Heritage in EuroPe: new tecHnologies in crAft for prEServing and innovaTing fUtureS

Project No. 101095123

Deliverable 2.1

Report describing the process for implementing technologies in craft processes

Document Control Page	
Project acronym	HEPHAESTUS
Project title	Heritage in EuroPe: New tecHnologies in crAft for prEServing and innovaTing fUtureS
Action	HORIZON EUROPE Culture, Creativity and Inclusive society
Duration	48 months
Grant no.	101095123
Work package	WP2 – Innovating craft through digital and cutting-edge technologies
Deliverable	A report on the opportunities to implement new technologies in craft processes
Tasks	Task n. 2.1.
Starting Date	01/10/2023
Due Date	30/06/2024
Submission Date	06/07/2024
Document type	Deliverable (D2.1)
Version	1.3
Dissemination level	Public
Abstract	Analysis of the use of cutting-edge technologies in craft, and presentation of innovations that link cutting-edge technologies and craft processes. The report will also have an analysis of the impact of the use of technologies on the local communities. The report includes a review on cutting-edge technologies used in contemporary crafts, and also used to restore traditional craft artefacts, to valorise heritage, preserve knowledge and materials. The report introduces 'craft-technology driven scorecards' of cutting-edge and digital technologies for craft-making processes, and a repository of their technical descriptions and potential application in the craft sectors.
Keywords	Digital fabrication, innovation, tradition, new processes, toolkit
Statement of originality	This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.
Deliverable Lead	Copenhagen Business School (CBS)

Author(s)	Alberta Menegaldo (FLV), Lea Jacobsen (CBS), Margot Bustamante (CBS), Enrico Macciò (CBS), Andrea Beye (CBS)
Point of contact	Alberta Menegaldo (FLV)
Reviewers & contributors	Marta Gasparin (CBS); Manfredi De Bernard (FLV)

Document History

Version	Date	Authors, reviewers, contributors	Changes
V1.1	10/05/2024	Alberta Menegaldo	First draft of the document
V1.2	21/05/2024	Alberta Menegaldo, Lea Jacobsen, Margot Bustamante, Enrico Macciò, Andrea Beye	Assessed table of content and full draft
V1.3	27/06/2024	Alberta Menegaldo, Lea Jacobsen, Margot Bustamante, Andrea Beye	Final version

Scheduled updates

We plan to keep collecting data through the survey with the main purpose of enriching the repository of applications with contributions from European labs and craft makers, and possibly evolving the proposed craft-bound business models after the residencies. We therefore plan to publish an updated version of the Annex at month 48.

Version	Expected by project month (M)
V2	48

Table of Contents

Table of Figures

About HEPHAESTUS

Working across the **regional craft ecosystems** of **Bassano del Grappa (IT)**, **Bornholm (DK)**, **Dals Långed (SE)**, and **Venice (IT)**, the overarching ambition of HEPHAESTUS is *to bring together cutting-edge technologies with traditional craft to co-create solutions in the form of a suite of tools, methodologies, and business models to make the future of European craft ecosystems socially, culturally, environmentally, and economically sustainable*. HEPHAESTUS will **test and evaluate solutions** co-created across the four regional craft ecosystems within a **"Future of Craft" Green Living Lab** situated in Bornholm, a Danish Island and regional municipality given the title of World Craft Region. Ultimately, the project sets out to create a **sustainable network** (especially including regional realities) of heritage sites, cultural and creative sectors, institutions, universities, local, regional and national authorities, enterprises, and other relevant stakeholders engaged in preservation of craft heritage that will take the project's results, further adapt and deploy them in a broader range of craft ecosystems, and ensure a long- lasting legacy of the HEPHAESTUS project. The work of HEPHAESTUS is organized around six work packages, each responsible for one specific objective related to the overarching ambition, namely:

Objective 1: Develop new **sustainable business models** for the craft sectors.
Objective 2: Combine **cutting-edge technologies** with craft materials and processes to research and develop new applications and solutions for the digitisation and innovation of the craft sector to improve sustainability and social innovation.
Objective 3: Explore visions for the role of **craft in the future**, integrating emerging technologies and contributing to the circular economy, by engaging craft communities in a participatory ideation process.
Objective 4: Develop a **lifelong learning methodology** and a set of innovative curricula to equip craft-makers with diverse skillsets for innovation.
Objective 5: Establish a **Green Living Lab** for testing the HEPHAESTUS innovations.
Objective 6: To design and operationalise a **bespoke dissemination, communication, and exploitation** strategy.

To achieve these objectives, the consortium includes prominent universities, business schools and a private organization selected for their proven knowledge and expertise on craft heritage, craft materials, and the use of digital technologies and cutting-edge technologies in craft, the proposed innovative and original contributions as well as their trustworthiness. A unique value-added brought to the consortium is represented also by the group of third parties, including craft makers and craft associations, as well as Museums and Municipality representatives, from each of the four regional ecosystems.

HEPHAESTUS Partners	Contact person	Contact
Copenhagen Business School (CBS)	**Marta Gasparin / Project Coordinator**	**mga.bhl@cbs.dk**
University of Gothenburg	Elena Raviola	elena.raviola@gu.se
Universita degli Studi di Roma Tor Vergata	Luca Pareschi	luca.pareschi@uniroma2.it
Bornholms Regionskommune / BOFA	David Andreas Mana-Ay Christensen	dc@bofa.dk
Universita Ca' Foscari Venezia	Fabrizio Panozzo	bauhaus@unive.it
Fablab Venezia	Alberta Menegaldo	alberta@fablabvenezia.org
Comune di Bassano del Grappa	Simone Giotto	hephaestus@comune.bassano.vi.it
WIT Berry	Linda Kimeiša	linda@witberry.lv

1. Executive Summary

This report proposes an overview of a selected set of applications of digital fabrication technologies in craft processes, analyzing the implications and positive outcomes of a technology-mediated dialogue between new digital technologies and traditional know-how. In this document, FabLabs are presented as pivotal spaces for grassroot innovations, highlighting their consolidated role in supporting artisans toward innovative and sustainable productions. By merging the experience of the European laboratories and FabLab Venezia's, a scorecard analysis has been conducted, analyzing the impact of digital technologies in social innovation-oriented and craft business models. This has led to the development of an operational toolkit for the implementation of digital fabrication processes in craft, specifically targeted to craft makers and artisans. This document constitutes the groundwork for the development of a methodology that merges technological tools, sustainability, and social responsibility, to train and support future-oriented innovative craft businesses.

Disclaimer

Acknowledgement

HEPHAESTUS project ID 101095123 is funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Agency. Neither the European Union nor the granting authority can be held responsible for them.

2. Purpose and structure of the report

Late capitalist network developments, rapid digital transformations, and sustainability issues present pressing challenges that require us to rethink how we produce and consume (Hartmann & Mietzner, 2017). The European Union has stated the utmost relevance of reconfiguring design and production to ensure that ethical, sustainable, and inclusive principles are upheld while also creating aesthetically pleasing products.

When focusing on craft productions, the opportunity to sustain and valorize the enormous and precious traditional heritage and the set of handicraft skills, necessarily calls for a reflection on the competitiveness of the sector and its ability to find its place in the contemporary market. It is, therefore, crucial to find ways and methods to integrate manual and historical know-how and processes with current tools in a broader sense. Digitization, communication, promotion, storytelling, and production itself, are identified as areas where there are opportunities to valorize craft production material and immaterial heritage, although these are, at times, identified with narratives concerning unreachable and too specific instruments that can lead to a certain fear of innovation.

Within the wider analysis of scenes for future craft, the HEPHAESTUS project has been deemed fundamental to dedicate a specific part of the research to the study of the possible virtuous interaction among craft production processes and digital fabrication technologies, that is, digital processes aimed at the production of physical artifacts.

Using cases and good practices developed by innovation spaces in Europe and by project partner Fablab Venezia, we demonstrate the potential of such technologies when used respectfully and collaboratively. This research is not just about showcasing success stories, but also about fostering a sense of community and shared learning among craft makers, researchers, and stakeholders.

In the Fablab Venice experience, in order to overcome potential bias on the topic, and to help overcome fears of the craft makers towards technology, which can be a strong barrier to the uptake and use of tech-aided processes, it is fundamental to perform careful and user-oriented informative activities, with the ultimate scope of showing possibilities and stimulating curiosity. Therefore, the main objective of the current work and the related milestone is to offer a repository of use cases, successful practices, and examples in a clear and accessible way, developing graphic material that can be easily consulted and understood by the user, i.e., the craft makers.

3. Digital fabrication technologies in craft processes and heritage valorization

3.1 Historical Review of Maker Movement and Maker spaces

The Maker Movement, as described by Browder et al. (2019), is characterized by three key features: diverse actor collaboration, the creation and sharing of knowledge and space, and the use of technological resources to produce material artifacts. This movement began gaining significant traction in the mid-2010s, with the first signs appearing in 2015 through the launch of Maker Magazine and the initiation of Maker Faire events in Silicon Valley (Anderson, 2012). The affordability of equipment like 3D printers and the global platform provided by the internet played crucial roles in democratizing innovation, making the tools and resources needed for product development accessible to a broader segment of the population.

Alongside the rise of the Maker Movement, maker spaces – of which FabLabs constitute one type - emerged as communal workstations providing shared access to technical infrastructure for creation. These spaces varied in type and name, with some integrated into educational institutions and others designed for professional use, while others functioned as informal public project spaces. Notably, makers in these spaces had the option to commercialize their creations, becoming producer-entrepreneurs, or to produce for personal use, becoming prosumers (Von Hippel, 2005; Fox, 2014).

From an entrepreneurial standpoint, makerspaces support business incubation by facilitating accidental entrepreneurship, where individuals discover marketable solutions while working on personal projects (Halbinger, 2018; Van Holm, 2015). They also provide startups with environments conducive to prototyping (Bergman & McMullen, 2020) and offer corporates a venue for ideation and experimentation in open innovation settings (Rieken et al., 2020). Additionally, the movement promotes citizen entrepreneurship and self-efficacy, empowering individuals to participate in urban design and create sustainable solutions through micro factories, thus facilitating local and flexible production processes.

The Maker Movement has garnered support from policymakers who recognize its potential for local economic development. In 2014, US President Obama hosted a Maker Faire at the White House, stressing the movement's significance (The White House, 2015). Similarly, the EU has incorporated makerspaces into development programs like the Creative Europe program, which established the Distributed Design

Platform to connect European Fab Labs (Distributed Design, 2023). Makerspaces are seen as drivers of regional development and economic growth (Van Holm, 2017; Clark, 2014).

3.2 Theoretical review: Fab Labs & Digital Fabrication Technologies

Considering the need for sustainable practices, maker spaces also offer the potential to reshape the way we create and consume goods. The intersection of the given technological advancements with traditional crafting methods presents both opportunities and challenges that demand a revaluation of our production paradigms.

Fabrication laboratories (FabLabs), as part of the Maker Movement, have emerged as community-oriented spaces which provide access to digital fabrication tools to democratise innovation and invention (Blikstein, 2013). They promote co-creation, knowledge-sharing and collaborative consumption, (Fleischmann, Hielscher, Merritt, 2016). However, FabLabs have often evolved in isolation from rich practices and know-how of traditional crafts like woodworking or ceramics, leading to distinct “silos”, where digital making and traditional crafting operate independently (Padfield et al., 2018). Yet, as makers and crafters increasingly experiment with new domains and digital technologies to continue to advance, there is an emerging potential for these two worlds to converge, with the aim to valorise, reconfigure and preserve the heritage inherent in crafting processes.

While the terms ‘FabLab’ and ‘maker space’ are often used interchangeably, they are formally distinct. FabLabs, a type of makerspace, have signed the Fab Charter of the Fab Foundation (Fonda & Canessa, 2016), which is an organisation that was established to ‘facilitate and support the growth of the international fab lab network as well as the development of regional capacity-building organisations’ (Rayna & Striukova, 2019). FabLabs can be fully open to the public, operate on a membership basis, or be restricted to internal members, such as when established by a corporation. These labs generally foster entrepreneurship and innovation by providing access to digital fabrication technologies such as 3D printers, laser cutters, computer numerical control (CNC), 3D scanners, and milling machines, that are typically inaccessible to the average person (de Boer, 2015; Suddaby et al., 2017). Consequently, FabLabs are often seen as gateways to a future or to enable the ‘next industrial revolution’ where digital fabrication is accessible to everyone.

The innovation fostered within FabLabs contributes to the realisation of Social Innovation (SI) (Phills et al., 2008; Howaldt and Schwarz, 2010; Gasparin et al., 2021).

Howaldt & Schwarz (2010) define SI as an: “intentional and targeted reconfiguration of social practices on certain areas of action or social contexts originating from actors […] that has the aim to solve problems or needs to satisfy them in a better way than it is possible on the basis of established practices” (p. 89). In this way, SI can exist in the form of technologies, products, social movements, or production processes and aims at configuring new cultural orientations by creating value that goes beyond ingrained ways of thinking about production and consumption, ultimately serving the whole of society rather than merely individuals (Bouchard, 2012). Therefore, the SI facilitated by FabLabs prioritizes social impact over profitability. This focus presents several challenges for FabLabs, particularly regarding their economic sustainability. They often depend on unstable funding sources such as grants, donations, memberships, and sponsorships, leading to inconsistent revenue streams. Currently, as outlined by Gasparin et al. (2021), the adequate articulation of business models to realize the creation of SI needs to be further researched and defined, which plays an essential role in the objective of this deliverable.

Furthermore, FabLabs ideologically offer the potential to re-conceptualize mass production and the way products are manufactured by instead focusing on mass customization. That is because the handicrafts offered by FabLabs distinguish themselves from industrial products by their size, uniqueness, specialisation, and production capacity (Savastano et al., 2023). In this context, digital technologies can play a significant role in fostering ‘digital social innovation’, as Bria (2015) argues, and FabLabs and other makerspaces can be catalysts to enable this.

Additionally, Casalegno & Winfield (2013) have studied how Italian artisans and crafters can apply their traditional methods in a FabLab environment and found that the craft makers have the potential to prototype new products and expand their skills through the small-scale production offered within the labs. FabLabs can link artisans with advanced digital production techniques, enhancing their processes and inspiring new manufacturing innovations. FabLabs can also serve as cost-effective and timely sources for producing tools that artisans would typically purchase from external vendors, allowing them to innovate their production processes and improve competitiveness.

This discussion of traditional artisans and digital technologies is particularly relevant for this deliverable, as it aims to demonstrate the potential for bridging traditional craft methods and processes with the digital fabrication technologies offered by makerspaces such as FabLabs.

3.3 Digital technologies and their use in craft: An overview

Synergies between FabLabs and craftsmanship have the potential to support and enhance traditional crafts rather than disrupt them. Craftmanship can be valorized through new pathways of production, that keep traditional slower processes integral, without altering the core unique aspects of craftmanship, of the embodied practice of making and tacit-knowledge transfer (Roy & Sarkar, 2023; Inno et al., 2023). FabLabs offer the opportunity for innovative synergies among technology, a knowledge-sharing community and traditional craftsmanship to take place (Kothala, 2017). A FabLab provides a platform where individuals can freely express themselves, fostering a community capable of solving issues that governments and corporations often struggle to address. Craft makers benefit from the various resources and tools available in a FabLab, enabling them to transform ideas into tangible projects, and eventually into products or businesses.

A successful example is the collaboration between FabLab RUC and the Glass Factory in Sweden. This collaboration explored ways to support glassblowing without fundamentally rethinking the craft process. The workshop, where glassblowers teamed up with digital practitioners, demonstrates that there can be a successful combination of techniques such as mold-making for the glass pieces, using and experimenting with CNC-cut forms. Egalitarian, non-hierarchical ways of working prove to be possible in workshops such as this, where a glimpse of a possible co-learning model with reciprocal apprenticeship can be seen. Highly skilled craftsmen from different fields teach and learn from each other simultaneously, while also leveraging from the talents of experienced digital practitioners. This approach encourages joint exploration of innovative paths toward shared goals, blending traditional expertise with new technological possibilities.

FabLabs, fitted with technological tools as well as non-digital equipment like woodworking tools, soldering equipment, and sewing machines, offer craft makers a broad spectrum of possibilities for rapid and accessible prototyping (Padfield et al., 2018). Digital tools like 3D printing create unique, easily reconfigurable molds, saving time that can be dedicated to other aspects of the glass-blowing process. These tools facilitate the rapid testing and refinement of craft makers' ideas and prototypes. By reducing time spent on repetitive tasks, artisans can focus more on the creative and communal aspects of their work. Ultimately, this approach can lead to cost-effective and timely production methods, which, in the long run, may evolve into more sustainable and democratic models (Padfield et al., 2018; Rogers, 2003; Spies, 2014). The democratization of production aligns with the values craftsmanship defends, emphasizing slower production processes and the creation of unique objects that stand against mass production. By recognizing the deep tacit knowledge and experience of traditional craftspeople and offering digital machines as a possibility to experiment sustainably, FabLabs help frame new tools as an option, a new possibility rather than a threat (Padfield et al., 2018; Kothala, 2017).

Synergies between FabLabs and craft makers can further valorize craftsmanship by allowing the exploration of new pathways or designs, through more sustainable practices, without interfering with or changing the tradition embedded in the process (Roy & Sarkar, 2023; Inno et al., 2023). This integration of old and new not only preserves the cultural heritage of crafts but can drive them into a sustainable future in a still mass-production centered economy. Craft makers can leverage digital design for various purposes, from prototyping to creating molds. This process is enriched by the opportunity to collaborate with other creative minds, fostering a dynamic and supportive community.

FabLabs, as informal spaces of innovation, offer a privileged space to mentor, train and experiment on hybrid processes in-between tradition and innovation. In contrast, institutional innovation spaces and formal training programmes prove to be almost intimidating or perceived as “far” by small enterprises, while operational, bottom-up species provide a more comfortable environment for innovation. This, however, should not lead to the assumption that the digitization services proposed to artisans are anything less than professional. These services demand solid experience and the ability to quickly find solutions, especially when working with craft enterprises or seasoned artisans and artists who expect high-quality results.
Parallelly, the multidisciplinary approach supported by FabLab spaces helps tackle innovation challenges from a wider perspective, focusing on the reduction of digital divide to achieve more competitive and economically sustainable businesses but also airer and more inclusive productions. Technology is seen as the way to empower workers by giving them means to operate in the contemporary digital environment and also as a tool to more easily incorporate universal design and inclusion principles in production.

3.4 FabLab Venezia and its operational framework as a catalyst for social innovation and digitization in craft

In this section, an analysis of FabLab Venezia and its socio-economic network will be presented. It will begin with a detailed examination of FabLab Venezia's business model. The discussion will include the sustainable practices integrated into FabLab's operations and its action model, highlighting the emphasis on responsible and impact-oriented business practices. Furthermore, the section will explore the ecosystem of stakeholders and collaborative partnerships that FabLab Venezia engages with, demonstrating its role in fostering innovation and social inclusion. Finally, it will analyze the integration of digital processes with traditional crafts, showcasing how FabLab Venezia supports artisans and craft makers in adopting and benefiting from new technologies.

Business model

FabLab Venezia was established in 2014 to develop this approach and values locally. Since the early years, the founders decided to set up different activity branches: the service, to help others realize prototypes, projects, and creative ideas of various kinds; the educational activities, from children up to adults, professionals, and enterprises; the open lab, to provide a space and equipment for makers and designers who already know the technologies to develop their creative projects. Parallelly, the lab has been engaging in collaboration with local institutions, grants and research-funded projects. The growth has been slow but steady; the activities of a FabLab have some characteristics that resemble a small artisanal activity: each project is different from the others, there is no “standard” service, and some projects require some specific solution. Although machines are used, manual work is still involved to different extents, depending on the project. This, of course, decreases the margins of revenue but provides a very stimulating and value-oriented work.

The service activities have provided the main revenue stream throughout the years, but the main users have evolved. At first, clients were mainly small manufacturing enterprises, some local artisans, and students; in recent years, the number of artists, creative enterprises, and cultural organizations coming to the lab has significantly increased, signifying a growth in each project's medium value. This gave FabLab Venezia important opportunities to experiment in cultural production and explore the potential of new technology to provide new means for cultural fruition and participation for disadvantaged people. Tactile replicas, multisensory models, and physical representation of data are some examples. These experiences, together with other projects concerning the development of aids and components for people with physical disability, led to the decision to create Prossimi in 2021, a social enterprise, a nonprofit entity whose mission is to use digital fabrication technology for social projects. The users are marginalized, impaired, or disabled, and citizens in general for dissemination and awareness activities on sustainability and resilient community building.

Sustainability

A company's goal is to operate fully aware of contemporary environmental and social conditions, reviewing its hierarchy of values and creating products that contribute to the quality of life of people and the environment. Community wellness is indispensable to sustainability. FabLab Venezia considers itself an integral part of a community, and decisions are made in its general interest. Company policy includes hiring people who share equal values and represent ethnic and cultural diversity.

FabLab Venezia aims to pursue environmental sustainability as a responsibility or commitment to reconcile a horizon of human prosperity with the flourishing growth of the natural world, such that ecosystems can be regenerated and do not affect future possibilities for enjoying nature as we have known in the past. This translates into not causing unnecessary harm by following methods of conscious, ethical, advanced production. The focus is on the proper use of resources employed in production, both from the materials and consumption point of view: in daily actions, in working and non-working environment (waste production, nonconsumerism...); supporting cleaner and more sustainable mobility.

Some specific actions on this include being the first FabLab in 2016 to certify the consumption from the 3D printing process, using 90% biopolymers for all 3D printing processes, and being part of the 1% for the planet programme (1% of annual revenues goes to supporting environmental protection projects).

Action model

While proposing as an open and informal platform, Fablab Venezia is effectively a non-profit entity. Throughout the years, the founders have questioned which type of entrepreneurship they were willing to pursue. It has become increasingly clear that Fablab is oriented towards a responsible, impact-oriented, fair, and not profit-centered business. Money and expansion are not part of the company's values, but rather just means to ensure economic sustainability and enterprise liveliness, also to be an example that forms of responsible, small-scale but still relevant business are possible. The enterprise should be a way to build solutions that respond to the current production and environmental crisis.

Within this context, digital fabrication and its associated business models are a crucial resource for simpler and greener manufacturing solutions. This approach is designed to bridge digital divides, educate, and foster participation, inspiring a new way of thinking about manufacturing.

Social innovation at large is a fundamental objective. This means giving everyone the opportunity to understand and act within a digital ecosystem, responding to the need for training on new tools and technologies, and, at the same time, offering people at any age the chance to develop their transversal skills and technical competences that will be useful for work and personal purposes. Innovation is being treated as an instrument to empower people, help them find a new, sustainable way to do things.

Ensuring wider access to tools and knowledge means taking a step in the direction of more equitable and democratized productions, distribution of knowledge, and implementation of new useful solutions. Fablab Venezia’s business and action models differ from most other Italian FabLabs. In Italy, Fablabs are often small associations or work inside bigger umbrella entities, universities, or business support associations. While this is not a problem per se, it implies a significantly reduced capacity of being open, acting in the network, and providing services to a wider audience. Moreover, many FabLabs focus mainly on educational activities and providing experimentation space for local makers. They play an important animation role in the local community but often lack the capacity to develop more structured projects.

Ecosystem

A pivotal aspect of FabLab Venezia's work and its capacity to advocate for structural innovation is its activity with the ecosystem of stakeholders.

With every project, FabLab Venezia proactively shares the vision and values that guide its work, fostering an open, respectful, and transparent relationship with stakeholders. Participation and cooperation are deemed fundamental to achieving impacts on local communities, so projects and ideas often involve institutions and organizations as partners. FabLab Venezia tries to be the catalyst of change and responsible innovation by proposing grassroots solutions and systemic projects.

The public administration, sectoral, and business support organizations are thus fundamental actors in this process.

This is also part of Fablab Venezia's overall take on future cities and productive ecosystems: FabLab Venezia strongly supports the vision of the Fab City, a paradigm that relies on the concepts of distributed design, small-scale production, and network logic to shape more responsible and inclusive economies, where things are produced locally with the aid of advanced systems and digital nets.

The main stakeholders are:

- local enterprises of different sectors, which usually are clients but can act also as partners in research projects;
- local and regional administrations and public institutions, policy makers, that sometimes are clients of the FabLab (support and services for cultural inclusion), sometimes provide fundings in form of grants for research or enterprise development, or could even be direct partners in projects;
- business support organizations and sectoral associations, mainly engaged as project partners or that refer to the FabLab as an operational partner for educational and training projects;
- cultural organizations, museums, mainly clients of the FabLab but also sometimes partners;

- public universities and schools, both clients for educational courses and partners in specific projects;
- the social sector, no-profit entities: clients and partners;
- makers, citizens, private persons: clients who see in the FabLab a reference for their personal projects and “problem solver” for specific necessities

Digital processes and craft

Merging contemporary craft techniques with more traditional skills and processes is both a methodology used to develop internal projects and services and the business-related objective when working with artisans and their sectoral association.

On one hand, much of the work developed internally—whether it involves services, applied research, or occasionally product design and sales—requires phases of post-production, manual manipulation, or non-digital processing. These tasks range from simple to complex, including 3D print support removal, sanding, varnishing, mold-making, creating positive or negative copies, and assembling parts. Even though a FabLab heavily relies on technology, manual work remains essential to FabLab Venezia, especially due to its active involvement in artistic, cultural, and creative productions. This unique approach has the potential to shape a new type of professional who is proficient in both digital processes and manual tools. This could be highly beneficial for developing new types of productions that integrate technology with traditional handwork and manual tooling.

On the other hand, in the last few years, FabLab Venezia has been strongly involved in activities and services aimed at supporting artisans and craft makers to understand and govern digital processes. This work has been developed in close collaboration with the local craft support organization, Confartigianato. Once again, the results could not have been achieved without the arrangement and cooperation of such institutions, as they can reach a higher number of potential users, thus, amplifying the impact of innovation actions supported by the lab.

It is important to note that the main goal is to raise awareness, provide mentorship, and demonstrate the potential of using digital fabrication technologies in craft, rather than forcing new paradigms into their activities. Once artisans understand how these technologies work, they often begin to explore how they can integrate them into their processes. Their responses can vary: some may reject the technology, others might choose to digitize certain tasks by outsourcing them (while keeping the creative tasks in-house), and a few may invest in learning to use the technology themselves and eventually purchase the necessary equipment. The experience shows that even those rejecting technological processes usually have a positive attitude towards them, still showing curiosity and willingness to explore the examples and materialities.

4. Exploration of cutting-edge technologies in craft

4.1 Methodology for collecting and narrating practice

4.1.1 Data Collection (Survey and operational experience)

Given the possibilities, opportunities, and potential of the synergies between digital fabrication technology and craftsmanship practices, the research leading to this deliverable took place through two main data collections. On one hand, a questionnaire was developed specifically on the experiences and practices of collaboration between FabLabs and craftmakers in Europe, in order to identify if, where, when, and how collaborations and experimentation in combining craftsmanship and digital fabrication technologies happened, to be paired then with the data resulting from the experiences on the field of FabLab Venice. Given that craft practices and FabLab activities vary significantly based on their specific ecosystems and the cultural infrastructures that influence their work, the questionnaire was designed to be as open-ended as possible. This approach aims to accommodate a wide range of possibilities while providing ample space in most questions for unforeseen and unscripted responses. The questionnaire is thus structured around three branches, one dedicated to each macro group that formed the overall target audience: Labs, in representation of technology providers, Craftmakers and Restores, in representation of customers and beneficiaries of FabLabs activities.

Labs: The branch dedicated to labs aims to inquire on several levels about the kind of organization a respondent represents, in terms of the type of facility, technologies used and owned, and the main users of the respondent facility (a list of the technologies mentioned within the questionnaire is listed in the Table below). Thus, the questionnaire focuses on the relations with craft-makers and the support and services the respondents could provide to them and in which way, the effectiveness of the collaboration, leaving space to present in respondents' own words the example and (optionally) attach pictures of the works they could do for/with craft-makers.

Craft-makers and Restorers: the branches dedicated to craft-makers and restorers are designed according to a similar logic as the previous section, inquiring how the respondents would define themselves in their occupation and if they work for an organization/enterprise, and if that is the case, in which kind. Furthermore, the questionnaire investigates the materials the respondents work with (a list of the technologies mentioned within the questionnaire is listed in the Table below). The second phase of the branches is dedicated to the relationship of the respondents with digital fabrication technologies, first inquiring about the experience of using such technologies or not. In an affirmative case, a sub-branch inquiries about the technology respondents used, how they learnt to use it, if it was useful and effective, and which are the positive and negative aspects in using digital fabrication technologies. Space has been left to respondents to talk about their experiences in their own words. This sub-branch aims not only to identify craft makers or restorers with prior experience in using technologies but also to understand the extent to which materials and technologies have been integrated. In cases where digital fabrication technologies are not used, this sub-branch investigates the reasons behind this decision. The goal is to recognize any controversies or challenges in the communication between maker spaces and craft makers/restorers.

Finally, each branch terminates asking about the respondents' perception in the rise of numbers of professionals using digital fabrication technologies in recent years and their opinion about it, if that is the case. Then, the last section of the questionnaire is dedicated to general questions related to the provenance, residence, age, role, and education of the respondents, to acknowledge more of the demographic groups who participated in the questionnaire.

Labs: <u>Technology used/owned</u>	• 3D Printers • Laser Cutters • 3D Scanners • Robotic Arm • Thermoforming • CNC* milling • CNC* embroider and/or knitting tools • Other **Computer Numerical Control*
Craftmakers and ***Restorers***: <u>materials</u>	• Wood • Glass • Stone • Ceramic • Paper • Textile • Metal • Precious metal • Precious stones • Leeather • Wax • Mixed • Other

Also, we decided to keep the questionnaire active after the delivery of this report, in order to collect new data throughout the whole life of the project, which will be integrated within the updated versions of the report. The questionnaire is reachable at the address https://copenhagenbusiness.eu.qualtrics.com/jfe/form/SV_eJ4ns428MKApN7E or through the QR code in Fig. 1.

Figure 1 - QR code to the questionnaire

Therefore, the questionnaire was distributed to FabLabs, maker spaces, technology providers, creative laboratories, craft-makers, restorers, and heritage professionals situated in different parts of Europe to develop an understanding of how, and if, experimentations and relationships between maker spaces and craft-makers happened in different ecosystems in Europe, and how in different ecosystems a synergy between craftsmanship and digital fabrication technologies has been intended and promoted.

The questionnaire was created using Qualtrics XM, which is compliant to the data rules within the Horizon Europe Framework. The questionnaire was developed in English only. In the questionnaire's opening, respondents are asked if they want to leave their name, surname, and email address to be contacted during the development of the Hephaestus projects for updates and results distribution. Respondents who agreed to leave this personal information had to explicitly accept sharing this personal data, after reading a GDPR-compliant informed consent written by the Copenhagen Business School's Data Protection Officer. Nonetheless, to prioritize the diffusion of the questionnaire, it was also possible to answer without providing name and email. In this case, though, as the info regarding the ecosystem the respondents pertain to is mandatory, we were in any case able to conduct analyses based on how respondents from different ecosystems answered.

As for the distribution of the questionnaire, given the absence of FabLabs within the Hephaestus ecosystems, with the exception of FabLab Venice, and since the main target audience of the questionnaire was primarily the population of maker spaces, we have decided to distribute the questionnaire beyond the boundaries of the projects ecosystems and towards realities located in Europe, in order to balance two equally relevant and important objectives. On the one hand, the objective is to maximize the number of responses to the questionnaire. On the other hand, however, we acknowledge, here and in previous deliverables (Pareschi and Leonardi, 2024), the concern related to the risks of damaging or jeopardizing the relationships that have been built with the artisans in the ecosystems, in some cases over the years, due to an excessive pressure and time-consuming requests. In other words, for artisans the most valuable and the scarcest resource they possess is time, and therefore they carefully select how to use it. Therefore, since the craft-makers of the Hephaestus ecosystems have been subject to several requests for interaction (as participation in research, questionnaires, interviews and focus group), it has been decided, in accordance with the local partners, that it was appropriate to not request for participation in this specific questionnaire.

In order to maximize the distribution of the questionnaire, it was decided to use, on one hand, connections and already established relationships between FabLab Venice and other FabLabs and, on the other, possible respondents have been selected from the page European Commission's page *Community of practice of the Competence Centre on Participatory and Deliverative Democracy* (https://cop-demos.jrc.ec.europa.eu/eu-makerspaces), and from the *Verbund Offener Werkstätten* (https://www.offene-werkstaetten.org/de/werkstatt-suche) that gathers makerspaces and FabLabs situated in Germany.

The information collected through the survey has been paired with the operational knowledge of FabLab Venezia, consolidated through its multi-year everyday practice and the contacts with peer laboratories in Europe. This experience has been valuable, as it provides firsthand documentation—including images and technical material—that can be accessed, utilized, and disseminated within the research. This documentation illustrates how the processes are implemented and how the final results are achieved.

4.1.2 Social Innovation and Impact analysis

As previously discussed, Social Innovation (SI) seeks to develop novel solutions to social problems, ones that are more effective, efficient, just, or sustainable than existing solutions. The value created by SI primarily benefits society at large, rather than private individuals (Phills et al., 2008, p. 39). SI is not about competitive advantage, but about achieving social outcomes, ecosystem changes, or regional development. In the case of reconceptualizing traditional craft productions with digital fabrication technologies, SI proposes new cultural orientations (Bouchard, 2012) that can lead to the development of new business models and the creation of significant social value. Within this context, craft-makers and artisans within the FabLabs are not just participants, but agents of social innovation (Leadbeather, 1997).

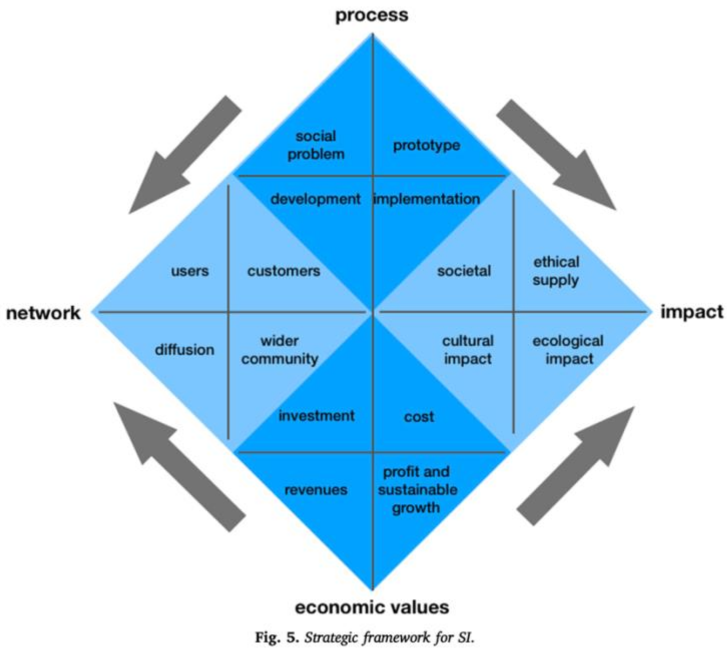


Figure 2 - Strategic framework for Social Innovation. From Gasparin et al., (2021).

FabLabs offer access to digital fabrication technologies, thereby democratizing inventions and innovations. This technology base is essential for creating SI since it goes beyond existing structures and traditional ways to craft objects. FabLab's value proposition is inherent in access to technologies such as 3D printers, scanning, or laser-cutting machines, providing socially innovative trajectories. Therefore, as Savastano, Bellini, and D'Ascenzo (2023) highlighted, technological advancements and innovations that once signaled the end of traditional craftmanship in favor of industrial manufacturing are now pivotal for its valorization, revival, and digital resurgence. Digital fabrication technologies expand the opportunities for collaboration, knowledge exchange, and design sharing, enabling continuous and direct communication, which was limited within traditional methods.

In this context, the strategic framework for SI (Figure 1, Gasparin et al., 2021) will aid in analyzing the collected data on various FabLab technologies. This analysis will contribute to a coherent review on the opportunities to implement new technologies in craft processes, further supporting the development of new business models for SMEs adopting digital fabrication technologies.

The SI framework is divided into four sections: 1. Process, 2. Network, 3. Economic Value, and 4. Impact.

1. **Process:**

This aspect entails the identification of social problems and needs and to define the innovative ideas on how to tackle and solve them. This also includes the ‘prototyping’ process, which focuses on the prototyping of a new service which can be introduced thanks to the specific technology in FabLabs. For instance, the analysis of the process includes mapping the social problems the technology contributes to solving, and what prototyping processes the introduction of this technology entails. Other important aspects that are necessary to consider when implementing the technology are outlined.

2. **Network:**

This aspect highlights the external and internal networks of customers and general beneficiaries which need to be mobilized to stimulate co-creation of cultural and social values, while simultaneously sustaining, gaining, and retaining economic value. For instance, the users of the technology are shown; who are those actively using the digital fabrication machines and those using digitally manufactured objects but are not paying for them. Moreover, the customers are also outlined, which include the entities paying for the use of the technology (can be users, but not necessarily). For example, a consortium (e.g. Confartigianato) might pay a FabLab craftmaker’s access to the technologies. Additionally, this framework examines the wider community that could benefit from the technology, exploring the broader relevance and potential advantages it offers to various community groups. It furthermore considers how the use of the technology and its benefits can be disseminated, ensuring that the positive impacts reach as many people as possible.

3. **Economic Values:**

This aspect focuses on strategies to support the economic sustainable growth of the company (FabLab) through the introduction of new technology. It identifies the required investment to introduce the technology. This includes the initial costs sustained by FabLabs, such as the purchase price of the technology and expenses related to training staff or users. It also outlines the ongoing costs associated with the technology. These costs are incurred by FabLabs and include maintenance expenses, consumables (e.g., 3D printer refills), and other operational costs. Moreover, it examines the potential revenue generated from the introduction of the technology. This includes exploring various revenue models such as pay-per-use, annual fees, or subscription-based models that can be implemented to monetize the technology. Additionally, this framework analyzes how the technology can promote sustainable growth by increasing profits. It considers ways in which the technology can enhance efficiency, open new market opportunities, and provide competitive advantages, contributing to the overall economic growth of the company.

4. **Impact:**

This aspect focuses on creating mechanisms to capture the social, economic, ecological, and cultural impacts of the technology on both society and the SME. Firstly, it identifies the societal impact of the technology. This involves assessing how the technology affects various social aspects, such as community engagement, accessibility, and overall quality of life. It furthermore outlines the ecological impact of the technology. This includes evaluating the environmental footprint of the technology, such as resource consumption, waste generation, and potential for promoting sustainability. It also addresses the ethical supply of the technology. This involves ensuring that the technology is produced and distributed in a manner that adheres to ethical standards. Lastly, it explores the cultural impact of the technology. This includes understanding how the technology influences cultural practices, supports the preservation and promotion of cultural heritage, and fosters cultural innovation and expression.

4.1.3 Development of technology-driven craft applications scorecards and toolkit

The technological applications extrapolated from the survey and from the operational experience of Fablab Venezia are expanded in a set of tables that present some relevant applications of digital fabrication technologies and analyse them considering the SI Framework. The textual explanation is paired with some photos, to visually describe the processes.

A further step towards the development of useful contents to enhance craft makers' awareness on potential applications is made through the production of a visual toolkit. As the most operational, almost ready-to-use part of D2.1, the toolkit is presented with a schematic overlook, giving direct hints on how to implement the technology. It presents with both textual and graphic content the pros and cons, the workflow and some examples to give a better understanding on how each tec-aided process is performed.

4.2 Results

4.2.1 Results I: craft-technology driven social innovation and impact

This section presents the results from the analysis of the strategic framework for Social Innovation (SI) as introduced in section 4.1.2 (see Figure 2).

The strategic framework for SI enables an analysis of relevant business models related to the implication of digital fabrication technologies (DFT) in craft ecosystems. Three main action models have been identified:

DFT for craft production processes, relating to how new technological tools are impacting the production processes in a narrower sense;

DTF for craft and inclusion, targeting the relevant aspects of inclusion enabled by a competent use of technologies in craft

DFT for contemporary craft education, to evaluate the impact a tech-aware training can have on current and future craft makers

The analysis is categorized into the four aspects of the framework: 1. Process, 2. Network, 3. Economic Value, and 4. Impact, to get an in-depth understanding of how SI is implemented within the business model of FabLabs and innovation ecosystems at large.

Process

The introduction of DFT in craft aims at allowing an overall expansion of the creative and experimental opportunities of craft makers and artisans, both to develop new products and to optimize production processes in terms of cost and effort. This means having new means to address the more boring, less creative tasks, but also increasing competitivity through a new capacity to produce very detailed, very big or more complex objects. Moreover, DFT can have an important role for engaging younger generations. The different levels of awareness, competencies and needs should be assessed as each craft maker has a different opinion, starting point and desire to understand technologies. Dissemination is needed for a successful uptake of technologies: artisans should be allowed to explore and understand the potential through real case studies and examples, to decide whether to include digital processes in their activities. Specific tech training for artisans that are willing to learn and use the techs themselves can be set up, along with economical support for purchases (including grants). Beyond all this, it is also important to set up a sincere and open dialogue between craft makers and tech providers, based on trust.

There is a general lack of accessible/'for wider audiences' objects on the market, bespoke solutions are expensive and hard to develop through traditional manufacturing processes. This results in a substantial absence of tailored solutions for specific impairments/necessities, including a lack of accessible, non-conventional solution for cultural participation. DFT are particularly suitable to produce one of a kind, custom objects. Cross sectoral awareness rising activities are necessary to develop inclusive, necessity-based craft objects. Different competencies and professionals need to collaborate to achieve significant results, but first a common language and understanding of innovation is needed. Best practices and examples can help understanding the potential and the possible outcomes, then specific training for social professionals, care and cultural operators can be done. Networking and collaboration is, once more, vital, as well as the involvement of the final users (people with impairments and their caregivers). Fundings are important to support new applications, as those still are mainly developed at experimental level, and also the involvement and awareness of policy makers and decision makers to build a wider innovation and inclusion ecosystem.

Given that education is the first and most effective step to achieve more responsible and innovative future communities, there is a lack of technological and digital know-how particularly in some sectors like culture, social and also craft. A proper digital-craft education would help reduce the digital divide in the sector and shape "future-ready" makers.

The development of adequate innovation curricula should entail the involvement of aggregators, associations, institutions to reach a critical mass, the use of hands-on and practical methodologies, a virtuous dialogue between tradition and innovation (refusing the idea of digital technologies as an unavoidable necessity) and a tailoring of the mentoring according to the participants.

Network

A virtuous craft innovation ecosystem is composed of innovation/technology provides, users but also of institutions and sectoral organizations that should facilitate the matching among actors and provide support. On one hand we name usually users those actively using the machines, in this case we include craft makers that are not performing digital processes but are subcontracting them to external providers (as often happens in Fablabs ecosystems) and thus act also as customers, beneficiaries instead are those using digitally manufactured objects and “tech supported” craft objects but not paying for those. The benefits for the users include enhanced capacity in term of production potential, solution of technical challenges and time-consuming tasks, new opportunities for creative and formal expression including the capability to tackle inclusion values by designing new forms of usability of the craft object and enhanced sustainability in case of material-intensive processes such as casting. Circulation of ideas and possible applications is fundamental to sustaining a more innovation-aware network. This can happen within educational environments but also through product marketing.

The definition of users gets even broader, including craft makers, designers, professionals and all those involved in developing new solutions that include the use of digital technologies. The customers can be people with impairments or fragilities (mainly in case of everyday use objects), but more often innovative solutions are “bought” by institutions and associations that can later make them available to actual end users or beneficiaries. More specifically social enterprises, cultural entities and operators can offer a new service/support to fragile people, whereas designers and artists learn and use new paradigms for accessible design and cultural production. Widespread knowledge on universal design means objects, spaces, services that are built not for some (whether impaired or not, without categorizing) but for all, so they can be used, enjoyed by the wider possible number of users. Impact is achieved if different professionals with different competencies and final users can collaborate. Benefits can be diffused by publishing and disseminating good practices, through local communities and to decision makers, institutions, support organizations, in a simple and result-oriented way.

The policy making level would necessarily be involved and can be reached and activated by a bottom-up approach, that is based on positive experimentation that are already in place. The subsequent top down development would aim at constituting an infrastructure of knowledge that involves a wide range of actors and a general support of networked business practices and open innovation. Users, beneficiaries and providers mix in such ecosystems, each entity being sometimes a receiver of services and knowledge and then an active actor of spreading innovation.

Economic values

The implementation of DFT in craft is strongly tied to the availability of specific equipment and know-how. Hardware investment can vary according to the proficiency of the service that should be

delivered. Specific technical competencies are required, which sometimes means up to years for professional use. This means one of the most efficient ways to support craft innovation is not forcing craft makers themselves to buy the technology but rather by economically supporting ecosystems, and businesses that provide services in this direction. Usually, high-end technology is not needed, but having a wide range of technological possibilities is important, as happens in a fablab. Including digital processes in craft production helps fostering a fair development which does not encompass a substantial scalability of the business nor great economic growth but rather promotes a dialogue between tradition and innovation in a way that could be beneficial for the surrounding community:
- by valorizing the importance of artisans in the contemporary social and productive structure of the city;
- promoting local collaboration and supply chains- by considering the environmental impact of the productions (use of bio-based materials and optimized use of resources)
- by supporting business models related to distributed design, small scale productions, making cities productive and multi-functional again against mass tourism-
- providing job opportunities in smaller towns

Opening craft and small-scale production to new “markets” by starting to develop inclusive solutions can surely have some positive economic connotation and result in stream of income. However, of course the main positive aspect is the that these new practices are socially sustainable by design and can pave the way to new forms of fair businesses. The emphasis is not on the profit but on the social value of the product. Developing these kind of solutions requires investments in terms of acquiring know-how and experience to develop this new kind of solution in a collaborative and open way, revenue is generated through service-like activities that also encompass manufacturing objects.

Technological and innovation education is still a growing business in some sectors. Training activities should be performed by those actively using the processes and technologies (avoiding general innovation gurus) and should be adequately supported by public programs. More aware communities call for new business opportunities and growth, many future jobs are yet to be defined and this can be also true in the field of culture and craft

Impact

The main societal impact relates to the opportunity of engaging younger people in a new discourse on craft, that proposes craft making as a contemporary, satisfying and forward-looking activity. This can have positive spillovers on the local productive communities at large. Greening and inclusion are tackled by considering the use of bio-based materials for technologically advanced processes and by keeping the productive dimension g-local: the best practices are spread at the international level thanks to open innovation paradigms and can be tailored according to local necessities systems. These applications are a good example of how technology can positively and respectfully take part in traditional processes, not devaluing in any way the skills and values of the artisans, that are indeed very satisfied with the results in terms of precision and delivery time. Understanding that innovation and tradition are not mutually alternative but instead the former can valorize the latter knowing that “tradition is innovation gone well”.

Opening craft and small-scale production to new “markets” by starting to develop inclusive solutions can surely have some positive economic connotation and result in stream of income. However, of course the main positive aspect is the that these new practices are socially sustainable by design and can pave the way to new forms of fair businesses. The emphasis is not on the profit but on the social value of the product. Developing these kind of solutions requires investments in terms of acquiring know-how and experience to develop this new kind of solution in a collaborative and open way, revenue is generated through service-like activities that also encompass manufacturing objects.

More aware citizens and workers can find, and push for, new solutions, in the right direction (profit not for profit's sake, but for sustainable growth). Trained enterprises would be also able to develop more sustainable products and a tech related education could help marginalized people enter the work environment.

4.2.3 Results II: Craft-technology driven applications scorecards and toolkit

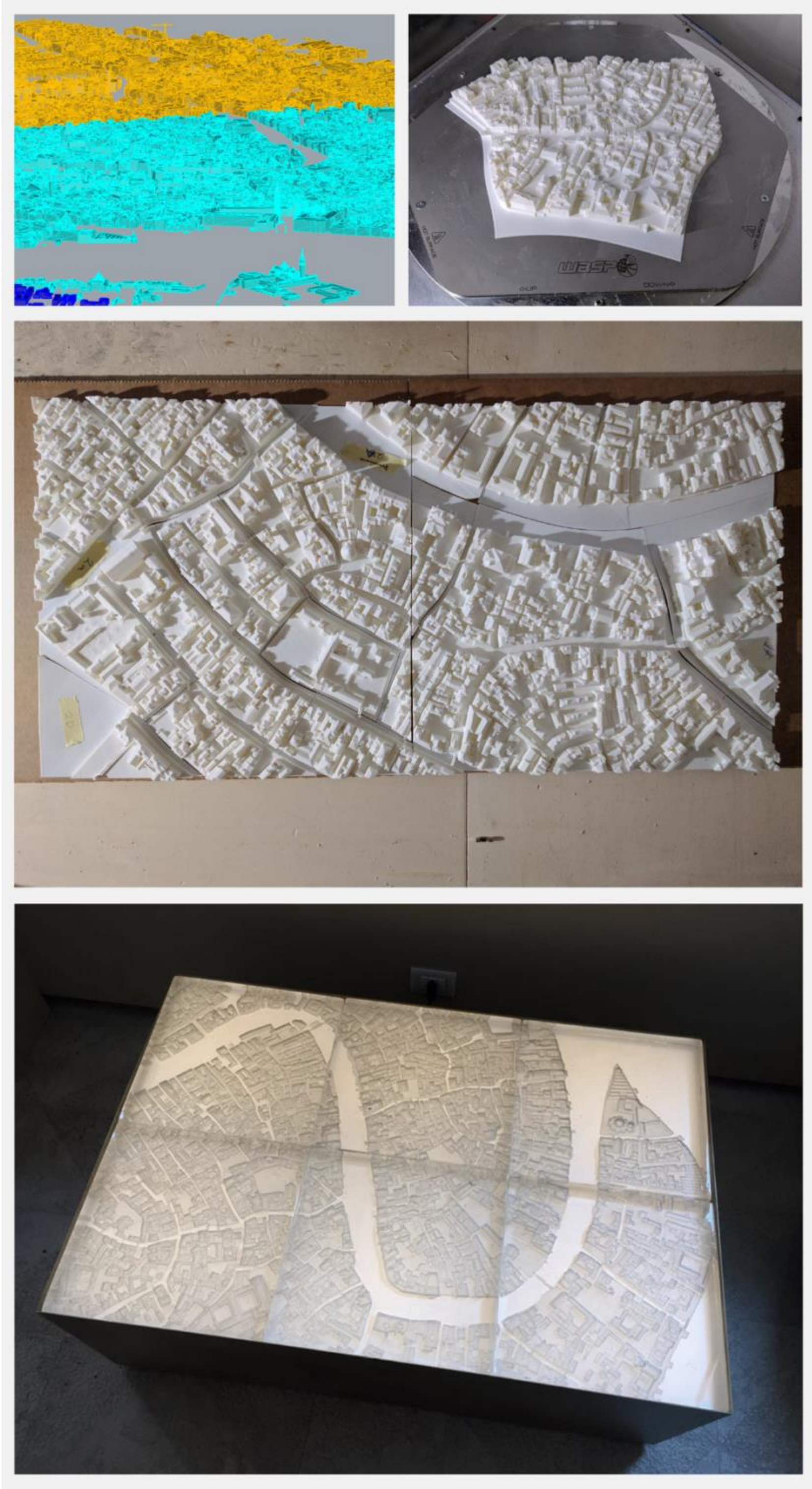
The section presents the tables developed as explained in chapter 4.1.3 and two examples of the content of the toolkit, one referring to technological applications and the other to the proposed action models (as in 4.1.2). The complete application toolkit can be found in the Annex and will be eventually expanded with further contributions throughout the project. We present also a prototype of the “action model" graphic card, an attempt to develop an operational, agile, support able to give hints on how to implement new business models, considering the analysis and experimentation presented in this document. We plan to expand this prototype after developing the methodology and testing it in the residences, to develop a hopefully useful support for future businesses but also policy makers and institutions.

4.3 Applications scorecards

Craft-tech application	**Making bespoke moulds for casting processes**

Craft techniques impacted	Lost wax, metal and glass casting
Digital fabrication technologies used	3d scanning, 3d modelling, 3d printing
Description of the innovative process	Artists and artisans that work with casting processes require real scale physical representation of the work to be produced in glass or metal. Often, however, particularly in case of bigger artworks, the refence model, bozzetto, produced by the artist has a smaller dimension and it would be necessary to manually scale it up. This sets some significant challenges: difficulty in reproducing the shapes in a precise way, large amounts of time and material needed. Those can be effectively overcome by 3d scanning the artefact, operating the scaling and/or editing on the digital model and the producing the final object through 3d printing or other processes such as robotic milling. The 3d scanning ensures a perfect reproduction of shapes and detail, up to 0.1 mm tolerance, the digital editing allows an easy scale up or down and eventual modification of the shapes, the 3d printing, if well engineered, can be performed with a contained amount of material (mainly hollow shapes). Big (even huge objects) can be reproduced by dividing the object in parts and then assembling them.
SI framework analysis (notes on process prototyping and impact)	Using digitally produced support and aids for craft production processes extends the capacity of craft makers to create very detailed, very big or more complex objects. This can increase competitivity but above all provide more creative freedom. A close dialogue between craft makers, technology providers and artists or designers is required to assess specific technical necessities linked to the artisanal processes (e.g. for lost wax processes material shrinking and the necessity of drainage canals should be considered). The application is usually provided by external services, artisans are not willing to learn how to digitally produce the supports themselves. Digitally fabricated moulds can be reused and can be produced using bio-based materials, moreover, the digital model remains as an useful support to produce other copies at different scales.
Examples	*Statue of Josef Ressel, Giorgio Del Ben – production of a life size positive for lost wax process*

Venezia table, Salviati, Fuorisalone 2017 - modular positives for cast glass process



Clessidra serie, Giorgio Andreotta Calò - positive for casting scanned from a real bricola

Craft-tech application	**Making replicas for product or marketing purposes**
Craft techniques impacted	various
Digital fabrication technologies used	3d scanning, 3d modelling, 3d printing, laser cutting
Description of the innovative process	Artists and artisans sometimes are willing to use the same artwork or artifact they have produced in one single piece or a limited number to produce less expensive replicas that could have the same use or aspect of the original one or, if scaled/simplified, can become a sort of promotional object or an easier to sell product. Once the original is digitalized through scanning or by modelling it ex-novo, it can be reproduced with 3d printing, milling (usually more expensive) or laser techniques.
SI framework analysis (notes on process prototyping and impact)	A trustfully dialogue between the artisan and the technology provider is fundamental as the former is aiming at a less elaborate object but still maintaining a high standard of quality and perceived value. This can be an "entry mode" for artisans to experiment with technologies.
Example	The forcola of Saverio Pastor

Craft-tech application	**Performing some very specific, time-consuming, tasks (eg. precision engraving for preliminary tracing)**
Craft techniques impacted	Wood engraving, mosaic pieces production,
Digital fabrication technologies used	laser cutting and engraving
Description of the innovative process	Craft makers seem willing to use laser technique to aid them in some low creativity but necessary tasks such as tracing some fundamental line on wood and other materials to be later used as guides for more crafty and valuable manufacturing. Sometimes laser cutting is also used to cut tiny or very complex pieces that will be later part of more articulated craft works that will be manually assembled (particularly for non-artistic pieces)
SI framework analysis (notes on process prototyping and impact)	The application is a prime example of the potential of technology to free artisans of some very time consuming and less creative tasks, to give them more time and freedom to focus on their research or on more skilful tasks. For this reason artisans are usually not willing to perform the cnc process in-house. The use of DFT allows for extremely precise and quick outputs.
Example	*Mother of pearl cutting for Zanin Venezia (https://zaninvenezia.com/)* 
	Dario Cestaro – paper laser-cutting for dioramas and pop-up books (https://www.dariocestaro.it/)

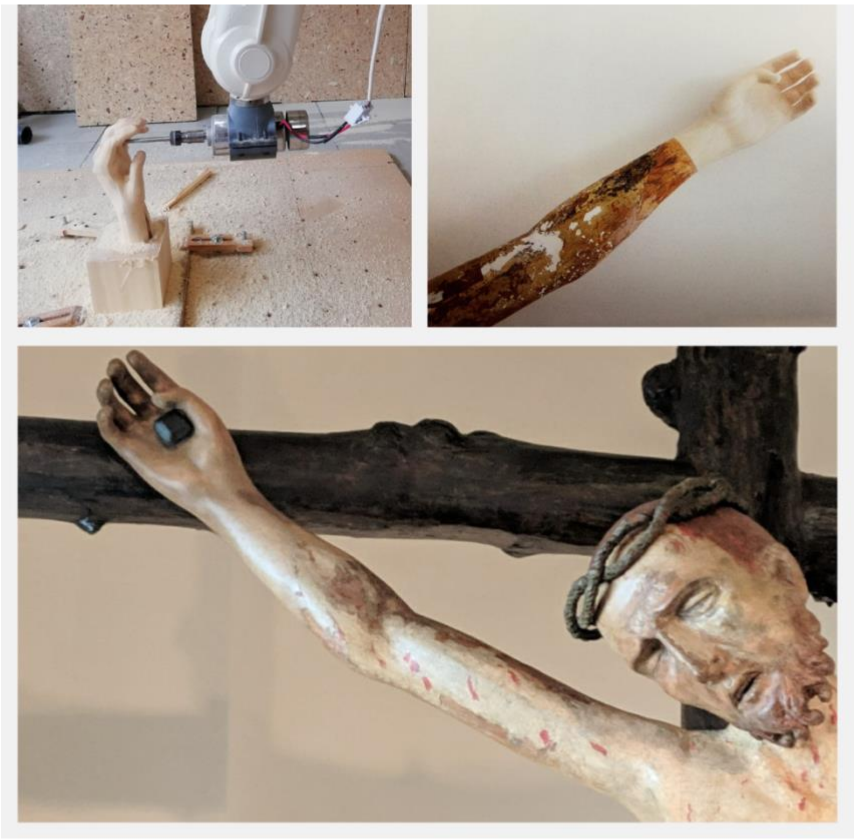
Craft-tech application	**Branding- Customization of existing products**
Craft techniques impacted	engraving
Digital fabrication technologies used	laser cutting and engraving
Description of the innovative process	Laser engraving techniques can be easily used to add bespoke logos or graphics on existing croft pieces. This is mainly use in case of small-medium scale artisanal productions that need to be marked, not for unique pieces or artworks.
SI framework analysis (notes on process prototyping and impact)	Similarly to the technology for preliminary work application, the digitally performed customization of existing products is not a creativity-intense process and artisans are very keen to use machines to do it. Sometimes, it could not be done in other ways.
Example	*Laser engraving of metal bottle caps - Venini* 
	Glass engraving 
	Leather engraving – Ufficio Vitello


Craft-tech application	**New product design**
Craft techniques impacted	various
Digital fabrication technologies used	various
Description of the innovative process	Digital fabrication technologies can be used as creative tools that help develop and produce new products with a peculiar aesthetic. Sometimes, the use of 3d printing, laser cutting, scanning become a part of a more complex process that also includes some hand work and advanced traditional skills. In other cases, the use of the technology stems from a deep knowledge of certain materials and traditional processes that are revisited through a tech-centred approach to create the product.
SI framework analysis (notes on process prototyping and impact)	Digital fabrication technologies can stand at the core of the development entirely new craft objects, for this to happen artisans need to deeply know how the technologies work, which are the limits and the streghts also in relaltion to specific materials. This requires structure awareness rising and training activities and the availability of places and/or economical support to experiment. This application greatly benefits from the presence of adequate innovation ecosystems in place, where all the parties (artisans, institution, innovative businesses and services) are actively involved in the transformation path. This way, also sustainability and inclusion related opportunities can be tackled altogether, resulting in new object that are not only "new" and aesthetically pleasant but also useful and coherent.
Example	*Violin kit, Liuteria Cadamuro – robotic milling, laser cutting for a new kit to support violin makers* 
	Ikebana Rock and roll, Andrea Salvatori – clay 3d printing

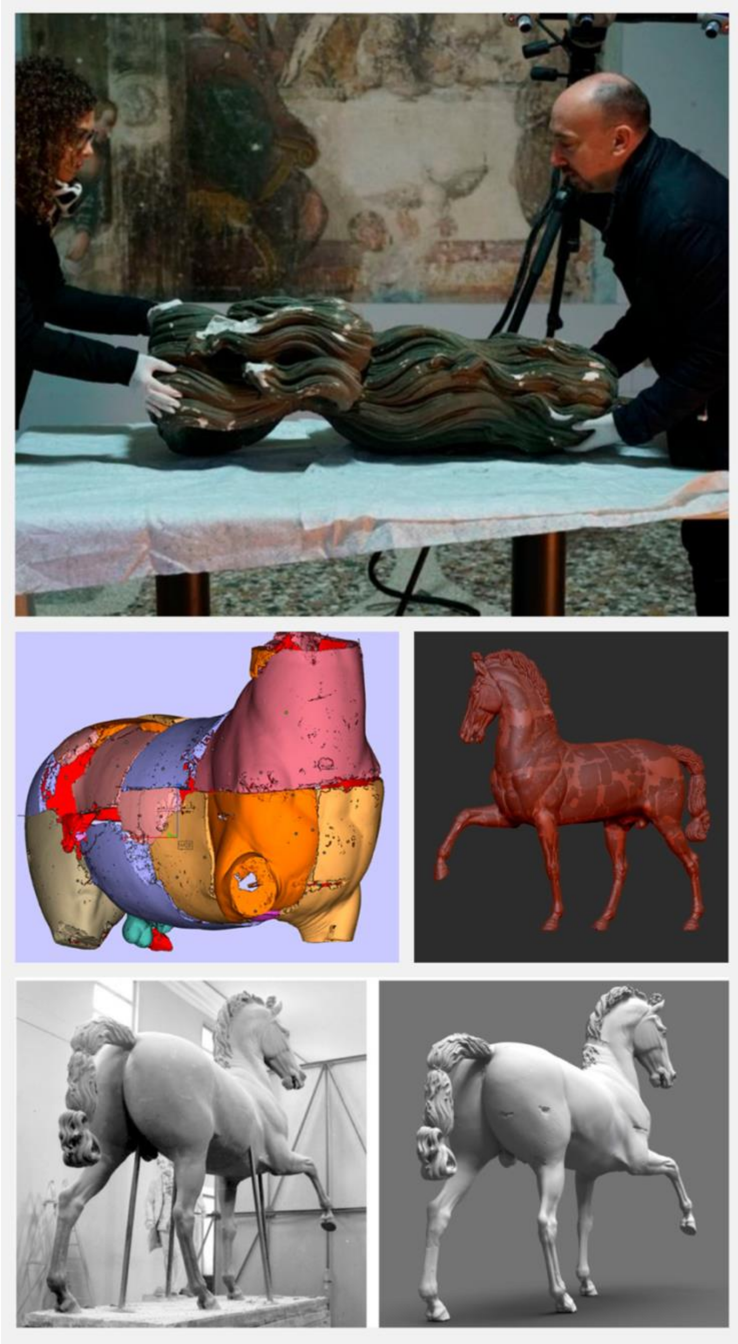
Trophies, Modifile – laser cut cardboard

Craft-tech application	**Digital archives – AR - renderings**
Craft techniques impacted	marketing
Digital fabrication technologies used	3d scanning – 3d modelling
Description of the innovative process	3d scanning existing collections and artefacts has an important role in passing on and preserving the body of work, experimentations, products developed throughout the years. This could serve for documentation, research, but also for commercial purposes: showcasing to clients different options, allowing a virtual 3d exploration of the product online, using rendered products for virtual showcases (seeing how the product can look like placed in your own space).
SI framework analysis (notes on process prototyping and impact)	New means and software for archiving and communicating craft object can be useful for artisans and particularly craft enterprises, both for internal production purposes and to reinforce the presence on the market. For an uptake of these tools, the training of internal resources would be preferable, or at least a general understanding, for a more agile and informed governance of visual outcomes for marketing purposes. The main advantages relate to an enhanced competitivity and presence on the market, with the possibility to engage with new audiences and clients. Impact is not bound to appreciable green and social connotation, although virtual modes of interaction can enhance accessibility of the clients.
Example	*Virtualization and 3d modelling, training on 3d and parametric modelling with Seguso Gianni*  

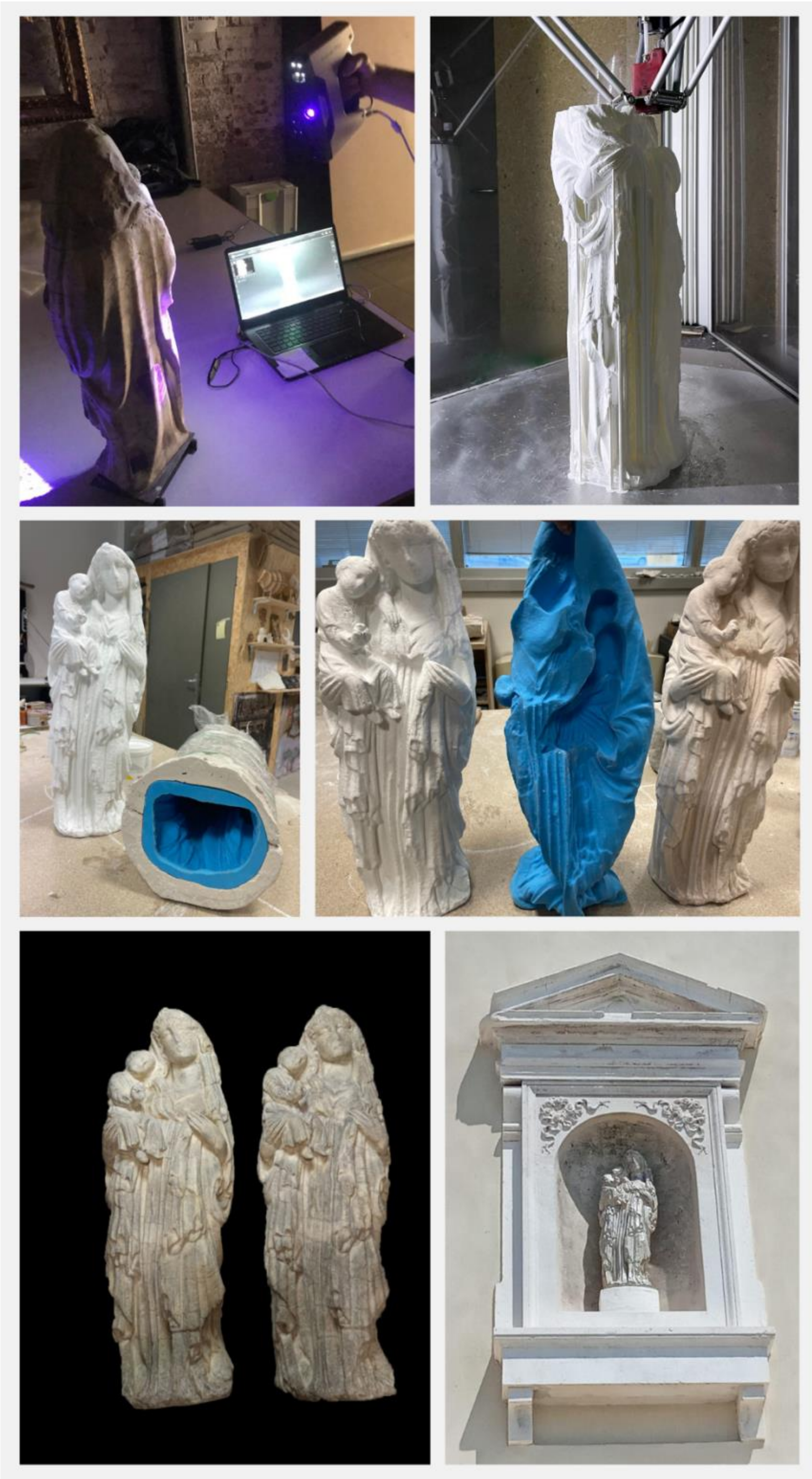
Craft-tech application	**Restoration of cultural heritage**
Craft techniques impacted	Various
Digital fabrication technologies used	3d scanning, 3d modelling, 3d printing/milling
Description of the innovative process	Digital fabrication technologies are playing an increasing great role in activities of preservation and restoration of the cultural heritage. 3d scanning and modelling activities allow for an extremely precise recording of the artefacts, that can be then virtually restored, as a base for later physical restoration or to provide a complete image of how the object used to be. Through 3d printing or CNC milling missing parts can be produced, to help heritage professionals to precisely rebuild the objects. Digitally fabricated part can of course be painted and finished with special material (gold foil, resins, wax) and patinas to give them the desired outer aspect.
SI framework analysis (notes on process prototyping and impact)	Digital technologies are proving to be an extremely valid support for culture related application and heritage study and discovery. While many businesses are rising tp provide services in this sector, it is of great importance that the heritage professionals themselves and the restorers are aware of how these technologies work, in case they need to participate in tenders or are asked by the institutions to provide specific services. Cultural institutions and policy makers too are asked to be well informed of the state of the art for heritage valorisation, to develop proper policies and programs. The creation of innovation ecosystems is clearly very important. Thanks to digital technologies is now possible to preserve and reconstruct particularly endangered ore totally gone pieces (see the Bamiyan Buddhas case) for didactic, archival or exhibition purposes. On field experience show that the cost of using digital processes is not higher than traditional methods, and sometimes it is the only possibility (e.g. when the piece should not be touched for casting).
Example	*Fossò Church's XIII century crucifix restoration – design and production of a new wooden hands* 



Virtual Restoration of Canova Horse statue in Bassano, Factum Arte – virtual restoration



Craft-tech application	**Replicas of cultural heritage**
Craft techniques impacted	Various
Digital fabrication technologies used	3d scanning, 3d modelling, 3d printing/milling
Description of the innovative process	With a similar process to that used for virtual restoration, the production of physical replicas of cultural heritage pieces can be a very valuable application for those pieces that required special conditions and protection to be preserved, and thus could not be shown to the public, or to allow a wider accessibility for people with disabilities and impairment (tactile replicas). The process usually starts with a digitization of the piece, which is then adapted for required physiscalization (scale, possible adaptation for tactile purposes) and then reproduced using 3d printing, milling and possibly casting processes. Materials are chosen according to the scope, the 3d print in very suitable for tactile replicas (lightweight but resistant), if the piece should be put outside, proper finishes or casting a copy in heavier materials (resins) can be more advisable.
SI framework analysis (notes on process prototyping and impact)	Reverse engineering techniques paired with cnc production are a prime way to quickly produce extremely accurate copies. Those can have archival purposes, but the relative ease of the process allows us for a deeper reflection on accessibility and fruition of the heritage. Thanks to digital fabrication technologies is now possible to developed new way to experience cultural heritage, and this positively affects all the restoration and preservation related jobs but also educators, cultural institutions and policy makers. Using digital for such applications proves to have a very positive cost-outcomes ratio, so it is being progressively more and more adopted by international cultural institutions.
Example	*Madonnina statue of the Ca' di Dio – replica making (artistic finishing by Mauve)*



La Caduta degli Angeli ribelli, Gallerie d'Italia Vicenza – 3d scanning for archive and visualization, tactile replicas

4.4 Presentation of Annex 1 and Annex 2

The toolkit is composed by “**Toolkit Applications Scorecards”**. The application is presented in the front of each card, showing which materials and techniques are involved, with an explanation supported by a graphical visualization of the process and the related pros and cons. On the back, the workflow is synthetized in operational steps, with some example images.

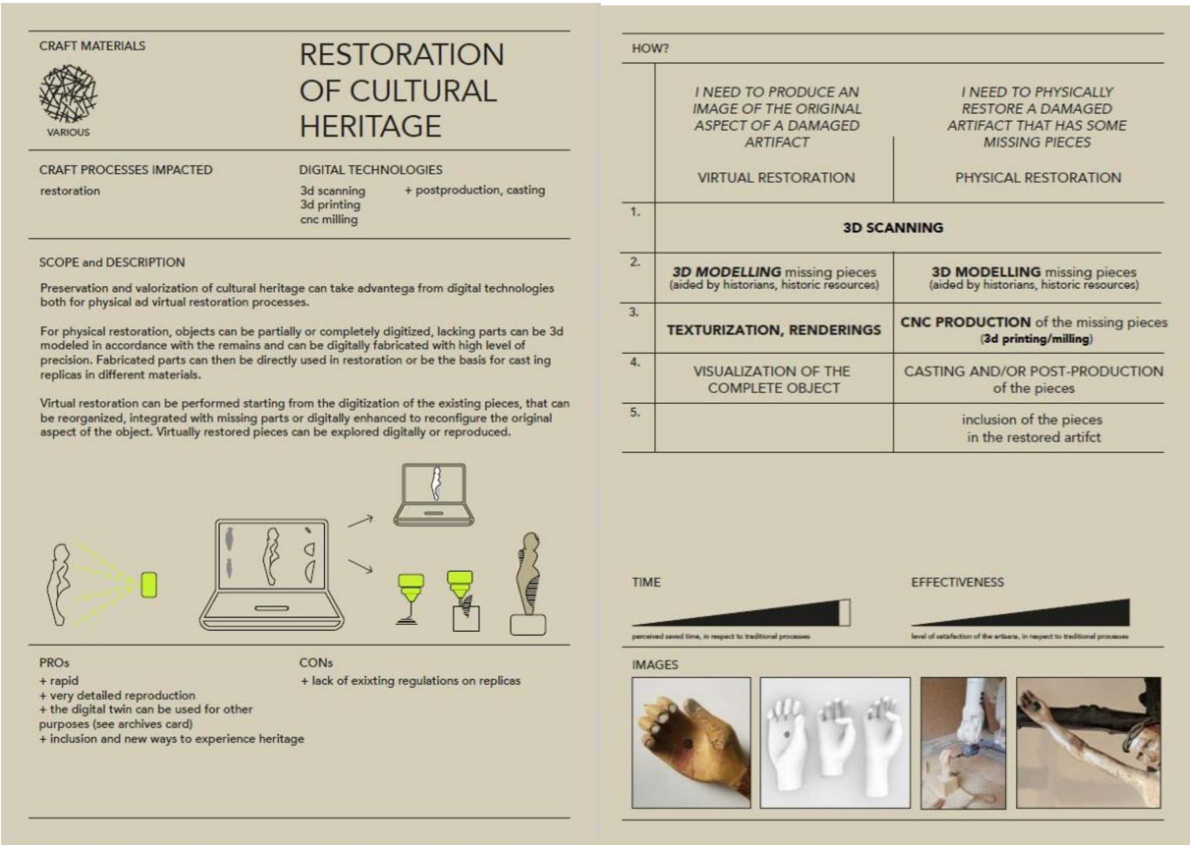


Figure 3 - Example of thematic cards from the toolkit (Annex 1).

The Toolkit Applications Scorecards are included in Annex 1, which includes the following six:

1. Making Molds
2. Replicas of cultural heritage
3. Restoration of cultural heritage
4. Making craft replicas / gadgets
5. Engravings preparatory work + Branding and customization
6. New Products Design

Moreover, together with the “toolkit applications scorecards”, we decided to provide also a prototype of a “**Business Model scorecard**” (Annex 2), suggesting key stakeholder, values and directions to establish a path for lively, future-proof craft communities based on sustainable values.
We plan to enrich and tune this early prototype by the end of the project, including the outcomes and experience originated from the project development and the residencies.

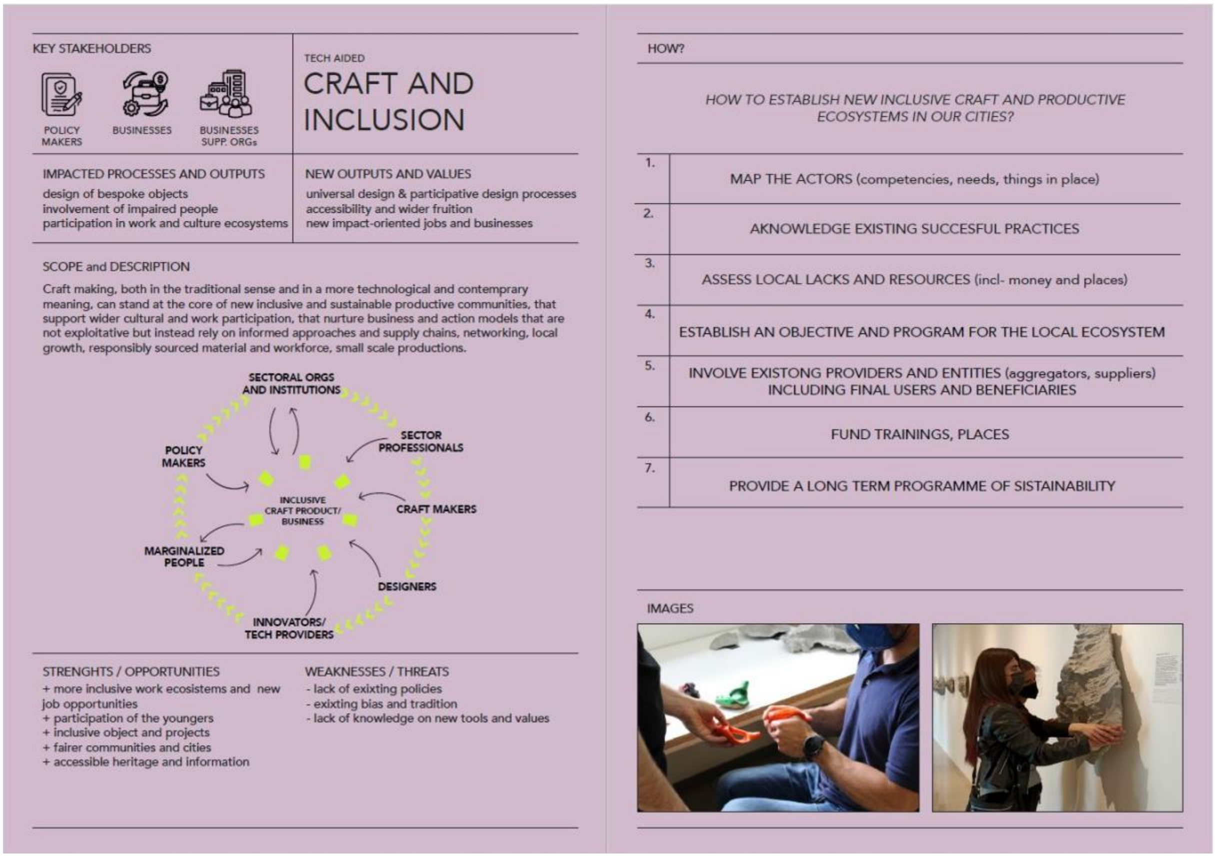


Figure 4 - Example of a "business model card" from the toolkit (Annex 2).

5. Conclusion

Digital fabrication technologies, while providing a significant tool to optimize craft production processes, have a strong potential to act as enabler of widespread **sustainable innovation in the local communities**. Fablabs and maker spaces, as places where digital processes and tools, traditional and crafting activities and people from different backgrounds come together can play a significant role in the development of new production paradigms and in the growth of sustainable communities. The grassroots nature of the activities and relationships that are established in such environments grant a consistent effectiveness of implemented innovation paths and future-oriented exchanges between the actors.

From this preliminary work of collection and analysis we have shown that the use of digital tools among craft practices, particularly if performed in social innovation-oriented innovation spaces, can lead to an overall improvement not only of the craft makers and enterprises' capacities but also of the whole surrounding ecosystems.
Beyond the process related changes, we can see that the **contact between crafts and digital technologies** mediated by the innovative, impact-oriented businesses contribute to:

- support an overall increase of awareness on sustainable practices and materials, both in terms of environmental performance and distribution models (which however are often already embedded in small craft productions), and social innovation;
- foster the participation and interest of younger generation in making-related processes, where the use of technology is not the scope as per, but rather one of the means to sustain creativity and empower the individual and their production capacity, by applying a playful yet value-oriented approach;
- provide examples of collaborative networks that go beyond the logic of competitivity and current profit-based market dynamics to propose a cooperation-led action model, based on common values and the possibility to replicate small, successful synergies in different territories, with an shared/open innovation logic;
- foster the birth of other responsible, impact-oriented businesses by promoting the dialogue on wider topics;
- valorize local specificities but with a global overlook: the best practices are disseminated at a local level to be used as a guideline to promote local material, talents, ecosystems;
- facilitate social inclusion trough the democratization of access and places

The applications and models we have analyzed and included in the **Toolkit Application and Business Model Scorecards** (Annex 1 and 2) have the potential to inform a new way of doing business if widely disseminated through a bottom-up strategy. The **Craft Innovation-driven methodology** that will be developed in the next years of the project draws upon this awareness, aiming to constitute a framework to replicate the successful examples presented, and provide policy makers with useful indications that can orient an effective inclusion of technology in the agenda for a responsible valorization and growth of craft jobs and productions.

6. References

Anderson, C. (2012). The next industrial revolution. New York: Crown Business.

Bergman, B., & McMullen, J. (2020). Entrepreneurs in the making: Six decisions for fostering entrepreneurship through maker spaces. Business Horizons, 63, p. 811–824.

Blikstein, P. (2013). Digital fabrication and “Making” in education: The democratization of invention. In: J. Walter-Herrmann & C. Büching (Eds.), FabLabs: Of machines, makers and inventors. Transcript Publishers.

Bouchard, M. J. (2012). Social innovation, an analytical grid for understanding the social economy: The example of the Québec housing sector. Service Business, 6(1), 47–59. https://doi.org/10.1007/s11628-011-0123-9.

Bria, F. (2015), Growing a digital social ecosystem for Europe, DSI report, EU commission, December 28, 2016, from: http://www.nesta.org.uk/sites/default/files/dsireport.pd

Browder, R., Aldrich, H., & Bradley, S. (2019). The emergence of the maker movement: Implications for entrepreneurship research. Journal of Business Venturing, 34(3), p. 459– 476.

Casalegno,F.,& Winfield,C. (2013). A mobile experience lab production.

Clark, J. (2014). Manufacturing by design: The rise of regional intermediaries and the re- emergence of collective action. Cambridge Journal of Regions, Economy and Society, 7, p. 433–448.

de Boer, J. (2015). The business case of FryskLab, Europe’s first mobile library FabLab. Library Hi Tech, 33(4), 505–518. https://doi.org/10.1108/LHT-06-2015-0059.

Distributed Design. (2023). [Homepage] URL: https://distributeddesign.eu/ (26.08.2023)

Fleischmann, K., Hielscher, S., & Merritt, T. (2016). Making things in Fab Labs: a case study on sustainability and co-creation. Digital Creativity, 27(2), 113-131.

Fonda, C., & Canessa, E. (2016). Making ideas at scientific fabrication laboratories. Physics Education, 51(6), 065016.

Fox, S. (2014). Third Wave Do-It-Yourself (DIY): Potential for prosumption, innovation, and entrepreneurship by local populations in regions without industrial manufacturing infrastructure. Technology in Society, 39, p. 18–30.

Gasparin, M., Green, W., Lilley, S., Quinn, M., Saren, M., & Schinckus, C. (2021). Business as unusual: A business model for social innovation. Journal of Business Research, 125, 698-709.

Gershenfeld, N. (2010). Fab labs - personal manufacturing. Advanced Manufacturing Technology, 31(11), 9.

Gershenfeld, N. (2012). How to make almost anything: The digital fabrication revolution. Foreign Affairs, 91(6), 58.

Halbinger, M. (2018). The role of makerspaces in supporting consumer innovation and diffusion: An empirical analysis. Research Policy, 47(10), p. 2028–2036.

Hartmann, F., & Mietzner, D. (2017). The maker movement-current understanding and effects on production. In XXVIII ISPIM Innovation Conference, Vienna. Retrieved August/28/2020 from https://www.
researchgate.net/publication/318339437_The_Maker_Movement
Current_Understanding_and_Effects_on_Production.

Hatch, M. (2014). The Maker Movement Manifesto: Rules for Innovation in the New World of Crafters, Hackers, and Tinkerers.

Howaldt, J. & Schwarz, M. (2010). »Soziale Innovation« im Fokus: Skizze eines gesellschaftstheoretisch inspirierten Forschungskonzepts. Bielefeld: transcript Verlag. https://doi.org/10.1515/transcript.9783839415351

Inno, P., Henriksson, T., Greco, L., & d'Ovidio, M. (2022). Production networks in the cultural and creative sector: Case studies from the artistic crafts industry (CICERONE report D2.3). https://doi.org/10.5281/zenodo.6885375

Kohtala, C. (2017). Making "Making" critical: How sustainability is constituted in Fab Lab ideology. The Design Journal, 20(3), 375-394.

Kralewski, D. (2012). Bottom-up decentralized approach to innovation strategy. In M.

Leadbeater, C. (1997). The rise of the social entrepreneur (No. 25). Demos.

Lipson, H., & Kurman, M. (2013). Fabricated: The New World of 3D Printing. Indianapolis: John Wiley.

Missikoff & F. Smith (Eds.), NGEBIS'12: New Generation Enterprise and Business Innovation Systems (pp. 55–61). http://ceur-ws.org/Vol-864/.

Padfield, N., Hobye, M., Haldrup, M., Knight, J., & Fagerberg Ranten, M. (2018). Creating synergies between traditional crafts and FabLab making: Exploring digital mold-making for glassblowing. FabLearn Europe'18: Proceedings of the Conference on Creativity and Making in Education, 11-20.

Phills, J. A., Deiglmeier, K., & Miller, D. T. (2008). Rediscovering social innovation. Stanford Social Innovation Review, 6(4), 34-43.

Rayna, T., & Striukova, L. (2019). Open social innovation dynamics and impact: Exploratory study of a fab lab network. R and D Management, 49(3), 383–395. https://doi.org/10.1111/radm.12376.

Rieken, F., Boehm, T., Heinzen, M., & Meboldt, M. (2020). Corporate makerspaces as innovation driver in companies: a literature review-based framework. Journal of Manufacturing Technology Management, 31(1), p. 91–123.

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). New York: Free Press.

Roy, M., & Sarkar, A. (2024). Craft approach to work: A humanist model of work in organizations. Management Review Quarterly. https://doi.org/10.1007/s11301-023-00392-y

Savastano, M., Bellini, F., & D'Ascenzo, F. (2023). FabLab and Digital Manufacturing: Innovative Tools for Social Innovation and Value Co-creation. In Smart Technologies for Organizations: Managing a Sustainable and Inclusive Digital Transformation (pp. 193-214). Cham: Springer International Publishing.

Seyfang, G., & Smith, A. (2007). Grassroots innovations for sustainable development: Towards a new research and policy agenda. Environmental Politics, 16(4), 584–683. https://doi.org/10.1080/09644010701419121.

Smith, A. (2017). Social innovation, democracy and makerspaces. http://www.ssrn.com/link/SPRU-RES.html.

Spies, P. H. (2014). The democratization of innovation: Managing technological innovation as if people matter. World Futures Review, 15-28.

Suddaby, R., Ganzin, M., & Minkus, A. (2017). Craft, magic and the re-enchantment of the world. In Management research (pp. 41-72). Routledge.

The White House. (2015). Building a nation of makers. URL: www.obamawhitehouse.archives. gov/blog/2015/05/04/building-nation-makers (26.08.2023)

Valenzuela-Zubiaur, M., Bustos, H. T., Arroyo-Vázquez, M., & Ferrer-Gisbert, P. (2021). Promotion of social innovation through fab labs. The case of proteinlab UTEM in Chile. Sustainability, 13(16). https://doi.org/10.3390/su13168790.

Van Holm, E. (2015). Makerspaces and contributions to entrepreneurship. Procedia – Social and Behavioral Sciences, 195, p. 24–31.

Von Hippel, E. (2005). Democratizing Innovation. Cambridge: The MIT Press.

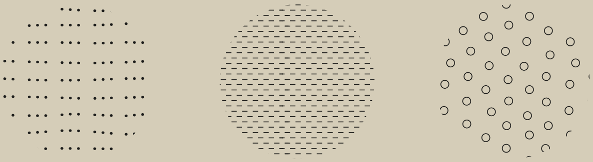
Heritage in EuroPe: new tecHnologies in crAft for prEServing and innovaTing fUtureS

Project No. 101095123

Deliverable 2.1 – Annex 1

Toolkit Application Scorecard

CRAFT MATERIALS



GLASS METALS RESINS

TA1

MAKING MOLDS

CRAFT PROCESSES IMPACTED

lost wax
microcasting
cast glass

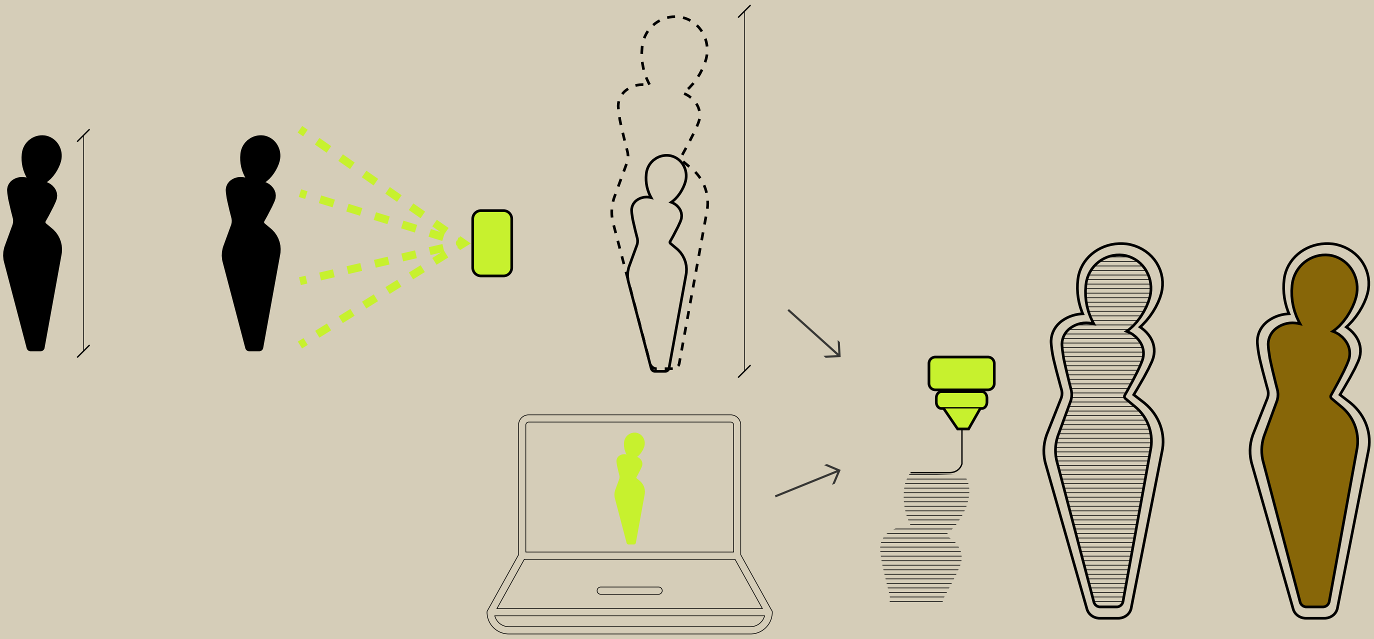
DIGITAL TECHNOLOGIES

3d scanning
3d modelling
3d printing / laser engraving / cnc milling

SCOPE and DESCRIPTION

Creating bespoke physical objects that can be used to shape positive or negative molds for various casting processes.

The starting point could be an existing object or a completely new digital model. Once the a virtual version of the object is produced, this can be altered, scaled, modified according to the necessities and then 3d printed. The printed model is the basis for the mold shaping, usually using silicone and gypsum or wax and earth material.



PROs

+ rapid
+ very detailed reproduction
+ the physical support can be re-used
+ very convenient for bigger projects
+ possibility to engineer the project dividing it in parts for easier casting
+ possibility to precisely scale it for technical purposes (e.g. against shrinkage for foundry processes)

CONs

- less convenient for smaller objects

HOW? TA1

1\. *I ALREADY HAVE A 3D REPRESENTATION OF THE OBJECT I NEED TO CAST* OR *I DON'T HAVE A 3D REPRESENTATION OF THE OBJECT I NEED TO CAST*

I ALREADY HAVE A 3D REPRESENTATION OF THE OBJECT I NEED TO CAST		I DON'T HAVE A 3D REPRESENTATION OF THE OBJECT I NEED TO CAST
I HAVE A PHYSICAL OBJECT	I HAVE A VIRTUAL 3D OBJECT	
⌄		⌄
3D SCANNING		**3D MODELLING**
⌄		⌄

2\. NOW YOU HAVE A DIGITAL 3D MODEL!

3\. **ALTERATIONS (IF NECESSARY)**
(dimension, positive/negative, form)

4\. FINAL DIGITAL MODEL
preparation for 3d printing (division in parts, optimization)

5\. **3D PRINTING**

6\. PHYSICAL OBJECT READY FOR ARTISANAL PROCESS

TIME

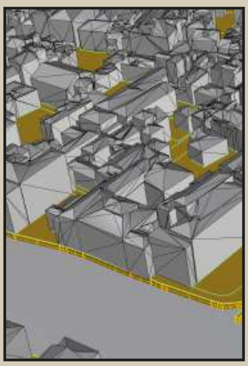
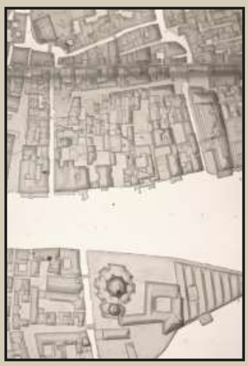
perceived saved time, in respect to traditional processes

EFFECTIVENESS

level of satisfaction of the artisans, in respect to traditional processes

IMAGES



CRAFT MATERIALS

VARIOUS

REPLICAS OF CULTURAL HERITAGE

TA2

CRAFT PROCESSES IMPACTED

restoration
sculpting

DIGITAL TECHNOLOGIES

3d scanning
3d printing
cnc milling

+ postproduction, casting

SCOPE and DESCRIPTION

Physical replicas of arts and cultural object can be extremely useful to allow a more dirct understanding and knowledge of the heritage. This is particularly important for people with mental or sensory disabilities.

Arifacts needs to be digitized (see also digital archives card) and then can be reproduced using various technologies.

Post-production processes (varnishing, patinas, materic cladding) can be used to replicate the sensation and the outer aspect of particular finishing and material.

PROs
+ rapid
+ very detailed reproduction
+ the digital twin can be used for other purposes (see archives card)
+ inclusion and new ways to experience heritage

CONs
+ lack of exixting regulations on replicas

I NEED TO PRODUCE THE REPLICA OF AN ARTIFACT BUT DUE TO CONSERVATION PURPOSES I CANNOT TOUCH IT

1.	**3D SCANNING**
2.	**3D PRINTING / MILLING**
3.	CASTING OR POST-PRODUCTION PROCESSES
4.	PROTECTIVE COATING

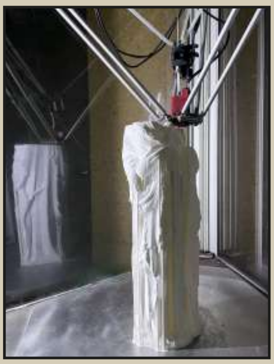
TIME

perceived saved time, in respect to traditional processes

EFFECTIVENESS

level of satisfaction of the artisans, in respect to traditional processes

IMAGES

CRAFT MATERIALS

VARIOUS

RESTORATION OF CULTURAL HERITAGE

TA3

CRAFT PROCESSES IMPACTED

restoration

DIGITAL TECHNOLOGIES

3d scanning
3d printing
cnc milling

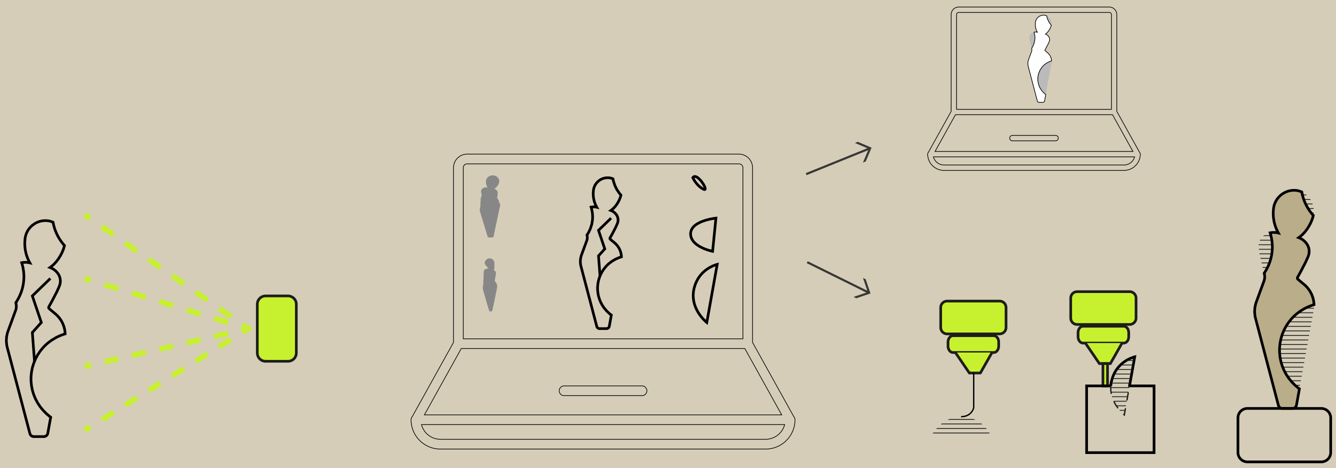
+ postproduction, casting

SCOPE and DESCRIPTION

Preservation and valorization of cultural heritage can take advantega from digital technologies both for physical ad virtual restoration processes.

For physical restoration, objects can be partially or completely digitized, lacking parts can be 3d modeled in accordance with the remains and can be digitally fabricated with high level of precision. Fabricated parts can then be directly used in restoration or be the basis for cast ing replicas in different materials.

Virtual restoration can be performed starting from the digitization of the existing pieces, that can be reorganized, integrated with missing parts or digitally enhanced to reconfigure the original aspect of the object. Virtually restored pieces can be explored digitally or reproduced.



PROs

+ rapid
+ very detailed reproduction
+ the digital twin can be used for other purposes (see archives card)
+ inclusion and new ways to experience heritage

CONs

+ lack of exixting regulations on replicas

	I NEED TO PRODUCE AN IMAGE OF THE ORIGINAL ASPECT OF A DAMAGED ARTIFACT VIRTUAL RESTORATION	*I NEED TO PHYSICALLY RESTORE A DAMAGED ARTIFACT THAT HAS SOME MISSING PIECES* PHYSICAL RESTORATION
1.	**3D SCANNING**	
2.	***3D MODELLING*** missing pieces (aided by historians, historic resources)	**3D MODELLING** missing pieces (aided by historians, historic resources)
3.	**TEXTURIZATION, RENDERINGS**	**CNC PRODUCTION** of the missing pieces (**3d printing/milling**)
4.	VISUALIZATION OF THE COMPLETE OBJECT	CASTING AND/OR POST-PRODUCTION of the pieces
5.		inclusion of the pieces in the restored artifct

TIME

perceived saved time, in respect to traditional processes

EFFECTIVENESS

level of satisfaction of the artisans, in respect to traditional processes

IMAGES

CRAFT MATERIALS

VARIOUS

MAKING CRAFT REPLICAS / GADGETS

TA4

CRAFT PROCESSES IMPACTED

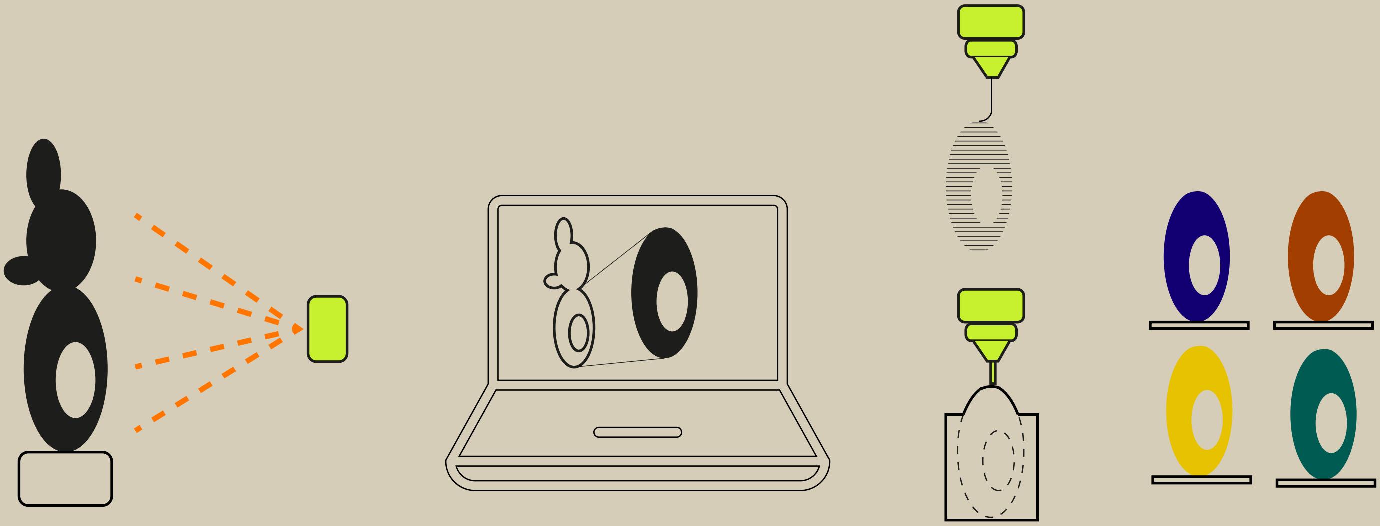
DIGITAL TECHNOLOGIES

3d scanning
3d modelling
3d printing / laser cutting / cnc milling

SCOPE and DESCRIPTION

With the aid of digital fabrication new ways to market and sell craft inspired products and art can be found, even to different target clients, while still maintaining an high standard of quality and perceived value.

Cornerstone products or historical patterns and objects can be transformend into more simplified and affordable versions, small collections or artist copies.



PROs

+ wide range of creative declinations
+ possibility to amplify the customer base

CONs

- resistence to the alteration of well established valuable products
- threat of lower perceived value of digitally fabricated object

I WOULD LIKE TO PRODUCE A SET OF SMALLER/lESS ELABORATE OBJECTS INSPIRED BY MY MAIN COLLECTION

1.	**3D SCANNING**
2.	**3D PRINTING / MILLING**
3.	POST-PRODUCTION / FINISHING

TIME

perceived saved time, in respect to traditional processes

EFFECTIVENESS

level of satisfaction of the artisans, in respect to traditional processes

IMAGES

CRAFT MATERIALS

VARIOUS

VISUALIZATIONS DIGITAL ARCHIVES VR
TA5

CRAFT PROCESSES IMPACTED

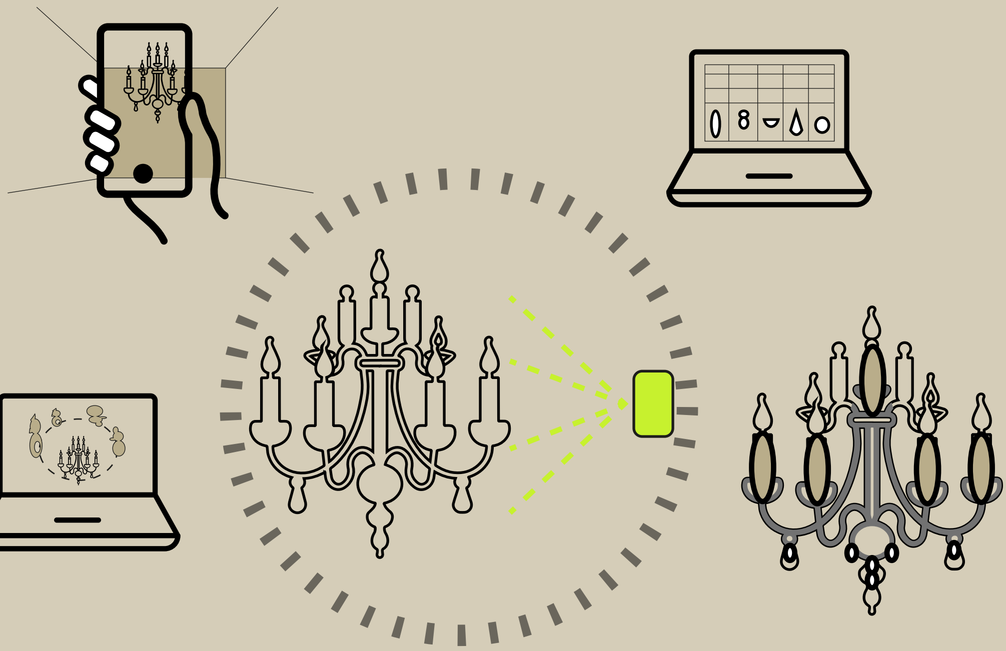
(marketing)

DIGITAL TECHNOLOGIES

3d scanning
3d modelling

SCOPE and DESCRIPTION

Having a digital copy of a craft and art object allows for many differnt uses: remote visualization (for clients at home, during fairs and exhibitions), virtual product placement (visualizing the object in a specific context through agumente reality), archival and documentation purposes, creative purposes (remixing parts and elements to create new projects).



PROs

+ wide range of creative declinations
+ possibility to amplify the customer base

CONs

- resistence to the alteration of well established valuable products
- threat of lower perceived value of digitally fabricated object

I NEED TO DIGITIZE MY ARCHIVE
I WOULD LIKE TO MAKE AN ONLINE REPOSITORY FOR MY CLIENTS/FOR INTERNAL PURPOSES
I'D LIKE MY CLIENTS TO SEE HOW MY PRODUCT FITS IN THEIR HOUSE

1.	**3D SCANNING / 3D MODELLING EX NOVO**
2.	ADJUSTING THE MODEL FOR VISUALIZATION

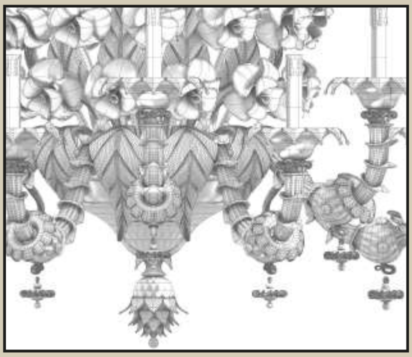
TIME

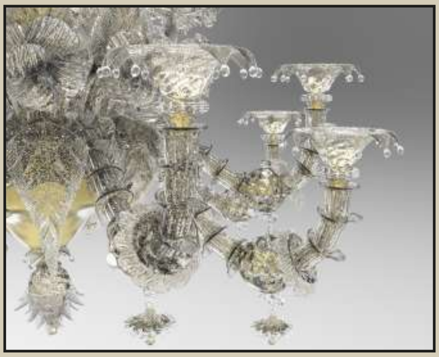
perceived saved time, in respect to traditional processes

EFFECTIVENESS

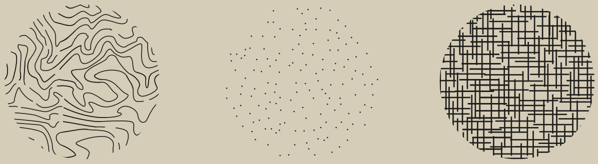
level of satisfaction of the artisans, in respect to traditional processes

IMAGES





CRAFT MATERIALS



TA6

ENGRAVINGS PREPARATORY WORK

+ BRANDING AND CUSTOMIZATION

CRAFT PROCESSES IMPACTED

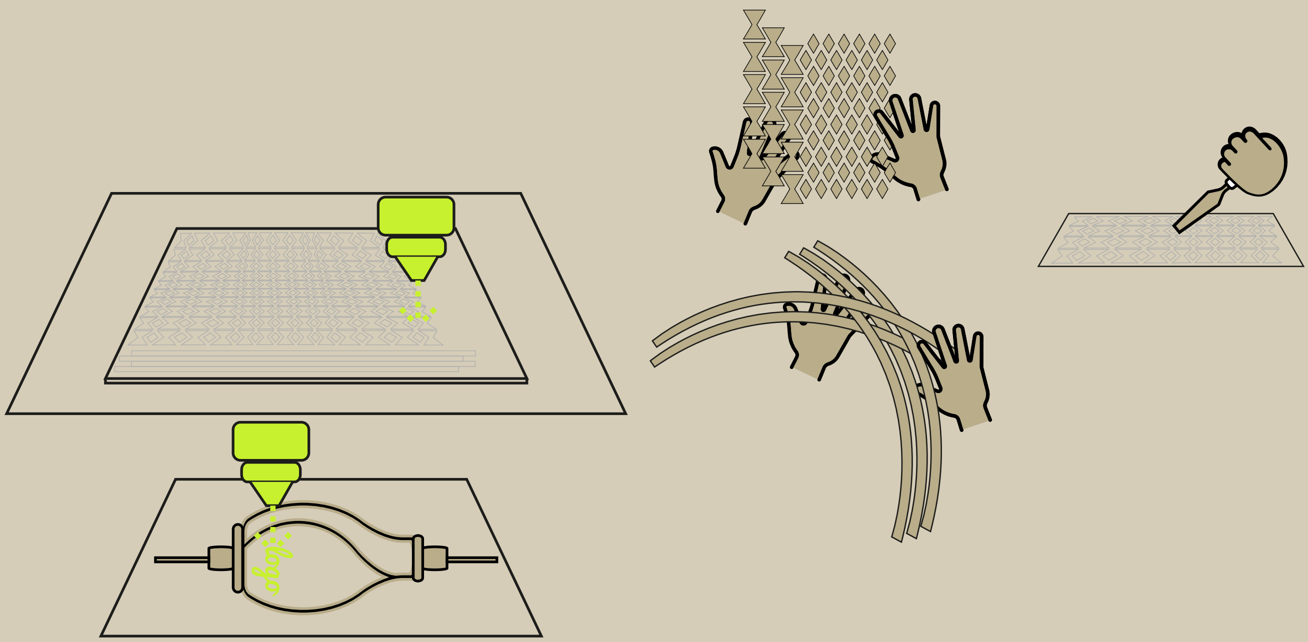
preparatory tasks (cutting, engraving, tracing shapes)

DIGITAL TECHNOLOGIES

laser cutting/engraving

SCOPE and DESCRIPTION

Craft making encompasses various phases, some of them are not related to creativity or tied to the most valuable craft skills and know-how of the artisans. It can be convinenet to use laser cutting and engraving techniques to perform some time consuming, labor intensive or even boring tasks such as: tracing preliminary shapes for sculpting or deeper engraving, cutting high number of pieces, cutting harder materials.



PROs

+ very quick and precise output
+ better capacity to handle certain materials

CONs

- craft makers lose agency on part of the process

I WOULD LIKE TO SPEED UP A REALLY TIME CONSUMING PROCESS

1.

direct LASER CUTTING /ENGRAVING

TIME

perceived saved time, in respect to traditional processes

EFFECTIVENESS

level of satisfaction of the artisans, in respect to traditional processes

IMAGES

CRAFT MATERIALS

VARIOUS

TA7

NEW PRODUCTS DESIGN

CRAFT PROCESSES IMPACTED

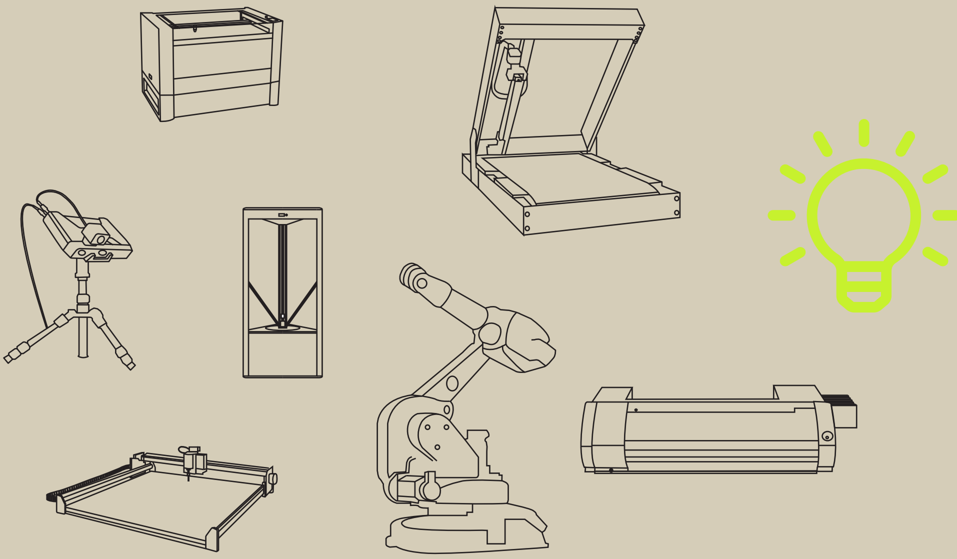
(design)

DIGITAL TECHNOLOGIES

all

SCOPE and DESCRIPTION

The relationship between new fabrication technologies and craft making can be very fruitful for the development of contemporary art and craft products. Technologies can provide new creative opportunities, to experiment with new shapes, develop articulated forms and overcome technical challenges.
It is fundametal to understand how new machines and material work together, which are the limits and the strenghts of these processes, to exploit the creative potential at best and develop truly contemporary and coherent new objects.



PROs

+ very quick and precise output
+ better capacity to handle certain materials

CONs

- craft makers lose agency on part of the process

I WOULD LIKE TO EXPLORE THE CREATIVE POTENTIAL OF THIS TECHNOLOGY FOR MY ACTIVITY

1.	**DISCOVER HOW THE MACHINES WORK**
2.	BRAINSTORM, EXPERIMENT AND PROTOTYPE

IMAGES

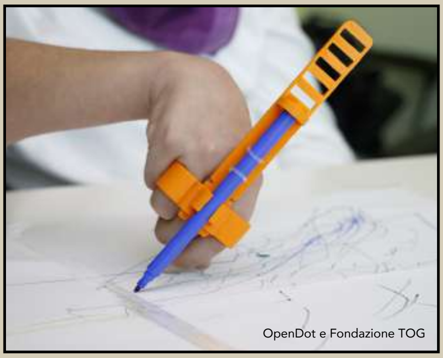
Bold Design

Bold Design

UAU project

Comme des Machines

Liuteria Cadamuro



OpenDot e Fondazione TOG

ReLight Venice

Creative Uprising

Heritage in EuroPe: new tecHnologies in crAft for prEServing and innovaTing fUtureS

Project No. 101095123

Deliverable 2.1 – Annex 2

Business Model Scorecard
(Prototype)

KEY STAKEHOLDERS

BM1

TECH AIDED

CRAFT AND INCLUSION

IMPACTED PROCESSES AND OUTPUTS

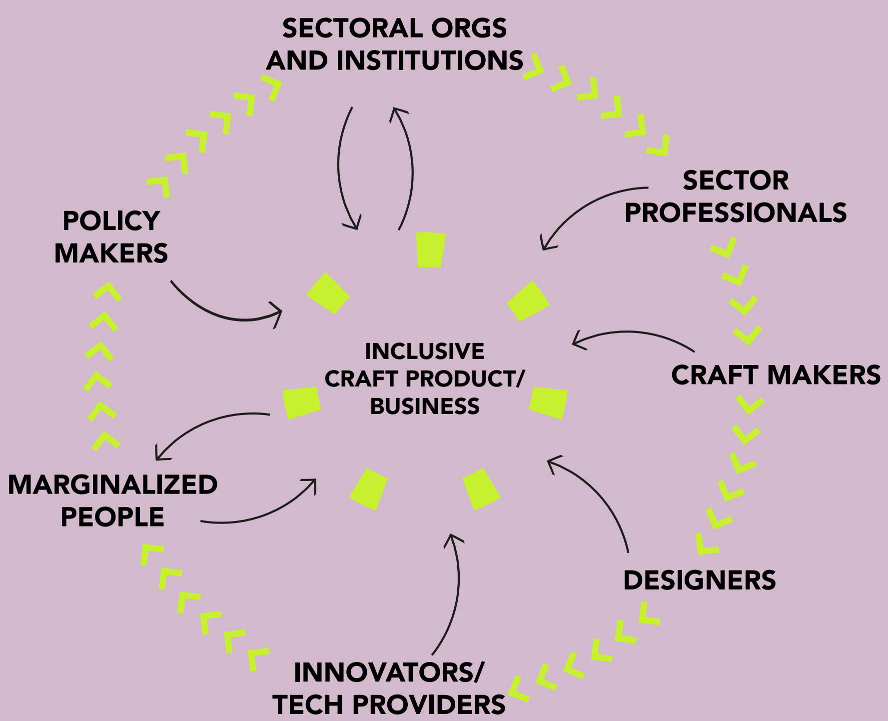
design of bespoke objects
involvement of impaired people
participation in work and culture ecosystems

NEW OUTPUTS AND VALUES

universal design & participative design processes
accessibility and wider fruition
new impact-oriented jobs and businesses

SCOPE and DESCRIPTION

Craft making, both in the traditional sense and in a more technological and contemprary meaning, can stand at the core of new inclusive and sustainable productive communities, that support wider cultural and work participation, that nurture business and action models that are not exploitative but instead rely on informed approaches and supply chains, networking, local growth, responsibly sourced material and workforce, small scale productions.



STRENGHTS / OPPORTUNITIES

+ more inclusive work ecosistems and new job opportunities
+ participation of the youngers
+ inclusive object and projects
+ fairer communities and cities
+ accessible heritage and information

WEAKNESSES / THREATS

- lack of exixting policies
- exixting bias and tradition
- lack of knowledge on new tools and values

HOW TO ESTABLISH NEW INCLUSIVE CRAFT AND PRODUCTIVE ECOSYSTEMS IN OUR CITIES?

1.	MAP THE ACTORS (competencies, needs, things in place)
2.	AKNOWLEDGE EXISTING SUCCESFUL PRACTICES
3.	ASSESS LOCAL LACKS AND RESOURCES (incl- money and places)
4.	ESTABLISH AN OBJECTIVE AND PROGRAM FOR THE LOCAL ECOSYSTEM
5.	INVOLVE EXISTONG PROVIDERS AND ENTITIES (aggregators, suppliers) INCLUDING FINAL USERS AND BENEFICIARIES
6.	FUND TRAININGS, PLACES
7.	PROVIDE A LONG TERM PROGRAMME OF SISTAINABILITY

IMAGES

design Boey Wang