

Roll out Strategy

D.T3.3.2 LP MUSE MUSEUM OF SCIENCE

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1. Incorporation of innovative services and tools to your portfolio

1.1. Chapter 1 - Background

FabLab, inside the MUSE, was established in 2013, as part of an unprecedented museological journey at the new Science Museum of Trento that follows social and technological evolution from prehistoric times until today, with a view to technology as an applicable extension of human thought and a potential tool for tackling the challenges of the 21st century.

FabLab is a place where ideas take shape: there are tools and skills for putting into practice those small or major innovations that can emerge in each of us. At FabLab, there are 3D printers, laser cutting and engraving machines, tools for electronics, programming, 3D drawing and also a classroom where students and adults can learn.

The cultural element is therefore the underlying theme that links all the activities offered and amplifies their meaning.

During the FabLabNet lifetime, MUSE FabLab had a great opportunity for experimenting various tools for engaging audience and promoting the role of FabLab in stimulating the bottom up innovation. There are 4 most important tools we can identify, basing this choice on the participants satisfaction, the output reach, the overall evaluation made by the MUSE FabLab personnel: The Pilot Actions 1 and 2 - Digital Transformation Camp and FabLab2Business, the Pilot Action 3 - Makers meet artisans, the Pilot Action 3 - Repair café, the Fab City - Rural Hack. These outputs will be implemented following the FabLab more recent hot topics: the fourth of the United Nations Sustainable Development Goals, the gender balance criterium, the STEAM, the Project Based Learning.

1.2 Chapter 2 - Goal and expected outcomes

Our way of educating, communicating and engaging new audiences in the use of digital technologies (adult-child couples, seniors, primary school children, university students) is basically our manifesto.

The mainstay of our FabLab lies in education and in technological literacy.

We constructed and developed most of the activities around this pillar, with the participation of numerous schoolteachers in our refresher courses, the progressive increase in memberships and a precious increase in female attendance.

Working with common sense, enthusiasm and the desire to build something to believe in, has repaid us, in terms of presence, beyond all expectations.

The second and equally important mainstay is the social one.

So far we have carried out a service to citizens that has materialized in providing help to all those with an idea or a project and allowing them to fulfil it here with us: university students who have made prototypes for their thesis, young people about to create a start-up business or even simple model-makers or aspiring inventors who came here to give a shape to their ideas.



The challenge we now want to undertake is to give a broader social meaning through the development of projects in favor of vulnerable social categories. The construction of a FabLab capable of involving both people with physical or cognitive disabilities, as well as youths risking educational poverty.

Lastly, Fablab is also working towards another goal, which we had been chasing until now, and that we cannot achieve on our own: that of Open Innovation. We realized that this cannot be a mainstay of the Fablab MUSE. We are not a space where small businesses in the territory can create/produce innovation at full capacity. On the contrary: we can act as collectors and catalysts; we can co-organize excellent Open Innovation events for ad hoc projects - together with the other local partners.

In this sense, we can use these events to make collaborations increasingly solid, thus creating a network, and direct companies towards Industry 4.0 technologies. It is the goal towards which the European FabLabNet project has committed itself, trying to understand which directions to take. We can therefore help small start-ups businesses to obtain more visibility, but we can only help make their product materialize if we involve external partners. In fact, if a small company needs to produce something that will be placed on the market, it is no longer us in the role of interlocutors, but other local entities. We can arrange dialogue between individuals and facilitate scouting, contact and mutual acquaintance. We are a place in which museum culture communicates with citizens, technology and business and, in this way, tries to innovate.

1.3 Chapter 3 - Target groups

MUSE FabLab will target the activities to students, professionals, businesses.

The students group ranges from elementary schools, involved with dedicated activities planned and executed in conjunction with teachers and professors, to high school and university students, involved with the contribution of their schools or faculties. The FabLab provides them a dedicated space where they can experiment and prototype, with all the needed tools and equipment for learning.

The professional group is constituted by a wide variety of domains: architecture, design, engineering, physics, electronics and so on. They are involved with both the activities such as the Pilot actions or the rural hack, but also with the basic courses recurrent all year round.

The Business domain includes technicians, R&D personnel, CEO of enterprises and artisan shops. They are involved similarly to the professionals.

1.4 Chapter 4 - Content of the action

We can describe the Pilot actions 1 and 2 together. The Pilot 1 will be constituted of a 1 week extensive course where participants will be stimulated by a real-life problem of a partner enterprise/artisan. They will be guided in creative thinking and practically realizing a prototype using the FabLab tools and knowledge. The Pilot 2 will be dedicated to move prototypes to a more advanced stage, almost ready for entering in the market.



For us, it is an occasion for involving the business domain in the FabLab, and a very good opportunity for give value to the FabLab members community by translating their creativity and ideas into a practical realization of prototypes.

This experience will be similar during the Pilot 3 - *Makers meet artisans*, where Artisans and FabLab members will be gathered together around the FabLab space and tools for making something together. There will be a clear mutual benefit for each of them: Artisans gets familiar with FabLab potentials and with FabLab members knowledge of new technologies, FabLab members will be stimulated to realize prototypes with the real market standards, and for some of them this opens the possibility of future working collaborations. For the FabLab this was a great occasion for demonstrating the FabLab capabilities, for promoting FabLab activities and courses.

The Pilot Action 3 - *Repair café*, was the FabLab participation to a repair café event, an international format where volunteer repairers help the general public to repair broken objects. This event was very important for the MUSE FabLab, since it has a very wide connection with the SDG - Sustainable Development Goals (repairing is better than recycling; repairing saves resources of buying new objects...). It was very beneficial for us because it was an occasion of demonstrating the FabLab capacity of providing population with tools or specifically designed spare parts in order to practice the *art* of repairing. Thus this is a good method for involving citizens in a hands-on activity, with an evident outcome for themselves (the repaired object), with a potential for training and diffuse knowledge.

The Fab City - *Rural Hack* was a two days event where participants learned how to add remote monitoring or control of rural spaces, greenhouses, machines. It was a very good occasion for the MUSE FabLab to learn about the latest technologies of IoT (internet of things) and wireless data transfer. It was also a precious event for involving the huge potential of farmers present in the Trentino territory, which are usually a public not much interested on the FabLab domains. The event had a success higher than the expected, with an overbooking of about 50 % of the places.

1.5 Chapter 5 - Timeline

The programming phase of the actions is scheduled for July 2019. The first part of activities will be communicated to the public in mid-September 2019, and executed in October 2019. Evaluation of results will be subsequent, and completed by December 2019.

1.6 Chapter 6 - Budget

Economic sustainability is important but, of course, success is not made of economic balance alone. We believe in our strengths: we are able to invent new proposals (sometimes new methods) that will allow our public to learn, be intrigued and have fun. Nevertheless, we will ask for sponsorships to the Artisan association and to other companies in the territory.



1.7 Chapter 7 - Assessment of the environment

We have identified the well known SWOT analysis as the optimal methodology for assessing the environment.

Strengths:

- Well established working group.
- Facility with easily accessible spaces, tools, audio media, catering.
- Experience in planning similar activities.
- Strong brand reputation.
- High visibility on local newspapers and social media.

Weaknesses:

- Working hours limitations (Tuesday-Friday 10-18, Saturday-Sunday 10-19).
- Limited possibilities of making noise and dusty works.
- Long decisional processes.

Opportunities:

- Good reputation among stakeholders.
- Good political level trust.
- Good social, technological, cultural regional environment.
- Presence of many funding opportunities at local level (incubators, bank foundations) and European level.

Threats:

- New FabLabs in the area.
- Schools, libraries promoting similar courses.
- Change at Province or Municipality political level.

1.8 Chapter 8 - Cooperation

Following the positive experience had with the FabLabNet project, we find the involvement of partners institutions to be a key factor for success.

Institutions in the domain of education (universities, schools), in business (business accelerators, incubators, SME, start-ups, Artisans), Associations (NGO, communities, local groups...) can be involved in planning phase, in communication and during the implementation of the activities.

While planning the activities the cooperation among institutions enables the activities to be grounded to real world needs. To real SME problems, to real Artisans necessities, to what students are really capable to achieve and so on. In this way the activities are planned in a way that sounds very attractive for engaging public.



Then, the cooperation among institution goes to the communication level, where the institutions are an active partner for sharing the knowledge and the invitation to the events. Finally, by involving institutions during the activities part, gives to the participants the feeling that topics are not abstract, but well grounded on real world necessities. It tells them that what is carried out during the event can be repeated and implemented as a real-case in the next future.

1.9 Chapter 9 - Advertisement

The target groups will be reached by the channel used during the FabLabNet activities, which proved to be very effective.

First of all we will define the target groups: teachers, makers, public, Artisans, Farmers.

For each of them we plan an engagement based on mailing lists of associations/enterprises, MUSE mailing lists, social media. We will also prepare event landing page, inscription form and Social media event page.

Word of mouth was also found to be very effective, thus we will encourage this type of communication by asking people to spread the word.

So far, the channels used by MUSE and the MUSE FabLab can easily reach 125.000 persons.

Channel	N° of people reached
Muse Fablab mailing lists	3.000
Newsletters MUSE	16.000
MUSE internal newsletter	150
Personal invitations	200
Association Invitations	50
Social media FabLabNet	800
Social media MUSE	102.000
Social media MUSE FabLab	3.000
TOTAL	125.200



2. Earning official academic credit for Fablab education programs

2.1 Chapter 1 - Background

The need for implementing an ECTS recognition system for courses held in FabLabs has two main reasons. The first one is the official recognition of the quality and effectiveness of the FabLab capacity in training. The second one is the international recognition of the credits, which allow FABLAB members to achieve ECTS in different countries and being recognized abroad.

The former is fundamental for integrating FL courses into official academic/high school courses, the latter encourages transnational mobility and mutual learning.

During the FabLabNet lifetime and before, the FabLab organized many courses for students and professionals. These courses are usually not recognized as part of an official individual's degree program.

The MUSE FabLab has begun a few processes for implementing the ECTS credits into its courses.

- A cooperation with University of Trento, for obtaining ECTS credits directly recognized by an institution which already has been accredited.
- An agreement with IPRASE - *Istituto provinciale per la ricerca e la sperimentazione educativa, Ente strumentale della Provincia Autonoma di Trento* (Institute for Educative research and experimentation) for training teachers who will later carry on courses for students. In this way the ECTS credits will not directly released by MUSE but by the schools those teachers work for.

Aside from these two main assets, the FabLab is carrying out detailed studies for innovating its training activities. The FabLab is encouraging the competences learning, the learning more than the teaching, the Project Based Learning with integration of humanistic and scientific disciplines, the integration of Artificial Intelligence (AI) on educational sector, the relevance of the STEAM matters and the educational poverty challenges.

2.2 Chapter 2 - Vision and Goal

The goal of the ECTS recognition of FabLab courses is to strength the FabLab capacity as educational institution. The FabLab wants to be an active actor of the education change which is foreseen in the next years.

The FabLab implements in this way the fourth of the United Nations Sustainable Development Goals, sat for the 2030 Agenda: Quality education - "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."

2.3 Chapter 3 - Expected outcomes

A general outcome we expect is to provide learner a level of knowledge sufficient for further developing the course topics in an independent way. We foresee an in progress and a final



assessment of the acquired knowledge via electronic surveys. Data acquired from intermediate survey will be used for providing the due deepening or integrations needed by the end of the course. Data acquired from the final survey will be used for improving the following courses.

Specific outcome of the *Digital Fabrication course* is the capability of using FabLab software, hardware and tools for creating functioning hardware prototypes. It is included the capacity of planning and drafting sketches, 3D modelling, 3D printing, CNC cutting, designing, laser cutting and engraving, soldering, using microcontrollers and basics of electronics.

Other specific outcomes will be defined after the course will be exactly identified and planned.

2.4 Chapter 4 - Target groups

The identified target groups are FabLab members, high school students and teachers, university students and professors, professionals, elderly, persons with learning difficulties or in a situation of educational poverty.

The institutions we could cooperate with are the University of Trento and the IPRASE - *Istituto provinciale per la ricerca e la sperimentazione educativa, Ente strumentale della Provincia Autonoma di Trento* (Institute for Educative research and experimentation).

2.5 Chapter 5 - Requirements for implementation of digital fabrication into credit system

The national requirements for the implementation of digital fabrication into formal education or non-formal and informal credit gaining process are ruled by three main normatives, the D.M. 270/2004, the D.M. 635/2016 and the D.M. 987/2016. According to the cited legislation, the recognition of ECTS credits is allowed

The digital fabrication course held in MUSE FabLab, can be formally considered as part of the so called integrative activities (*Attività Integrative*), the autonomous activities (*Attività a scelta autonoma*) or the other activities (*Altre attività*).

In any of these cases the domain of the extra course should be relevant for the university course itself. In addition, it has to be coherent with the course objectives and the career opportunities.

These typologies of courses have a dedicated ECTS slot in any university course, which depends on the course itself and ranges from 6 to 12 ECTS.

2.6 Chapter 6 - Course content

The content of the course is foreseen to respect the followings:

- Mode of delivery is face-to-face, with a relevant practical co-designing mutual learning part.
- The Prerequisites are being capable of using a Personal Computer, having familiarity with practical hands-on works. A general understanding of mathematics, mechanics, electronics, programming is welcome but not mandatory.



- Course content will be focused on the main digital fabrication techniques: 3D modelling, 3D printing, CNC cutting, designing, laser cutting and engraving, soldering, microcontrollers and electronics.
- There are several Recommended reading and other learning resources/tools freely available as a creative commons, such as those in the *Arduino*, *Instructables*, *Github*, *Thingiverse* websites. There are also many tutorials for the various techniques and tools in several *Youtube* channels.
- Planned learning activities and teaching methods will be in the style of workshops, with a training module constituted by an explanation of an argument and the immediate related hands-on activity. This format ensures participants will have high rate of success, since they immediately put in practice the information acquired.
- The assessment will be realized at the end of each matter, and at the end of the course via an electronic based survey. The criteria of assessment will include the comprehension of the matters, the training quality, the quality of the space and tools provided for the practical parts, the overall satisfaction with the information provided and so on.
- The Language of instruction will be Italian.

2.7 Chapter 7 - Financial resources

The course can be funded by 3 main sources:

- It can be paid directly by the participants.
- It can be funded by the University of Trento or the IPRASE, eventually with the contribution of the Ministry of Education, University and Research (*Ministero dell'Istruzione dell'Università e della Ricerca*).
- It can be paid by sponsors (Medium and Large enterprises, Bank foundations...).



3. Annexes

3.1 Conceptual Map of MUSE FabLab



3.2 SWOT Analysis of MUSE FabLab

