the newbie and the cMDF, exploiting the tutorials, tools and they all shared a good communication with each other. ProM and the local cMDF were able to fulfil the task on time and within expected budget.

	The professional and the newbie user were satisfied with the outcome. There was a follow-up with all partners and an external SME to verify the possibility to exploit the final prototype towards industrialisation.
Flow:	**PHASE 1: IDEATION** Let's assume the user is a newbie and he/she had a nice idea but has no skills to develop it. The idea is a "robo-shaker" to shake a fan and find some relief during hot summer days. This product consists of a mechanical HW support that interfaces a motor with the fan and the electronics to let the user switch-it on or off and maybe control its speed (somehow). The newbie enters the iPRODUCE platform and using the Digital Fablab Kit learns basics on Arduino programming and mechanical/electronic design. Being she/he not skilled enough and not having money to invest too, she/he decides to ask for additional support to a friend who is experienced in engineering (professional/expert), to whom she/he requests the idea development. The expert understands she/he has to create a device whose function is to transform rotational movement into a linear movement. The expert elaborates his/her own first technical and functional requirements, but he/she knows also about the newly developed iPRODUCE platform that can support the next stages. She/he creates an account on iPRODUCE platform and logs in. After entering iPRODUCE platform, the professional, by using the co-creation and design tool, roughly designs the mechanical and aesthetical parts of the "robo-shaker", sharing this ideation and creation activity phase with the newbie. Now the professional needs the support of cMDF for two reasons: ● To have the mechanical design finalized and the first prototype component finalized, on the basis of his/her previous work, in compliance with newbie requirements and quality and safety standards; ● To have the electronics made from scratch. For this purpose, the professional enters the iPRODUCE platform and through the cMDF Marketplace and Matchmaking & Agile Network Creation tool identifies the reference cMDF (primary node of the Federation) for embedded devices and microcontrollers, which is ProM Facility in Rovereto (Italy). ProM contacts a member of the local cMDF network and bids with it a subcontracting activity for the realisation of the work requested by the professional. The contracts of this negotiation phase are made with the support of the Ricardian Contract Tool. **PHASE 2: DESIGN AND PROTOTYPING** When the request comes, engineers in ProM collaborate with the expert through the Generative Design function to propose a design, price and timeline included to the professional. In the proposed design, the "robo-shaker" consists of a plexiglas support on top of which the motor and the electronic boards (based on ecosystem) are installed. Shafts and gears that implement the mechanical interface are 3D printed with polymeric technology. For the design of the mechanical parts of the device, ProM uses iPRODUCE Generative Design function to involve a local partner of Italian cMDF to design and realise (3D polymeric printing) a few small parts of the robo-shake case. Once the prototype design has been completed, through the AR/VR tool ProM facility

	proposes the final result to the professional and the final user, who can also use the AR/VR tool to see how the object is functioning. **PHASE 3: PLANNING AND PROTOTYPE CREATION** The newbie and his/her expert friend are very satisfied with the rendering, so they confirm and go ahead. At this point, ProM makes a planning and tasks division in order to produce the prototype, and then, through the use of 3D printer, laser cutting, electronic instruments, soldering station and integrating polymeric parts printed by the local cMDF partner, realises the "robo-shake" prototype.
Alternative Flows:	The following alternative flows may be identified. The user is not so "newbie", so s/he decides to enter more in the technical development of the prototype, for example by designing autonomously: • Electronics development based on DIY devices (ST-Nucleo boards, Raspberry-Pi, Arduino...) • Custom electronic design (PCB and SW) • Design of mechanical structure/support only These options may vary on the basis of the final user expertise.
Exceptions:	iPRODUCE tutorials do not cover the basic knowledge needed by the newbie. Machinery and/or specific competences are not found in the cMDF's network.
Requirements:	cMDF machinery needs to be accessible in the time framework. The IPR policy should be in place, if possible through disclaimers or other functions of the iPRODUCE platform.
Objectives to achieve:	Newbie user(s) should be able to learn at least the basics about open HW tools (Arduino; Raspberry Pi; ..), electronics and mechanical design in order to effectively transfer its product idea to the professional and to verify the final result. Design an object compliant to certification and standard requirements.
KPI:	• Maximum lead time (from the contact between the professional and the cMDF through iPRODUCE platform to the final prototype design): 30 days. • Providing results with a maximum delay of 10% from the original planning. • Making the final results visible and available to all other cMDF within 1 working day after completion through the iPRODUCE (internal) marketplace.

Use Case Diagram

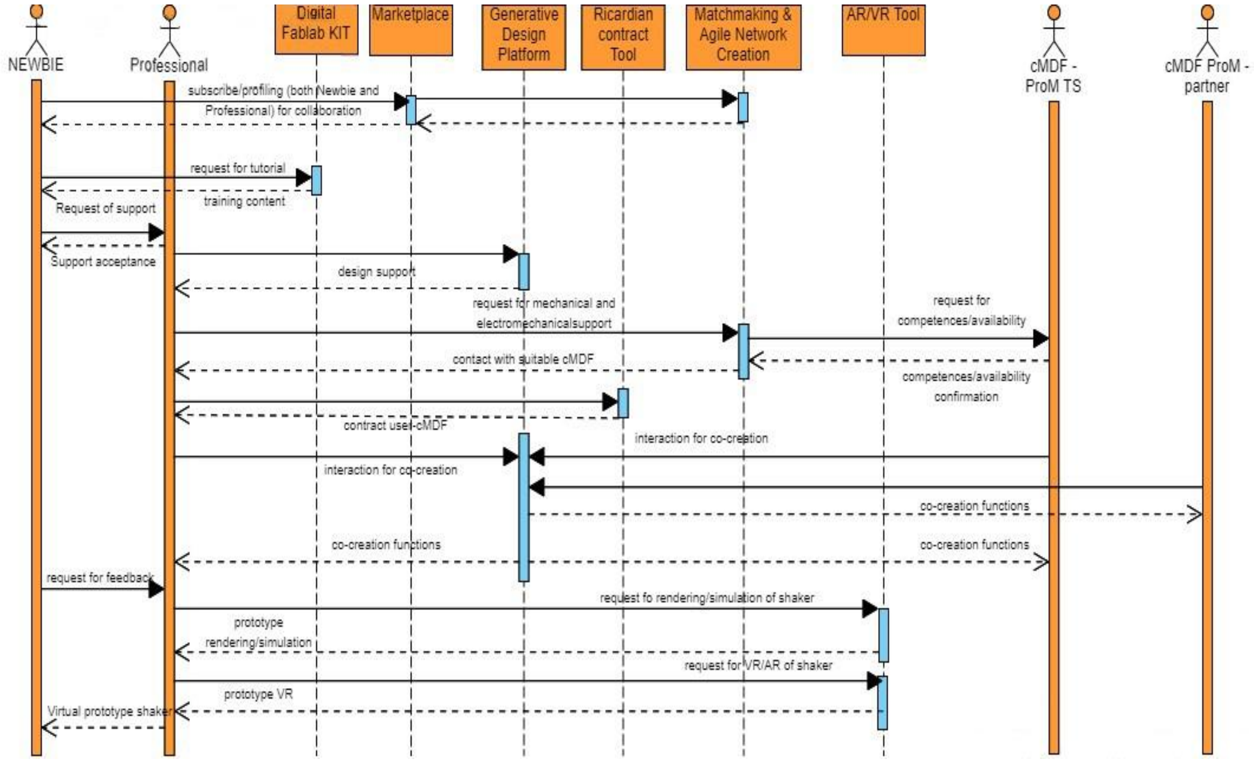


Figure 10 Italian Use Case Diagram 1

3.5.2. cMDF_IT_UC2

Name of Use Case:	cMDF_IT_UC2		
Created By:	Luca Capra	**cMDF Involved**	Italian cMDF
Date Created:	29/06/2020	**Last Revision Date:**	02/07/2020
Description:	INTRODUCTION: The user wants to keep the right soil humidity for its apartment plants without the fear of forgetting the task. To achieve the purpose, the user is looking for a customized mechatronics device that automates watering operations. The device has to periodically monitor when a pot is too dry and then, if needed, delivers a certain amount of water to the pot. The watering machine needs to be connected to up to 16 pots and can keep a different level of humidity in each pot. The user can be a professional trained person but also a tech-newbie, as well a company that wants to create a new B2C product. In all cases the i-PRODUCE cMDF services can help.		
Actors:	● CMDF node ("ProM"/cMDF engineer) ● Other CMDF's/cMDF local member ● User (professional, newbie)		

	● iPRODUCE Platform
User doubts:	In case of the tech-newbie: He/she feels insecure about design, creation and other tools provided by the iPRODUCE platform and is inexperienced about which steps to take. Furthermore, he/she is uncertain about defining the technical requirements of the final product. In case of the professional: He/she feels insecure about design, creation and other tools provided by the iPRODUCE platform and is inexperienced in which steps to take. He/she must interpret the final user requirements and translate in the specifications for the iPRODUCE platform. In case of the company: They are not acquainted with the use of co-creation and other tools of iPRODUCE platform.
User motivation:	In case of the tech-newbie He/she - feeling him/herself as a DIY fellow - wants to improve his/her basic knowledge and skills about design, creation, etc. Furthermore, he/she wants to create his/her own customized object for personal use. In case of the professional: He/she wants to provide with an efficient, cost effective, and small appliance for his/her client. In case of the company: They need a new device in order to sell it to the hobbyist GDO or their selling channels.
Health and Safety Issues:	Misuse of equipment can lead to major / fatal injuries. Nevertheless, the machining is carried out by ProM and other cMDFs, that respect safety and health rules established by local laws. The final product must be safe for the final user, being compliant with quality and safety standards (for instance CE certification).
Preconditions:	The user/professional needs to have access to tutorials installed into the iPRODUCE platform. The user/professional must be able to provide as much information as possible to let the cMDF engineer design and size properly both electronic/microelectronic and mechanical parts. The user/professional is capable of designing part of the product, but is not experienced and skilled enough to perform the complex design of it (microelectronics, mechanical, electrical, etc.). The cMDF local network shall be established and running. cMDF must be able to carry out its work and needs to have a total understanding of the goals of the user in terms of not only the design and manufacturing of the prototype, but also its exploitation.
Postconditions:	The professional was able to relate both to the newbie and the cMDF, exploiting the tutorials, tools and they all shared a good communication with each other. ProM and the local cMDF were able to fulfil the task on time and within expected budget. The professional and the newbie user were satisfied with the outcome. There was a follow-up with all partners and an external SME to verify the possibility to

	exploit the final prototype towards industrialization.
Flow:	**PHASE 1: IDEATION** Let’s assume the user is a newbie and he/she had a promising idea but no skills to develop it. The idea is a “watering machine” to keep his/her plants watered during the holiday time and during the frequent working travels. This product consists of a mechanical hardware support that interfaces a water-delivering system with the electronics/microelectronics that check the humidity and the plants’ pots. Using a simple LCD screen and few buttons, the user can switch-it on or turn-off the machine but also set the number of pots connected and the humidity desired. The newbie enters the iPRODUCE platform and using the *Digital FabLab Kit* learns basics on Arduino programming and mechanical/microelectronic design. Being she/he not skilled enough and, not having money to invest too, she/he decides to ask for additional support to a friend who is experienced in engineering (professional/expert), to whom she/he requests the idea development. The expert understands she/he has to create a networked device system whose function is to sense the humidity of a network of remote “objects” and, as an IoT appliance network, to elaborate data collected in a central unit, communicate with the user via an HMI and control a remote network of actuators that water plants. The expert elaborates his/her own first technical and functional requirements, but she/he also knows about the newly developed iPRODUCE platform that can support the next stages. She/he creates an account on iPRODUCE platform and logs in (Market place). After entering iPRODUCE platform, the professional, by means of the Generative Design function, roughly designs the mechanical and aesthetical parts of the watering system, sharing this ideation and creation activity phase with the newbie. Now the professional needs the support of the cMDFs for two reasons: ● To have the mechanical design and the first prototype component finalized, on the basis of his previous work, in compliance with newbie requirements and quality and safety standards ● To have the electronics/microelectronics made from scratch. For this purpose, the professional enters the iPRODUCE platform and through the cMDF Marketplace and Matchmaking&Agile Network Creation tools identifies the reference cMDF (primary node of the Federation) for embedded devices and microcontrollers, which is ProM Facility in Rovereto (Italy). ProM contacts a member of the local cMDF network and bids with it a subcontracting activity for the realisation of the work requested by the professional. The contracts of this negotiation phase are made with the support of the Ricardian Contract Tool. **PHASE 2: DESIGN AND PROTOTYPING** When the request comes, engineers in ProM collaborate with the expert through the Generative Design function to propose a design, price and timeline included to the professional. In the proposed design, the watering machine consists of a network of IoT objects, that implement the sensor/transducer/actuator functions, together with the communication with the base station function. They must be aesthetically charming (they are conceived for the use in apartments) and small enough not to ugly impact on the domestic environment. The “watering machine” consists of a support made out of wood and laser-cutted

	metal. Two rotating metallic disks distribute the water to the target pot and the electronic boards (based on Arduino) are installed and programmed. Some custom electronics are needed to check the humidity and control of the water pump. For the design of the mechanical parts of the device, ProM uses iPRODUCE Generative Design function to involve a local partner of Italian cMDF for part of the machining. Once the prototype design has been completed, through the AR/VR tool tools ProM facility proposes the final result to the professional and the final user, who can also use the AR/VR tool to see how the object is functioning. **PHASE 3: PLANNING AND PROTOTYPE CREATION** The newbie and his/her expert friend are very satisfied with the rendering, so they confirm to go ahead. At this point, ProM makes a planning and tasks division in order to produce the prototype, and then, through the use of turning CNC machine, 3D printer, laser cutter, electronic instruments, soldering station and integrating polymeric parts printed by the local cMDF partner, realises the plant watering system.
Alternative Flows:	The following alternative flows may be identified. The user is not so "newbie", so she/he decides to deal much more with the technical development of the prototype, for example by designing autonomously: • Electronics development based on DIY devices (ST-Nucleo boards, Raspberry-Pi, Arduino…); • Custom electronic design (PCB and SW); • Design of mechanical structure/support only. These options may vary on the basis of the final user expertise.
Exceptions:	iPRODUCE tutorials do not cover the basic knowledge needed by the newbie. Machinery and/or specific competences are not found in the cMDF's network.
Requirements:	cMDF machinery needs to be accessible in the time framework. The IPR policy should be in place, if possible through disclaimers or other functions of the iPRODUCE platform.
Objectives to achieve:	Newbie user(s) should be able to learn at least the basics about open HW tools (Arduino; Raspberry Pi…), electronics and mechanical design in order to effectively transfer its product idea to the professional and to verify the final result. Design an object compliant to certification and standard requirements.
KPI:	• Maximum lead time (from the contact between the professional and the cMDF through iPRODUCE platform to the final prototype design): 30 days. • Providing results with a maximum delay of 10% from the original planning. • Making the final results visible and available to all other cMDF within 1 working day after completion through the iPRODUCE (internal) marketplace.

Use Case Diagram

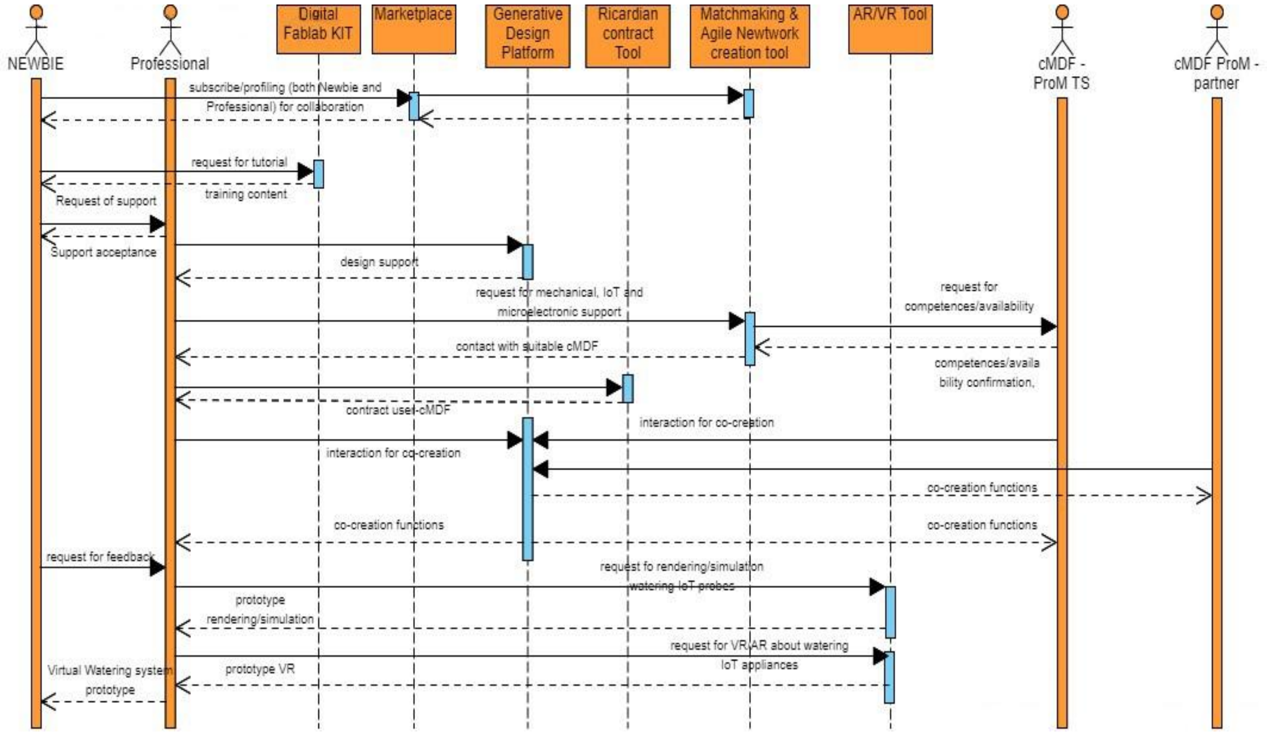


Figure 11 Italian Use Case Diagram 2

3.6. Danish Use Cases

3.6.1. cMDF_DK_UC_1

Name of the Use case	cMDF_DK_UC_1		
Created By:	Rasmus Bo Nielsen & Isabel Froes	**cMDF Involved**	Danish cMDF
Date Created:	01/07/2020	**Last Revision Date:**	28/07/2020
Description:	INTRODUCTION: Co-creation in schools: we want to inspire teachers, students to think of digital fabrication as a low-entry method for making hands-on interior productions and urban space interventions. Also, we want to enable schools lacking resources to offer these technologies to their students. AS-IS-SITUATION: Currently, public schools across Denmark acquire existing ready-made solutions in the market towards setting up their classrooms, libraries and other activity rooms. Besides the cost, many of the solutions are not optimized to the existing spaces. Aggravated by COVID-19 and governmental requirements for social distancing and related school routines, classrooms and other school areas need to be adapted and customized to fulfil		

such requirements.

<u>TO-BE-SITUATION:</u>

Through co-creation workshops with local school groups and associations, we will define how to best engage primary and secondary Danish students to learn and experiment with digital fabrication and other sets of tools towards creating and developing furniture solutions to their school spaces.

The BetaFactory Mobile Unit, which comprises a 40" side-opened shipping container, that can be deployed anywhere. The container will be equipped with digital manufacturing equipment for processing of standard plywood sheet, size 1250x2500mm.

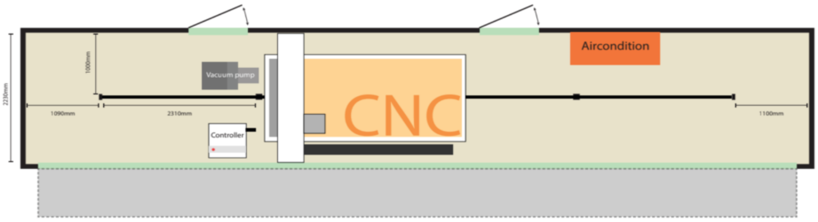


Figure 12 Tentative floor plan.

It will contain ventilation systems to remove process air and wood dust. The container will need to be equipped with a material (industrial standards 1250x2500) storage section. The BetaFactory Mobile Unit will facilitate this interaction in the school context, through bringing the tools to the school spaces. The workshops will be run by BetaFactory design and engineering team with support from the CBS team, to co-create and co-develop with students and school staff new solutions to transform various spaces at the schools.

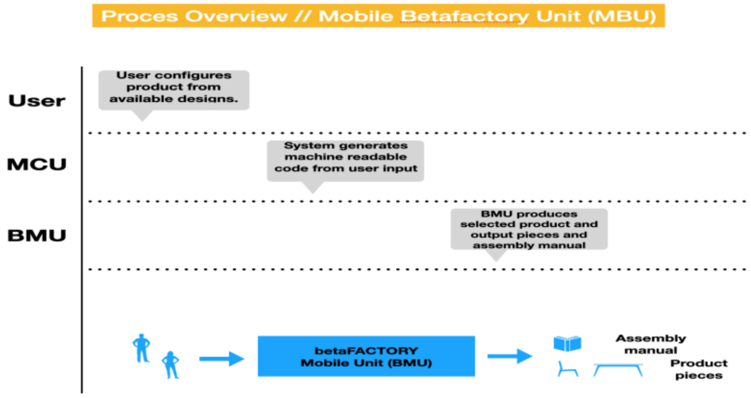


Figure 13 Process Overview

Eg. interior products:

- Chairs
- Tables
- Shelves
- Exhibition
- Podiums

Exterior products

	• Tables • Seating • Fences/space dividers • Rain and sun cover/roofing • Signs • Benches By using co-creation tools early identified in the iPRODUCE project, the schools will be able to: • Learn and get hands-on with co-creation tools and methods • Co-create with the students • Hands-on learning with design thinking concepts and fabrication • Create new spaces for the schools (school yard, classroom etc.) • Learn about STEM and digital fabrication • Engaging teachers in STEM and digital fabrication
Actors:	• The primary/secondary schools who can provide with a good Use Case • Students and teachers • Designers and facilitators • School management • Teachers
User doubts:	How to best get the schools to learn and engage in the project. Schools are overwhelmed with the current changes; can they spare personnel to dedicate time to engage in new activities? Due to the limitations imposed and the new school organisations, how to plan and run the workshops in safe and controlled environments?
User motivation:	Schools do not have the infrastructure to support digital fabrication. Schools do not have the technical expertise, but are eager to acquire and help students in the process. Schools have not been granted the funding for setting up a FabLab/MakerSpace. School staff struggle with how to integrate the STEM digital fabrication curriculum into existing curriculum. BetaFactory Mobile Unit: Want to encourage and inspire the next generation with the principles of design thinking and digital fabrication - both teachers and students. Teachers: Want to Gain insights on how to adapt a hands-on approach for making theory into physical objects. Students: Want to learn and play with tools and opportunities within digital fabrication. See their ideas made real and useful. School management They will gain insights on the possibilities of having a makerspace at hand.

Health and Safety Issues:	There should be no problem as long as the customer uses iPRODUCE's digital interface and the manufacturers use their own machines. All active participants are therefore supposed to have received the appropriate training and safety requirements to use them. All participants will be required to wear appropriate protection. All spaces need to be cleaned and disinfected following COVID-19 requirements.
Preconditions:	• The Mobile Unit must be completed and tested • Budgets and materials have to be described • Municipalities and educational related entities will communicate about the project and invite schools to participate in it (this will start in August 2020).
Postconditions:	• The staff and the students have been successfully trained through a digital fabrication design, production and assembly process • Students have achieved new skills and understanding of STEM • Teachers have gained new knowledge about digital fabrication technologies • The schools ability to act on the new findings regarding makerspaces has increased
Flow:	We communicate about the project through local municipalities and related educational groups, inviting schools to indicate their interest through an online form describing their current wishes to rebuild some of their spaces (school yard, classroom or another urban spatial intervention). The schools will then be contacted and invited to an initial co-creation workshop, where we will acquire an overview of current challenges and co-develop initial approaches to run the manufacturing workshops. Concomitantly, we will start to assemble the team that will run the in-situ workshops alongside the students. The team will start working in the design, based on the input from the workshop with the schools. An agreement between BetaFactory and the selected local schools will be signed, as to define the roles and expectations through the activities. Through applying the iPRODUCE platform during the in-situ workshops, we will choose designs from the parametric design catalogue from the iPRODUCE platform. We will teach about CAD/CAM design processes, learn about materials, digital fabrication and assembly. We will employ the BetaFactory mobile unit in a central location and start fabrication and throughout the process capture and evaluate with students. See image below (Image 2) The deployment of the mobile unit will help to bring the experience of manufacturing closer to students and school staff, helping teachers and leaders learn, elaborate and evaluate how-to apply more STEM teaching to the curriculum and possibilities on establishing their own MakerSpace or using of other labs or makerspaces. Furthermore, the iPRODUCE tool should facilitate their engagement and access to local manufacturing. The in-situ co-creation workshops will also inform and help evaluate how the iPRODUCE tool can best fit to existing and upcoming needs in local manufacturing, as well as optimize the use of labs and related DIY spaces.
Alternative Flows:	If for some reason we have to postpone the deployment of the mobile unit, postpone the start of the workshops due to the pandemic, or the infrastructure unexpectedly doesn't support the mobile unit, we will continue the process with the institution, agreeing on how to fulfil the set goals - this might include having to produce elsewhere. However, informative videos will be distributed across the school and follow up with further materials as needed. Besides, any of the fabricated units will be brought to the school for

<table>
<tr><td></td><td>local assembly.</td></tr>
<tr><td>Exceptions:</td><td>If the schools change their mind in regards to the process, we will need to evaluate and consider the process to best adapt it to the needs and, if needed, cancel the agreement. In this case, we will consider if we will need to find another institution to partner or if what has been achieved is sufficient to proceed.</td></tr>
<tr><td>Requirements:</td><td>There should be no problem as long as the customer uses iPRODUCE's digital interface and the manufacturers use their own machines. All active participants are therefore supposed to have received the appropriate training and safety requirements to use them.
All participants will be required to wear appropriate protection equipment.
All spaces need to be cleaned and disinfected following COVID- requirements.
We will have to follow regulations within the space we need to work on. Interior and public spaces and so on, have different regulations that need to be followed. The expectations needs to be aligned within the agreement between the schools and BetaFactory</td></tr>
<tr><td>Objectives to achieve:</td><td>• Having at least 3 agreements in place with local Danish schools.
• Having run and deployed workshops in schools
• Co-creating and delivering developed units to schools
• Engaging schools in optimizing their spaces through learning and access to digital and physical manufacturing.</td></tr>
<tr><td>KPI:</td><td>• Having more than 20 submissions from schools, description of their applied use case.
• Executing at least 3 co-creation workshops nationwide.
• Manufacturing and delivering co-created solutions to partnering schools.
• Having partnering schools use and evaluate the iPRODUCE platform.</td></tr>
<tr><td colspan="2">Use Case Diagram

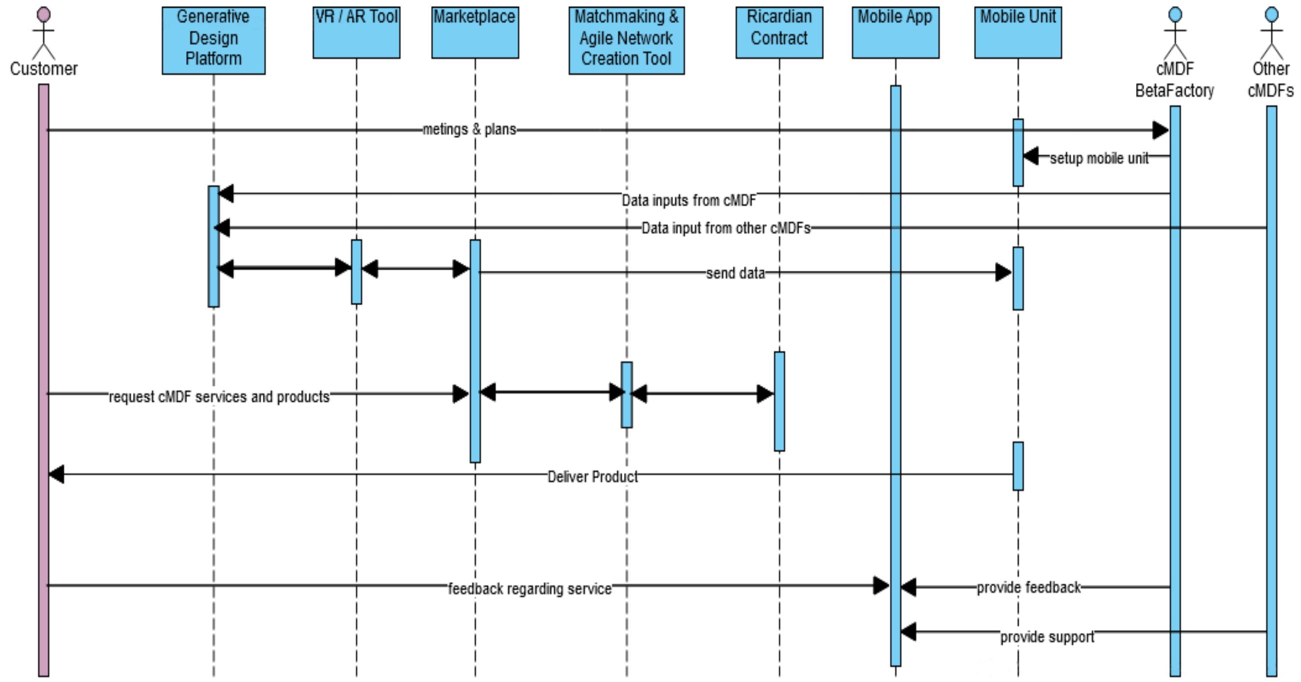


Figure 14 Danish Use Case Diagram 1</td></tr>
</table>

3.6.2. cMDF_DK_UC_2

Name of Use Case:	cMDF_DK_UC_2		
Created By:	Rasmus Bo Nielsen	**cMDF Involved**	Danish cMDF
Date Created:	05/07/2020	**Last Revision Date:**	28/07/2020

Description: Distributed Design Market

AS-IS-SITUATION

A client wants customized bespoke furniture for housing or office purposes. Up to now, this has been very high-end work done by architect studios and creative bureaux, while mostly subcontracting the build process to cabinet maker companies.

TO-BE-SITUATION

By using a Mobile BetaFactory Unit, the project can be manufactured on site using CNC-technology. The client can be fully be immersed in the collaborative co-creation process as it happens, and ideas can be thought out and tested on site

The main goal is to apply the iPRODUCE fabrication platform, from where individuals and businesses can browse through (distributed CAD) designs, select the one they prefer, and then 'print'/produce the object in situ. We would like to showcase the opportunities with local digital fabrication and 'open-source' parametric distributed designs. We will collaborate with a design market to get a quick reach in certain cities and sites.

The BetaFactory Mobile Unit, which comprises a 40" side-opened shipping container, that can be deployed anywhere. The container will be equipped with digital manufacturing equipment for processing of standard plywood sheet, size 1250x2500mm.

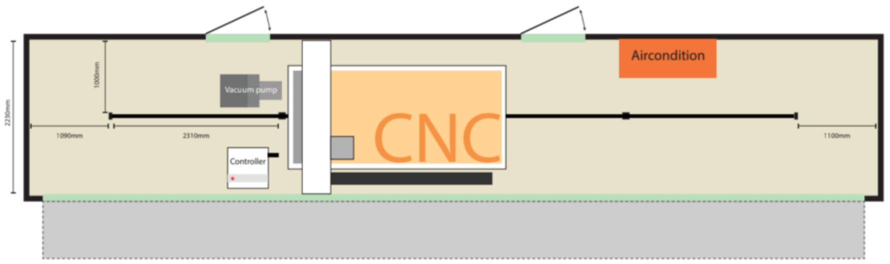


Figure 15¨ Tentative floor plan.

It will also contain extraction systems for wood and laser. The container will also need to be equipped with a material (industrial standards 1250x2500) storage unit. The design market workshop will be run by a BetaFactory design and engineering team with support from the CBS team, to co-create and co-develop with customers, new solutions to transform various spaces in homes.

E.g. interior products:

- Chairs
- Tables
- Shelving

	• Beds • Wardrobe • Kitchen • Storage Exterior products: • Tables • Seating • Fences/space dividers • Rain and sun cover/roofing • Signs • Benches
Actors:	• Open-source 'Distributed design' designers. • Individuals and business who need to have bespoke objects made • Municipalities - where our mobile fabrication unit can be placed • Design markets
User doubts:	The client: When making things on-site, in a mobile unit, we cannot provide facilities for all furniture making processes (e.g. surface treatment like oil, paint etc). Meaning that the client should be willing to contribute to the manufacturing process himself/herself, depending on which design/object we need to fabricate. When making bespoke objects you have to be very accurate when taking measures. Measuring will have to be done by the client themselves.
User motivation:	The client: The client wants to produce his/her custom-made furniture at a lower price and to his/her own personal specifications and to be part of the fabrication process. Open-source 'Distributed design' designers: The designers have a motivation getting their designs made and earning revenue from the fabrication.
Health and Safety Issues:	Attention to local health and safety regulations should be made when manufacturing as the process will produce dust particles. There is also heavy lifting involved when loading the machine. Only trained operators should use the machine.
Preconditions:	The client: Before starting the fabrication process, the client needs to get acquainted with the fabrication opportunity and the advantages of custom-made furniture. Customers' needs, concerns and limitations need to be identified prior to production through a general workshop. Open-source 'Distributed design' designers: We need to make sure that all submitted designs are production ready and tested. And we need to develop and distribute instructions for clients on how-to assemble the furniture when it has been made.
Postconditions:	The transaction must have taken place smoothly and transparently for the customer who will have contracted with the furniture company.

BetaFactory will have dealt with and paid directly to the entity that designed the furniture, ensuring the final quality of the object.

The customer must have received the object in accordance with his request within the announced deadlines.

Flow:

The client needs to get acquainted with the project and the platform. Then possibly attend an online (or offline) workshop to learn more about the available opportunities within the iPRODUCE platform to use the mobile fabrication unity.

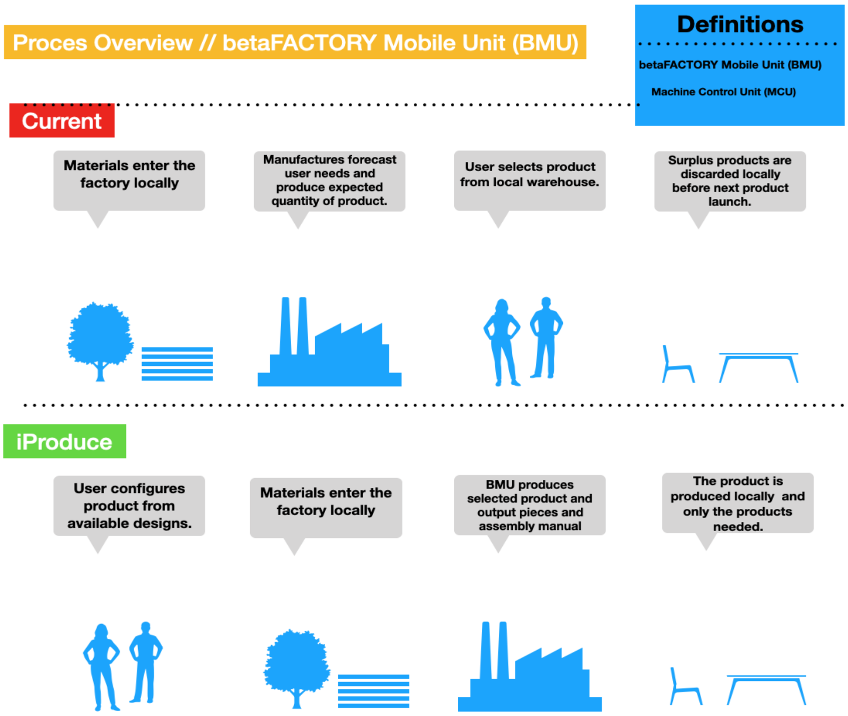


Figure 16 Process Overview

Before the customer goes to the mobile fabrication unit, he/she will have to have read an instruction with the expectations/requirements for a distributed design project. When that has been done, the client needs to book a timeslot for the design phase, and when getting the design finalized, an appointment for the fabrication will have to be made.

When getting to the mobile fabrication unit, the customer and our staff will:

- Choose materials
- Make sure that the CAD drawings have correct measurements
- Check the auto generated in the iP CAM g-code viewer
- Execute the fabrication

The products will be packed for the customer to bring home for assembly and if needed a top-surface treatment.

The Customer will be able to get support from the iPRODUCE platform - if something is off or wrong.

- Find manuals
- Order replacement parts

	• Material database Besides, the customer should be invited to evaluate about the experience with the iPRODUCE platform and how it can be optimized. This input will help improving the iPRODUCE platform user experience to fit with customer needs. The customer is encouraged to send a picture of the finished product.
Alternative Flows:	If something unexpectedly is wrong with the design or assembly process. A new part can be made at a local/regional makerspace, for pick up or sent afterwards.
Exceptions:	Terms should be very clear, and a sales contract should be made between us and the client. Just as a contract between us and the 'distributed design' designer should be made. Sharing the responsibility between stakeholders.
Requirements:	Companies must be declared and exist legally. Intellectual property issues must be settled and set out in a contract. Standard models must be proposed. In exceptional cases, tailor-made conditions can be set up if all parties agree.
Objectives to achieve :	The BetaFactory mobile unit ability to be deployed and operational at most locations. Good iPRODUCE interface integration in the operation of the hardware Lower costs in customized furniture production
KPI :	• Presence in 3 cities • Fabricate at least 5 designs/day • 75% customizable products offered • Customer survey to evaluate the platform and the process filled out by every customer (laid out in the contract).

Use Case Diagram

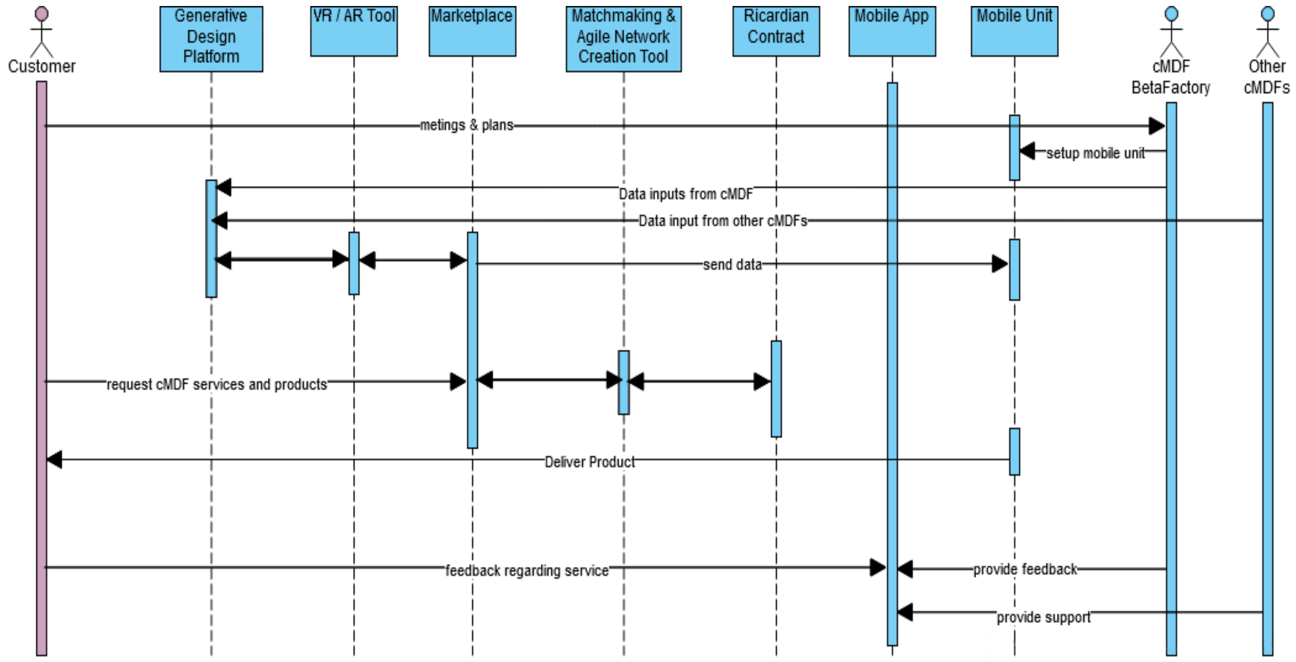
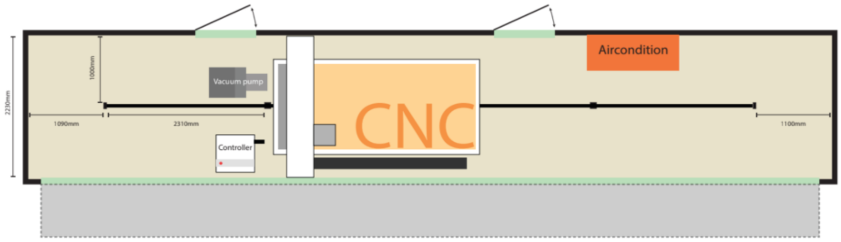
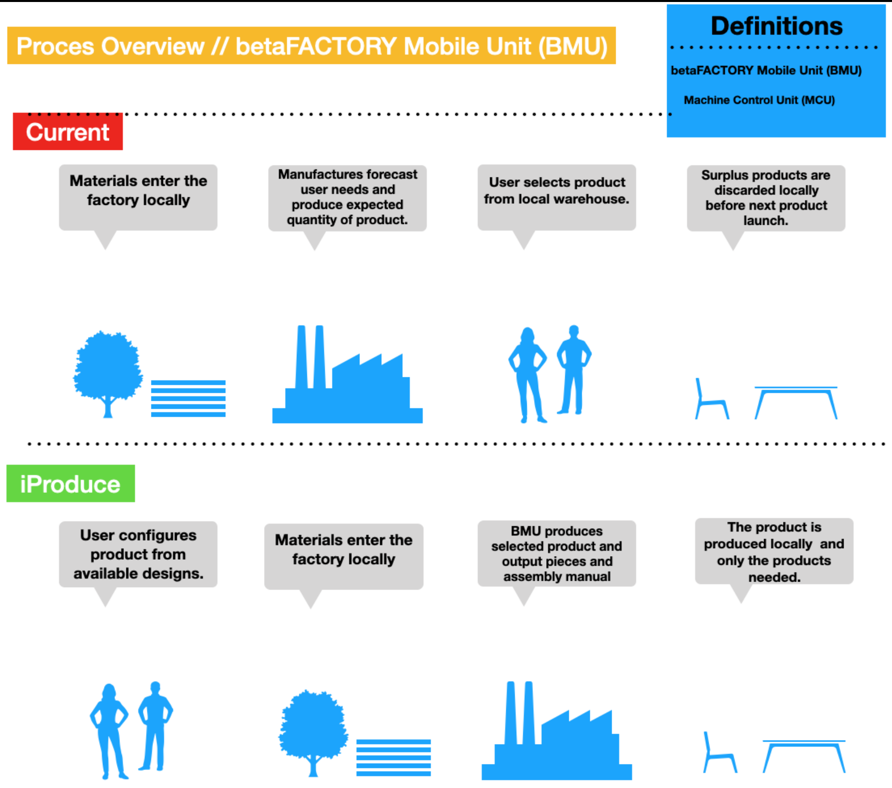


Figure 17 Danish Use Case Diagram 2

3.6.3. cMDF_DK_UC_3

Name of Use Case:	cMDF_DK_UC_3		
Created By:	Rasmus Bo Nielsen	**cMDF Involved**	Danish cMDF
Date Created:	01/07/2020	**Last Revision Date:**	28/07/2020
Description:	Temporary Architecture: AS-IS-SITUATION: Currently many venues, festivals, construction sites etc. are building everything from scratch every time they start a new production. And when the assignment is done they discard it - and start from scratch again the year after or on the next assignment. Within the urban temporary built environment, there are a lot of improvements that can be made, using adaptive and a parametric design approach on the installations. TO-BE-SITUATION: By applying our Mobile Production Unit in conjunction with the iPRODUCE platform to this use case, with assistance from our design and engineering team, we will create designs that will be parametric and more sustainable. • Co-creation workshops with the stakeholders to identify current needs and co-create solutions • Hands-on learning with design thinking concepts and fabrication • Co-create a new space for a festival/event (eg. Benches, seating, signage, visual installations, separations walls) • Modular, adaptive and parametric designs • AR viewer - used for presentations on venue • Change the way temporary design is applied. The BetaFactory Mobile Unit, which comprises a 40” side-opened shipping container, that can be deployed anywhere. The container will be equipped with digital manufacturing equipment for processing of standard plywood sheet, size 1250x2500mm.  Figure 18 Tentative Floor Plan It will also contain extraction systems for wood and laser. The container will also need to be equipped with a material (industrial standards 1250x2500) storage unit. The BetaFactory Mobile Unit will facilitate this interaction in the festival context, through bringing the tools to the venues. The workshops will be run by BetaFactory		

	design and engineering team with support from the CBS team, to co-create and co-develop with volunteers, clients and festival staff and make new solutions to transform various spaces at festival venues. Eg. interior products: • Chairs • Tables • Shelves • Exhibition • Podiums • Decor • Signs • ...iterate Exterior products • Tables • Seating • Fences/space dividers • Rain and sun cover/roofing • Signs • Benches • ...iterate By using co-creation tools early identified in the iPRODUCE project, the festivals will be able to: • Learn and get hands-on with co-creation tools and methods • Co-create with the SMEs and crew • Hands-on learn with design thinking concepts and fabrication • Create new spaces • Teach clients and crew about STEM and digital fabrication • Engage volunteers and SMEs in STEM and digital fabrication
Actors:	• Festival management • SMEs / Trade Professionals (commerce, food etc) • Designers and facilitators • Festival crew
User doubts:	Festival Management: It's a big change, and it requires changes in their logistics/storage facility. Trade Professionals: Need to be willing and 'investment' in the future. Constructors: They need to know how to assembly a prefab kit.
User motivation:	Festival Management: They can cut down the usage of building materials, and reuse it the years to come Trade Professionals: Easier to build, faster to repair, custom-made aesthetics

	Constructors They need to know how to assembly a prefab kit.
Health and Safety Issues:	There should be no problem, as long as the customer will only use iPRODUCE's digital interface and the producers will use their own machines. They are therefore supposed to have received the appropriate training and awareness to use them. All participants will be required to wear appropriate protection equipment.
Preconditions:	• The Mobile Unit must be completed and tested • Budgets and materials have to be described • Infrastructure on-site should be specified, electricity, garbage disposal etc.
Postconditions:	• Successfully take participants through a digital fabrication design, production and assembly process. • Participants gain new knowledge about digital fabrication technologies and get acquainted with the iPRODUCE platform
Flow:	 Figure 19 Process Overview First, prospective clients will be contacted and informed about the iPRODUCE project and the mobile unit platform. Then, they will be invited for an initial workshop/meeting to get further acquainted with the iPRODUCE platform and manufacturing unit, as well as understand existing needs and concerns in existing solutions. The clients are invited to send an idea for a project and we provide guidelines to how to do it. We follow up the communication to reinforce the invitation to submit a project proposal for the mobile unit through the iPRODUCE platform. Based on the interest from the client part, a contract will be made between BetaFactory and the Festival. When the client submits a project to our studio, requiring a space to be a

	transformed or another urban spatial intervention, they are required to provide specific details of that space and an initial budget plan. Based on the design requirements, we will start assembling the team that will provide a co-creation workshop alongside the festival professionals. The teams will start to co-design and co-develop the ideas, based on the input from the workshop. Based on parametric and distributed designs, we will adapt the solutions for their needs. We will teach about CAD/CAM design processes, learn about materials, digital fabrication and assembling. We will employ the mobile unit in a central location and start fabrication. The lessons from this process will feed the iPRODUCE platform both the tools used and input towards interface assets and challenges to be adjusted. The manufacturing process will be coupled with an evaluation with stakeholders about how-to apply more parametric design to the construction phase. Based on the overall process, we will look into opportunities to make a long term agreement and to support the client in his use of the iPRODUCE platform. Furthermore, we will document, capture and evaluate the project process with stakeholders.
Alternative Flows:	If, for some reason, we have to postpone the deployment of the mobile unit or the infrastructure unexpectedly doesn't support the mobile unit, we will have to continue the process with the festival, and therefore have to produce elsewhere. Then, we will bring the fabricated units to the festival and start the assembly.
Exceptions:	We will have to follow regulations within the space we need to work on. Interior and public spaces and so on, have different regulations that need to be followed. The expectations need to be aligned within the contract.
Requirements:	We require to sign a contract/agreement with the festival/company laying out the tasks and objectives to be fulfilled within a defined timeframe. We need to follow work-, and safety regulations. And construction regulations.
Objectives to achieve:	• SMEs will save time on construction and get a unique customized project • Faster product to market • Better architecture • Will they keep and reuse the installation for the future ?
KPI:	• Make 3 different kinds of festival specific productions • Reuse, reduce and installations should be used for more than 1 year.

Use Case Diagram

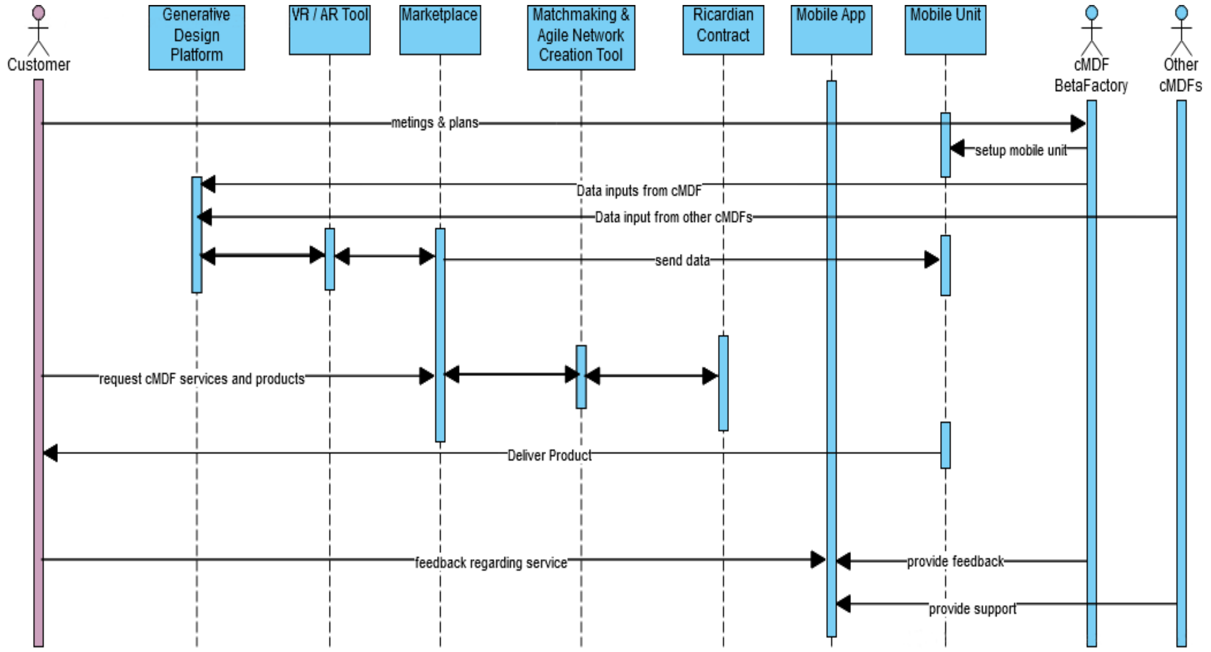


Figure 20 Danish Use Case Diagram 3

3.7. Greek Use Cases

3.7.1. cMDF_GR_UC1

Name of Use Case:	cMDF_GR_UC1		
Created By:	Dimitris Moustakas	**cMDF Involved**	Greek
Date Created:	20/04/2020	**Last Revision Date:**	23/07/2020
Description:	INTRODUCTION: The proposed pilot use aims at examining further iterations of an orthopaedic back brace solution designed by AidPlex with the aim of higher comfort levels and retrofitting the resulted design with IoT sensors. Use scenarios: scoliosis, kyphosis or similar spinal deformities are currently treated with heavy incumbent back braces, which lead to fatigue, reduced manoeuvrability and potential social exclusion especially in younger patients. The overarching goal is to finetune the design of a back brace by examining aspects like weight distribution, modularity, size, adaptability and overall comfort, whilst IoT sensors will help patients self-assess and adapt their back braces leading to higher degrees of adherence and outcome. With the IoT system, AidPlex is going to inform both the Doctor and the patient when the right time for a new brace has come, due to child's growth, achieving the best possible fit of the medical device. The IoT component of the solution will also support gamified processes which		

	stand to help patients follow through treatment and exercises more diligently achieving better results and subsequently increase their quality of life.
Actors:	AidPlex: AidPlex is under R&D for this product. This product is going to be developed together with patients and physicians. Physicians and patients will be contacted and invited to participate in order for the design process to include skilled, as well as experiential feedback. Participants will be divided into teams with similar skillsets, informed about the goals of the workshops and called upon to provide their initial design thoughts and suggestions. These will then be put under a Delphi process of elimination resulting in two prevalent designs, which will be printed, equipped with basic sensors (e.g. pressure sensors) and subsequently tested by patients, leading to the design of choice.
User doubts :	Users have 3 main doubts: • Sensors may be disturb/scare children • Maybe back brace sensors will need to be recharged every week. This is going to make the process more difficult for the user • Maybe the 3d printed back brace is going to more heavy
User motivation:	AidPlex is looking for innovative features to adapt them to advanced customizable products that can differentiate them from their competitors. Patients & Physicians are expecting a more efficient back brace. Also, gamification is expected to help children make the wearing habit more joyful and effective.
Preconditions:	AidPlex can design and manufacture back braces and the IoT system, but AidPlex needs to know more about children daily back brace use and back brace improvements. Design thinking sessions can be established with patients and physicians in order to identify the best possible features, to achieve higher levels of conformity. The cMDF must be able to carry this forward and need to have a total understanding of the goals of the company in terms of not only the design and manufacturing of the prototype, but also its exploitation.
Postconditions:	At case completion, AidPlex must ensure that all requirements were addressed, the doubts stated before were all solved, and that the products developed were added to the normal flow of the company as any other existing product. For an unsuccessful case, failing reasons must be identified and corrected, and it is up to the parties to decide about the viability of the product and whether or not it should be discarded, changed, or implemented again applying the changes detected.
Flow:	**IDEATION INITIAL PROCESS:** Through the cMDF profiling marketplace provided by iPRODUCE OpIS, AidPlex establishes contact and a working relationship with the cMDF which brings to their attention that target users are demanding a new type of a back brace, which is going to be more accepted by the patients/children. Doctors & children are going to select the features of patients' and doctors' app in order to be more useful to them.

	DESIGN THINKING: AidPlex starts by doing desk research and then asks for patients’ and physicians’ feedback on AidPlex’s assumptions. Design thinking usually includes the following processes and activities (in brackets): 1) Empathize (sorting card boards for cases, trends, etc.); 2) Define (empathy map, POV statements, affinity diagrams); 3) Ideate (Scamper lateral thinking, mind map creator, challenge launcher), 4) Prototype (storyboard, sketch, mock up gallery), 5) Test (surveys). **DESIGN & PROTOTYPING:** After the design thinking stage, a design brief is elaborated with the selected new product idea. AidPlex’s engineers are going to start developing both the system of sensor and the 3D models. Then, AidPlex is going to print the first models in order to test them with the patients and the physicians. With AR/VR system, AidPlex is going to demonstrate the proposed solution to patients and physicians to achieve better understanding of the solution and off course to give them the chance to select their favorite features.
Alternative Flows:	Different options can occur here. Third parties can be brought in to collaborate with the cMDF and the physicians/patients to offer totally customized solutions to the predicament in place. The main product can change during the course of the engineering phase, and result in altering the initial idea.
Exceptions:	Timing or planning errors or lack of 3D printed materials, the system will warn the user and provide a correction path should a delay occur. Execution errors, the system detects that a user is not executing an assigned task that was due on a specific date. The system reacts and tries to correct giving higher priority.
Requirements:	• Collaboration agreement needs to be put in place, so that all tasks and responsibilities are correctly identified. • A confidentiality agreement must be signed between the parties. • Exploitation rights must be settled. • The new product needs to comply with the quality and safety standards and regulations. • Elaborate a planning of each of the phases. The system controls and monitors them, and warns should a deviation occur. Then the system offers possible corrections according to plan.
Objectives to achieve:	• Increasing the ratio of ideas related to new innovative products brought to market • Reducing the product development´s cost • Increasing the company’s portfolio of innovative products • Improving the adequacy/effectiveness of the idea from its original state due to the focus group feedback • Raising co-creation practices between the industry and users
KPI :	• Average time lapse between first contact and production of prototype • cMDF staff hours • Average speed of response (minutes or hours) • Conversion ratio of prototypes becoming market products • Budget to capture and generate ideas • Time spent discussing hypotheses • Number of formally formulated ideas

	• Diversity of sources of ideas • Number of reported errors by system • Average time solving reported errors • Average time from start to finish the whole design • Availability of tools and devices • Number of exploitation agreements • Number of annual new products development • Annual % of new product in catalogue • Annual % growth of new products in catalogue • Number of needs detected that will be covered by the product • Number of differential aspects of the proposal • Number of feedback contacts with focus group • Success factors by stage of development (resolution rate) • Number of conducted design thinking workshops • Number of people taking part in design thinking workshops • Number of prototypes derived from workshops • Number of collaboration agreements • Number of confidentiality agreements • Number of manufactured co-created items (products, components, etc.) • Perceived Value Metrics • Behaviour change metrics

Use Case Diagram

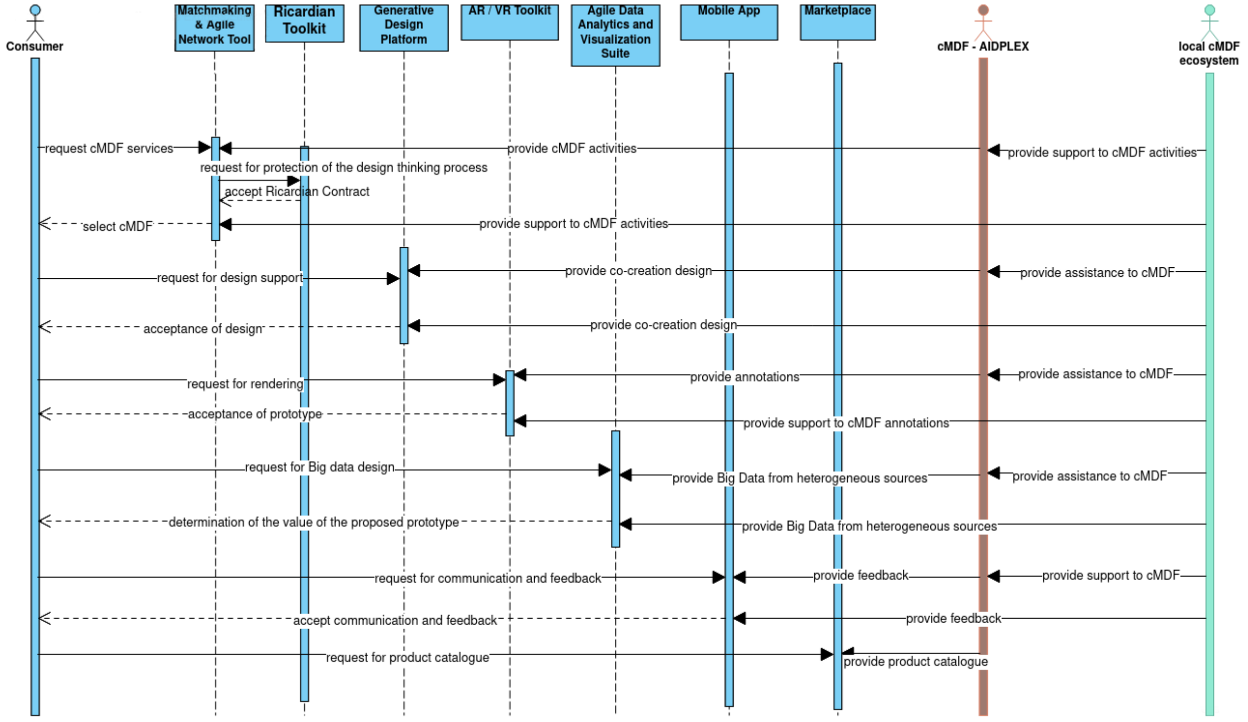


Figure 21 Greek Use Case Diagram 1

3.7.2. cMDF_GR_UC2

Name of Use Case:	cMDF_GR_UC2		
Created By:	Dimitris Moustakas	**cMDF Involved**	GREEK

<table>
<tr><td>Date Created:</td><td>20/04/2020</td><td>Last Revision Date:</td><td>23/07/2020</td></tr>
<tr><td>Description:</td><td colspan="3">INTRODUCTION:
Until now, AidPlex has only designs for adults. As a pilot, AidPlex, Doctors and patients are going to design new sizes & designs for children, in order to provide with the best possible treatment experience. In addition, the patient can select not only the possible size but, the colour of the splint and the type of the strap.
AidPlex's team design its products based on patients' needs during the healing procedure. The main features of AidPlex splint are: waterproof, lightweight and skin friendly. First of all, patients can easily bathe themselves without the use of plastic covers around their broken bones. In addition, we offer a 6 times lighter solution, giving to patients a more useful splint in a very difficult period of their life. AidPlex's splint has a lot of holes, therefore patients' skin can breathe normally and eliminate the chance of skin irritation problems. Finally, it is ideal for children. Sometimes Doctors may prescribe drugs to children in order to be easy to easily splint their broken bone. Our quick and easy-to-apply solution helps on the one hand healthcare professionals do their job easier and on the other hand, avoiding drug delivery to children.
AidPlex wants to help healthcare organizations and professionals to reduce their health economics. The splint we designed is ready for use anytime needed and takes only few minutes to be fully set. This feature saves significant time spent by professionals which could be used more efficiently. Thanks to AidPlex, healthcare professionals reduce their costs and limit their inefficiencies, whilst patients are provided with an excellent quality splint.</td></tr>
<tr><td>Actors:</td><td colspan="3">Physicians and patients will be contacted and invited to participate, in order for the design process to include educated as well as experiential feedback. Then all together are going to design the children's splint design and patients(children) are going to mold it, in order to give us feedback.</td></tr>
<tr><td>User doubts:</td><td colspan="3">Both physicians and patients have not expressed any doubt about this process.</td></tr>
<tr><td>User motivation:</td><td colspan="3">AidPlex is looking for innovative ways to deliver patient-centered products and expand the portfolio of customizable products that can differentiate them from their competitors.
Users are expecting a more efficient children splint, both for Doctors and children.</td></tr>
<tr><td>Preconditions:</td><td colspan="3">AidPlex can design and manufacture splints, but with patients' feedback AidPlex can make more effective splints. In addition, the patient can select the colour of the splint, increasing their quality of life during the treatment process.
Design thinking sessions can be established with patients and physicians, in order to identify the best possible features, to achieve higher levers of comfort.
The cMDF must be able to carry this forward and need to have a total understanding of the goals of the company in terms of not only the design and manufacturing of the prototype, but also its exploitation.</td></tr>
<tr><td>Postconditions:</td><td colspan="3">At case completion, AidPlex must ensure that all requirements were addressed, the doubts stated before were all solved, and that the products developed were added to the normal flow of the company as any other existing product.</td></tr>
</table>

	For an unsuccessful case, failing reasons must be identified and corrected, and it is up to the parties to decide about the viability of the product and whether or not it should be discarded, changed, or implemented again applying the changes detected.
Flow:	**IDEATION INITIAL PROCESS:** Through the cMDF profiling marketplace provided by iPRODUCE OpIS, AidPlex establishes contact and a working relationship with the cMDF which brings to their attention that target users are demanding a better treatment experience, which is going to be more accepted by the patients/children. Doctors & children are going to select the features of size, colour and type of the straps. **DESIGN THINKING:** AidPlex starts by doing desk research and then asks for patients' and physicians' feedback on AidPlex's assumptions. Design thinking usually includes the following processes and activities (in brackets): 1) Empathize (sorting card boards for cases, trends, etc.); 2) Define (empathy map, POV statements, affinity diagrams); 3) Ideate (Scamper lateral thinking, mind map creator, challenge launcher), 4) Prototype (storyboard, sketch, mock up gallery), 5) Test (surveys). **DESIGN & PROTOTYPING:** After the design thinking stage, a design brief is elaborated with the selected new product idea. AidPlex's engineers are going to start developing the 3D models. Then, AidPlex is going to print the first models in order to test them with the patients and the physicians. With AR/VR system, AidPlex is going to demonstrate the proposed solution to patients and physicians to achieve better understanding of the solution and off course to give them the chance to select their favorite features.
Alternative Flows:	Different options can occur here. Third party actors can be brought in to collaborate with the cMDF and the physicians/patients to offer totally customized solutions to the predicament in place. The main product can change during the course of the engineering phase, and result in altering the initial idea.
Exceptions:	Timing or planning errors or lack of 3D printed materials, the system will warn the user and provide a correction path should a delay occur. Execution errors, the system detects that a user is not executing an assigned task that was due on a specific date. The system reacts and tries to correct giving higher priority.
Requirements:	• Collaboration agreement needs to be put in place so all tasks and • responsibilities are correctly identified. • A confidentiality agreement must be signed between the parties. • Exploitation rights must be settled. • Compliance of the new product with the quality and safety standards and regulations. • Elaboration of a planning of each of the phases. The system controls and monitors them, and warns should a deviation occur. Then, the system offers possible corrections according to plan.

Objectives to achieve:	• Increasing the ratio of ideas related to new innovative products brought to market • Reducing product development´s cost • Increasing the company's portfolio of innovative products • Improving the adequacy/effectiveness of the idea from its original state due to the focus group feedback • Raising co-creation practices between the industry and users
KPI:	• Average time lapse between first contact and production of prototype • cMDF staff hours • Average speed of response (minutes or hours) • Conversion ratio of prototypes becoming market products • Budget to capture and generate ideas • Time spent discussing hypotheses • Number of formally formulated ideas • Diversity of sources of ideas • Number of reported errors by system • Average time solving reported errors • Average time from start to finish the whole design • Availability of tools and devices • Number of exploitation agreements • Number of annual new products development • Annual % of new product in catalogue • Annual % growth of new products in catalogue • Number of needs detected that will be covered by the product • Number of differential aspects of the proposal • Number of feedback contacts with focus group • Success factors by stage of development (resolution rate) • Number of conducted design thinking workshops • Number of people taking part in design thinking workshops • Number of prototypes derived from workshops • Number of collaboration agreements • Number of confidentiality agreements • Number of manufactured co-created items (products, components, etc.) • Perceived Value Metrics • Behaviour change metrics

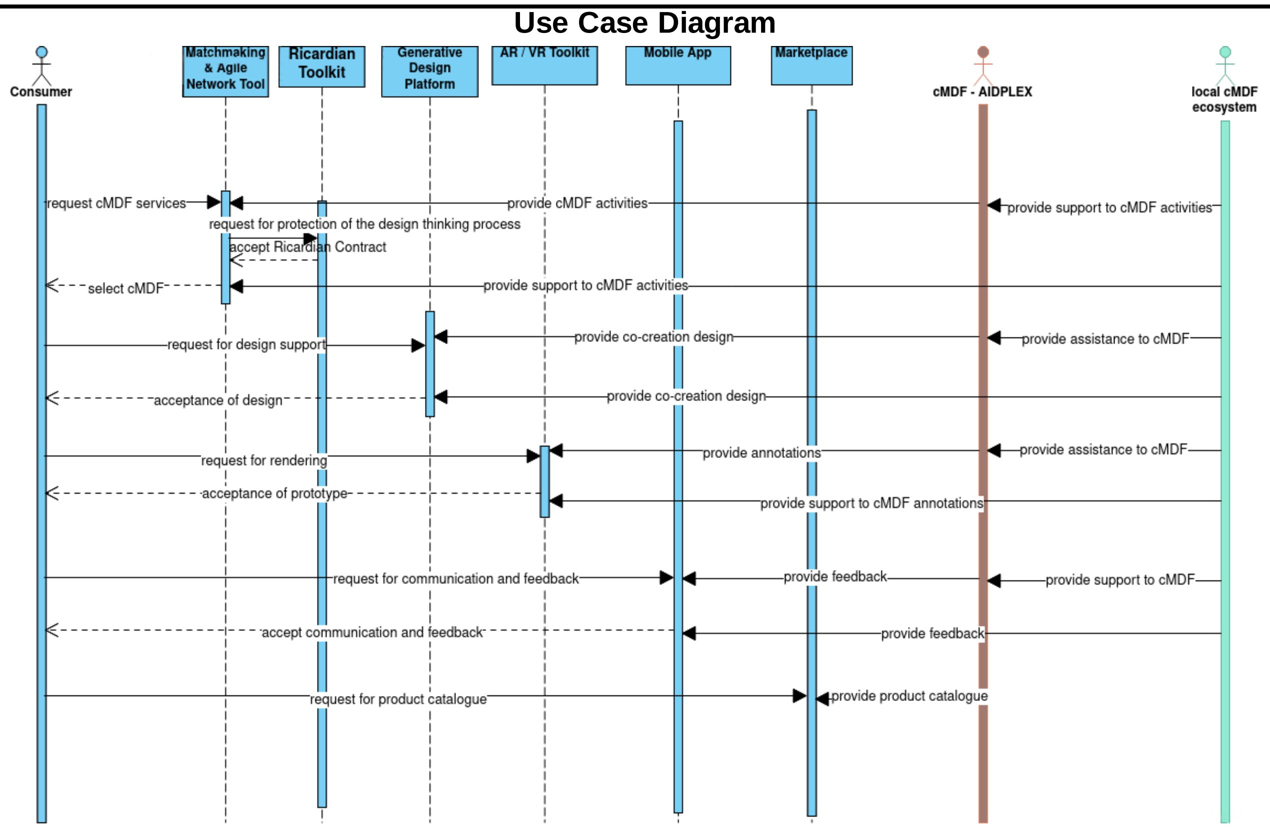


Figure 22 Greek Use Case Diagram 2

3.7.3. cMDF_GR_UC3

Name of Use Case:	cMDF_GR_UC3		
Created By:	Dimitris Moustakas	**cMDF Involved**	Greek
Date Created:	20/04/2020	**Last Revision Date:**	23/07/2020
Description:	Until now, AidPlex has designs only for humans! As a pilot, AidPlex and Vets are going to design new designs for pets, in order to provide the best possible treatment experience. In addition, the owners can select not only the possible size but, the color of the splint and the type of the strap. AidPlex's team design its products based on patients' needs during the healing procedure. The main features of AidPlex splint are: Waterproof, Lightweight and Skin Friendly. First of all, patients can bathe themselves easily without the use of plastic covers around their broken bones. In addition, we offer a 6 times lighter solution, giving to patients a more useful splint in a very difficult period of their life. AidPlex's splint has a lot of holes, therefore patients' skin can breathe normally and eliminate the chance of skin irritation problems. Finally, it is ideal for pets! Sometimes, pets pee their splint and then there is a need for change of the splint. Our waterproof & quick and easy-to-apply solution helps on the one hand healthcare professionals do their job easier and on the other hand. AidPlex wants to help healthcare organizations and professionals to reduce their		

	health economics. The splint we designed is ready for use anytime needed and takes only few minutes to be fully set. This feature saves significant time spent by professionals which could be used more efficiently. So with AidPlex, healthcare professionals reduce their costs and limit their inefficiencies, whilst patients are provided with an excellent quality splint.
Actors:	Physicians and patients will be contacted and invited to participate in order for the design process to include educated as well as experiential feedback. Then all together are going to design the children's splint design and patients(children) are going to mould it our their, in order to give us feedback.
User doubts :	Both physicians and pet owners has not expressed any doubt about this process.
User motivation :	AidPlex is searching for innovative ways to deliver patient-centered products and to expand the portfolio of customizable products that can differentiate them from their competitors. Users are expecting a more efficient pet splint, both for vets and pets!
Preconditions:	AidPlex can design and manufacture splints, but with patients' feedback AidPlex can make more effective splints. In addition, the patient can select the color of the splint, increasing their quality of life during the treatment process. Design thinking sessions can be established with patients and physicians in order to identify the best possible features, to achieve higher levels of comfort. cMDF must be able to carry this forward and need to have a total understanding of the goals of the company in terms of not only the design and manufacturing of the prototype, but also its exploitation.
Postconditions:	At case completion, AidPlex must ensure that all requirements were addressed, the doubts stated before were all solved, and that the products developed were added to the normal flow of the company as any other existing product. For an unsuccessful case, failing reasons must be identified and corrected, and it is up to the parties to decide about the viability of the product and whether or not it should be discarded, changed, or implemented again applying the changes detected.
Flow:	IDEATION INITIAL PROCESS Through the cMDF profiling marketplace provided by iPRODUCE OpIS, AidPlex establishes contact and a working relationship with the cMDF which brings to their attention that target users are demanding a better treatment experience, which is going to be more accepted by the patients/children. Doctors & children are going to select the features of size, color and type of the straps. DESIGN THINKING AidPlex starts by doing desk research and then asks for vets' feedback on AidPlex's assumptions. Design thinking usually includes the following processes and activities (in brackets): 1) Empathize (sorting card boards for cases, trends, etc.); 2) Define (empathy map, POV statements, affinity diagrams); 3) Ideate (Scamper lateral thinking, mind map creator, challenge launcher), 4) Prototype (storyboard, sketch, mock up gallery), 5) Test (surveys).

	DESIGN & PROTOTYPING After the design thinking stage, a design brief is elaborated with the selected new product idea. AidPlex's engineers are going to start developing the 3D models. Then, AidPlex is going to print the first models in order to test them with the pets and the vets. With AR/VR system, AidPlex is going to demonstrate the proposed solution to owners and physicians to achieve better understanding of the solution and off course to give them the chance to select their favorite features.
Alternative Flows:	Different options can occur here. Third party actors can be brought in to collaborate with the cMDF and the physicians/patients to offer totally customized solutions to the predicament in place. The main product can change during the course of the engineering phase, and result in altering the initial idea.
Exceptions:	Timing or planning errors or lack of 3D printed materials, the system will warn the user and provide a correction path should a delay occur. Execution errors, the system detects that a user is not executing an assigned task that was due on a specific date. The system reacts and tries to correct giving higher priority.
Requirements:	LEGAL AND REGULATORY REQUIREMENTS: ● Collaboration agreement needs to be put in place so all tasks and responsibilities are correctly identified. ● A confidentiality agreement must be signed between the parties. ● Exploitation rights must be settled. ● Compliance of this new product with the quality and safety standards and regulations. ORGANIZATIONAL REQUIREMENTS: ● Elaborate a planning of each of the phases. The system controls and monitors them, and warns should a deviation occur. Then the system offers possible corrections according to plan.
Objectives to achieve :	1. Increase the ratio of ideas related to new innovative products brought to market 2. Reduce the product development´s cost 3. Increase the company's portfolio of innovative products 4. Improve the adequacy/effectiveness of the idea from its original state due to the Focus Group feedback 5. Raise co-creation practices between the industry and users
KPI :	• Average time lapse between first contact and production of prototype • Staffing hours CMDF • Average speed of response (minutes or hours) • Conversion ratio of prototypes becoming market products • Budget to capture and generate ideas • Time spent discussing hypotheses • Number of formally formulated ideas • Diversity of sources of ideas • Number of reported errors by system • Average time on solving reported errors • Average time from start to finish the whole design • Availability of tools and devices • Number of exploitation agreements

	• Number of annual new products development • Annual % of new product in catalogue • Annual % growth of new products in catalogue • Number of needs detected that will be covered by the product • Number of differential aspects of the proposal • Number of feedback contacts with focus group • Success factors by stage of development (resolution rate) • Number of conducted design thinking workshops • Number of people taking part in design thinking workshops • Number of prototypes derived from workshops • Number of collaboration agreements • Number of confidentiality agreements • Number of manufactured co-created items (products, components, etc.) • Perceived Value Metrics • Behavior change metrics

Use Case Diagram

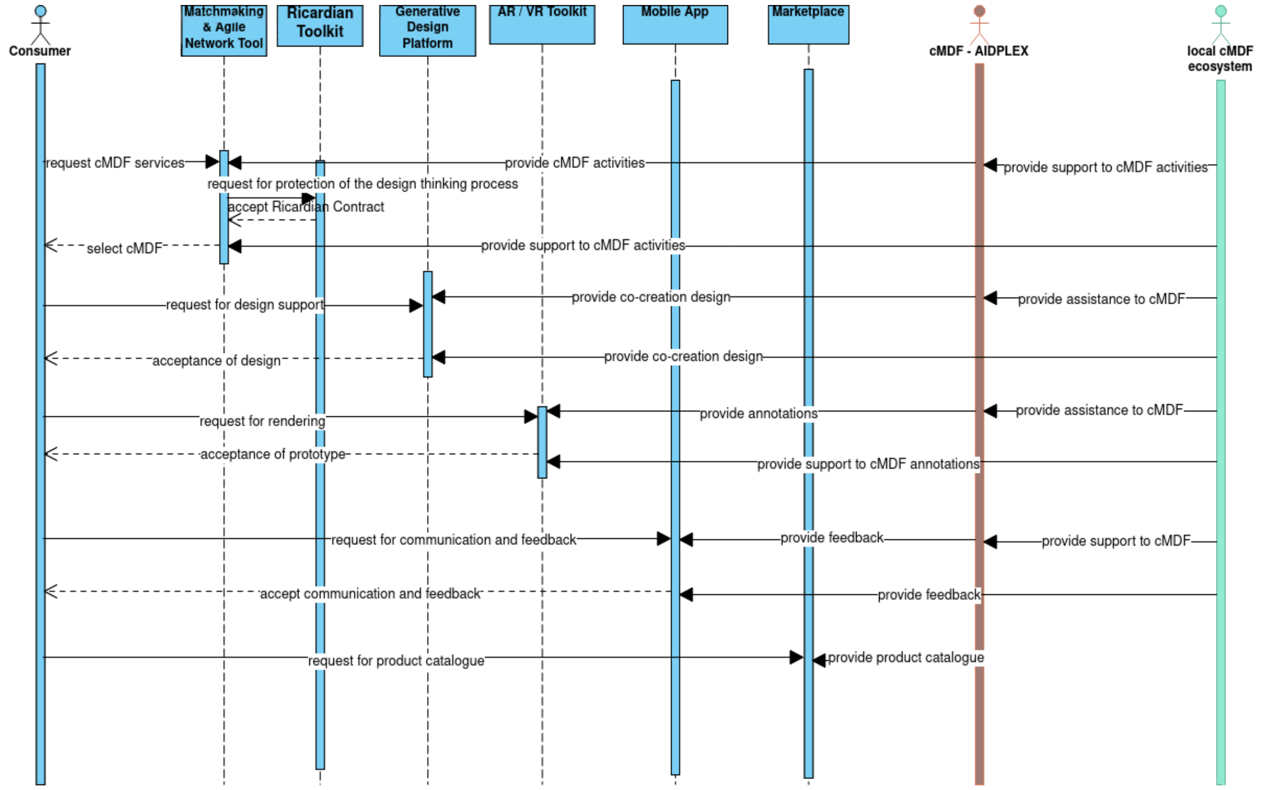


Figure 23 Greek Use Case Diagram 3

3.7.4. cMDF_GR_UC4

Name of Use Case:	cMDF_GR_UC4		
Created By:	Dimitris Moustakas	**cMDF Involved**	Greek
Date Created:	20/04/2020	**Last Revision Date:**	25/05/2020
Description:	INTRODUCTION: AidPlex develops protective face shields for both adults & kids in the fight against		

	COVID-19 After three weeks of intense efforts, more than 50,000 face shields had made their way across multiple Greek cities and to more than 170 groups from different medical associations, hospitals and others. The face shield is one of several projects being run by the COVID-19 Response Greece action. This project aims to make the design of protective gear open source and available to everyone that has relevant production facilities, under the license terms of Creative Commons (4.0 International License) Attribution-Non Commercial. After a lot of discussions with Hospitals for Kids & Adolescents, AidPlex realized that all the solutions in the market are designed for adults. So, in order to offer high levels of protection to kids, AidPlex is going to design custom face shield to perfectly fit kids' sizes.
Actors:	**PRIMARY ACTORS:** • COVID-19 Response Greece, a Greek volunteer action who has worked and contributed towards the development of protective gear. This includes, for example, the development and mass production of two types of protective face shields. **SECONDARY ACTORS**: • AidPlex, as project coordinator of project face shield, Soulis S.A. as the manufacturer. Of course in this volunteering act there are almost 300 members, with a big variety of different backgrounds (scientists, engineers, business developers, software developers)
User doubts:	The only doubt the users had, was if the redesign is going to be ideal for children.
User motivation:	Users are expecting a more efficient face shield, providing a better treatment experience to patients.
Preconditions:	AidPlex can design and manufacture 3D printed face shields, but with patients' feedback AidPlex can make them more effective. In addition, the patient can select the colour of the face shield, increasing their quality of life during the pandemic. Design thinking sessions can be established with patients and physicians in order to identify the best possible features, to achieve higher levels of comfort. cMDF must be able to carry this forward and need to have a total understanding of the goals of the company in terms of not only the design and manufacturing of the prototype, but also its exploitation.
Postconditions:	At case completion, AidPlex must ensure that all requirements were addressed, the doubts stated before were all solved, and that the products developed were added to the normal flow of the company as any other existing products. For an unsuccessful case, failing reasons must be identified and corrected, and it is up to the parties to decide about the viability of the product and whether or not it should be discarded, changed, or implemented again applying the changes detected.

Flow:	**IDEATION INITIAL PROCESS:** Through the cMDF profiling marketplace provided by iPRODUCE OpIS, AidPlex establishes contact and a working relationship with the cMDF which brings to their attention that target users are demanding a better treatment experience, which is going to be more accepted by the patients/children. Doctors & children are going to select the features of size, colour and type of the straps. **DESIGN THINKING:** AidPlex starts by doing desk research and then asks for vets' feedback on AidPlex's assumptions. Design thinking usually includes the following processes and activities (in brackets): 1) Empathize (sorting card boards for cases, trends, etc.); 2) Define (empathy map, POV statements, affinity diagrams); 3) Ideate (Scamper lateral thinking, mind map creator, challenge launcher), 4) Prototype (storyboard, sketch, mock up gallery), 5) Test (surveys). **DESIGN & PROTOTYPING:** After the design thinking stage, a design brief is elaborated with the selected new product idea. AidPlex's engineers are going to start developing the 3D models. Then, AidPlex is going to print the first models in order to test them with the pets and the vets. With AR/VR system, AidPlex is going to demonstrate the proposed solution to owners and physicians to achieve better understanding of the solution and give them the chance to select their favourite features.
Alternative Flows:	Different options can occur here. Third parties can be brought in to collaborate with the cMDF and the physicians/patients to offer totally customized solutions to the predicament in place. The main product can change during the course of the engineering phase, and result in altering the initial idea.
Exceptions:	Timing or planning errors or lack of 3D printed materials, the system will warn the user and provide a correction path should a delay occur. Execution errors, the system detects that a user is not executing an assigned Task that was due on a specific date. The system reacts and tries to correct giving higher priority.
Requirements:	• Collaboration agreement needs to be put in place so all tasks and responsibilities are correctly identified. • A confidentiality agreement must be signed between the parties. • Exploitation rights must be settled. • Compliance of this new product with the quality and safety standards and regulations. • Elaborate a planning of each of the phases. The system controls and monitors them, and warns should a deviation occur. Then the system offers possible corrections according to plan.
Objectives to achieve:	• Increasing the ratio of ideas related to new innovative products brought to market • Reducing the product development´s cost • Increasing the company's portfolio of innovative products • Improving the adequacy/effectiveness of the idea from its original state due to the focus group feedback

	• Raising co-creation practices between the industry and users
KPI:	• Average time lapse between first contact and production of prototype • cMDF staff hours • Average speed of response (minutes or hours) • Conversion ratio of prototypes becoming market products • Budget to capture and generate ideas • Time spent discussing hypotheses • Number of formally formulated ideas • Diversity of sources of ideas Number of reported errors by system • Average time on solving reported errors • Average time from start to finish the whole design • Availability of tools and devices • Number of exploitation agreements • Number of annual new products development • Annual % of new product in catalogue • Annual % growth of new products in catalogue • Number of needs detected that will be covered by the product • Number of differential aspects of the proposal • Number of feedback contacts with focus group • Success factors by stage of development (resolution rate) • Number of conducted design thinking workshops • Number of people taking part in design thinking workshops • Number of prototypes derived from workshops • Number of collaboration agreements • Number of confidentiality agreements • Number of manufactured co-created items (products, components, etc.) • Perceived Value Metrics • Behaviour change metrics

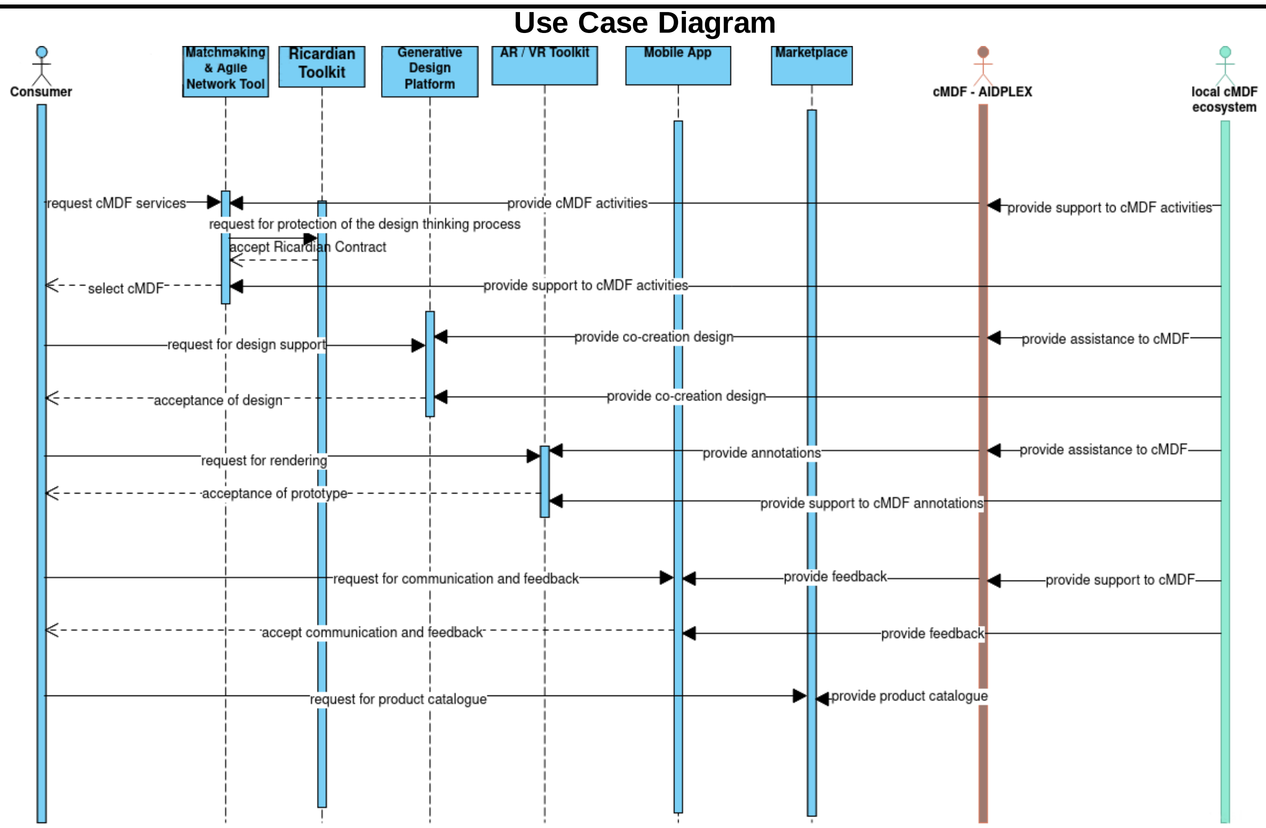


Figure 24 Greek Use Case Diagram 4

3.7.5. cMDF_GR_UC5

<table>
<tr><td>Name of Use Case:</td><td colspan="4">cMDF_GR_UC5</td></tr>
<tr><td>Created By:</td><td colspan="2">Ria Pechlivani</td><td>cMDF Involved</td><td>Greek cMDF</td></tr>
<tr><td>Date Created:</td><td colspan="2">10/7/2020</td><td>Last Revision Date:</td><td>11/10/2020</td></tr>
<tr><td>Description:</td><td colspan="4">CERTH through its Additive Manufacturing Unit (AMU), a research unit laboratory of Information Technologies Institute (ITI) of CERTH will support the Greek cMDF ecosystem enables social manufacturing at local and regional level. Also, with the state of the art 3D printing systems and 3D scanners, robust product design, assembly and IoT technologies will offer rapid smart 3D prototypes to makers communities.
Under the coronavirus disease (COVID-19) pandemic, AMU encourages students in engaging with creation of 3D printed prototypes based on customized and personalized solutions, using additive manufacturing technologies. Students can co-create with AMU experts, 3D Printed Smart Luminous Artifacts based on their favorite historical and mythological figures, such as Olympian Gods, Alexander the Great or Cultural Heritage artifacts.
The 3D Printed Smart Luminous Artifacts are divided to three printed parts using three different 3D printing technologies: a) the 3D printed transparent artifact which is constructed by Stereolithography (SLA) using optical transparent polymeric materials, b) a 3D printed electronics housing with adjusted LED stripes using Fused Filament Fabrication (FFF) and c) an advanced 3D printed hybrid circuit board using silver nanoparticles ink which are printed onto plastic substrates by Inkjet technology.
This 3D Printed Smart Luminous Artifact will be connected by WiFi and Bluetooth with a new user-friendly specialized mobile application, the AMU4you that will be semi-programmable. The student apart from learning how to create a 3D printed prototype will quickly learn how coding skills by programming software is super easy to use and how to incorporate these skills in their own smart 3D printed prototypes. The student using the AMU4you application will select the preferred color, motive, and brightness according to the mood and activity that would like to follow for example studying or sleeping and use it as an RGB controllable table lamp. The 3D Printed Smart Luminous Artifact will integrate a battery for full operation autonomy 12 hrs and enables USB recharging.</td></tr>
<tr><td>Actors:</td><td colspan="4">• students</td></tr>
<tr><td>User doubts :</td><td colspan="4">• Has no experience with 3D PCB manufacturing, assembly with electronic parts, prototyping and testing of IoT devices
• Has no programming/developing knowledge
• Not familiar with 3D Printing technologies</td></tr>
<tr><td>User motivation :</td><td colspan="4">• Rapid and functional 3D printed PCBs assembled with functional electronics
• Customized prototypes using 3D scanning
• Self-made complete prototype from app to hardware
• Experience with state-of-the-art additive manufacturing & IoT technologies
• Custom app user interface and 3D printed figure</td></tr>
<tr><td>Health and Safety</td><td colspan="4">No toxic materials or chemicals are used.</td></tr>
</table>

Issues:	
Preconditions:	• Provision of the prototype design in ECAD files, STL • Provision of electronic parts for pick and place • Provision of 3D Printing equipment – materials, post process tools, printers • Supervising and training
Postconditions:	• Quality control and testing • AR/VR ○ 3D viewer of the virtual product and/or other environment necessary models (e.g. virtual environments/indoor spaces, human figure) ○ Configuration for customer, designer, manufacturer ○ 3D scene - 3 - 4 indicative virtual environments as templates to change the background ○ Smart 3D printed luminous Artifacts add human figure and - configure weight and height or other important dimensions for ergonomics, color • Generative design platform for personalized design and manufacturing • Digital Fablab Kit for training on software programming, product design and use of 3D printers
Flow:	1.) Actor designs the prototype in his CAD program etc 2.) File is exported to be handled by CERTH's machine (e.g. FFF, SLA, PCB 3D printer) 3.) Prototype is manufactured according the suitable 3D printing process 4.) Quality control 5.) Set up and place electronics, components and necessary parts 6.) Assembly prototyping and testing
Alternative Flows:	• CNC machine for PCB fabrication instead of 3D inkjet printing • Material Jetting (MJ) processes or FDM using transparent PLA instead of SLA
Exceptions:	• Tolerances are too tight during production • Soldering process fails (too much/not enough solder paste, heat, etc) • Short Circuits • Design Flaws • Wrong/fake parts • Human error • Machine failure • Parts are unavailable • Errors during file preparation/export
Requirements:	• Working as test bed for all students by providing ASAP services • Available suitable materials – transparent material for sufficient brightness • Available post-process tools
Objectives to achieve :	Quick prototyping cycles and know-how transfer
KPI :	• Convenience and simplicity • USB Port for Power Supply - V_o=5V V_{real}=4.936V • Low energy RGB LED WS2812b • Microprocessor ESP32 WROOM-32D (MCU & WIFI & BLUETOOTH Module) • V_o=3.3V V_{real}=3.18V • Battery charging & Protection - 1200mhA I_o=160~260mA I_{real}=183mA (on – not stable) with 12 hr Autonomy • With sufficient material transparency, brightness reaches 15-25 Lumens • Color variety: red, blue, green, magenta, orange, white, cyan, yellow • Normal and Fast blinking motif with 6 different mood modes.

Use Case Diagram

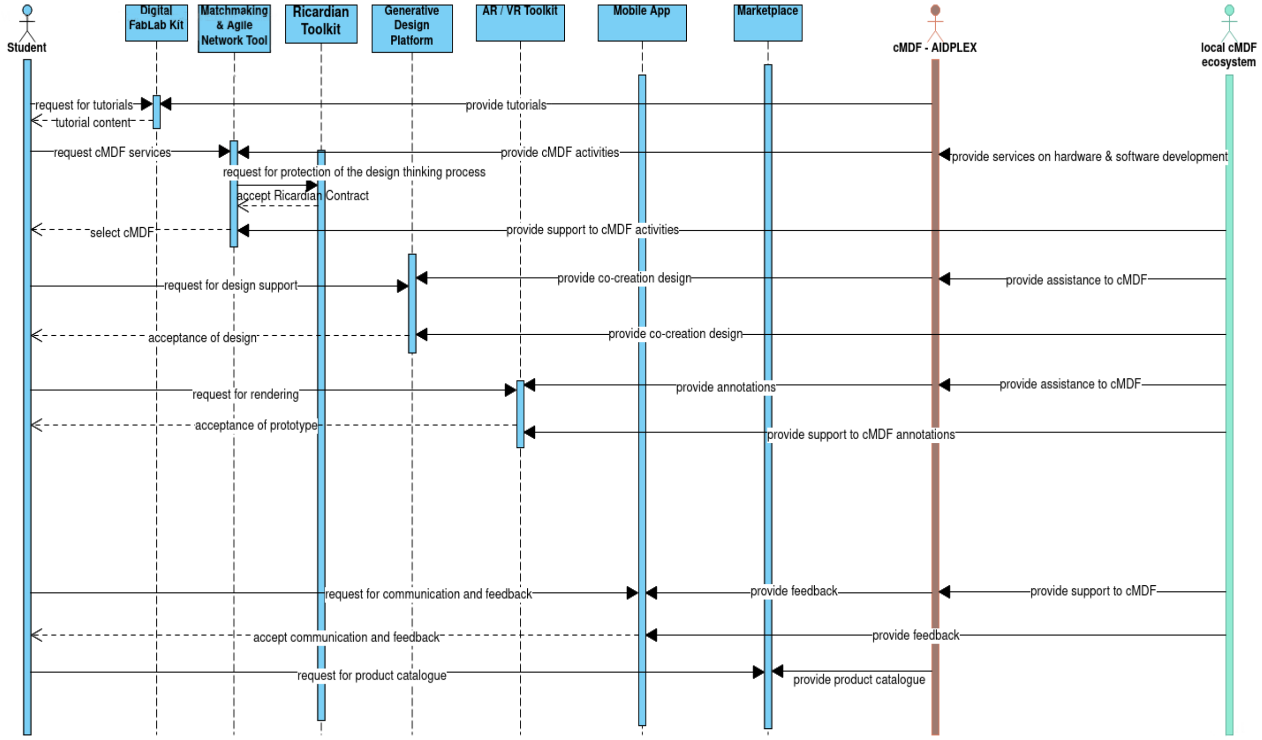


Figure 25 Greek Use Case Diagram 5

4. Co-creation challenges & recommendations

The establishment of collaborative projects, integrating at least one academic and one industrial partner, is becoming an increasingly popular practice, since it offers significant advantages for each player involved in the approach (increased competitiveness, improved performance, cost reductions, pooling of skills, accelerated development, etc.). Nevertheless, even if co-innovation and collective intelligence practices are becoming more common,[1] major problems often have to be overcome before achieving the expected results.

Thus, in this chapter Materalia has mapped the various challenges encountered and/or collected from different stakeholders of our ecosystem (start-ups, SMEs, Laboratories, big companies, etc.), based on our experience as an innovation facilitating structure. In a second step recommendations and/or avenues of reflection to address these challenges are presented.

This section describes 3 major phases of the life cycle of a collaborative innovation project: the framing phase, the development phase and the valorisation phase. This analysis could have been divided into more phases but the main reason for the selection of this structure is that it is quite common in all innovation projects, regardless of their size, the number of partners or their temporality.

4.1. Challenges and recommendations during the framing Phase:

This phase is undoubtedly the most crucial step for a collaborative innovation project to be successful, as it allows, in particular, to clearly define the specific objectives of each associated structure, as well as the common objectives. Indeed, its main purpose is to formalize the project in all its dimensions: distribution of roles, budget implementation, definition of technical-scientific objectives, clarification of intellectual property issues, sharing of risks and investments, etc.

The major challenges associated with this phase are the following:

4.1.1. Strength and significance of the consortium:

Collaborative projects federate various types of structures (legal form, size, etc.). It is therefore important to consider the sometimes strong differences between the different partners in order to avoid an imbalance in the collaboration. For example, the relationship between large groups/start-ups in a consortium requires particular attention, since there is a strong asymmetry of strengths and resources between these two actors. Indeed, large companies have a segmented organisation with services dedicated to their different activities (administrative, innovation, etc.) and a strong deployment capacity. On the contrary, start-ups are often less structured, with very often the same person taking on several roles: legal director, Human Resources (HR) director, CFO, project manager, etc. These disparities in the way they operate inherently influence working methods: risk taking, temporality, relationship to decision making, human resources, budgetary capacity, communication etc. These aspects must be considered during the project framing phase and discussed upstream in order to avoid discrepancies during the project. In the same vein, similar divergences may also coexist in collaborations involving academic structures and manufacturers (regardless of the typology). Moreover, there are aspects of temporality. Indeed, industries often deplore the slow inertia of laboratories but also a development methodology that is not in line with their market-oriented objectives. When Industrials or manufacturers are dependant of the market and therefore have to think and act fast, the academic structures will not follow at the same path because their objectives are different. The pace of research is not the same as that of the industry. For all these reasons, a

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[1] https://www.tandfonline.com/doi/abs/10.1080/09537287.2010.536619

tendency to work with technological platforms has been noted, since they offer a faster service and, above all, a working philosophy that is in total agreement with their objectives.

4.1.2. Consortium agreement:

A consortium agreement makes it possible to respond at an early stage and prevent problems that may arise during the life cycle phases of a project. More concretely, it provides with a framework of trust, enabling the partners to bring their know-how and intellectual property rights to the consortium with confidence throughout the project. An efficiency framework allows, once the solution has been implemented, to have a legal and operational framework favourable to the exploitation of the solution. Thus, the consortium agreements integrate the intellectual property rights aspects, which are the "sinews of war" of collaborative projects and the major point of contention between the different partners.

Also, as mentioned above, the power imbalance between the stakeholders is also present in the formalisation of IPR and it is often a major obstacle. Indeed, the expertise of legal aid is uneven among stakeholders. Large companies may benefit from the expertise of specialized legal services, while others have to rely on external provision or even on their own knowledge.

With regards to IPR, some examples of good IPR management practices:

- Signing a confidentiality agreement to frame any discussion relating to the consortium project.
- Defining precisely the purpose of the consortium and formalise the common goal of the partners.
- Selecting partners on the basis of complementarity as the main selection criterion, and assessing the nature of each partner's contribution.
- Precisely listing all the IPR of each partner and identify the IPR that will be contributed to the consortium. Then, define the framework for the exploitation by the partners of each of the IPR pooled.
- Setting up multidisciplinary working groups and collaborative tools in order to accurately identify the contributions and expectations of each partner, particularly in terms of IPR, in order to avoid future disagreements or blockages.
- Setting up a steering committee to ensure that the consortium's objectives are met and to monitor the delivery of deliverables according to the timetable agreed by the partners. The steering committee ensures that the change control procedure is followed at all times. It is vested with real decision-making power.
- Agreeing on the future of the new knowledge resulting from partners collaboration, and its protection. If the new knowledge is attributable to a partner, that partner has ownership of it and grants at least one license to the other partners. If the foreground is common and inseparable, the partners who participated in its creation shall have joint ownership of it and shall put in place (i) an indivision agreement which shall govern the rights and obligations of each partner who is co-owner and (ii) a licence of exploitation for the other partners.
- Agreeing on the terms of entry of any new partner and on the IPR granted to the new entrant, in particular on the foreground created by the partners within the consortium independently of the new entrant.
- Agreeing on the exit modalities of a partner and on the future of the IPR, in particular with regards to the exploitation of foreground, in order to ensure the sustainability of the consortium.
- Agreeing on the modalities of exploitation, in particular for research or commercial purposes, of the foreground created within the consortium in the consortium contract, the co-ownership agreement and the exploitation licences.

- Agreeing on the consortium contract, the joint distribution agreement and the operating licences on the terms and conditions for updating, correcting and updating the foreground created within the framework of the consortium.
- Agreeing on the consortium contract on the conditions likely to engage their liability. This shall include a clause recalling their independence.
- Agreeing on the Consortium Agreement, depending on the nature of the consortium, on the terms of a non-competition clause.
- Agreeing on the consortium agreement, depending on the nature of the consortium, on the terms of a non-solicitation clause.
- Agreeing on the applicable law and the competent court to hear disputes arising from the consortium agreement.

To sum up, if in the framework of an innovation programme with a multitude of actors, the formalization of the collaboration in a consortium agreement seems unavoidable, the imbalance of the forces involved (in particular the difference of resources between large companies and SMEs) constitutes a blocking point which can be dangerous for the objective pursued by the collaboration. Moreover, while the framing phases are necessary to avoid drifting, they must not be allowed to drag on, at the risk of losing motivation along the way. There is therefore a difficult balance to find in the formalization of collaborative projects to avoid excessive rigidity.

4.1.3. Definition of the budget and the funding search:

Last but not least the funding search is one of the key stages during the Framing Phase of collaborative projects. There are sometimes numerous innovation funding schemes with multiple eligibility criteria that need to be broken down. Also, the funding mechanism can sometimes become complex, when involving multiple sources of funding for the same project (grants, loans, etc.). In order to overcome this problem, a funding research platform is often made available. However, it cannot replace targeted support to avoid funding misidentification.

4.2. Challenges and recommendations during the development phase

The development phase corresponds to the technical implementation of the collaborative project. Building first usable prototypes and testing those in real world settings are an essential step. The major challenges associated are:

4.2.1. Communication & information storage:

One of the major challenges lies in the communication between the different partners. Transmitting information, sharing it, centralizing it, monitoring the project, are elements to be taken into consideration for the success of the project. Thus, a project management tool makes it possible to solve the first problem by providing a single and secure platform, accessible to all partners. This methodology makes it possible to remotely manage the project and have visibility at all times on the progress made.

Also, the interpersonal dimension must be considered. A good understanding of the cultural habits and work philosophy of the different actors is also a determining factor in the success of the project because it will directly influence the behaviour and even the mood of the individuals and ultimately their commitment.

To remedy this, regular physical meetings are to be favoured. Also, in our experience, the inclusion in the consortium of a trusted third party (federator) to create a link between the different partners is a good alternative in the case of consortia with little experience in collaborative projects.

Finally, for large-scale projects with more than 5 partners, it is still advisable to encourage the collaboration of structures that have already worked together in other projects.

4.2.2. Resource, planning and budget management:

Resources allocation, tasks and budget management are key issues in the successful implementation of the project. Experience has shown that the project launch phase is very long and costly. It very often leads to a loss of motivation of the partners and ultimately to their demobilisation over time. This last observation is most visible among actors with relative resources.
Also, too many partners in the consortium is often the cause of the poor inertia of the project. It is therefore often advisable to limit the number of partners (2 to 7).

4.3. Challenges and recommendations during the valorisation phase:

This last phase is often neglected or even forgotten by project leaders. However, it is the stumbling block of collaborative projects. Indeed, collaborative projects aim to boost the capacity for innovation, improve competitiveness but also to export the skills and knowledge capitalized during the project.

Moreover, it is often observed at the end of the project that there is a lack of visibility on the orientations to be given at the end of the project.

Thus, depending on the project objective, it is important to introduce the post-project strategy as early as the framing phase in order to perpetuate relations and thus maintain a collaborative dynamic.

5. Conclusion

Task 2.4 will have made it possible to define a framework for the use of the IPRODUCE platform. Each of the pilots has defined in collaboration with its partners initial Use Cases that will best meet the needs of their ecosystem. The definition of these Use cases is done iteratively in collaboration with the project development teams to ensure the feasibility of the work.

During this process, each of the cMDFs has also defined an identity card that presents its activities, its purpose and a draft development strategy. This identity sheet proved useful when the cMDFs were looking for partners to strengthen local networks and transnational interactions between cMDFs.

Based on our experience in clustering and collaborative project management, we have drawn up a list of the main obstacles to the success of these projects. This list aims at bringing a particular attention to blocks that can easily be removed in order to minimise any issues in the functioning of the platform

While task T2.4 has defined the Uses Cases, the pilots and their expansion strategy in a local way, WP3 in the iPRODUCE work program will define the tools and strategies for the operation of networked cMDFs. The objective is to be able to operate on a local level but also to leverage the strength of the network and the specialties of each region to provide a relevant and optimized service for each user, regardless of its geographical location. Thus, a German user will be able to benefit from the expertise of his cMDF but also from that of Greek cMDF if his project includes medical or Italian cMDF if his project includes electronic components....

6. Table of abbreviations

AIDIMME: the Metal-Processing, Wood, Furniture and Packaging Technology Institut (Instituto Técnológico Metalmecánico, Mueble, Madera, Embalaje y Afines)

AR: Augmented Reality

BF: BetaFactory

CAD: Computer Aided Design

CBS: Copenhaguen Business School

CFO: Chief financial officer

cMDFs: collaborative Manufacturing Demonstration Facilities

CNC: Computer Numerical Control

DIY: Do It Yourself

IoT: Internet of Things

IPR: Intellectual Property Rights

KPI: Key Performance Indicator

MCU: Machine Control Unit

MSB: Maker Space Bonn

MMC: Manufacturers, Makers and Consumer communities

OEM: Original equipment manufacturer

ON: Océano Naranja

OpIS: Open Innovation Space

PCB: Printed Circuit Board

POC: Proof of concept

SME: Small and Medium Enterprises

STEM: Science, Technology, Engineering and Mathematics

TS: Trentino Sviluppo

VR: Virtual Reality

7. List of Figures

iPRODUCE