

Blueprint for Urban Manufacturing – An Exploratory Multi-Dimensional Canvas

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Abstract

The term Urban Manufacturing (UM) is used to refer to the production of goods within urban areas using locally sourced materials, with the resulting products being released in the same location. Factories that adhere to these principles are known as Urban factories. Within the project LAUDS Factories – a research initiative focused on establishing guidelines for scaling up production in urban areas that embody the principles of Local, Accessible, Urban, Digital and Sustainable manufacturing – a co-creation approach has been explored focusing on the development of experimental urban productions that are both compliant with fundamental UM concepts and advanced LAUDS principles. This co-creation approach in designing future production infrastructures and models is significant; therefore, a specific framework has been designed and tested to comprehensively document how the experimental initiatives are set up and developed. The paper presents the work in progress on the design of a documentation tool called LAUDS Blueprint which has been designed, prototyped and tested as an initial step towards detailing the processes involved within LAUDS-centric factories, elucidating their objectives through the identification of challenges, proposed solutions, accumulated knowledge, and potential business opportunities. The aim of this paper is to offer insights into the development process of this LAUDS Blueprint through an iterative approach, alongside two real-case applications.

Keywords

blueprint, urban manufacturing, blueprint for manufacturing, manufacturing documentation, canvas for manufacturing

1 Introduction

The term *blueprint* generally refers to technical drawings produced by designers for manufacturers (Hammer, 2001). In the manufacturing sector, blueprints serve as part of a broader process known as the manufacturing cycle, which begins with product ideation and culminates in the creation of initial instruction documents. This iterative process includes activities such as production, assembly, distribution, customer feedback, and subsequent modifications that influence future iterations (Hammer, 2001). Different professionals within the product development sector employ various frameworks: engineers often use the SCRUM methodology (Sutherland & Sutherland, 2014), designers utilise the double-diamond model (Kochanowska et al., 2022), and others may adopt different methodologies. To establish a common ground among these diverse approaches, it was necessary to design a multi-dimensional tool by applying design thinking methods as well as knowledge from the domain of digital product development.

In the context of our research, a blueprint is a tool for mapping a production process from core product development to interaction with end-users, customers, and communities. From a technical drawing, the blueprint becomes a documentation tool aiming at supporting the replicability of a complex production process as well as a tool for self-reflection on a set of diverse dimensions beyond manufacturing.

As a working in progress contribution, we present a new type of blueprint, defined as LAUDS Blueprint, designed to support the replicability and documentation of urban sustainable productions with a high community engagement and social impact. The blueprint aims to serve as an initial documentation component of a larger framework to track needs and solutions adopted during the development of production, issues encountered, and their resolutions.

The development of the LAUDS Blueprint involved several steps tailored for supporting teams carrying out experimental productions integrated into the project LAUDS Factories, a research and innovation action funded by the EU Horizon program (*Local Accessible Urban Digital and Sustainable Factories: New European Bauhaus Approach to Open and Decentralised Urban Manufacturing*, 2024). The initial version of this tool emerged from a co-creation workshop involving actors of local design productions, then a second iteration allowed iterative enhancements that led to its current form (LAUDS Project, 2024). This latest iteration is being tested in two distinct urban factory initiatives that have been selected in the first round of open calls of LAUDS Factories started in September 2024. The blueprint aims to raise awareness about the importance of thorough process documentation and tracking key milestones and dimensions throughout project execution.

The subject of the present contribution is a work in progress tool that has been tested in order to document the initial development phases of two experimental production projects supported by the Open Call of the LAUDS Factories project. The contribution explores the prototype journey resulting in an exploratory multi-dimensional canvas to support urban manufacturing.

2 Tracing the lines of a blueprint for documenting experiments of Sustainable Urban Manufacturing

As the evolution of the concept of Urban Manufacturing reflects the dynamic interplay between industrialisation, urbanisation, and socio-economic transformations, it is also heavily impacted by today's discourse on environmental issues as well as by the introduction of emergent technologies or new business models promoted by the internet economy (Garetti & Taisch, 2012). Principles of eco-social design expand the concept of urban manufacturing towards models of factories that are not only the result of optimised designs for production maximisation (Sehun Oh, 2017), but also environments in which tools like Life Cycle Assessment (LCA) and Design for Environment (DfE) are employed to enhance energy efficiency, reduce waste, and integrate sustainability into production processes (Fitzgerald et al., 2007; Klöpffer & Grahl, 2014). Sustainability is central to modern manufacturing paradigms, and it affects also

decisions in urban planning for post-industrial adaptation. The connection with the regeneration of industrial areas stretches the concept of urban manufacturing towards the rise of new economic models in the cities. All these dimensions require novel tools for capturing the key dimensions of contemporary urban manufacturing in a qualitative way while defying a model in which sustainability and communities are at its core: if the white lines in architectural blueprints make it possible to reproduce construction plans, then *tracing the lines* of a blueprint for sustainable urban production should lead to a multilayered tool composed of different dimensions.

Given this research challenge, we propose an original and work in progress contribution based on the co-creation and bottom-up definition of a blueprint for documenting contemporary urban manufacturing initiatives in which the involvement of practitioners and actors can help define an effective method that can facilitate replication, thus a blueprint for the replication of successful model should take into account dimensions that are including different perspectives.

3 Research context: LAUDS Factories

The LAUDS Factories project (2024) is a research and innovation action that aims to generate a forward-looking model of production that emphasises locality, inclusivity, digital integration, and environmental responsibility. Conceived as a response to contemporary challenges in manufacturing, the initiative redefines industrial processes through the establishment of urban-based, open, and sustainable micro-factories. These spaces are envisioned not merely as production units, but as social and cultural hubs embedded in metropolitan contexts, designed to foster collaboration among artists, small and medium enterprises, technology providers, and citizens. At the core of the project is the ambition to create a European ecosystem of digitally connected and community-oriented manufacturing centres, capable of supporting short-run production while maintaining high adaptability and responsiveness to local needs.

Given this mission, LAUDS Factories prototypes a systemic shift in the way goods are designed, fabricated, and distributed within urban territories. Particularly, one element of its envisioned model is the integration of digital tools with physical productive infrastructure, and the activation of co-created and distributed innovations across multiple locations. In doing so, the project also includes a fundamental element of design based on the environmental impact through localised supply chains as well as the strengthening of the social fabric, namely the engagement of diverse communities and actors in collaborative design and skill-building processes. The concept extends beyond production efficiency to address broader societal transitions, such as the need for sustainable consumption patterns, the circular economy, and equitable access to technological advancements.

The project is founded upon a series of guiding principles that collectively inform its design and implementation. These include:

- the proximity to urban centres is to be minimised in order to reduce transportation needs and encourage the use of local materials;
- accessibility is to be ensured in both a physical and operational sense in order to facilitate participation across socioeconomic divides;
- digitalisation is to be emphasised not as an end in itself, but as a means to facilitate transparency, data exchange, and cooperative workflows.

3.1 Open innovation approach to sustainable urban manufacturing

LAUDS Factories implements an open innovation approach through the organisation of Open Calls, which invite teams to propose experiments in sustainable urban production. These experiments must actively engage local communities and utilise co-creation methodologies. The Open Calls are open to diverse multidisciplinary teams made by creatives, artists, and enterprises that together implement novel, low-impact production pathways aligned with local values.

The initiative is driven by a consortium of 15 European partners representing a wide range of competencies, from academic institutions and design labs to technology developers who collaborate to implement the principles of the New European Bauhaus program claiming beautiful and sustainable solutions (European Union, 2021). This multidisciplinary collaboration ensures the implementation of an open approach: each partner contributes to different facets of the initiative, from technological infrastructure and training programs to the governance of shared resources and the development of sustainable business strategies. Through this network, LAUDS Factories aims to deliver a prototype for future manufacturing practices, offering a replicable and adaptable framework that aligns economic innovation with ecological and social impact imperatives.

3.2 Intersection with Fab Labs

The advent of fabrication technology in laboratories (N. A. Gershenfeld, 2005) has initiated a paradigm shift in manufacturing processes. This novel model has been shown to enhance the feasibility of the relocation of manufacturing facilities, which are widely regarded as major contributors to pollution in rural areas, back into urban centres (Herrmann et al., 2020).

The concept of Digital Fabrication Laboratories (or Fab Labs) evolved following the introduction of the first course on the subject in 1998, entitled "How To Make (almost) Anything", at the Massachusetts Institute of Technology (N. Gershenfeld et al., 2004). In the contemporary era, a Fab Lab can be defined as a facility where individuals have the opportunity to utilise a prototyping platform comprising machinery and expertise to construct a wide range of objects. The digital fabrication laboratory is an entity that facilitates interaction between its members and the global community of makers, researchers, technologists and innovators, which is dispersed across all continents, with the exception of Antarctica, comprised of over 1,700 active laboratories (Fabfoundation, n.d.).

In recent years, the FabLab concept has been scaled up and redesigned to accommodate on one side different business models, on the other the needs emerging from sustainability frameworks such as the Sustainable Development Goals of the United Nation. The latter, for example, is supported by community initiatives such as the working group on the SDGs and Fablabs with a series of workshops that work as catalyst for the creation of a manual designed to assist these managers in aligning their makerspace with the SDGs objectives (Pieter van der Hijden et al., 2018). On the side of the business models, FabLabs are also expanding their list of activities moving slowly from prototyping spaces to centres for new alternative and environmentally friendly economies in the city (Garnier & Capdevila, 2022).

For those FabLabs enabling sustainable productions in urban environments, it is fundamental to evaluate how to adapt or integrate capabilities and skills related to management and implementation of manufacturing processes while at the same time keeping the values of P2P knowledge transfer and community engagement. Therefore, the work developed within LAUDS Factories aims to support Fablabs with a community of inventors, designers, creatives and technologists in expanding their infrastructure and methodology in order to become partially or completely a LAUDS Factory namely a production space that:

- is aligned with the New European Bauhaus principles (European Union, n.d.);
- is sustainable because facilitates the utilisation of local resources, thereby fostering a sense of community;
- it serves to reduce the impact of distribution costs;
- is functioning as a social urban hub, with the objective of fostering cohesion among heterogeneous communities, comprising artists, SMEs, mid-caps and start-ups;
- it utilises digital data that facilitates collaboration processes (LAUDS Factories, 2024).

The work documented in this paper, it is an effort to enable a transition without an overwriting of the Fablab model rather offering tools and knowledge to laboratories that can effectively be a viable platform for localising productions in a sustainable way. For this reason, the project involves existing Fablabs that feature already a "from prototype to production": the FabLab SUPSI (SUPSI, n.d.), situated in the Canton

Ticino of Switzerland, serves as a prime example. This laboratory is integrated into the LAUDS Factories project, which also functions as a LAUDS Factory, thereby facilitating the development of LAUDS Projects during the second open call (LAUDS Factories, 2025).

4 From co-creation to design: the iterations of the LAUDS Blueprint

Given the evolving nature of Urban Manufacturing and the research context proposed by LAUDS Factories, the development of a tool for documenting new urban production initiatives has been conducted through a process based on iterative design phases, followed by testing during the monitoring of experiments carried out by the teams selected through the open calls.

The process included a co-creation session conducted during a workshop at the 2024 Milan Design Week and two design sessions validated through online meetings with consortium members. Following these phases, two tests were conducted: the first involved a young designer developing a limited series of plant vases made from waste materials sourced from marble quarries and construction sites; the second involved a team participating in one of the Open Call experiments.

4.1 Co-creation Workshop¹

The co-creation workshop centred on envisioning a factory model that prioritises sustainability and advanced production techniques. The participants were practitioners and representatives of small and medium-sized enterprises from the Milan area. The workshop also included owners of production and prototyping facilities, such as makerspaces and FabLabs, which offer a range of services and activities. The workshop was attended by fourteen participants. Six of these participants were professionals from business and industry, including designers, entrepreneurs, technologists, and makers. Five participants were researchers, some of whom combined roles in design, technology, and entrepreneurship. The remaining participants were design students. This composition ensured a balanced representation of industry, academia, and emerging talent.

The workshop, with a duration of one hour, proposed an activity in which participants were invited to envision and design their ideal factory, combining their professional experience with speculative thinking to contribute to the LAUDS model of future manufacturing. The documentation of the components of their ideal factory was facilitated by the utilisation of stickers. A range of colours was employed to differentiate between the various component typologies, encompassing the purpose of the factory, resources, challenges, actors, benefits, and targets. Participants were instructed to annotate their contributions, providing contextual details and justifications for their inclusion. Furthermore, participants were asked to reflect on how each component with one or more of the core LAUDS values (Local, Accessible, Urban, Digital, and Sustainable), and with mapping relationships and interdependencies among them. Participants were then instructed to position the stickers within the canvas according to the value each component helped to achieve. This process enabled the visual articulation of the systemic nature of the proposed factories.

¹ The workshop is part of the official deliverable of the LAUDS Project T1.1 Co-Creation Workshops and is documented in the LAUDS co-creation at LAMPO Isola Design (LAUDS Project, 2024) webpage. The workshop has been designed by the core research team of SUPSI composed by Serena Cangiano, Antonella Autuori, Ginevra Terenghi, Desirée Veschetti.



In developing this blueprint, the existing model of Product Development Principles & Process, as established by Sophia Höfling (2022), was considered as a starting point since it applies the divergent and convergent concept at the base of the Double Diamond (Kochanowska et al., 2022) and gives space to the project's iterations. The model was initially designed with three main sections:

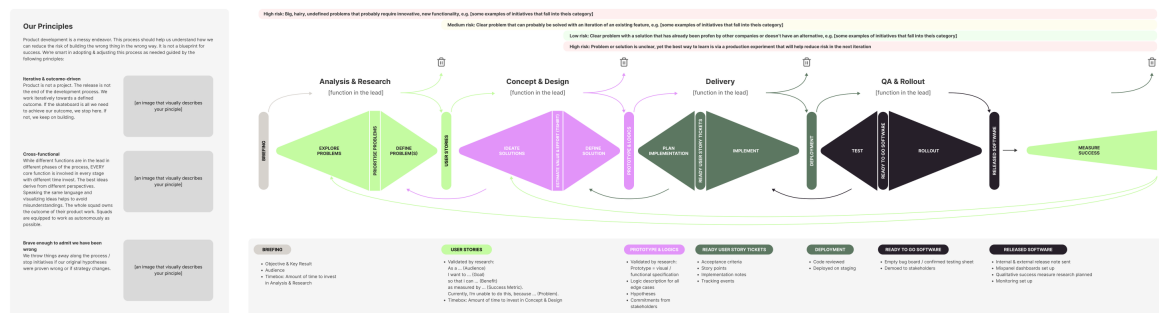
The Development Analysis Section is the primary section that analyses the developmental stages of the product. It commences with the identification of potential risks at the outset, categorised into high, medium, and low-risk levels. The subsequent section delineates the various phases of development, interwoven with action blocks such as briefings, user stories, ideation sessions, planning, testing, implementation, definition, release, and measurement of success. The development phase is specifically divided into divergent and convergent stages. The double-diamond logic (Kochanowska et al., 2022) is utilised to guide these phases: the divergent stage involves exploration, ideation sessions, planning, and testing; the convergent stage includes definition, implementation, release, and measurement of success. Arrows between stages indicate iterative processes that allow for continuous improvement throughout development.

Furthermore, the canvas proposes a possibility after each phase of blocking the process. The overarching objective of the developed blueprint is to systematically document issues and challenges encountered

during the product development process without compromising the continuity of the development process itself. The mapping of these problems is of crucial importance for the purposes of iterative refinement and the measurement of success.

Figure 2: the product development principles and process canvas developed by Sophia Höfling. Image courtesy of Sophia Höfling CC BY 4.0

[company name]'s Product Development Principles & Process



The other part of the previous framework was not taken into consideration since considered not relevant for the mapping of the development of a LAUDS factory.

The analysis of the base canvas facilitated the creation of our first personalised model, specifically designed for LAUDS factories. The adapted blueprint is divided into new sections that better suit the unique needs of developing such facilities:

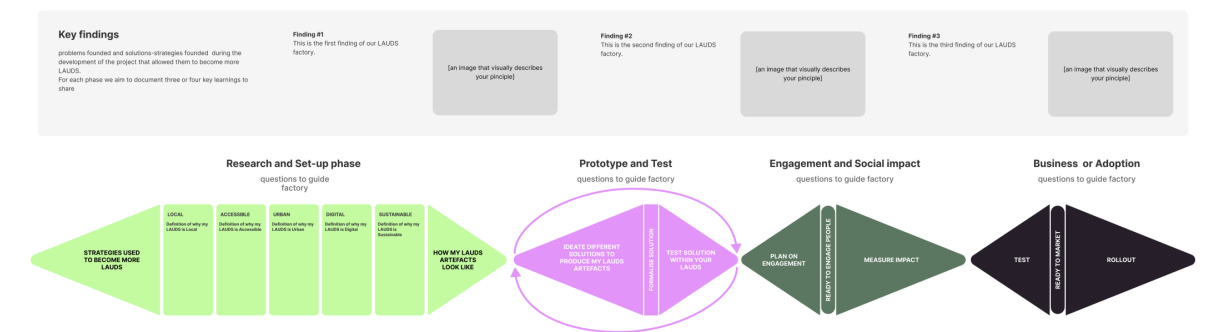
1 The objectives section delineates the overarching aims of the project. This section delineates the factory's primary objectives, emphasising the documentation of three pivotal learnings that emerged during its development.

The development stages section is divided into different stages. The Research and Setup Phase is characterised by the division of findings according to the LAUDS definitions: Local, Accessible, Urban, Digital, and Sustainable. The Prototype and Test Stage is characterised by the objective of addressing specific issues in the realisation of the final artefact. This stage involves the identification of problems and the documentation of solutions adopted to facilitate progression to subsequent phases. The Engagement and Social Impact Phase is then built upon these foundations, with the objective being the identification of strategies for reaching out to people and engaging with communities whilst measuring social impact. The final stage is concerned with the business aspects of implementing the factory or product. This stage entails the identification of advantages and disadvantages associated with the actual implementation process, as well as the addressing of any concomitant business issues.

The incorporation of the other parts of the aforementioned framework was considered less relevant for the documentation of the development process specific to LAUDS factories.

Figure 3: the blueprint underwent modification to align with the specifications of the LAUDS factories project. Image courtesy of LAUDS Factories CC BY 4.0

[LAUDS Factory] Blueprint



Following the alignment of the model developed by Sophia Höfling (2022), the subsequent stage was to establish our requirements for the mapping of LAUDS factories. The intervention of the project team enabled the definition of a revised model. The revised version encompasses a more extensive range of project elements. In contrast to the previous version, the revised model is now structured as follows:

1 The objectives section encompasses not only the key learnings but also the main issues encountered during the project development. This section is intended to serve as a compendium of the primary learnings and challenges encountered during the development of the LAUDS factory.

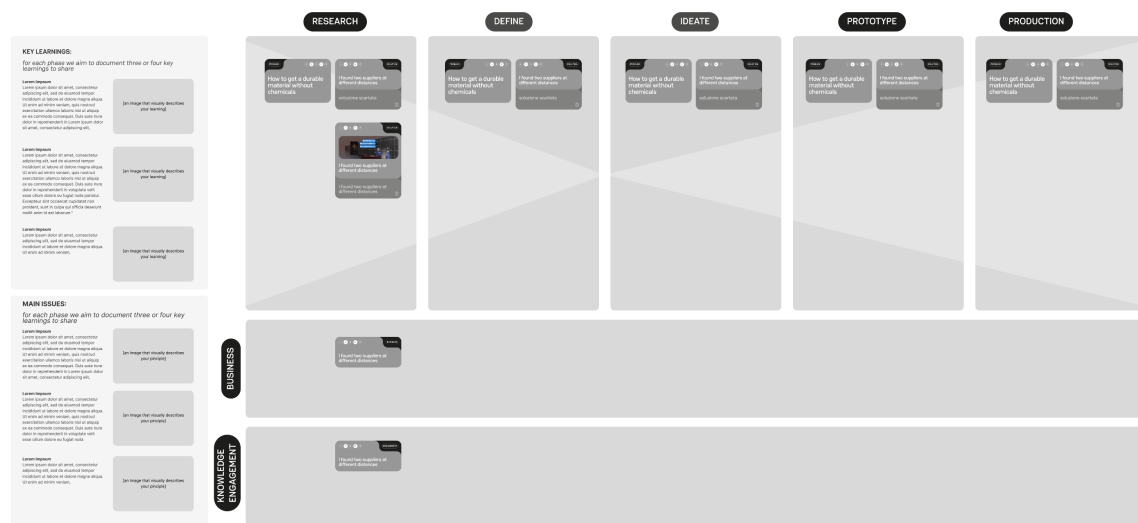
The primary section, which illustrates the various stages of the project, has been subdivided into several new categories: Research, Define, Ideate, Prototype and Production. Each section may encompass multiple cards, defined as either problems or solutions. Users are permitted to integrate text to provide further elaboration and to indicate the five tags: Local, Accessible, Urban, Digital, and Sustainable. These tags are represented by round circles that can be selected or deselected as appropriate. The background of this section contains two cones, which are intended to identify the convergence or divergence of the phases, thus aligning with the established concept of convergent and divergent thinking.

The lower section comprises two categories: business and knowledge and engagement. These categories allow users to include further information discovered during the development of the LAUDS factory. Specifically, the business section should include any references related to the eventual partnership that the factory could sign. Conversely, the knowledge and engagement section is intended to serve as a repository for references to courses completed or materials found to be beneficial in the development of the factory.

This second iteration of the blueprint was employed in the initial user testing with a factory that, despite not being funded by LAUDS, adheres to the principles of the project. The test facilitated the identification of additional insights concerning the utilisation of the model.

Figure 4: the second blueprint was modified after a preliminary evaluation by the LAUDS project team. Image courtesy of LAUDS Factories CC BY 4.0

How to produce like a LAUDS Factory: [Project Title] Blueprint



Thanks to the user testing it was possible to identify different issues of usage, and so another iteration in the development was needed. The main difficulty was the strictness of the model, if the user were in between specific stages, it was hard to suit a specific card. Moreover, a more precise map of the project is needed to better frame the actual state of the development. The last iteration on the canvas was then made, the structure is very similar to the previous one, including a section related to the project information, a different frame for the main development stages and an alignment with the identity of the project. The actual blueprint is now divided into the following sections:

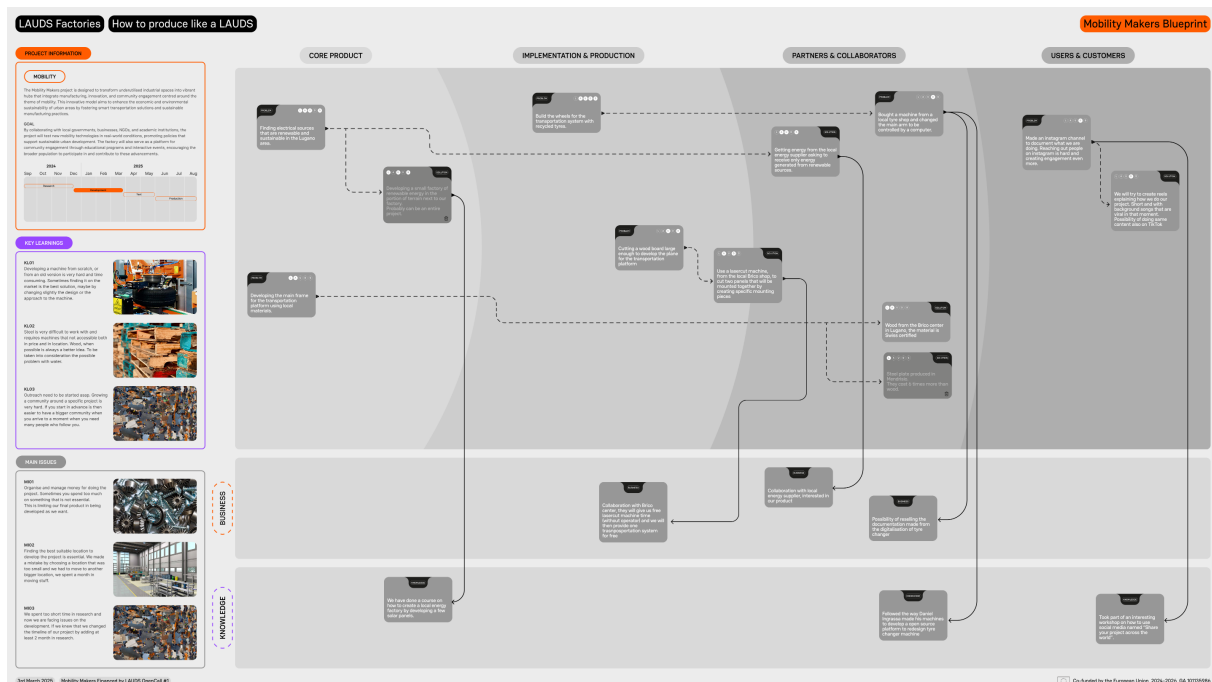
2 The objectives section includes a section where to include the main information on the project with a general description, the objectives and a brief timeline to better frame the actual state of the development.

The central section is the one that changed more, in fact, the stages are now less strict, including a unique rectangle with smooth division between sections that can then communicate with each other. The stages also have been modified, with the new one focusing more on the development of the factory itself. Core product, that identifies issues and solutions related to the product or technology that the project is developing. Implementation and Production, which illustrates the techniques and technologies used in the development process. Partners and Collaborators include relations with business partners like those who are providing resources, institutions, or any similar collaborations. Users and Customers, including the communication and dissemination of the project to the world.

The last section is not affected by any changes, besides the naming of the previous Knowledge and Engagement, which now is only Knowledge to not be confused with the upper section related to dissemination.

All the sections can be connected using a set of arrows already made, to visualise in a better way the interconnection between stages and related business or knowledge achieved thanks to the needs of the project. The blueprint, in the actual stage, could serve as well as a first stage of documentation of processes that have been solved by the LAUDS factory with the aim of solving similar needs to other urban factories.

Figure 5: the actual blueprint, compiled with fictional data, modified with insights after the first test.
Image courtesy of LAUDS Factories CC BY 4.0



The last iteration that was done considered how the blueprint would be compiled. As project managers, our objective was to provide assistance to factories funded by the project with the initial implementation of the blueprint. To this end, we sought to identify a potential solution for producing a preliminary version of the canvas through the utilisation of an in-person interview session.

The experiment was conducted utilising the Microsoft Teams platform, which incorporates a transcription technology to meticulously document the content of the interview. The interview was conducted by a team of members, with the objective of achieving the necessary level of proficiency. The first member of the team was responsible for posing questions and facilitating the conversation, while the second member took notes on the conversation to subsequently create a transcript. This process, in conjunction with a predetermined set of questions, enabled the initial user testing of the novel model developed. Following a 20-minute interview with the same project that was previously tested, it was possible to validate the actual canvas and method of completion.

5 Reflections and Future works

The paper presented a work in progress contribution focusing on the design and development of a tool for documenting and supporting the replication of sustainable urban production processes in the context of an evolving and bottom-up definition of Urban Manufacturing. Developed within the EU-funded LAUDS Factories project, the tool has been tested in experimental settings, and it maps the production process while integrating dimensions such as social impact, sustainability, and community engagement. By combining design thinking with product development, the goal of this work is to test and validate a blueprint in the format of a canvas that could be used to monitor urban product processes as well as inform the design of innovative production in the cities.

During the preliminary design iterations, a number of observations were made. In order to validate the design process, it is necessary to carry out a more in-depth investigation into contemporary tools that are utilised in both industry and experimental contexts. This investigation should be informed by the results of a literature review. The incorporation of certain dimensions, such as engineering specifics, is a potential

avenue for consideration. Nevertheless, the present version exhibited the minimum duration required for the completion of the documentation. It is acknowledged that the documentation of an urban manufacturing process necessitates a more detailed approach. The developed blueprint is intended to serve as a foundational starting point, or a means to highlight needs and solutions mapped through the development of the urban factory. The blueprint's actual version must undergo rigorous testing with the LAUDS factories projects on multiple occasions. Following the testing phase, it is inevitable that further refinements will be considered. Despite the advanced prototype's current iteration, it is imperative to recognise its status as a preliminary version, necessitating further refinement to meet the criteria of a finalised blueprint. The stable version will be released under open access in the Figma community and as a canvas on Zenodo.

In the following period, the finalised blueprint will be used to inform specific training programmes that address the identified gaps in the areas of local, accessible, urban, digital and sustainable factories.

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We profoundly thank the teams from the two urban factory initiatives selected to conduct the user testing for their commitment to evaluating the Blueprint in real-world settings and for providing invaluable insights that have contributed to its continuous improvement. Their engagement has been integral to the validation of the tool and its capacity to document and support complex production processes with strong community involvement and social impact.

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