

OPEN_NEXT

Deliverable 1.3

Open Source Development (OSD) Framework



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OPEN_NEXT – Transforming collaborative product creation

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Delivery 1.3
**Open Source Development (OSD)
Framework**

List of abbreviations and terms

C3	Company-community collaboration
CAX	Computer-aided x
CIS	Continuous Idea Storage
DIN	Deutsches Institut für Normung e. V.
EC	European Commission
EU	European Union
ICT	Information Communication Technology
OSH	Open Source Hardware
OSD	Open Source (Product) Development
PIL	Prototyping improvement logic
PR	Public relations
PSS	Product-Service-System
PST	Problem solving team
SME	Small and Medium-sized Enterprise
TRL	Technology readiness level
WP	Work package

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Abstract

This deliverable outlines the first version of the OPEN_NEXT Open Source Development (OSD) framework. A framework that presents the OSD journey which will be taken by the six Small and Medium-sized Enterprises (SMEs), the three maker spaces (referred to here as Labs) together with OPEN_NEXT research and practice partners. The journey aims at harnessing the promising potential of collaborative product creation in an open source context. Upon the end of the first six pilots with OPEN_NEXT SMEs partners, the framework will be revised, expanded and be deployed through the last phase of the project i.e. the demonstration with a new twelve SMEs from all across Europe.

The deliverable consists of the main guide, the pre-pilot phase, the pilot phase, the post-pilot phase and an OPEN_NEXT deliverable map diagram. The main guide works as a welcome introduction to the framework, the OSD concept and serves as a guiding map through the content of this deliverable. This will be followed by a sequential coverage of the three main phases of the OSD journey the pre-pilot, the pilot and the post-pilot. The deliverable will be closed by highlighting the links between this deliverable (D1.3) and several others delivered or upcoming deliverables.

1 Main Guide

1 Main Guide

1.1 Introduction

Small and medium-sized enterprises (SMEs) are believed to be in an ideal position to take on a leading role in transformation as a key driver for socio-economic development all over the globe (Karadag, 2016). This is evident as they are accounted for 67% of all employment, 57% of all created added value in the EU (EC, 2017).

Up to 93% of SMEs are classified as micro-SMEs (EC, 2018), with less than ten employees which highlight the crucial need for innovative strategic collaborations to overcome the lack of network and resources, the increasing competition, the high transactional costs. On another hand, online grassroots communities have demonstrated an increased interest and capacity to manage and perform product development activities, leading the development of convincing, high quality and innovative products. Besides, the global maker-movement is promoting technological literacy for everyone producing a transformative effect of citizen active participation in product development.

Therefore, OPEN_NEXT is bringing SMEs, maker communities across Europe to fundamentally transform collaborative product creation. By enabling SMEs to engage in company-community collaboration (C3) for means of co-development and market exploitation of Open-Source Hardware (OSH) products and related services openly on digital platforms as well as physically on local Fabrications Labs /maker spaces.

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1.2 Understanding this framework

This document outlines the OPEN_NEXT OSD framework, a framework designed to describe and foster a smooth, effective collaboration between SMEs interested in the co-development of user-centric consumer products and maker space which offers a package of services to host and facilitate such a journey. Together with both local and online community members, the formulated team will be entering a step-by-step guided journey throughout three consecutive phases (pre-pilot, pilot and post-pilot) phases.

The document will be covering each of the three phases separately allowing a holistic yet specific overview of the OPEN_NEXT OSD journey. A journey that allows the SMEs, the OSD Labs, and the corre-

sponding engaged community members to explore new horizons of possibilities when it comes to collaboration from ideation, co-design up to prototyping.

This framework is built upon previous efforts by OPEN_NEXT teams in both Work Package (WP) 4 and WP5 through the integration of the work developed and presented in the following deliverables:

- D4.1: First release of Open-source business model development framework
- D5.1: Open-source sociotechnical design components

1.3 Open Source Development (OSD)

The open-source innovation refers to the case where C3 happens around the development of open-source content. That is, both the process of developing content and the outcome of this process are open. In other words, open-source innovation refers to a development process that is open for the participation of every interested individual and whose outcome is open source. In the case of physical products, which is the main specific focus of this journey, open-source innovation is termed as open-source development (OSD).

In OPEN_NEXT, we consider that the process of OSD includes products and product-related services. This approach opens room for citizen participation in the product development process and goes far beyond the state of the art in customer-innovation.

1.4 Target audience

SMEs

SMEs, who manufacture physical products (hardware, in the broadest definition of the word) and seek to innovate their product development and manufacturing towards a new business model based on open source principles and empowerment of users towards becoming co-creators. SMEs will participate in three rounds: pilots (six SMEs, partners in the EC H2020-funded OPEN_NEXT program), demonstrators (twelve SMEs, to be recruited as part of the project) and finally in a blue print for an “open market” version of the demonstrator to be offered in Labs around the world after the EC H2020-funded project ends.

OSD Labs

OSD Labs, as creative hubs for open source maker culture, who will act as experts on community building and facilitators of the learning journey for the SMEs, while at the same time developing the OPEN_NEXT OSD Framework as a business offering inspired by the documented journeys and experiences in the of EC H2020-funded project.

Research partners

Research partners, who throughout the EC H2020-funded project period will conduct research to help build the OPEN_NEXT OSD Framework as well as derive and publish learnings from both the OPEN_NEXT six pilots and the twelve demonstrators.

Community members

Local and online community members, who will mainly be represented by associated existing community members of both the SMEs and the Labs involved in the OSD journey, as well as recruited members during the continuous collaboration outreach activities throughout the different phases of the OSD.

1.5 Framework components

The OPEN_NEXT OSD Framework consists of the four main components ‘*Main guide*’, ‘*Pre-pilot phase*’, ‘*Pilot phase*’ and ‘*Post-pilot phase*’ as shown in Figure 1: OSD Framework components.

Main guide

Provides the key actors (SMEs, Labs) with an overall higher-level overview of the envisaged OSD journey as part of the OPEN_NEXT project, its significance and the strategic aim behind it. The main guide gives an overall glance for potential participants supporting them taking an informed decision to take part based on a well-structured road map and navigation routes.

Pre-pilot phase

(This section is built upon and expand the efforts in D4.1)

Before starting the actual collaboration process, the OSD journey participants (SMEs, Labs and community members) need to find each other to go through a matchmaking and agreement process process to strategically align their motives, vision, and overall envisaged goals of the journey. The Pre-pilot phase allows the OSD participants to prepare themselves effectively to be able to tackle the challenge of working together collaboratively during the OSD journey. It provides a systematic five stages process starting with an announcement of potential collaboration service through a ‘*service pitch*’ and closing with a concrete summary of the challenge ahead.

These stages are:

- Stage 1: “OSD service Pitch by the Lab” (Announcement of the collaboration opportunity)
- Stage 2: Checklist step 1 “Finding the right match” (Individual checklist for SME and Lab)
- Stage 3: Checklist step 2 “Seeing eye to eye” (joint checklist for SME and Lab together)
- Stage 4: Checklist step 3 “Getting off on the right foot” (Individual checklist for SME and Lab)
- Stage 5: Pre-pilot boot camp “Visualization of the project vision” (outline of the OSD project)

Pilot phase

(This section is built upon the efforts of D5.1)

This phase is the core phase of the OPEN_NEXT OSD journey. After the match confirmation, the self/mutual checklist preparations, this phase aims at supporting the OSD participants through the actual open-source product development process. The pilot phase consists of six phases starting with the technical collaboration requirements ending with a physical prototype tested in a real world environment. These phases are:

- Phase 0: Preparation: “Prepare everything for a great collaboration with the community”
- Phase 1: Analysis: “Digging deeper into your challenge area and gathering new perspectives”
- Phase 2: Identifying potential: “Identifying new insights & looking for exciting opportunities”
- Phase 3: Conception: “Turning your idea into something tangible you can experiment with”
- Phase 4: Specifications: “Convert solution variants into concrete products”
- Phase 5: Realisation: “Getting ready to launch your idea in the real world.”

Post-pilot phase

In this stage, the OSD participants systematically close the collaboration throughout the piloting phase. During the post-pilot phase, the participants will be guided to take part in two-stage post-pilot process.

These stages are:

- The post-pilot boot camp
 - Collaboration project closure
 - Documentation and information preservation
 - Reporting (Technical and financial)
 - Best practices and lessons learned
- Beyond the OPEN_NEXT OSD journey:
 - Continuation of the collaboration
 - Spin-off or new collaboration opportunities
 - Termination of the collaboration

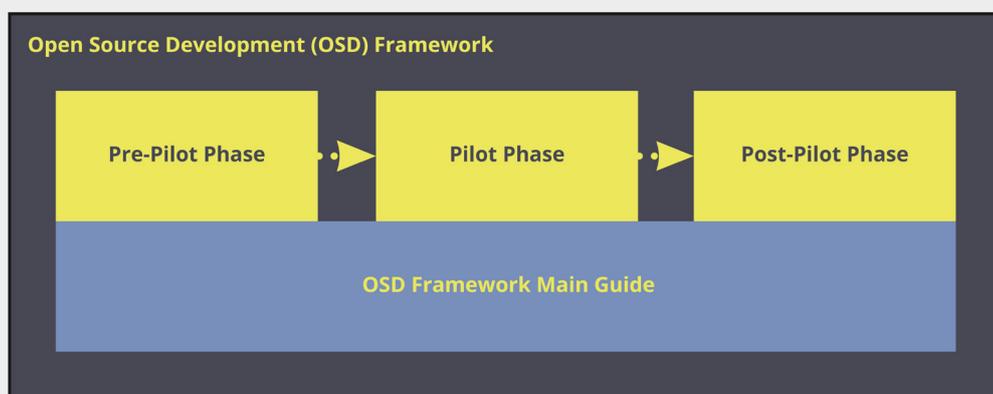


Figure 1: OSD Framework components

1.6 The OPEN_NEXT deliverables map diagram

The 19 partners of the OPEN_NEXT consortium are working collaboratively to develop, facilitate and practically demonstrate a collaborative product development ecosystem for SMEs and consumers. This is achieved through high efforts in four different dimensions:

- The design and demonstration of OSD collaboration mechanism
- The development of the required Information Communication Technology infrastructure
- The business models and strategy
- The establishment of sustainable value creation for participants in the C3

As shown in Figure 2: Deliverables map, D4.1 ‘First release of open-source business model development framework’ and D5.1 ‘Open-source sociotechnical design components’ provide the basis for the present deliverable. This ensures that the common efforts, of the work packages with the strongest relation to the pilots, are merged and the findings and insights are combined. This combined framework generates requirements for D3.2 ‘Platform Demonstrator’, D4.2 ‘Second release of open-source business model development framework’ as well as D5.2 ‘First release of Prototyping Improvement Logic’ and helps to elaborate them more specifically in the coming months.

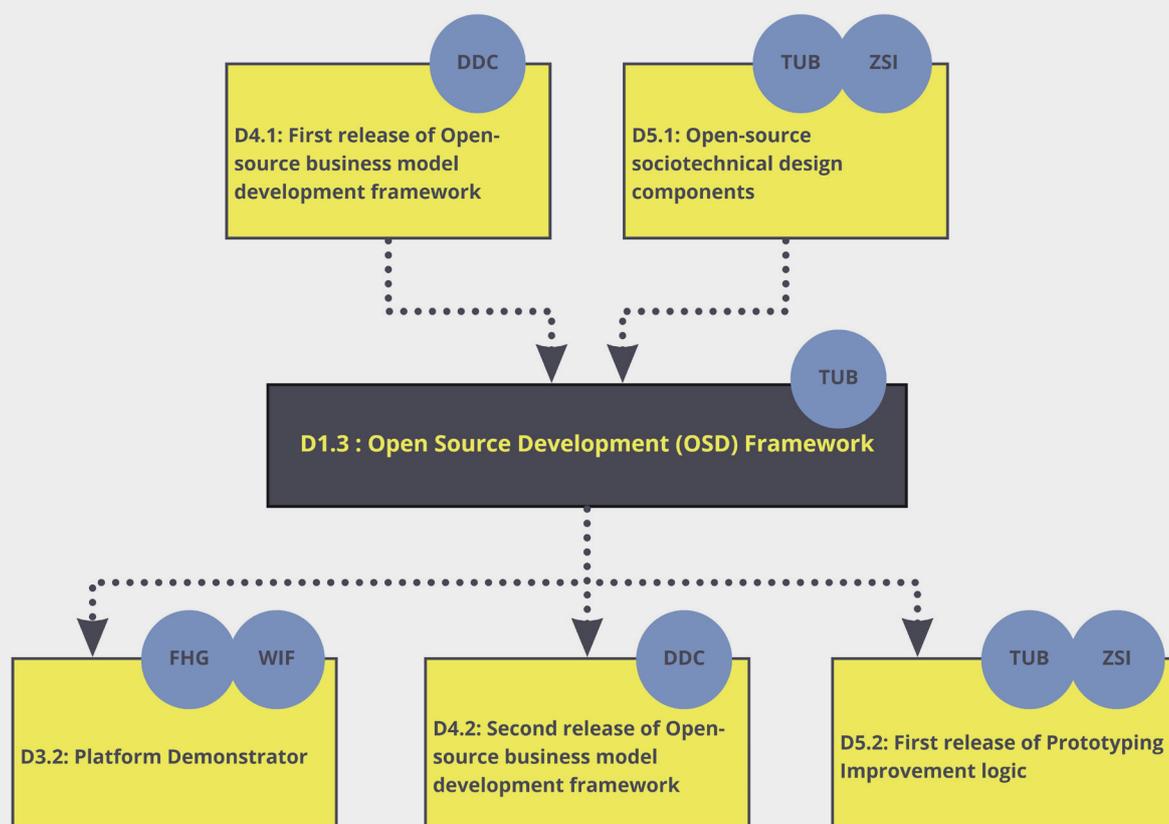


Figure 2: Deliverables map

1.7 Timeline

The OPEN_NEXT OSD journey is designed to run over a duration of twelve months, this will be tested in the OPENNEXT pilot and demonstration phases. We currently propose a duration distributed between the three core phases as follow:

- Pre-pilot phase: two months
- Pilot Phase: nine months
- Post-pilot phase: one month

1.8 OSD Framework formats

This PDF-document is the first version of the OSD framework and functions as the general description of the OSD journey where the proposed steps are now tested as part of the OPEN_NEXT pilot study with the six SME partners, three labs together with the local and online communities. To complete the OSD framework, toolkits, models, platforms and status dashboards will complement the process at a later stage in the project (please refer to the next section (future inclusions)).

During the course of the project, two instructive versions will be created based on this framework.

- **OSD Framework: OPEN_NEXT pilots’ version**
A shorter tailored made instructive version is produced to function as a guideline for the ongoing OPEN_NEXT pilot phase. This is to be provided to the SME-Lab pairs participating now as project partners.
- **OSD Framework: Dissemination version**
An updated complete final version will be produced as a dissemination version at the end of the project. This version will be designed in an instructive playful manner intended for the independent use of future SME/labs interested in participating in the OSD journey.

1.9 Future inclusions

This section introduces currently under development toolkits, maturity model, collaboration and documentation platform, dashboard as well as the generation of a service pitch for the Labs.

Open product business toolkit

As part of WP4, a toolkit for open-product business is currently under development to address the general strategic challenges associated with OSD. This toolkit will offer tools for the development of suitable business models for use within the participating companies as well as suggestions for the provision of business model development by consulting companies.

Company Community Collaboration Maturity Model (C3MM)

As part of WP2, an effort to create a model to assess the maturity level of active collaboration between SMEs, Labs, and open design communities is ongoing. The model is intended to provide the means to identify concrete strategic measures towards achieving a higher maturity stage. This will support the maximizing of economic, social, and sustainability benefits of company-community collaboration (C3). A testing of the initial version of the model is planned during the OPEN_NEXT pilots and then demonstration phase with twelve SMEs. C3MM will be added to the OSD framework as a tool to support collaborative open source product development.

OSD status report dashboard

As part of WP2, great efforts are made to create a design process facilitation dashboard. Delivering an OSD process model touches upon fundamental questions in OSD and the larger field of design science. It requires grasping what success in OSD means, what fac-

tors contribute to it, and how to provide a measure of these factors based on file versioning information. The developed dashboard will be installed as an add-on on OSD repositories hosted in Github and Wikifactory. It provides project status as well as delivering concrete recommendations derived from actual practices. Once again, the dashboard will be tested during the demonstration phase of the project.

Wikifactory platform

As part of WP3, the project partner and platform owner Wikifactory is working towards the creation of an online domain to support OPEN_NEXT SMEs when it comes to the technical and process documentation. These efforts directly foster information and experience preservation, as well as support, facilitate peer-to-peer sparring, knowledge sharing, and support between participating SMEs and Labs. The ongoing solution ideas for the platform include 1) interoperability using import/export tools, 2) documentation & guide support through structural templates, 3) support community management with skill-based collaboration concept and 4) collaborative production engineering and manufacturing support by finding and connecting to manufacturers. The outcome of this experience will be evaluated at the end of the OPEN_NEXT six pilots and recommendations and templates will then be added as part of the OSD framework.

OPEN_NEXT project case examples

During the pilot study of OPEN_NEXT, six SMEs from the sustainable mobility, consumer electronics, and furniture industries are pairing together with Fablabs /maker spaces in three clusters (Berlin, Amsterdam and Copenhagen) to collaboratively take the OSD journey. This will be followed by a second batch of twelve SMEs joining the existing three clusters as well as an additional cluster in Vienna. As part of WP4, the 18 OSD journey will be well documented including lesson learned and best practices to serve as examples supporting the future OSD journey participants.

2 Pre-Pilot Phase

2 Pre-pilot phase

“Interested in open collaborative product development? Find the right match, align your vision and strategy and get prepared to dive in.”

To engage in OSD, the involved participants (SMEs, Labs, community members) need to find an attractive collaboration opportunity as well as potential partners sharing a common vision or interest in reaching a certain goal. This phase aims to:

- Promote the OSD collaboration opportunities through putting forward your key contribution (lab side) or project idea, customer needs and assumption (SMEs, community members)
- Prepare the OSD participants both individually and together through the three-steps OPEN_NEXT Primer checklist to prepare both the SMEs and the labs for the common journey ahead of them (see D4.1)
- Facilitate a pre-pilot boot camp to align visions, finalise project plans including resource allocation and budgeting.

The pre-pilot phase runs approximately for around two to two and a half months.

Current status

At this stage, SMEs involve in detailed planning to engage in C3, which allow them to be able to exchange, contribute and benefit in a meaningful way from collaboration with Labs and community members. On the other hand, fabrication labs engage in detailed planning how to open their doors to business partners offering key services and tools for OSD.

Pre-pilot challenges

Now four main questions arise in particular: ‘How can interested parties in OSD find each other’, ‘how can the OSD participant align their individual visions towards a common vision and coherent project idea’, ‘what are the individual and mutual preparation needed to guarantee a smooth effective collaboration’ and also ‘how can the collaboration project be set up from a project management point of view (technical preparation follows in pilot phase)?’

Pre-pilot outcomes

At the end of the pre-pilot phase, a complete project plan is prepared including a concrete definition of the project goal, resource allocation, budget, roles and responsibilities. This follows an intensive preparation phase following D4.1 OPEN_NEXT Primer checklists.

Pre-pilot roadmap

The activities in this phase can be divided into three main thematic consecutive blocks. The first block ‘*OSD collaboration opportunity*’ covers the necessary steps needed to shed the light upon potential collaboration. This requires each of the participants to move in the right direction. The Lab as the facilitator of the OSD is to encourage preparing a service pitch demonstrating their facilities and provided service. To create the desired impact, the service pitch needs to reach the target audience that could potentially join a C3 community through the website, social media, related conferences and platforms. On the other hand, SMEs need to exhibit their project idea and reach out to potential partners as well as tap into existing online communities. In doing so, the different parties increase their chances to find potential collaboration partners to be able to move one more step towards OSD.

The second block ‘*OPEN_NEXT Primer checklists*’ are the first official steps the potential OSD participants take together to confirm their match and prepare themselves both independently and together for the OSD journey. These checklists were developed by the project partners in WP4 and were described in depth in D4.1 ‘*First release of Open-source business model development framework*’. This deliverable provides a very structured, well-documented process where each of the checklists is paired with a guideline, which is intended to be read first. The filling of the checklists has three stages¹:

- “*Finding the right match*” individual checklists (please refer to D4.1_Section 1A (SME) and 1B (labs) which will be filled out by the SMEs and lab individually to better understand the OSD context, set their expectation and allocate resources
- “*Seeing eye to eye*” joint checklist (please refer to D4.1_Section 2 (Both) through which the individual elements will be combined and discussed
- “*Getting off on the right foot*” individual checklists (please refer to D4.1_Section 3A (SME) and 3B (lab) where a single vision for the challenge ahead will be formulated

The step-by-step process is presented graphically in Figure 3: Pre-pilot flowchart.

After match confirmation, participant preparation for the OSD journey, the participant forms a project team and kick-off by entering a one-week ‘*Pre-pilot boot camp*’ as the third block. The main aim is to collaboratively engage in a series of workshops and sessions to pitch the project idea, get consultation and feedback, prepare

1 Remark: In both the OSD framework: OPEN_NEXT and dissemination versions the checklist will be included as part of the framework. In this deliverable, we are referencing to Deliverable 4.1: First release of Open-source business model development framework submitted on the 31.05.2020 to the project EC portal by the responsible partner the Danish Design Center (DDC).

the operational plan including the division of roles and responsibilities as well as the financials and contracts. At the end of the boot camp week, the team prepares a single page challenge brief. The brief sets the stage for the OSD journey participants and it is an outline of the project idea to start forming a community around at the beginning of the next phase. It provides concrete orientation and good inspiration to kick-off.

Reflection

At the end of this phase, the OSD journey participants should be well prepared as well as ready to start the pilot phase. It should be ensured that the checklists are filled out, the challenge brief is prepared and reviewed and a project committee approves the project plan.

At the end of the pre-pilot phase, a complete project plan is prepared including a concrete definition of the project goal, resource allocation, budget, roles and responsibilities.

Summary

1. Prepare a service pitch and advertise strongly (Lab)
2. Share your project idea with potential collaboration partners and reach out to target Labs and online community (SME)
3. Fill out the OPEN_NEXT Primer checklist
4. Prepare the project plan, agreements and get approval
5. Fill out your challenge brief and share it with current and future participants as an onboarding and orientation strategy

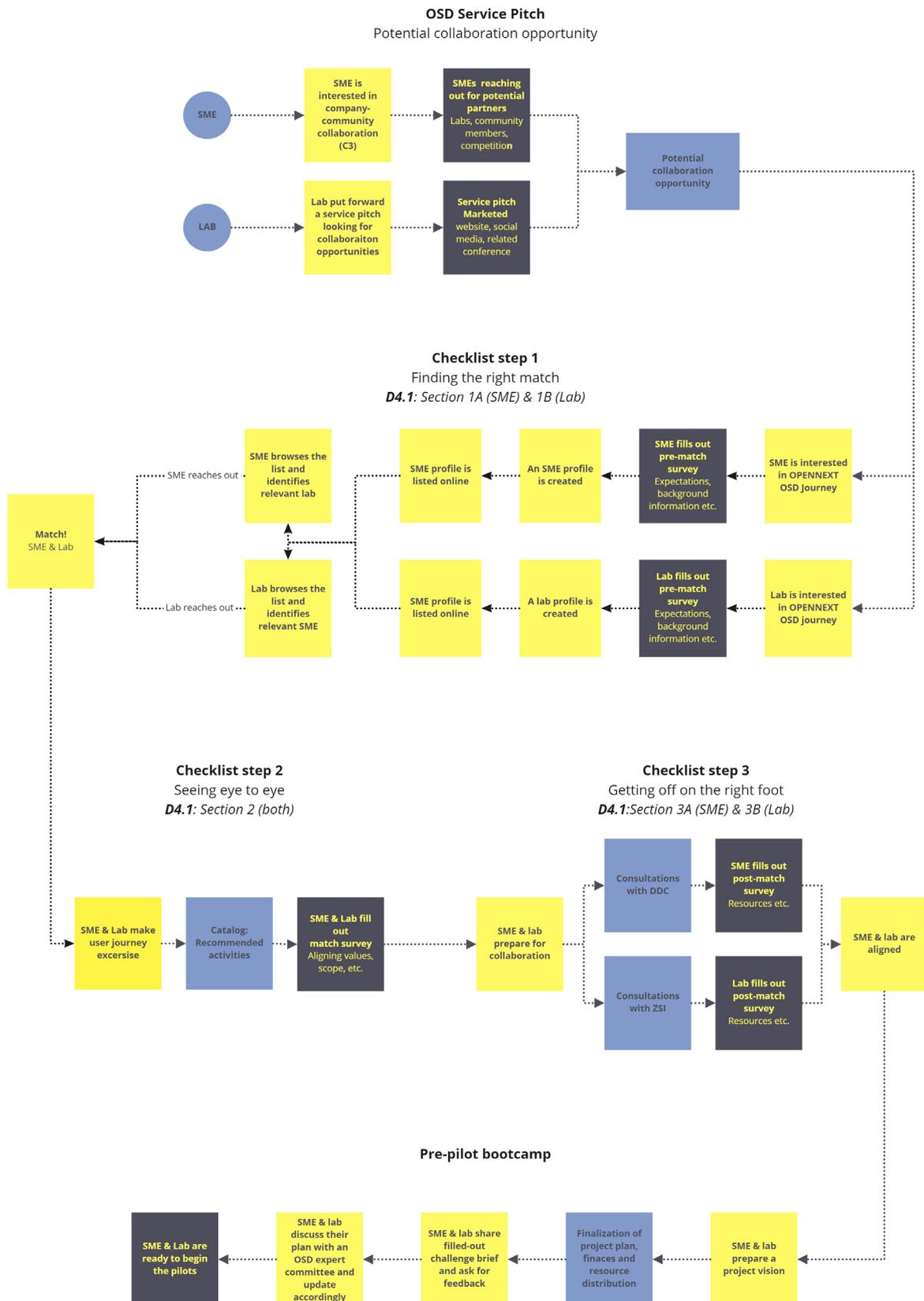


Figure 3: Pre-pilot flowchart

3 Pilot Phase

3 Pilot phase

In the pilot phase, the focus is on how OSD Labs, SMEs and their communities can work together to reach the product realisation phase which means that the developed solution has reached the Technology Readiness Level 6 (TRL 6). It is important to note that not only the physical product must be considered, rather the Product-Service-System (PSS), which does not see products only as what is physically present, but explicitly embed them in C3 practices to help shape them. This means that a PSS prototype integrates tangible and intangible elements of the overall system in a single prototype.

In the OSD context, product development encompasses a multitude of activities of operational management, knowledge management and continuous improvement. These activities bring together very different disciplines, such as design, engineering, natural and social sciences. The development process within this pilot study starts with the initiation of a project for a new product generation and ends with the evaluation of a product specifications. These specifications include among others information concerning the applied technology and subsystems as well as their share of carryover and new development. This allows a valid evaluation of the planned product regarding relevant parameters such as manufacturability, necessary resources and the technical and economic risk.

The differentiation of the phases is based on the degree of maturity of the solutions developed for the vision described in the pre-pilot phase and the related activities for developing and validating it. Based on the artefacts and elements of the solution to be worked out for each phase, it is possible to determine where one is in the current product development project. It is not necessary to start from scratch, as it is possible, for example, to build on previous projects. However, it is advisable to consider the phases in this sequence for a better decision making and optimal use of resources.

On the following pages, the different phases are described in more detail and serve as an overview of the processes of the OSD project from the point of view of the cooperation between the OSD Lab and the SME. The contents of the illustrated flowcharts of the phases are based on D5.1 ‘*Open source sociotechnical design components*’ and provide a first outlook on D5.2 ‘*First release of prototyping improvement logic (PIL)*’.

Each of the phases is structured according to the seven steps of problem solving which have a fractal and iterative character:

1. Analysis of the situation
2. Problem containment and formulation of the objective
3. Synthesis of alternative solutions
4. Analysis and selection of the solutions
5. Assessment and consequences analysis
6. Decision and implementation
7. Reflection and best practices

The individual elements in the flowcharts are shown in a chronological order, with no fixed temporal relationship. In addition, the activities are sorted by responsibility (OSD Lab, SME or both together). The presented processes and assignment of responsibility functions as a general reference for the processes of the OSD project. For the individual pilot, the process must be adapted according to local conditions, resources and objectives.

3.1 Phase 0: Preparation

“Prepare everything for a great collaboration with the community”

Before the OSD development project can start, the stage for collaboration must be set. This means that all the requirements for communication and teamwork with the community are clarified on a technical level including the preparation of all tools. In addition, the recruitment of potential participants accelerated. This phase complements the process from D5.1 ‘Open source sociotechnical design components’ and takes about one to one and a half months.

Current status

After a successful matchmaking between OSD Lab and SME, joint cooperation terms were defined and conditions were checked. Based on this, the partners worked out a common plan for the development project and visualised their vision such as in form of a challenge brief. Furthermore, a core team was defined and responsibilities were clarified. Together with the OSD experts from OPEN_NEXT everything was optimised once again and is now available for further steps.

What are the challenges?

Two questions arise: ‘How can the OSD journey participants work together on a technical level’ and ‘how can the Lab and SME attract participants and community members for the OSD project?’

What are the phase outcomes?

At the end of ‘Phase 0: Preparation’, there is a portfolio of func-

tioning collaboration tools which enable communication and collaboration to be guided and boosted. Special attention is paid to the platform for exchanging technical data of the solution to be developed. There is also a set of mainly digital advertising materials and a recruitment plan.

Roadmap

The activities in this phase can be divided into two thematic blocks. The first part covers all necessary steps to enable collaboration at a technical level. This includes in particular the development of a digital collaboration portfolio. Among other things, it requires a platform for collaborative work, which allows data to be stored, exchanged and jointly processed. This also includes the continuous documentation of the developing solution and the development process. For this purpose, suitable materials, structures and templates are prepared, adapted, uploaded and implemented on the platform. In doing so, best practices, templates, structures, tools from previous, well-run projects should be used, so that not all materials have to be created from scratch. Furthermore, the tools for effective communication between the teams and with the core team must be provided and adapted.

In order to ensure that the technologies built up are fully utilised, the core team needs to be instructed and trained before starting the OSD project. In addition, training materials, best practices and FAQs need to be compiled to ease the acceptance of the tools for the community. Along with the digital tools, the system that provides access for community members to maker spaces machinery must also be prepared. At the end of the phase, it will be ensured that access to the platform, tools and workstations is enabled.

In parallel, the second part focuses on the development and implementation of public relations activities in order to find suitable participants for the collaboration. In addition to the development and provision of advertising material for the individual project, this includes the integration of existing communities of the Maker spaces and SMEs as well as activities to attract new members. For example, a special website or event platform can be set up for an open call. These activities will be carried out in an adapted form throughout the entire project to ensure that the problem solving team (PST) is optimally composed and strengthened for each phase.

Since the different activities also require different competences, the consideration of the PST plays a crucial role in the process. Thus, creative people can make a valuable contribution in the activity of generating alternative solutions. It is beneficial to cover a wide variety of background knowledge in the PST to avoid tunnel vision and to overcome limitations.

Of course, the planning of an official OSD Project Kick-off event should not be forgotten.

Reflection

At the end of the phase, the execution of the individual steps should be reflected upon and the results checked. Are all technical requirements met and are tools and materials available for collaboration? Is the outreach of the PR activities large enough and is there enough response to start the OSD project?

Summary

1. Prepare and introduce options for collaboration technologies
2. Show the world what your vision is and who you are
3. Reach out to people and motivate them to join your journey
4. Plan and organise an official OSD project Kick-off event

Phase 0: Preparation "Prepare everything for a great collaboration with the community." **1 month**

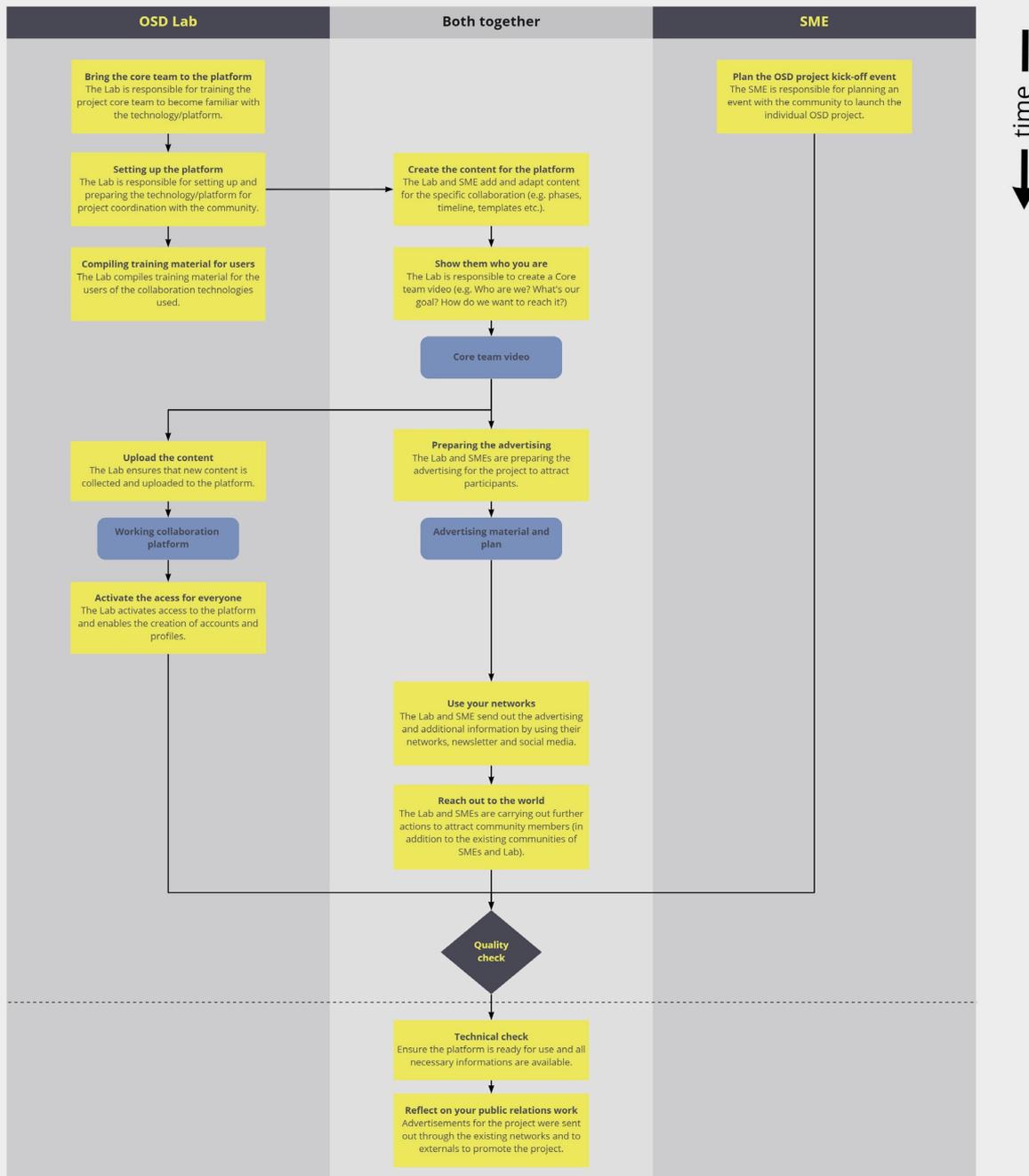
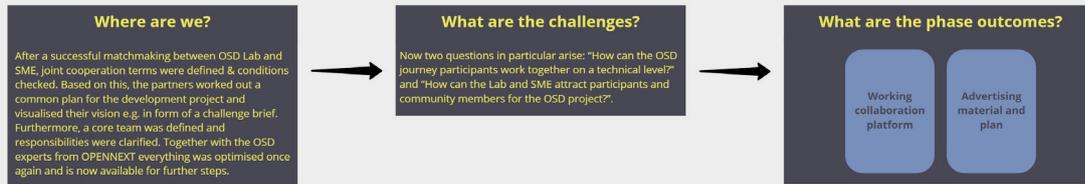


Figure 4: Pilot - Phase 0: Preparation flowchart

3.2 Phase 1: Analysis

“Digging deeper into your challenge area and gathering new perspectives”

With ‘Phase 1: Analysis’ the OSD project finally begins. This includes further exploring the initially formulated challenge and looking at it from new perspectives in order to gain a better understanding of the underlying issues, needs and target domain. Also, the pilot’s analysis teams consider what the various partners already know and what needs to be discovered in the field. It also helps to examine potential markets and the competitive situation as well as to develop consistent future scenarios. Most importantly, the identification of possible reference products and reference processes plays such a significant role in order to reduce the development time and minimise risks. To complete the initial analysis, roughly one to one and a half months are needed.

Current status

At this stage, the collaboration technologies are ready for use and the public relations activities have ensured that there are enough potential participants for the OSD project. The kick-off event has been planned but has not yet taken place, which means that the communities are only partially involved in the project and not aligned yet. The knowledge for certain topics or parts of the product is widely distributed and usually only available to individuals. Furthermore, there is no knowledge repository where all necessary information, data and references are available and can be openly shared.

What are the challenges?

This raises the question of *‘how can basic knowledge about the background to the challenge be gathered and made available to all?’* This is especially important for new collaborators joining over the course of the project, so that all the basic knowledge needed is easily accessible. Another challenge is to motivate interested people to collaborate in the OSD project and to involve stakeholders.

What are the phase outcomes?

At the end of this phase a knowledge database with the initial documentation of the existing knowledge (repository like e.g. a Wiki) will exist. This database will be based on defined research fields to answer all important key questions that can be derived from the task definition. Additionally, there will be a list of open questions for upcoming interviews to deepen and broaden the knowledge and a Continuous idea storage (CIS) to archive all ideas that arise through all phases.

Roadmap

One of the important points in this phase is the OSD project kick-off event. It aims at particular encouraging active participation in the project community. For this purpose, the open source vision and values are shared, the challenge is collectively reviewed and the desired impacts debated. Having the overview of the schedule, structure of the project as well as an introduction on how to use the collaboration platform including access details, the teams can start.

The second part of this roadmap deals with building and maintaining the knowledge repository. For this purpose, the research framework is adapted to create a first rough structure and to define the key questions to be answered. The SME provides information and also mentors with specific expert knowledge to whom the community can turn at this phase. It is also recommended to invite the community to the SME’s workshop to see what the experts are working on and to provide insights into everyday life. At the same time, the Maker spaces manages the knowledge gain as well as the documentation of it and supports the analysis teams with suitable methods and tools.

Based on the knowledge gathered, a list of open questions which derive from the analysis will be compiled. This can be addressed in upcoming interviews with for example users, customers and manufacturers in subsequent phases, whereby the initial knowledge base is continuously expanded.

Besides, at the beginning the Continuous Idea Storage (CIS) is set up to archive all ideas for PSS solutions that are generated during all phases. In this way, ideas that are not pursued further are also available as inspiration for others during and after the end of the project.

Reflection

It should be ensured that the knowledge of the individual teams is shared at the milestone, all key questions are adequately answered and the information is documented.

Summary

1. Build an online knowledge repository
2. Customise the research framework for the individual OSD project
3. Organise and support the research teams
4. Create a Continuous Idea Storage (CIS)
5. Maintain a list of open questions for upcoming interviews
6. Share the collected knowledge openly

Phase 1: Analysis "Digging deeper into your challenge area and gathering new perspectives" **1 month**

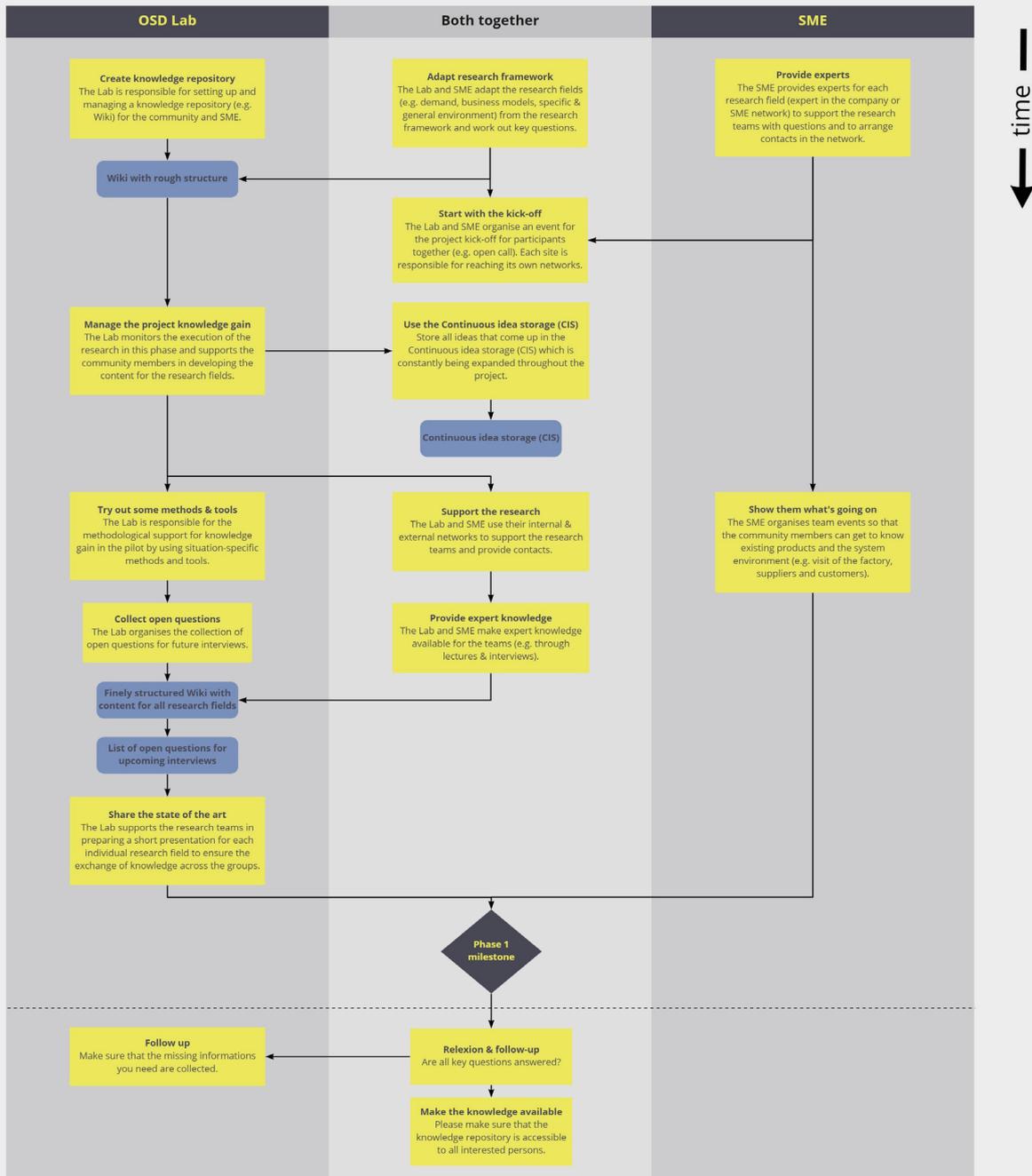
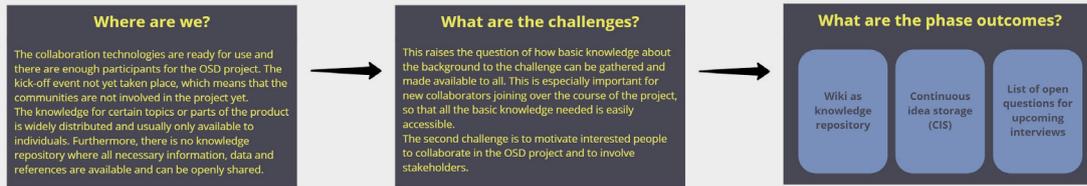


Figure 5: Pilot - Phase 1: Analysis flowchart

3.3 Phase 2: Identifying potential

“Identifying new insights and looking for exciting opportunities”

Over a period of about one and a half months the teams identify and characterise potential stakeholders (e.g. customers, users), empathise with their situation (e.g. physical and mental limitations) and narrow down the design challenge with user stories. To summarise insights from this and previous phases the concept of a product profile is introduced.

A product profile defines a demand situation in the market, emphasises the relevant use cases, characterises the future product in its main properties and considers the customer, user and provider benefits. In addition it lists opportunities as well as risks and includes the boundary conditions. That means a product profile makes the intended provider, customer and user benefits accessible for validation throughout all future phases and explicitly specifies the solution space of possible products and related services.

Current status

At the beginning of this phase there is an initial, reliable knowledge repository, which will be continuously expanded in the course of the project. It also serves as a basis and entry point for new members of the PST. Furthermore, an initial set of questions for further interviews and possible solutions was created during the analysis phase. What is missing now is an extended basis for decision making (e.g. knowledge about users). This is needed for all the following phases of the OSD process.

What are the challenges?

There are three major questions to be answered here: *‘What are the actual underlying problems behind the challenge defined in the project vision’, ‘how can the needs and requirements of the target users, customers and other stakeholders be identified and clearly documented’* and *‘how can market potentials be systematically uncovered?’*

What are the phase outcomes?

During this phase, the data generated from interviews, surveys and observations as well as the information and insights gained are stored centrally. Based on this, the bigger picture of the actual problem to be solved is made accessible by means of elaborated, evaluated and sharpened product profiles. With the help of personas and media presentation these are made more comprehensible. Of course, a collection of all created product profiles is created, which are available beyond the OSD project.

Roadmap

In the beginning, the teams must be reviewed and, if necessary, adapted to obtain PST optimised for the task. This should be actively encouraged. Also, the persons involved in the PST should be placed on the same level as the employees in the company. In order to enable structured cooperation, methods of agile product development such as Scrum are introduced and applied in the further course of the project. Likewise, a purposeful working method should be methodically supported.

Regarding the content, the focus is on the elaboration, evaluation and selection of product profiles. For this purpose, the concept of a product profile is explained to the teams and discussed. The elaboration of a wide range of profiles is explicitly desired and is supported by situation-specific methods and appropriate tools. For this purpose, further interviews and surveys are conducted and observations are analysed. The teams use the insights gained to iteratively develop the profiles. In a second step the profiles are clustered, combined and the most suitable ones are selected.

At the milestone, a selection of the best product profiles will be presented and supported by additional media (e.g. short video/animation). In addition, a collection of all product profiles developed, including those not selected, will be made publicly available. To motivate and encourage teams to use the tools and deliver great pitches, an award system can be used. In contrast to financial participation from the fourth phase onwards, the work of the teams should also be recognised in this and the next phase.

Reflection

This phase will conclude with an evaluation of the results and the mood of the teams. In the course of this, the company selects which team will continue working with which product profiles. To support the teams in a targeted manner, team mentors are selected as contact persons for each specific team. The Maker spaces ensure that the feedback from the milestone is used to refine the product profiles and that the documentation of the development process is completely shared online.

Summary

1. Form appropriate problem solving teams (PST)
2. Get the PST out on the street to get an idea of the situation
3. Support creativity to develop a wide variety of product profiles
4. Select the best product profiles and assign team mentors
5. Ensure development process documentation and share all knowledge gained

Phase 2: Identifying potential "Identifying new insights and looking for exciting opportunities" 1.5 months

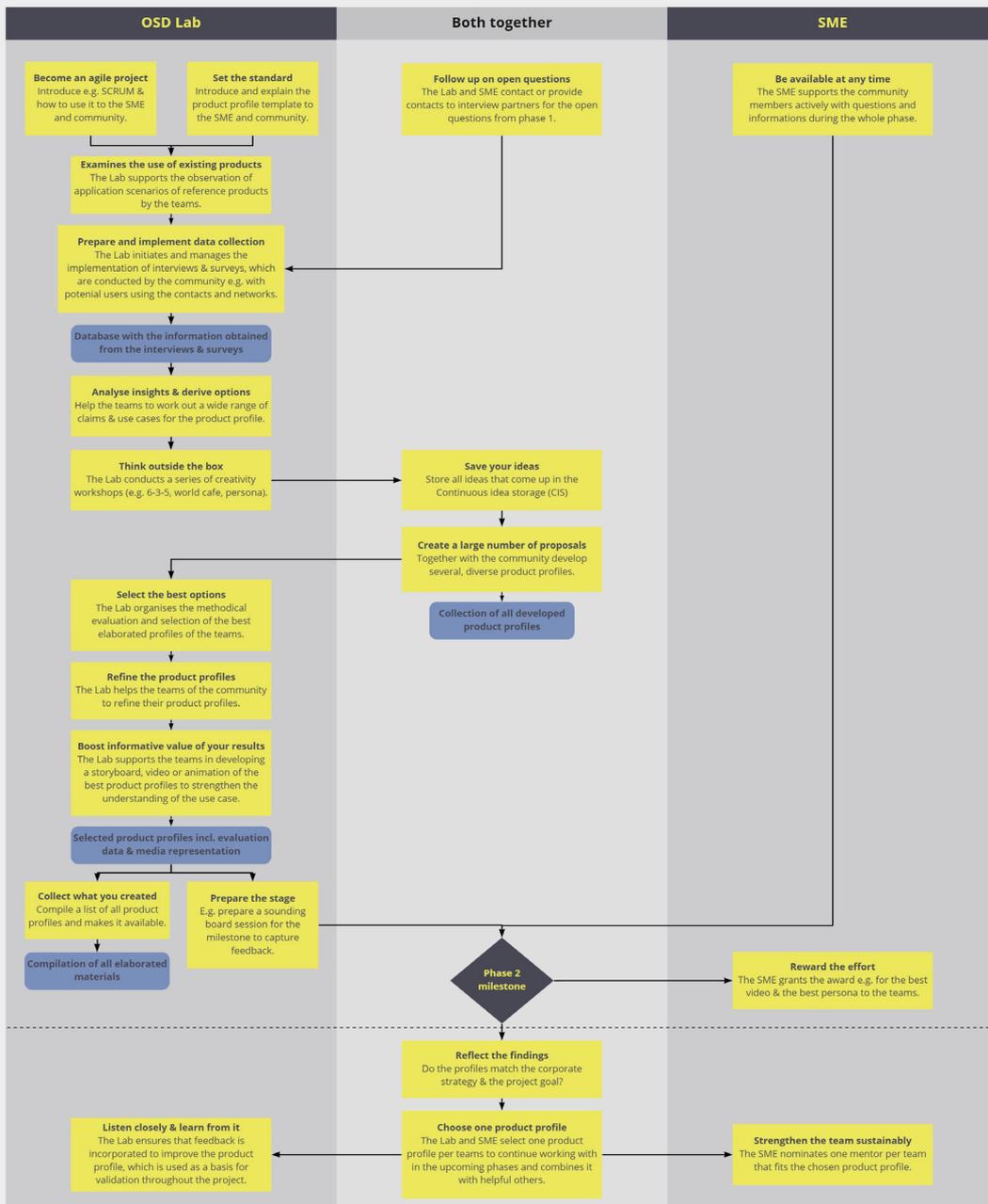
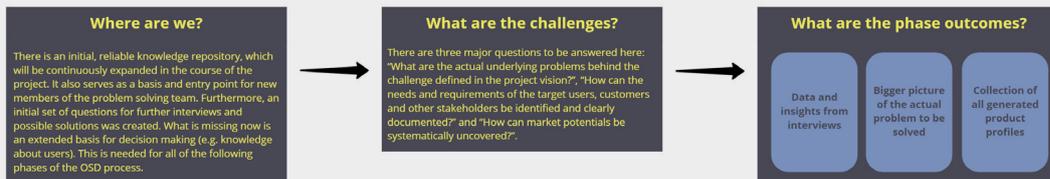


Figure 6: Pilot - Phase 2: Identifying potential flowchart

3.4 Phase 3: Conception

“Turning your idea into something tangible you can experiment with”

In the next one and a half to two months we will finally move from the identified and well analysed problem to possible solutions. By generating ideas for product service systems and testing with a small group of users using early physical prototypes, the solution space is systematically described. The best ideas are then turned into concepts by combining solution principles and focusing on details. At this stage creativity workshops play a key role in promoting inventiveness and unconventional thinking.

Current status

The needs and benefits of the stakeholders are analysed and recorded in the product profile. The overall problem and target group were also defined. Each problem-solving team now has a different focus and is assisted by an individual mentor of the SME.

What are the challenges?

So far there are no elaborated and validated solutions to the problem described. Therefore, ideas must now be generated and based on these ideas, concepts must be developed and tested. Furthermore, basic knowledge of the principles of prototyping such as the combination of artefact and confrontation method) is not particularly available among individuals. Also the way to make a good prototype must be taught.

What are the phase outcomes?

By the end of this phase, a series of initial physical representations will be presented as prototypes of several concepts. The functionality of the device/system is demonstrated in a workshop environment. Besides there is a resource and cost plan for further iterations in the upcoming phase. For this purpose, some technical workshops have been carried out (e.g. 3D printers, laser cutters, etc.) and design sprints for testing and validation with users are conducted. Furthermore, a collection of all developed ideas and concepts including evaluation and gathered data will be created.

Roadmap

In the beginning, there is an introduction to prototyping including theory, methods, tools and machines. A workshop on evaluation is also part of this. Afterward the Idea phase starts with the development of solutions for the product service system. For the exploration, a creative mindset is promoted and the whole process is methodically supported by the OSD Lab. In addition, ideas from the CIS will be considered. All ideas are then clustered, evaluated and the best ones selected for the next step.

In the concept phase, the selected ideas are further developed into concepts, which are implemented and tested with the help of design sprints. The iterative development of the physical representation including the prototypical implementation of the related service plays a fundamental role in this process.

Similar to the previous phase, the milestone will involve pitching and evaluating the concepts selected by the teams as well as openly sharing the collection of all the materials developed. This ensures that the documentation of the product development process and the solutions developed are accessible.

Reflection

Finally, the SME evaluates the results obtained and selects which concepts are to be pursued further. Based on this, the teams and their mentors develop a plan for the next steps. This plan should include, among other things, resource planning, a target agreement including a reward system and a possible adjustment of the problem-solving team for optimal implementation of the selected concept. The OSD Lab continuously ensures that the feedback is incorporated and missing information is provided.

Summary

1. Show and demonstrate best practices in prototyping
2. Support the idea generation and concept development with suitable methods and tools
3. Encourage the development of the first physical prototypes
4. Running design sprints to test assumptions
5. Develop the solutions for the product service system iteratively
6. Share lessons learned, best practices and above all, failures

Phase 3: Conception "Turning your idea into something tangible you can experiment with" **1.5 months**

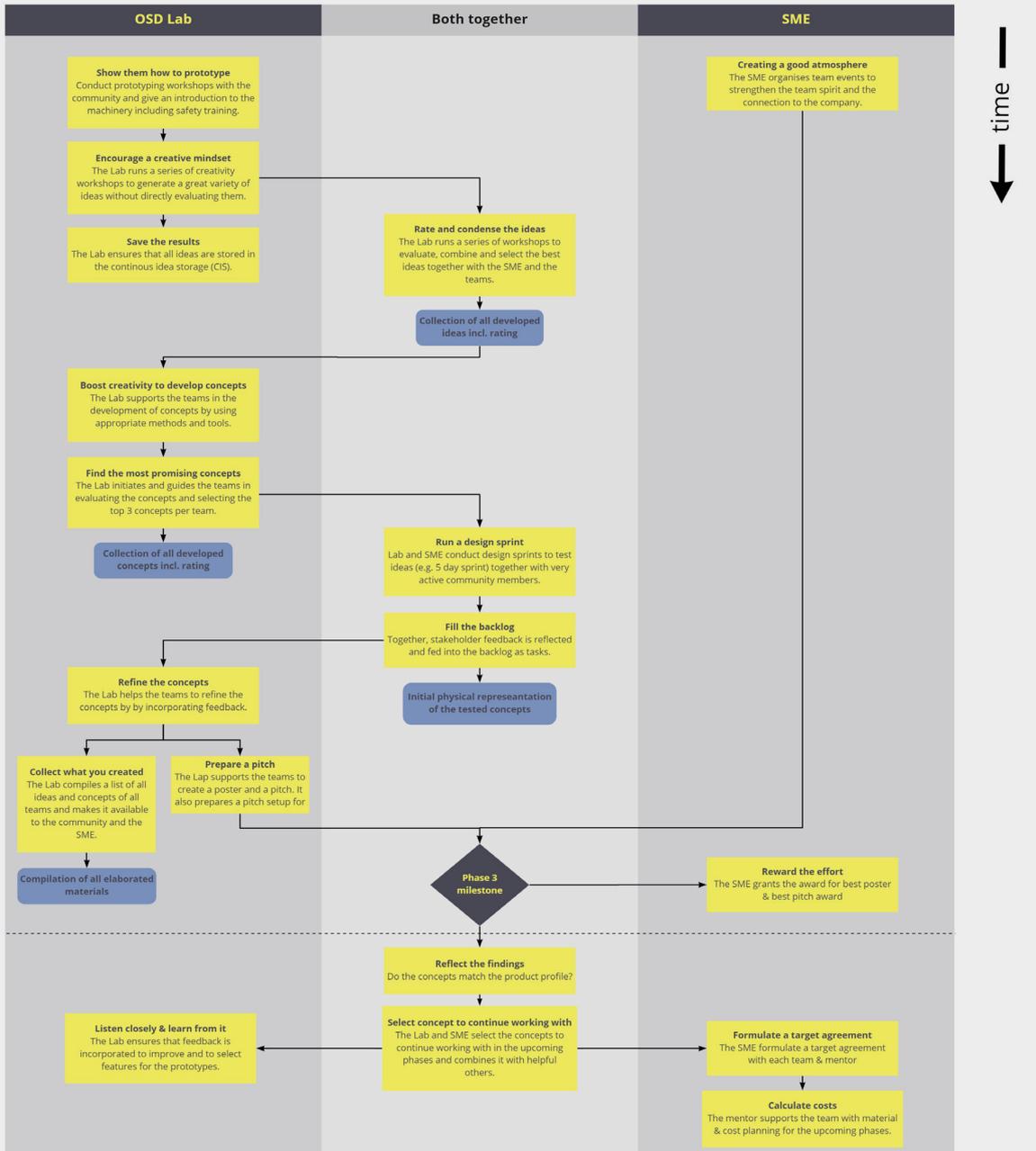
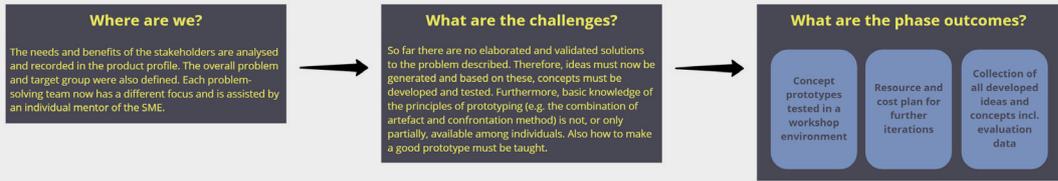


Figure 7: Pilot - Phase 3: Conception flowchart

3.5 Phase 4: Specification

“Convert solution variants into concrete products”

Within the next two months, the knowledge gained through the phases and at the milestones continuously flows into further development. The systematic integration of users and other stakeholders in this process is used to increase the maturity of the prototypes to be able to integrate them into the concrete system environment.

Current status

The concept was selected, evaluated concerning the product profile and the prototype was successfully tested in a workshop environment. Also, suitable functional principles were documented so that the solution can be further elaborated.

What are the challenges?

Now the concepts must be more and more adapted to the real users and the prototypes to the real system environment. In some cases, special technologies are required to manufacture and implement prototypes. This may require the involvement of new cooperation partners. Furthermore, in this phase, more attention must be paid to the quality of the technical documentation to ensure the benefit for the open source community.

What are the phase outcomes?

At the end of the current phase, there will be a prototype that will be validated in a simulated relevant environment with a small group of users to meet a requirement for the target group. For this purpose, CAx and digital manufacturing tools are used to document and evaluate different designs. Furthermore, initial product documentation is worked out and shared openly.

Roadmap

Based on the findings and existing prototypes, an optimised PSS solution is developed with the help of further design sprints. This means that improved physical prototypes are built and appropriate service concepts for the hardware are detailed, which contributes to iterative improvement through continuous validation using the product profile.

An important point is an evaluation under Laboratory conditions with test users. The test rounds must be well prepared and the factors to be observed need to be specified. The test environment must be prepared accordingly, test groups selected and invited. After the execution, the results are evaluated and the insights gained are used to improve the PSS. Of course, failures should also be documented to make better decisions in the process.

To make the actual hardware design openly accessible to the public, the product documentation according to the DIN SPEC 3105 standard is initiated. This will enable, among other things, to make, modify and distribute the solution.

Stakeholders such as suppliers, customers, etc. should be invited to the milestone at the latest and the presentation of the developed solutions to as many employees of the SME as possible should be made possible. At the same time, additional participation possibilities for the teams should be worked out and discussed with the SME.

Reflection

After the milestone, it should be checked which features will be focused on in the next phase and which further partners have to be involved in the process to produce the prototype. In addition, the approach to cooperation between SMEs and the teams will be reflected upon.

Summary

1. Adapting PST to the new situation
2. Run more design sprints to refine the solution
3. Plan, prepare and evaluate under Laboratory conditions
4. Share the initial product documentation of the developed solution
5. Pitch to get even more valuable feedback
6. Never forget to celebrate achievements

Phase 4: Specification "Convert solution variants into concrete products." **2 months**

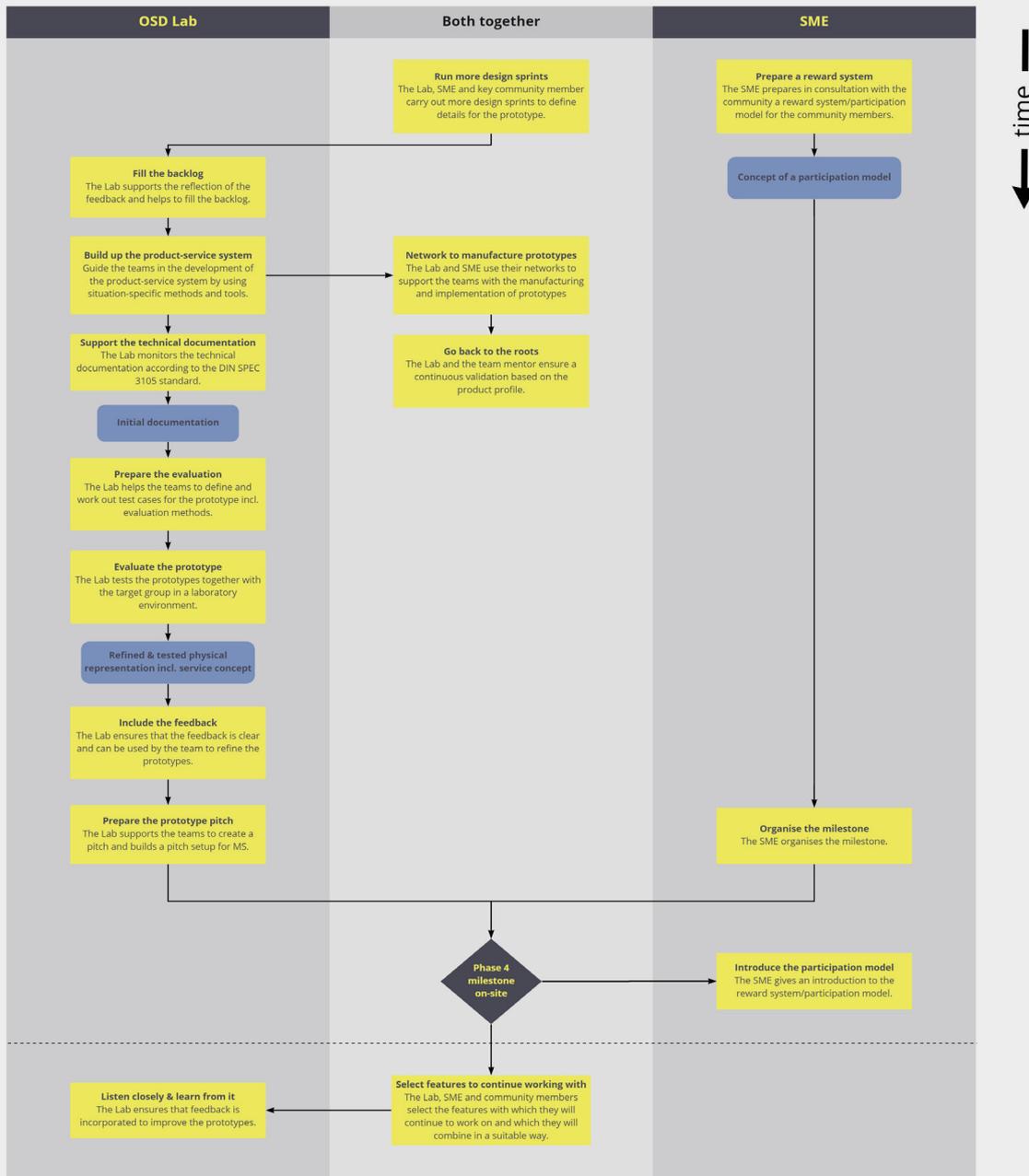
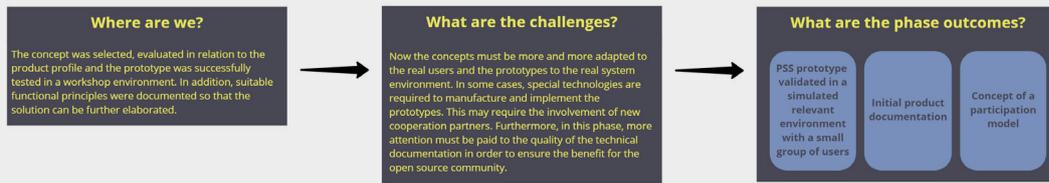


Figure 8: Pilot – Phase 4: Specification flowchart

3.6 Phase 5: Realisation

“Getting ready to launch your idea in the real world”

In the next two months, the teams will enter the critical phase. Because in the “real world”, additional influencing factors occur which have not been taken into account in the Lab. So set up a measurement and evaluation framework to gain further important insights into the socio-technical system. The improved prototype will enable the solution to be clearly articulated and its value to be demonstrated. It will also validate the feasibility of the PSS.

Current status

The first technical prototypes have been tested in a Laboratory environment and the associated service concept has also been prototypically implemented in an artificial environment. In addition, the technical documentation was started and relevant stakeholders for this phase were contacted.

What are the challenges?

So far, tests of the product service system in the real operating environment are missing. These are extremely important because people sometimes behave completely differently in everyday life and the technical system itself is at the mercy of new influencing factors which could not be observed or reproduced in the simulated environment. In addition, proof of the reproducibility of the technical system is still missing, which also requires complete and comprehensible documentation.

What are the phase outcomes?

The phase aims to have positively evaluated the prototype, integrated into the real target system, in the realistic environment of the target user group’s everyday life. In addition, proof of reproducibility with the intended production methods will be provided and the technical documentation will be finalised. Finally, the entire product development process of the OSD project would be analysed and documented so that it is possible to carry out further projects of this kind based on it.

Roadmap

The procedures in ‘Phase 5: Realisation’ is similar to the previous one. Design sprints are carried out to quickly test the changes and the prototype is further iteratively adapted to the knowledge gained. However, it is now being evaluated in a real-world environment. For this purpose, the data collection has to be re-planned in order to influence the everyday behaviour of the test users as little as possible. Accordingly, sufficient time should be planned for the planning and execution of the tests. Test persons should also

be invited early on.

The second objective is to adapt the hardware by intensively involving manufacturing stakeholders in the process. This also includes finalising the technical documentation so that everyone interested can manufacture the product.

Reflection

At the end of the fifth phase, it should be checked again whether everything is ready for a transition to Phase 6: Release, in which the prototype is redesigned and optimised for production.

As this is the preliminary end of the OSD project, all steps, activities and generated elements of all phases of the previous development process have to be reflected again. In addition, an individual reflection of the development process should take place at the OSD Lab together with the Maker community on the one hand and the SME including the employees who are even only slightly involved on the other hand. Based on this, possible next steps of the collaboration will be discussed. The OSD Labs will also work out future service offers.

Summary

1. Use your networks to support the PST concerning manufacturing
2. Prioritisation of the development of details to be worked out
3. Tests the PSS prototype in the real world with the target group
4. Update the documentation of the development process and the developed solution and ensure that all information is openly available
5. Reflects on the development project and derives next steps
6. Spread your enthusiasm for OSD

Phase 5: Realisation "Getting ready to launch your idea in the real world." **2 months**

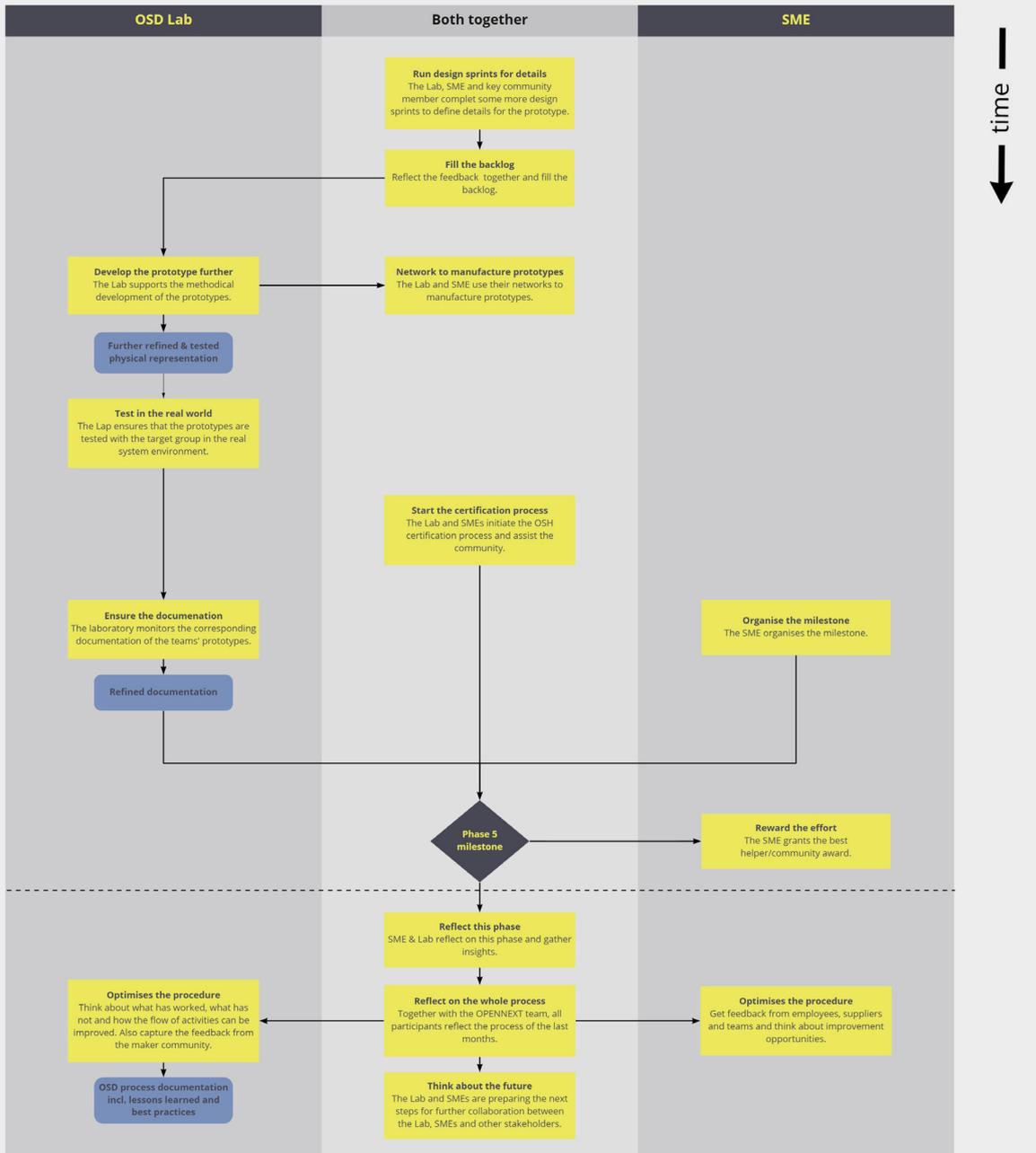
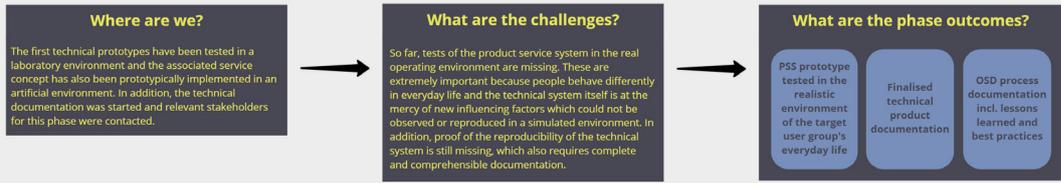


Figure 9: Pilot - Phase 5: Realisation flowchart

4 Post-Pilot Phase

4 Post-pilot phase

“OSD journey is approaching its end with a prototype tested in a real environment”

After finalising the product development process during the nine-month pilot phase, the OSD journey has reached its goal. As a well-planned collaborative project, a proper project closing process is required to ensure smooth professional handover as well as maximize the OSD journey outcome through proper knowledge preservation and reflection on best practices and lessons learned. The post pilot phase runs for approximately one to one and a half month.

Current status

During the pilot phase of the OSD journey, the team has gone through the six-step product development process where a prototype has been evaluated and integrated into the real target system as well as tested with users. The overall product development process excluding the release of the pilot (not the focus of this pilot) has been analysed.

Post-pilot challenges

The OSD journey is a defined project which brings together different organisations and stakeholders among some pre-set agreements were defined and needs to be fulfilled. This raised the need for a project outcome assessment, financial compensations, and proper handovers. Despite ongoing technical documentation during the piloting process, actual process documentation is needed to ensure proper project documentation and ease of future replicability. Additionally a reflection on the OSD journey in terms of outcomes and lessons learned is still missing including deciding on the way forward after the OSD journey.

Post-pilot outcomes

By the end of the post-pilot phase, a proper project handover will be done and all obligations including financials will be fulfilled. This includes an OSD outcome assessment against pre-defined criteria at the pre-pilot phase. A Project report will be generated and shared with all concerned participants of the OSD journey.

Proper documentation according to the guideline of the DIN SPEC 3105 (please check: [link](#)) will be prepared this includes technical and process documentation. Best practices and lessons learned will be documented and shared openly. A clear answer to what is next questions should be collaboratively found and agreed upon by all OSD journey participants.

Post-pilot roadmap

The post-pilot phase starts when the ‘*Phase 5: Realisation*’ is done. At this stage, the PST runs a real environment test with the real target user group. The feedback provided during the testing will then be incorporated by the related PST.

At the end of ‘*Phase 5: Realisation*’ of the pilot phase, the OSD team members enter a three-step post-pilot boot camp to systematically close the OSD project. Those steps include:

- Step 1 ‘*OSD outcome assessment and project closure*’ includes a proper handover and the fulfilment of the financial obligations.
- Step 2 ‘*Documentation and knowledge preservation*’ ensures the completion of all technical and process documentation of the OSD journey as well as the compliance with DIN SPEC 3105. These documentations are to be shared openly on several platforms to maximize their impact.
- In Step 3 ‘*OSD journey lessons learned and best practices*’ the OSD team evaluates the OSD journey and reflects on their experience. The best practices and lessons learned will then be documented and shared.

Reflection

At the end of the post-pilot phase, a collaboration closure has taken place. From agreement fulfilment, documentation, and OSD journey reflection, the team is now ready to close the project and make well thought decisions regarding the next steps.

OSD journeys are highly case-specific and therefore, decisions regarding what is next are highly dependent on the outcome, experiences during the OSD journey as well as the strategic goals and interests of the organisations and individuals participating. This includes the following:

- Continuation of the OSD collaboration
- Termination of the OSD collaboration
- A spin-off project /idea creation

Summary

1. OSD project outcome assessment and handover
2. Fulfilment of individual and mutual obligation and preparation of the financial report
3. Ensure proper technical and process documentation and compliance with standards
4. Reflect on the OSD journey and share the lessons learned and best practices with the world to maximize the impact
5. Keep your network and discuss future steps
6. Thank everyone for his or her valuable contribution and support

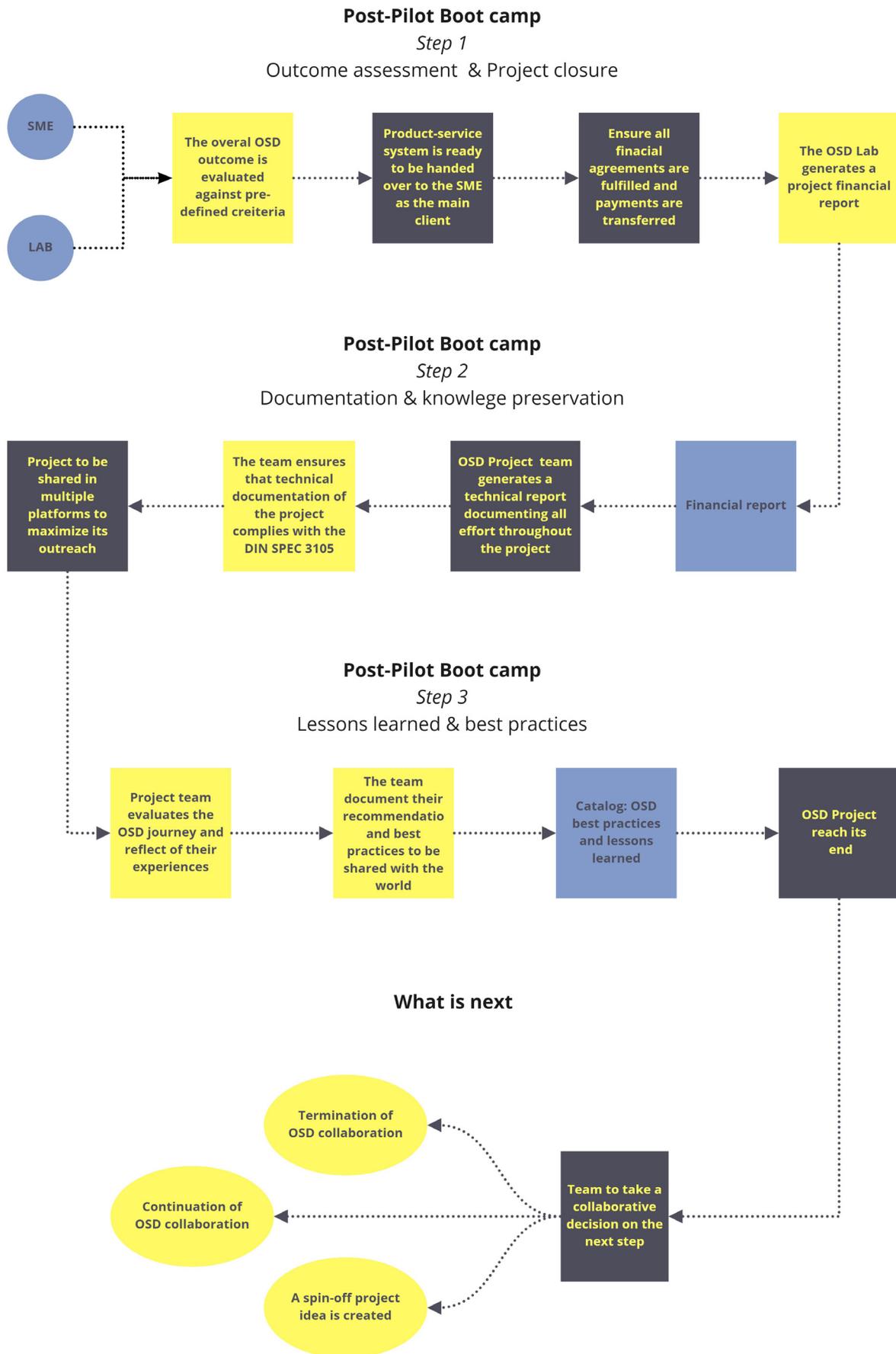


Figure 10: Post-pilot flowchart

5 Conclusion

5 Conclusion

The OPEN_NEXT main objective revolves around supporting SMEs and makerspaces in developing user-centric consumer products utilizing the aspects of open-source hardware with communities through providing the needed methods and tools. To achieve that in a systematic way, OPEN_NEXT proposed what is called the OSD journey to those stakeholders. This deliverable combines the outcome of D4.1 ‘*First release of Open-source business model development framework*’ and D5.1 ‘*Open-source sociotechnical design components*’ to provide a holistic framework that describes and govern the OSD journeys in the context of the OPEN_NEXT pilots. It provides a step-by-step approach starting with technical and project preparation in the pre-pilot phase before going to an intensive product development process to the tested prototype. The framework then provides a solid process for collaboration closure in the post-pilot phase.

This document is considered the first version of the OSD framework and is planned to be tested during the OPEN_NEXT pilot phase through the six SME-Lab teams taking place. After reflection in the post-pilot phase, a revised and updated version of the framework will be developed for the twelve OPEN_NEXT demonstrators. In addition, the results will be used to develop D4.2 ‘*Second release of Open-source business model development framework*’ as well as D5.2 ‘*First release of Prototyping Improvement Logic*’ and serve as a basis for D3.2 ‘*Platform Demonstrator*’.

6 Reference

6 Reference

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