D4.7 Community engagement and integration protocols – initial version

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101134083

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Work Package	4
Delivery Date (DoA)	M12
Actual Delivery Date	M12 - 24/12/2024
Abstract:	This deliverable develops a comprehensive framework for community engagement protocols aimed at democratizing agricultural technologies through the co-creation of Agricultural Digital Solutions. Drawing from successful case studies and theoretical foundations, it provides structured guidelines for engaging diverse stakeholders in technology development processes. The framework identifies certain levels of community engagement with corresponding methods and tools for implementation. The protocols emphasize participatory approaches while maintaining flexibility for local adaptation across different agricultural contexts. The deliverable outlines an iterative process through a Working Group of technology developers, farmers and researchers that will refine these protocols based on implementation experiences across OpenAgri's Sustainable Innovation Pilots.

Document Revision History			
Date	**Version**	**Author/Contributor/ Reviewer**	**Summary of main changes**
26.08.2024	0.1	Nikiforos Tsiouris, Vasilis Niaros (P2PLAB)/ Nikolaos Marianos (GSC GR)/ Sandra Novakovic (FSH), Theodoros Chalazas (EV ILVO)	ToC and description of the chapters
02.09.2024	0.2	Nikiforos Tsiouris, Vasilis Niaros (P2PLAB)	Incorporated the comments
21.10.2024	0.5	Nikiforos Tsiouris, Vasilis Niaros (P2PLAB)/ Nikolaos Marianos (GSC GR), Sandra Novakovic (FSH)	Initial draft of the deliverable
02.11.2024	0.5	Nikiforos Tsiouris, Vasilis Niaros (P2PLAB)/ Nikolaos Marianos (GSC GR)	Comments
22.11.2024	0.7	Nikiforos Tsiouris, Chris Giotitsas, Vasilis Niaros (P2PLAB)	Deliverable ready for internal review
13.12.2024	0.9	Nikolaos Marianos (GSC GR)/ Sandra Novakovic (FSH), Theodoros Chalazas (EV ILVO)	Internal review
20.12.2024	1	Nikiforos Tsiouris, Chris Giotitsas, Vasilis Niaros (P2PLAB)	Finalization

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Funded by the European Union

Title: Democratising digital farming through tailored open source and open hardware solutions
Type of action: HORIZON Research and Innovation Action
Topic: HORIZON-CL6-2023-GOVERNANCE-01-13
Start date of project: 1 January 2024 ● Duration: 36 months

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Table of Contents

Executive summary 5
1. Introduction 6
1.1. Project summary 6
1.2. Document scope 6
1.3. Document structure 6
2. Theoretical foundations 8
2.1. Guiding concepts 8
2.2. The role of protocols in community engagement 10
3. Developing the protocols' framework 12
3.1. Overview 12
3.2. Relevant milestones and KPIs 12
4. Good practices 14
4.1. Tzoumakers: The emergence of a community makerspace 14
4.2. Mobile hops harvester: A multi-stakeholder collaboration 16
4.3. Cereal brush: A solution for small-scale farmers 17
4.4. Otomate: A cooperative's greenhouse automation system 19
5. Blueprints for community engagement 21
5.1. Levels of community engagement 21
5.2. Methods for community engagement 24
6. Roadmap 27
7. Concluding remarks 32
References 33

List of figures

Figure 1: Guiding concepts for community engagement 11
Figure 2: Co-creation events organized by the Tzoumakers 16
Figure 3: The mobile hop harvester 18
Figure 4: Images from the development of the cereal brush 19
Figure 5: Technological solutions produced by the CAPÉ network 21
Figure 6: The five levels of community engagement 22
Figure 7: The OpenAgri Roadmap for co-creation events and protocols development 30

List of tables

Table 1: List of abbreviations and acronyms 5
Table 2: Methods for the various levels of community engagement 26

List of Abbreviations and Acronyms	
ADS(s)	Agricultural Digital Solution(s)
EU	European Union
KPIs	Key Performance Indicator(s)
KR	Key Results
OS	Open Source
SIP(s)	Sustainable Innovation Pilot(s)
WG	Working Group
WP	Work Package

Table 1: List of abbreviations and acronyms

Executive summary

This deliverable establishes protocols for community engagement fostering the democratization of digital farming through the co-creation and deployment of Agricultural Digital Solutions (ADSs). It provides a structured framework for engaging diverse stakeholders in technology development processes, drawing from successful case studies and methodologies for community-driven innovation.

The document establishes integral guiding concepts and values for effective community engagement. These concepts form the ethical and practical foundation for developing technologies that prioritize community needs while enabling long-term sustainability. The deliverable emphasizes the role of protocols in facilitating collaboration, protecting community interests, and ensuring more inclusive participation in technology development. Successful community-driven agricultural technology initiatives from Greece, the USA, France and Canada are presented to provide practical insights into different approaches to stakeholder engagement and technology development. These cases demonstrate how various levels of community participation can lead to beneficial outcomes while highlighting the importance of adapting engagement strategies to local contexts and capabilities.

This deliverable identifies and elaborates on five progressive levels of community engagement: informing, consulting, involving, collaborating, and empowering. For each level, methods and tools for implementation are provided, enabling project partners to select and adapt appropriate engagement strategies based on their specific contexts and objectives. This approach recognizes that different situations may require a different mix of engagement while maintaining the overarching goal of participatory co-creation of ADSs.

The deliverable outlines a roadmap for implementing and refining the protocols across OpenAgri's Sustainable Innovation Pilots. The roadmap includes co-creation events, prototyping workshops, and the establishment of a Working Group to facilitate knowledge exchange and protocol refinement. The iterative approach to protocol co-configuration ensures continuous improvement based on real-life experiences. While providing structured approaches that can be replicated across different settings, the protocols are designed to be adaptable to local conditions, technological capabilities, and social contexts. By emphasizing participatory approaches and local adaptation, the protocols support OpenAgri's broader goal of democratizing digital farming while creating new opportunities for sustainable agricultural innovation through open collaboration and knowledge sharing.

1. Introduction

1.1. Project summary

The overall aim of the OpenAgri project is to democratize digital farming by enabling the development and deployment of innovative cost-effective, energy-efficient open-source (OS) software and open hardware-based ADSs that can operate at a high performance even in remote areas with weak connectivity. This will be achieved by a) ensuring the co-creation of ADSs by engaging farmers and farm advisors in participatory prototyping activities inspired by the makerspaces approach; and b) providing access to a number of reusable OS software services designed to support the edge and mixed computing mode, and a "sociotechnical infrastructure".

Using a multi-actor approach, OpenAgri will involve farmers, ADSs providers, farm advisors and scientists in 14 SIPs in ≥10 countries across Europe, and guide them in co-creating and piloting edge, cloud and mixed-model ADSs addressing important challenges of agricultural production. 5 Sustainable Innovation Pilots (SIPs) have been pre-selected and 9 more will be awarded through an Open Call, enabling a dynamic response to a changing policy and technology landscape. Finally, building on a thorough analysis of EU agriculture and the results from the SIPs, OpenAgri will create a Decision Support Tool that will allow policymakers, farmers and farm advisors to select the best possible cloud, edge or mixed ADSs for any given set of conditions.

1.2. Document scope

In the rapidly evolving landscape of technology development, community engagement has emerged as a crucial factor in ensuring that innovations are not only technologically advanced but also socially responsible and inclusive. The protocols that guide this engagement are far more than mere procedural guidelines; they are the embodiment of our collective values and aspirations for how technology should be developed and integrated into society. By establishing clear values and principles within these protocols, we create an ethical framework that fosters trust, promotes equity, and ensures that the voices of diverse stakeholders are heard and respected throughout the development process.

D4.7 aims to develop a framework of good practices, tools, processes, stories, and blueprints for engaging diverse stakeholders in co-designing and prototyping ADSs. It will focus on creating socially inclusive, responsible, and sustainable solutions. The deliverable will document protocols for identifying local needs, conceptualizing ADSs using participatory methods, prototyping in open collaborative settings, and facilitating technology adoption and learning among stakeholders. It will be based on workshops with SIP partners, input from a working group including farmers, advisors, and tech startups, and practical application in co-design and prototyping events across the five core SIPs.

1.3. Document structure

This deliverable is comprised of the following chapters:

Chapter 1 presents the vision of OpenAgri along with the scope and structure of this deliverable.

Chapter 2 provides an overview of the key concepts and values this deliverable has built on.

Chapter 3 introduces the tools and processes used in the development of this deliverable and describes the connections with other tasks and WPs, as well as the milestones and KPIs of the project.

Chapter 4 transfers knowledge and experience from communities or groups that have been involved in agricultural technology development, highlighting their approaches and processes followed regarding community engagement.

Chapter 5 highlights the multifacetedness of community engagement depending on several factors and aspirations. It then presents a range of strategies and methods that can be used for community engagement.

Chapter 6 describes the next steps for the development of the OpenAgri protocols.

Chapter 7 summarizes the knowledge generated throughout the development of this deliverable.

2. Theoretical foundations

2.1. Guiding concepts

This chapter first highlights the importance of well-defined values and principles in community engagement protocols and then outlines the key guiding concepts for the ethical and practical foundation of effective community engagement in technology development. These concepts enable the creation of protocols that facilitate collaboration and ensure that the development process remains socially responsible, inclusive, and aligned with community needs (see only Cox and White, 2023; Giotitsas, 2019; Manzini, 2015; Russell, 2014; Vetter, 2018).

After incorporating these guiding concepts into our engagement protocols, we can provide practical ways to transform the ideals of democratic technology development into concrete practices. This approach aligns with successful policy frameworks like the European Green Deal, which demonstrates how comprehensive stakeholder engagement can drive systemic transformation toward sustainability (European Commission, 2020). Each of these principles and values contributes to creating an environment where innovation flourishes, community voices are amplified, and the resulting technologies are truly relevant through a robust framework for participatory technology development:

Transparency is a pillar for community engagement, as it ensures that all decision-making processes, development progress, and challenges are openly shared with the community. It involves providing clear and accessible information about the goals, methodologies, and outcomes of the technology development process. By making this information readily available, transparency fosters trust and allows community members to follow and understand the project's trajectory.

Openness promotes a culture where ideas can be freely shared, discussed, and improved upon. Through exchange of information and perspectives, it encourages a transparent approach where everyone feels comfortable voicing their thoughts leading to more innovative and effective outcomes. In agriculture, openness has significantly benefited rural communities with limited access to resources, engendering opportunities for collaboration through sharing experiences, tools and knowledge.

Inclusivity emphasizes the importance of actively involving diverse, and especially those that are marginalized or underrepresented, stakeholders in the development process. Inclusivity means creating spaces and opportunities for all voices to be heard and valued, regardless of background or expertise, enriching the development process with a wide range of perspectives and experiences. Inclusivity is also a core value of the EU's Green Deal and its "Farm to Fork Strategy" for a fair, healthy and environmentally-friendly food system.

Equity ensures that engagement processes are fair and accessible. It seeks to address power imbalances as well as in resources, or opportunities, seeking to level the playing field so that all participants can contribute effectively. Equity goes beyond mere inclusion to actively counteract barriers that may prevent full participation.

Empowerment involves equipping community members with the right knowledge, skills, and tools to participate and contribute to the development process. This principle supports capacity development within the community, enabling individuals to engage meaningfully rather than passively, transforming them from mere consumers into active co-creators of technology. In agriculture, empowering youth and women is considered key in stimulating the development of the sector.

Respect is essential in fostering a positive and productive engagement environment. It means treating community members with dignity and valuing their contributions, regardless of their level of expertise or background which encourages ongoing participation.

Responsiveness entails being agile and adaptable to feedback and evolving needs. Listening to the community and adjusting strategies and approaches to better serve them. Responsiveness demonstrates respect for community input and a commitment to continuous improvement thus eliciting stronger engagement.

Accountability ensures that developers and stakeholders are held responsible for their commitments and actions, making sure that community input leads to tangible outcomes. It is based on clear mechanisms for addressing concerns, conflict resolution, and tracking progress in a fair and transparent manner. Accountability solidifies the connection between community engagement and actual impact, ensuring that promises are kept and expectations are managed.

Trust is a core value that underpins all successful engagement efforts. Building and maintaining trust between engineers/designers and a community is paramount for an effective development process. Trust is earned through transparent communication, accountability, and a genuine commitment to meeting the community's needs across all stages of the process.

Ethical considerations place the focus on ethical dimensions in technology development. This includes careful attention to privacy, security, and the overall impact on the community. This involves making decisions that align with broader societal values and respect for human rights, ensuring that the technology developed serves the greater good and does not harm or exclude any group.

Sustainability puts forth engagement practices for social and environmental sustainability, both in terms of resource allocation and community involvement. The EU's Farm to Fork approach shows how sustainability must be integrated across multiple dimensions - environmental, social, and economic - while ensuring that transitions are just and inclusive (European Commission, 2020). It considers the long-term impacts of the technology on the community and the environment, aiming to create solutions that are viable and beneficial today but also for future generations.

Finally, **shared purpose** fosters a sense of unity and common goals among all stakeholders. It aligns the efforts of developers, community members, and other stakeholders towards achieving the same objectives and everyone understands the value of their contributions. A shared purpose motivates collective action, enhancing the overall impact of the engagement process.

Figure 1: Guiding concepts for community engagement.

These guiding principles and values inform the foundation for developing protocols that enhance community engagement in any technological development activity, ensuring that the process is not only inclusive and participatory but also effective and sustainable with consistent uptake. As demonstrated by major policy initiatives like the European Green Deal, successful implementation requires not only inclusive and participatory processes but also careful attention to monitoring, assessment, and continuous improvement (European Commission, 2020).

2.2. The role of protocols in community engagement

In the context of community engagement for technology development, protocols can be viewed as structured guidelines or frameworks that outline the processes, procedures, and rules of interaction between technology developers and community stakeholders. They are designed to facilitate meaningful collaboration, and promote the values and principles previously discussed with the purpose of maximizing technology uptake.

Protocols play a key role in facilitating effective and ethical community engagement. Primarily, they provide a standardization of processes, offering a robust approach to engagement across different projects and stakeholders (Raturi et al., 2022). This standardization helps set clear expectations for those involved and ensures the application of core values and principles. Further, protocols serve as a protection mechanism for community interests. By codifying ethical practices and community rights, they act as safeguards against potential exploitation or marginalization of community members, ensuring that community voices are genuinely integrated into the development process.

In addition to protecting interests, protocols are key for facilitating dialog. They create the space for open communication, offering structure for when and how stakeholders can contribute, and ensuring that all voices have the opportunity to be heard and considered. This structured approach to communication is particularly valuable when conflicts arise. Protocols provide predetermined methods for addressing and resolving disagreements, helping to keep projects moving forward constructively.

Accountability is another key role of protocols in community engagement. They establish clear responsibilities creating a framework for tracking commitments and ensuring that promises made to

communities are upheld. This is crucial for building and maintaining trust between technology developers and community stakeholders.

Furthermore, well-designed protocols often include mechanisms for a two-way exchange of information between developers and communities, which can lead to capacity building within communities to engage more effectively in technology development projects. This aspect of protocols is particularly important in addressing power imbalances and promoting long-term community development.

Cultural sensitivity is an often overlooked but crucial role of protocols. They can be tailored to respect and incorporate local cultural norms and practices, ensuring that engagement methods are appropriate and effective for specific communities. This cultural sensitivity is essential for building trust and fostering genuine collaboration.

Last, protocols play a vital role in aligning community engagement processes with regulatory requirements. They can be designed to ensure compliance with relevant laws and regulations, such as data protection laws or ethical research guidelines. This alignment not only protects all parties involved but also lends credibility and legitimacy to the engagement process.

By fulfilling these diverse roles, protocols transform the abstract values and principles of community engagement into concrete, actionable practices. They provide a structured yet flexible approach that can adapt to the unique needs of different communities and technology development projects. Ultimately, well-designed and implemented protocols help build trust between technology developers and communities (Raturi et al. 2022). This trust is the foundation for collaborative innovation that truly serves community needs and contributes to positive societal change.

3. Developing the protocols' framework

3.1. Overview

The **P2PLAB** has implemented a comprehensive methodological approach to facilitate the activities and outcomes of T4.2, leveraging their experience as founders and leaders of Tzoumakers, one of Europe's pioneering agriculture-focused makerspaces. With a proven track record in supporting farmers to co-create open-source software and hardware solutions, the **P2PLAB** is uniquely positioned to guide the community engagement aspect within the OpenAgri project.

OpenAgri will synthesize existing knowledge and capacities within the consortium, drawing from a broad array of collaborative development processes. Recognizing the unique characteristics of digital open-source and cloud/edge technologies, OpenAgri will attempt to incorporate lessons from pilots to systematize more tailored protocols for community engagement protocols.

During the project's first year, the **P2PLAB** conducted individual meetings with representatives from each SIP to familiarize with their aims and needs concerning their activities within the OpenAgri project. These discussions enabled a comprehensive mapping of each SIP's current status and objectives, forming the foundation for their community engagement strategies.

Building on this groundwork, the **P2PLAB** organized two workshops focused on knowledge exchange and training in participatory engagement and co-creation practices. The initial workshop introduced grassroots innovation and community engagement strategies, emphasizing agricultural and maker projects. Participants from SIPs explored various engagement levels through real-life case studies, gaining practical insights into values, protocols, documentation, and implementation challenges. The session was structured to facilitate knowledge transfer and practical insights that project partners could potentially apply in their own pilot initiatives.

The second workshop bridged theoretical understanding to practical implementation of community engagement strategies through the establishment of a Working Group (WG) (see Chapter 6). The session built upon the foundations laid in Workshop #1, moving from conceptual knowledge to defining and structuring the WG, simulating its activities, and establishing feedback mechanisms. The workshop's practical focus, including dedicated time for Q&A and next steps, aimed to equip participants with concrete tools and procedures for implementing community engagement initiatives within their respective pilots.

These workshops contributed to configuring the foundations of the framework for the community engagement protocols. The subsequent formation of the WG, comprising farm advisors from SIP communities, technology developers, and researchers, ensures ongoing collaboration to refine and enhance community outreach and integration protocols through regular meetings.

By combining **P2PLAB**'s expertise in open-source agriculture technologies with the diverse knowledge of the consortium partners, OpenAgri strives to establish a robust, participatory framework for innovation in the agri-food sector. This approach facilitates the development of tailored, community-driven solutions while fostering knowledge sharing and capacity building among farmers and other stakeholders in the agricultural ecosystem.

3.2. Relevant milestones and KPIs

This deliverable is directly linked to Milestone 6, which states that the community engagement and integration protocols will be created by M12. This milestone is crucial for establishing the framework for participatory practices throughout the OpenAgri project.

D4.7 contributes to several Key Performance Indicators (KPIs), particularly KR1.1, titled "Community integration and co-creation protocols". This KPI aims for ≥15 open co-creation events, ≥50 co-creators engaged, and ≥5 community-driven ADSs developed.

This deliverable also supports KR2.1, titled “Co-created innovative OS ADSs” by providing the methodological framework for engaging stakeholders in the co-creation process across the 14 SIPs. Additionally, the protocols developed in D4.7 will indirectly contribute to KR3.2 “Success stories, demo events and webinars” by facilitating community engagement in these activities.

The deliverable aligns with OpenAgri's overall objectives of democratizing digital farming and enhancing sustainability performance through participatory approaches. It supports the target of reaching and influencing >20,000 farmers across Europe within 5 years after the project’s completion by establishing effective community engagement strategies.

4. Good practices

This chapter examines four exemplary cases of community-driven agricultural technology development. Each case demonstrates a different approach on how local communities, farmers, and technical experts can work together to co-create agricultural tools that meet their local needs while embracing open-source principles and knowledge sharing. These cases illustrate how community engagement throughout the development process enhances more inclusive and sustainable technological solutions in conjunction with building local capacity and fostering collaborative networks.

4.1. Tzoumakers: The emergence of a community makerspace

The Tzoumakers is a community makerspace, located in the mountainous region of northwestern Greece. It focuses on the design and manufacturing of small-scale agricultural solutions. The project was initiated by the **P2PLAB**, a partner of the OpenAgri project which researches open-source technologies and community-driven innovation. The Tzoumakers comprise two main components: the physical infrastructure of the makerspace and the community of people involved. It is an exemplary case which demonstrates how local communities can collaborate to address their needs while connecting and reaping the benefits of global knowledge networks. They follow an overall inclusive approach thus exemplifying a strong model of community engagement (Kostakis et al., 2023).

The establishment of the Tzoumakers makerspace required significant community participation from the outset. Before the space was set up, the instigating organization, **P2PLAB**, organized multiple focus groups across the region, consulting with people from both urban and rural areas. This process helped create a core group of individuals who actively participated in establishing the makerspace. Community members were involved in the design and construction of the physical infrastructure of the makerspace. The makerspace is hosted in a building that used to be the Cultural Centre of the village, with the local municipality conceding the building and covering fixed costs. This arrangement demonstrates the local stakeholders' commitment to the project. The makerspace's equipment was determined through a combination of community feedback and expertise from the **P2PLAB** team. Local farmers and makers, well-versed in using low-tech tools, provided valuable insights, while the **P2PLAB** team introduced digital fabrication tools that could be proven useful in the local context.

The Tzoumakers employ a collaborative approach to developing agricultural tools and technologies. To that end, they have developed operational protocols tailored to their local context, needs and capacities. The process begins with community members expressing specific needs, which are then addressed collectively if there is sufficient interest. This needs-based approach ensures that the technologies developed are relevant and useful to the local community. For example, community members initiated the development of tools like a hand tiller, a grinder for aromatic plants, and a mechanical press.

The makerspace also facilitates knowledge transfer between local and international communities. Workshops often involve makers from both the local community and international networks, allowing for the exchange of designs, blueprints, skills, and know-how. This cross-pollination of ideas has led to the development of various tools, such as a nursery with an automated irrigation system, a water jet for monitoring wetlands, and a harvester for small vegetables. The sharing and adaptation of designs creates many opportunities for transcending local spatial restrictions. For instance, multiple versions of a mobile chicken coop design have been shared globally via the Internet and adapted to specific settings, demonstrating how local innovations can have a global impact.

Figure 2: Co-creation events organized by the Tzoumakers.

As the Tzoumakers community grew, the need for formal organization became more evident. A code of conduct was developed to ensure proper and safe use of the makerspace while allowing for inclusive decision-making processes. Importantly, this code of conduct was collectively articulated and approved by the community in a public event, demonstrating a commitment to participatory governance (Kostakis et al., 2023). The activities at Tzoumakers are proposed by community members, reflecting a bottom-up approach to decision-making. When a critical mass of interest forms around a proposed activity, resources are gathered to develop the solution, often in an impromptu fashion.

The most successful example of a tool produced in the Tzoumakers is the grinder for aromatic plants. The development of the grinder emerged from a specific community need. A community member, who is an oregano producer, expressed interest in manufacturing a grinder and was willing to help coordinate its construction. After two initial planning meetings, manufacturing began during a three-day workshop soon after. The development process was intensive and involved multiple phases. The initial phase was led by a community member who is an experienced craftsman. The co-creation process continued with additional workshops focused on completing the tool's construction with extensive contribution by the community.

The grinder gained recognition beyond the local community, winning first place in the Incredible EU project contest in 2021 out of 257 submissions. This success led to interest from other farming communities, particularly a group of producers in the Greek island of Crete who sought to create their own version. The producers tested the original grinder with their oregano production and, while encountering some initial challenges with motor temperature and plant feeding, were able to resolve these issues through modifications and shared their improvements back with the Tzoumakers community.

The grinder project exemplifies the Tzoumakers' approach to co-creation and knowledge sharing. The tool has attracted interest from multiple small-scale farmers who cannot afford commercial alternatives, with the community offering various forms of support - from sharing documentation to allowing temporary use of the tool. This has enabled new farmers to get started while providing them the opportunity to understand the tool's design and exposing them to a more collaborative configuration of technology development.

Tzoumakers has inspired and supported the creation of other community-driven initiatives in the region. For example, some members established an energy cooperative named Commonen to self-produce electricity and decommodify energy. The project has also contributed to the formation of Epirus' first Association of Social and Solidarity Economy initiatives, consisting of thirteen social cooperatives and other affiliated members, with the President being a key member of Tzoumakers.

In conclusion, Tzoumakers demonstrates a highly engaged model of community participation, from technology development and makerspace operation to decision-making. This approach not only addresses local needs but also connects the community to global networks of knowledge and resources, fostering innovation and resilience in a rural, economically challenged area.

4.2. Mobile hops harvester: A multi-stakeholder collaboration

The development of the small-scale, portable hop harvester was a project realized by a University of Vermont spin-off in collaboration with local and national organizations. The UVM Mobile Hops Harvester project demonstrates a unique approach to agricultural innovation, combining traditional engineering with open-source principles and strong community engagement (Callahan and Darby, 2014). The professor in charge of the project is an agricultural engineer and led the development of this technology adopting a co-design approach, where farmers and other stakeholders were actively engaged throughout the process.

The project began in January 2011 to address the need for portable, mechanized hop harvesting in the emerging United States hops industry. The professor formed a diverse team that included hop growers, farmers of other crops and other relevant experts. This inclusive approach broadened the inquiry and challenged engineering assumptions from the outset. Non-engineering personnel were intentionally integrated into the design process. This collaboration allowed for rapid exchange of ideas and virtual trial-and-error of design concepts. The practical knowledge of team members, especially farmers, significantly influenced design features and concept selection in ways that a traditional engineering approach might have missed.

Iterative cycles of reviews and feedback were held at crucial points of the design process. This led to important design choices based on real-life considerations. For example, when discussing portability requirements, a farmer's comment that "Everything is portable. It is just a question of how portable it is" helped refine the concept. Similarly, a grower's input about the ease of repairing hydraulics versus electrical systems in urgent situations influenced the choice of power source.

The collaborative approach extended beyond the initial design phase. The project leader made the machine details open-source, invited feedback via a discussion forum, and solicited willing beta testers to use the machine for harvesting. The open-source method allowed for incomplete designs to be released sooner, with users bearing some of the burden of verification and validation (Callahan and Darby, 2014).

Figure 3: The mobile hop harvester (source: https://tinyurl.com/4nr9ysr8)

The project's impact has been both local and broad. Locally, the prototype harvester is used each year to enable the harvest of multiple farms' crops and the university's variety trial plots. More broadly, the design is available for download from an instructional wiki and the FarmHack network. Users must register to download the design documents, enabling follow-up to determine how the design was used and what improvements were made. At the same time, the project team continued to learn and improve the harvester based on real-life use.

Throughout the project, the project leader maintained their role as the primary developer while fostering a collaborative environment that valued and incorporated farmers' practical knowledge and experience. This resulted, not only in a more refined and user-driven design, but also created a sense of ownership and engagement within the farming community, potentially accelerating adoption and further innovation in the field.

4.3. Cereal brush: A solution for small-scale farmers

The cereal brush was a tool developed by L'Atelier Paysan in collaboration with local farmers. L'Atelier Paysan is a French cooperative that emerged in 2009 from a group of organic farmers developing their own agricultural tools (Giotitsas, 2019). The organization facilitates the creation of open-source farm equipment by engaging directly with farmers and relevant communities. They help farmers design, build, and maintain their own farming equipment through participatory methods and skill-sharing workshops. L'Atelier Paysan cooperative documents and openly shares all tool designs through its platform, emphasizing technological sovereignty for farmers. Operating with a mix of state support and cooperative funding, the cooperative provides training, engineering expertise, and mobile workshop facilities across France. Their approach combines traditional farming knowledge with modern co-design principles to promote farmers' resilience and sustainable agriculture. They adopt a highly collaborative and community-driven approach to creating agricultural tools.

The project for the development of the cereal brush originated in early 2016 when ARDEAR, a farmers' association from the region, approached L'Atelier Paysan. A group of bread farmers needed a machine to remove husks from cereals and reduce mycotoxin levels, but commercial options were too expensive and unsuitable for their smaller-scale production.

Community engagement was central to the entire development process. L'Atelier Paysan initially met with farmers to establish basic parameters for the tool, ensuring it would meet their specific needs for better flour quality. The design process involved extensive communication between L'Atelier Paysan and the farmers. Email exchanges and meetings allowed farmers to provide input on technical specifications and desired features.

The project brought together diverse expertise, including farmers, the cooperative's staff, and a collaborator who manufactures small-scale artisanal mills. The mix of perspectives ensured that the design incorporated practical knowledge from various angles. During design meetings, farmers were actively involved in selecting solutions for technical problems, prioritizing ease of implementation, adjustment, and balancing. The development process incorporated tacit knowledge from all participants, leveraging collective wisdom.

Figure 4: Images from the development of the cereal brush (source: L' Atelier Paysan)

A key component of the process was a two-day prototyping workshop where 13 farmers, both experienced and novice, participated in building three prototypes. This hands-on involvement allowed farmers to gain valuable fabrication skills. When issues arose during the prototyping process, all participants gathered to brainstorm and collectively offer solutions. Many farmers joined the workshop not just to acquire the tool, but to learn fabrication skills for future tool-making, maintenance, and repairs. The workshop also provided opportunities for socializing and knowledge exchange, especially beneficial for younger farmers learning

from more experienced ones. After the initial prototype, a second working group was set up in another branch of L'Atelier Paysan to build on the experience and create an improved version.

The cereal brush project also highlights some tensions within the community regarding technology complexity. While some members, particularly older ones, advocate for simpler, low-tech tools that are easily reproducible, others recognize the potential of incorporating modern open-source hardware like Arduino microcontrollers. L'Atelier Paysan's approach emphasizes farmer autonomy and skill development. They believe that by understanding and participating in tool development, farmers can make informed decisions about which technologies are suitable for their practices and maintain control over their farming activities.

This case exemplifies a model of technological development that prioritizes user needs, fosters community engagement, and promotes knowledge sharing. By involving farmers throughout the process - from conceptualization to prototyping and beyond - L'Atelier Paysan ensures that the resulting tools are not only functional but also aligned with the values and practices of the farming community they serve.

4.4. Otomate: A cooperative's greenhouse automation system

The Otomate is a greenhouse automation tool developed by CAPÉ, a cooperative of 300+ farms in Canada. Since 2013, CAPÉ has been designing agricultural equipment and machinery adapted to the needs of small-scale vegetable farms. After more than 10 years of innovation, CAPÉ published an evolving catalog of professional machines designed by its members: the Fabrico-lab catalog. The Otomate tool exemplifies the community-driven innovation process followed in CAPÉ. Its development traces back to a coop member, a farmer and technology tinkerer, who created the initial prototype (Oslund, 2023).

The prototype, built using an open-source Arduino microcontroller, was initially designed as a simple thermostat to control a greenhouse furnace. The member who instigated the prototyping combined their programming skills with information from online forums to create this early version. The prototype caught the attention of other farmers at a 2016 CAPÉ workshop focused on building mechanical relay boxes for greenhouse side-roll automation.

Following the workshop, a small group of interested farmers organized a follow-up event at a member's farm to learn more about the DIY microcontroller. This informal gathering marked the beginning of wider community engagement with the project. As interest grew, the prototype became the basis for what would eventually become the Otomate. The development process truly took off when several other members recognized the potential in the initial design and decided to refine it further. The team's collaborative efforts led to significant improvements. They aimed to create a version that was "100% farm proof and 'noob proof' electrically, and that anyone could fix without blowing stuff up." This focus on usability and repairability reflected the community's needs and values.

Figure 5: Technological solutions produced by the CAPÉ network (source: https://tinyurl.com/2kj6wevz)

The Otomate's development process demonstrates how the CAPÉ network facilitates knowledge sharing and skill development among its members. One member, for instance, gained programming and electrical engineering skills through their involvement with the project. The open nature of the development process allowed for continuous refinement based on user feedback and experiences. As the Otomate evolved, it became one of the CAPÉ's most popular tools. The organization now offers complete kits in addition to hosting collective workshops every two years, showing how community engagement has led to a sustainable model for technology dissemination.

The case of the Otomate also illustrates how the CAPÉ's approach to innovation extends beyond just creating affordable tools. There is a strong emphasis on keeping technologies open and easily modifiable by users. The openness allows farmers to question each design choice and ensure the tool meets their specific needs, rather than serving the interests of external parties with potentially different objectives. The network's structure emphasizes building the capacity of its members, creating a self-reinforcing process that surfaces new ideas and opportunities from various nodes within the network.

Overall, the Otomate case demonstrates how community engagement in technology development can lead to tools that are not only affordable and accessible but also align closely with users' needs and values. It showcases the power of collective intelligence and open innovation in addressing the specific challenges faced by farmers.

5. Blueprints for community engagement

5.1. Levels of community engagement

Community engagement in technology development forms a spectrum, based on varying degrees of community involvement and decision-making power. The level of engagement applied in a technology development process can significantly impact its outcomes, acceptability, and long-term success. By understanding these different levels of engagement, technology designers and manufacturers, policymakers, and community leaders can foster more effective collaborations, leading to technologies that empower and serve the needs of communities. This chapter explores the different levels of community engagement, starting from the least and towards the most intensive forms of community participation (Jami and Walsh, 2017; International Association for Public Participation, 2016).

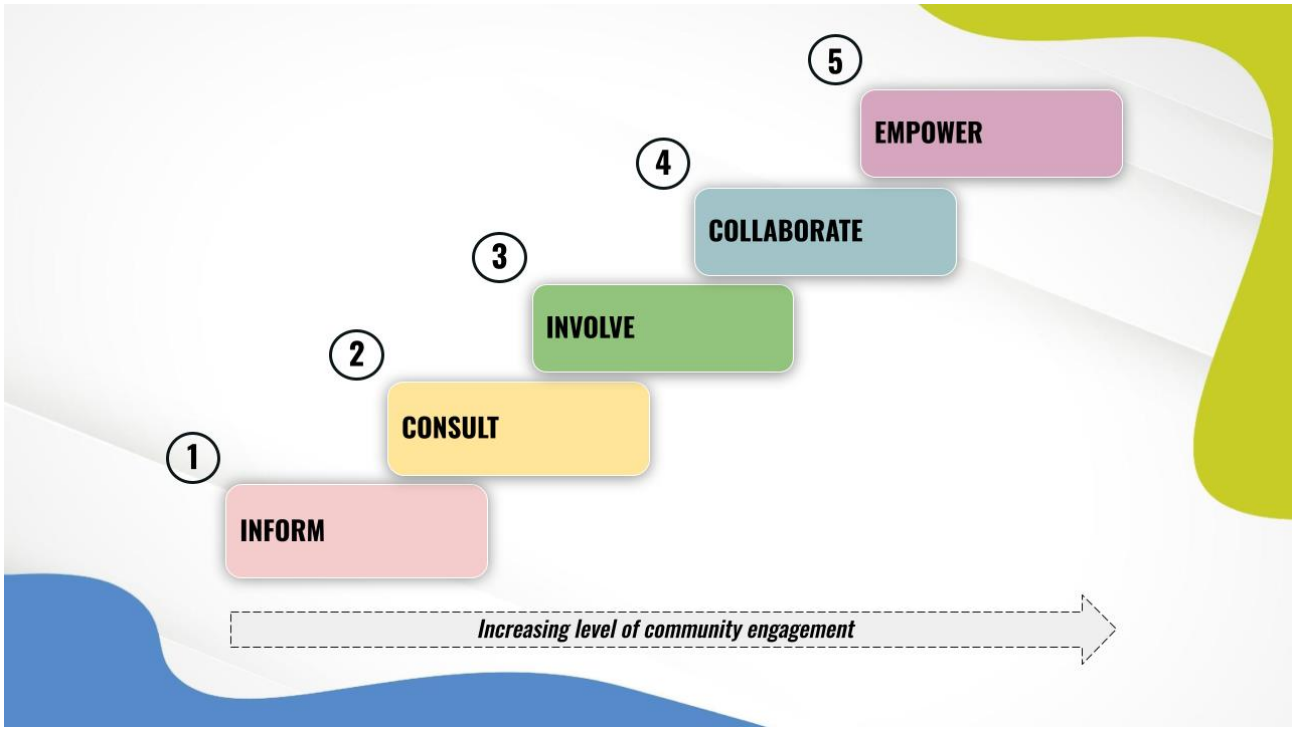

Figure 6. The five levels of community engagement

Level 1: Informing

The informing level represents the most basic form of community engagement in technology development. At this level, the goal is to provide the community with balanced and objective information about the technology being developed. It is a one-way flow of information with the focus on keeping community members informed about plans, decisions, and progress.

In practice, the informing level might involve public announcements about a new technology project, the creation of informational websites or brochures describing the technology, or social media updates on project milestones. This approach is often used in the early stages of projects where plans are formulated, for technologies with minimal direct community impact, or in situations where rapid development is crucial.

Drawing insight from the examples of good practices described in the previous chapter, it becomes evident that all made significant efforts to communicate the activities of their projects, both in the early stages as well as during the development of their technologies or initiatives.

The advantages for this type of engagement include ensuring a baseline level of community awareness, the ability to reach a large audience quickly, and its relatively low-cost implementation. However, it also has significant limitations. The lack of community input means potentially missing important insights that could improve the technology or its implementation. It may not effectively address community concerns or build trust, which can be crucial for the acceptance and adoption of new technologies.

While useful for increasing public awareness, the informing level is often insufficient for technologies significantly impacting the lives of users.

Level 2: Consulting

The consulting level of engagement entails community feedback on specific aspects of the technology development process. While more interactive than the informing level, the decision-making power remains primarily with the developers at this stage. Consultation is characterized by limited two-way communication. Community input is sought on predefined issues or stages of the process. The feedback received is considered in the development process but does not always directly influence decisions.

In practice, consultation might take the form of surveys to gather opinions on proposed features of a technology, focus groups to discuss potential impacts, or public comment periods on draft plans or designs. Specific examples from the cases presented above are the iterative cycles of reviews and feedback that were held in the case of the hop harvester (subchapter 4.1) that led to design choices based on real-life considerations, as well as the focus groups and surveys organized in the case of Tzoumakers (subchapter 4.2) to consult with the locals on their actual needs and the equipment needed for the makerspace.

This level of engagement is particularly useful when specific community insights are needed to inform development, in projects where community acceptance is important but full collaboration is not feasible, or in situations where regulatory requirements mandate some level of public consultation.

The consulting approach offers several advantages. It provides valuable community perspectives to inform the development process, which can lead to more user-friendly and appropriate technologies. It can help identify potential issues or concerns early in the process. Additionally, it builds some transparency, which can ease the path for technology adoption. However, this level may not fully address power imbalances and can lead to frustration if community input is not visibly incorporated.

Level 3: Involving

The involving level of community engagement represents a significant upgrade in terms of community participation and influence on the technology development process. At this level, the community's concerns and aspirations are not only heard but also directly considered in the decision-making process.

In the involving stage, community members are actively engaged throughout various phases of the technology development cycle. This could include participation in design workshops, ongoing advisory panels, or regular community forums. The key characteristic of this level is that community input is sought proactively and often, rather than at isolated points in the process.

This level of engagement is pertinent when the technology developed has a significant impact on community life or requires substantial community adoption to be successful. It is also valuable when local knowledge and perspectives are crucial for the technology's effectiveness.

A representative example of this level of engagement is the two-day prototyping workshop organized by L'Atelier Paysan for the construction of the cereal brush (see subchapter 4.3). This event invited both experienced and novice farmers to participate in the building of three prototypes, thus allowing them to acquire valuable fabrication skills. In the process they helped refine the tool based on their tacit knowledge and deep understanding of what works for their needs. Similar workshops have also been held in other cases, such as Tzoumakers and Otomate.

The advantages of this level of engagement are numerous. It fosters a sense of ownership among community members, which can lead to higher adoption rates and more effective use of the technology. It also allows for the early identification of potential issues or concerns, potentially saving time and resources in the long run.

However, the involving level requires a significant investment of time and resources from both the developers and the community. There is also the risk of raising expectations that cannot be fully met, which could lead to disappointment or frustration. Careful management of the engagement process and clear communication about the extent of community influence are crucial at this level.

Level 4: Collaborating

The collaborating level takes community engagement a step further, establishing a true partnership between the technology developers and the community. At this level, decision-making power is shared, with the community shaping not just specific aspects of the technology, but its overall direction and implementation. In a collaborative engagement model, community members are treated as co-creators rather than just advisors or sources of feedback. This may take place through the formation of joint working groups or committees where community representatives have equal standing with the technology development team. These groups might be involved in setting project goals, defining success metrics, making key design decisions, and even participating in the actual development work when appropriate.

An example of this level of engagement is the process followed at Tzoumakers for the selection of the tools to be manufactured, which reflects a bottom-up approach to decision-making. Also, in the case of Otomate, a small group of farmers organized a follow-up event to learn more about the DIY microcontroller. This informal gathering was the beginning of wider community engagement with the project.

The benefits of collaborative engagement are significant. It leads to solutions that are truly tailored to community needs and contexts. It builds strong relationships and trust between technology developers and the community, which can be valuable for future initiatives and technology uptake more broadly. It also builds local capacity and fosters a sense of ownership for the involved parties that can sustain the technology long-term.

However, collaborative engagement is also the most resource-intensive approach. It requires a significant time commitment from all parties and a willingness to share decision-making power and navigate potential conflicts. It may also slow down the development process, which can be challenging in fast-paced technology sectors. Despite these challenges, for projects where community adoption and long-term sustainability are crucial, the benefits of collaboration may often outweigh the costs.

Level 5: Empowering

The empowering level represents an ideal degree of community engagement in technology development. Here, the community itself holds the primary decision-making power, with technology developers acting more as facilitators or resources rather than leaders of the process.

In an empowering model, the initiative for technology development often comes from within the community. It identifies needs, sets agendas, and makes key decisions throughout the development process. External technology experts may be brought in to provide technical knowledge and skills, but they work under the direction of the community rather than leading the process.

This level of engagement is characterized by community ownership of both the process and the outcomes. It might involve community-led technology cooperatives, where local stakeholders collectively own and manage the technology. Or it could take the form of participatory action research, where community members are trained to conduct their own research and development activities.

For example, Tzoumakers has inspired and supported the creation of other community-driven initiatives in the region, such as Commonen, the energy cooperative to self-produce electricity and decommodify energy, and Epirus' Association of Social and Solidarity Economy initiatives (see case 4.3). Thus, community members themselves decided what problems to tackle and how to solve them. Similarly, Otomate became one of the CAPÉ's most popular tools and the organization now offers complete kits and hosts collective workshops every two years, illustrating how community engagement has led to a sustainable model for technology dissemination.

The benefits of this approach are profound. It leads to technologies that are truly owned by the community, both literally and figuratively. This ownership often translates into high adoption rates and sustainable long-term use. It also builds significant capacity within the community, leaving behind not just a new technology, but new skills, knowledge, and confidence in tackling future challenges.

However, the empowering approach requires a high level of community capacity and organization, which is not present typically. It can be a slower process, especially if the community needs to build technical skills along the way. There is also a risk of reinforcing existing power dynamics within the community if the process is not carefully managed to be inclusive.

In conclusion, these five levels of community engagement - informing, consulting, involving, collaborating, and empowering - represent a spectrum of approaches to integrating community perspectives and needs into technology development. Each level has its place, depending on the nature of the project, the community context, and the desired outcomes. By considering each case's conditions and implementing the more suitable level of engagement, technology developers can create solutions that are technically sound as well as socially relevant, ethically grounded, and genuinely beneficial to the communities they aim to serve.

5.2. Methods for community engagement

Below you may find a table with selected methods that can be used for community engagement in technology development. Each method has its own strengths and challenges, and often a combination of these methods will be most effective in ensuring comprehensive and meaningful community engagement in technology development.

METHOD		LEVELS	PURPOSE	ADVANTAGES	DISADVANTAGES
1	**Online platforms and social media**	1	Use digital tools to reach and engage with the community.	• Broad reach • Real-time interaction • Convenient	• Digital divide issues • Managing online interactions can be challenging
2	**Surveys and questionnaires**	1, 2	Gather quantitative data on community needs, preferences, and feedback.	• Reach a wide audience • Easy to analyze data	• Limited depth of responses • Possible low response rate
3	**Public meetings**	1, 2	Open forums for community members to discuss issues, share ideas, and provide feedback.	• Transparent • Allows for broad participation	• May be dominated by vocal participants • Less structured
4	**Focus groups**	2	Get qualitative insights through moderated discussions with a small group of community members.	• In-depth understanding of community perspectives • Interactive discussions	• Time-consuming • May not be representative of the entire community
5	**Feedback mechanisms**	2	Create channels for ongoing feedback from the community, such as suggestion boxes.	• Continuous improvement • Easy to implement	• Managing feedback can be resource-intensive
6	**Workshops and co-design sessions**	3, 4, 5	Collaboratively design solutions with community members.	• Direct involvement in the design process • Fosters creativity and innovation	• Requires significant time and resources
7	**Prototyping and piloting**	3, 4	Test technology solutions with a small group from the community before wider implementation.	• Real-life feedback • Reduces risks	• Limited scalability • May not capture all potential issues
8	**Education and training programs**	3, 4, 5	Equip community members with the skills and knowledge to	• Builds capacity • Promotes long-term engagement	• Requires investment in

			engage in technology development.		time and resources • Not immediately impactful
9	**Partnerships with local organizations**	3, 4, 5	Collaborate with grassroots organizations to reach and engage community members.	• Leverage existing trust and networks • More effective outreach	• Requires alignment of goals • Potential for conflicting priorities

Table 2: Methods for the various levels of community engagement

It is important to note that the level of engagement often depends not just on the method chosen, but on how it is implemented. For example, a workshop could be used simply to inform, or it could be designed to empower the community, depending on how much decision-making authority is given to participants. The key is to align the implementation of these methods with the intended level of community engagement.

6. Roadmap

In the OpenAgri project, we adopt a comprehensive approach to community engagement through carefully co-designed protocols that enable a more inclusive and sustainable development of ADSs. The community engagement protocols provide a framework to enable the collaboration between technology developers, farming communities and farm advisors and aid the tackling of real agricultural challenges through participatory co-creation processes.

The community engagement protocols emphasize methods and practices that foster the identification of local needs and specificities, the development of context-appropriate solutions, and the long-term technological capacity of the involved stakeholders. At their core, these protocols aim to co-create ADSs that are both user-friendly and tailored to actual agricultural challenges, while ensuring the solutions remain sustainable beyond the project's timeline.

This deliverable is the first of three iterations of the protocols that will be developed in the OpenAgri project. This first iteration is informed by two workshops which engaged all partners to collect requirements and familiarize them with participatory methods to approach the community and enhance uptake. These protocols will guide the process of co-creating at least one new ADS per SIP. In this context, **each SIP will hold at least 3 co-creation events where farmers and relevant actors (at least 10) will actively participate in the development of the new ADS**. These events serve to involve and mobilize local ecosystems by facilitating collaborative co-creation processes that prioritize users' needs. The springboard to this approach is **a major co-creation kickstart event planned for each SIP**. Through these kickstart events, stakeholders will work together to conceptualize at least one ADS per SIP, yielding at least five new community-driven ADSs by project completion. The protocols will be further refined, informed and co-configured alongside the series of strategic co-creation events organized across the five core SIPs.

Following the initial kickstart events, the OpenAgri project will deploy **at least two follow-up stakeholder meetings per SIP**. The scope of the meetings is to enable iterative design improvements and feedback integration, hence adapting solutions to local technological capabilities and specific user requirements. Additionally, **dedicated prototyping workshops** will be organized where end-users can develop practical skills in ADS production and maintenance, fostering common practices and shared understanding among participants.

In that sense, the three co-creation events should signify and coincide with important milestones of the co-creation process, **which should be populated with additional activities based on the specificities of each SIP**. This allows for significant flexibility in terms of organising the overall process provided key objectives are met. Specifically:

- The first, kickstart, co-creation event should include a diverse range of potential stakeholders (centered primarily around farmers) and a primary identification of their needs which could be addressed by the co-created ADS. The event should provide the SIPs with the outline of a new ADS to begin designing and developing in the following months alongside their co-creators.
- The second co-creation event should take place after an appropriate development period and necessary interactions with the co-creation community (using the methods best suited for each SIP - e.g. live meetings, web calls, farm visits, etc). An iteration of the ADS should be presented to stakeholders to discuss and decide whether it has reached a level fit for field testing. This event should also serve as an opportunity to develop know-how and technical capacities amongst the stakeholders. Both for understanding the technical foundation of the solution as well as its proper

use and basic maintenance. Additionally, feedback on the co-creation protocols up to this stage should be compiled too.

- The third co-creation event should ideally coincide with the completion of at least one round of robust field testing, which will be facilitated by the SIP according to their capacities. The SIPs should collect valuable feedback from stakeholders on the readiness of the solution following its use in the field and collectively discuss the further deployment. They should also reflect on the whole process and provide the final round of feedback for the protocols building on the entire experience.

Throughout all stages, continuous remote support will be available to address emerging needs and challenges. To facilitate the implementation and co-configuration of the protocols, the **P2PLAB will coordinate a dedicated Working Group (WG)** comprising representatives from all five core SIPs. The WG plays an integral role in enhancing the project's community engagement efforts as it will meet regularly and provide iterative feedback on community engagement processes and practices. Further, **site visits will be conducted** when needed to attract and engage stakeholders, ensuring strong connections between the technical aspect of the project and what happens on-the-ground. The WG's function will help maintain alignment between the SIPs' technological capabilities and users' needs while supporting the broader goal of creating sustainable, community-driven solutions. The co-configuration process will be deployed as follows:

- The initial version of the protocols will be tested in the SIPs' events.
- The SIPs will transfer the experiences gathered in the events to the WG.
- The WG will digest the feedback and **P2PLAB** will enrich the protocols with the lessons learnt.

This iterative process will inform the updated version of the protocols delivered in M24 of the OpenAgri project. The protocols will be tested in practice by SIP partners under the coordination of the **P2PLAB**, which will lead to the final version of the community engagement protocols in M36.

Despite the comprehensive and concise approach, a number of challenges are expected to arise during the development of the community engagement protocols. The OpenAgri project acknowledges potential influential factors that need to be taken into consideration throughout the development process. Specifically, the diversity of settings, the varying partner competencies, the available infrastructure, and the different levels of local stakeholder engagement across the SIPs could complicate the uniform application of participatory approaches and potentially affect the quality of co-created results. To address these challenges, **P2PLAB** will utilize the WG to collaborate closely with all partners to co-design flexible processes and protocols that can be adapted to different contexts, deliberately moving away from a one-size-fits-all approach. The strategy will be adapted to local contexts and needs to ensure that each SIP can effectively engage the potential community while maintaining the overall integrity and objectives of the OpenAgri project.

The **sequential guide of practical community engagement that follows shall be viewed as the initial version of the co-developed protocols**, which will be reconfigured during the implementation of the co-creation activities. It is indicatively populated with the methods described in the previous chapter, and should be adopted at the stage each respective SIP is currently located in terms of their engagement with their potential end users (for example stakeholder and needs mapping may already have been accomplished). A bespoke mix of approaches and methods should be applied in each case according to the local specificities and needs as well as the nature of the technological innovations pursued.

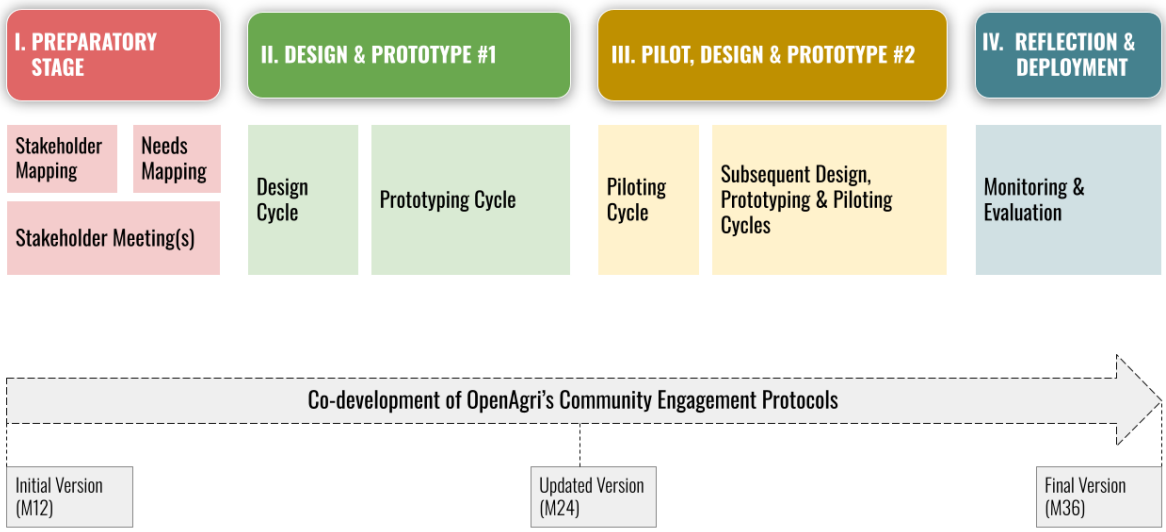

Figure 7: The OpenAgri Roadmap for co-creation events and protocols development

Phase I: Preparatory stage

Stakeholder mapping

This step entails the identification of all relevant stakeholders which can be included in co-designing and manufacturing a novel technological artefact. It should start from the end user, primarily farmers, but also include all other relevant farm activity adjacent actors in the OpenAgri case as well as institutional stakeholders when applicable. Relevant examples include farming associations and coops, farm advisors, SMEs engaging in complementary technological activities, local makerspaces, fablabs and other tech enthusiast hubs, municipal chambers of agricultural activity and commerce, engineering and agriculture departments of universities for interested students, etc.

Indicative methods to apply in this step are:

- Social media tools for initial advertising of co-creation events and communicating the project's goals.
- Identifying key individuals and organisations to act as networking nodes.
- Employ snowballing (using one identified stakeholder to recommend others) to aggregate more unforeseen stakeholders.

Needs mapping

This step is an early attempt to map the broader needs of identified stakeholders in order to better plan the co-creation activities and foresee practical needs which may emerge (for example in terms of expertise and technological infrastructure required).

Indicative methods to apply in this step are:

- Social media tools (like groups and fora) for engaging in tentative dialog.
- Online surveys and questionnaires.
- Small scale open events where possible and applicable to gauge community interactions.

Stakeholder meeting(s)

Upon compiling a list of stakeholders and potential needs, this step is the first attempt to aggregate as many stakeholders as possible in the same space (this coincides with the co-creation kickstart event). This event should serve a dual purpose. First, to align the needs and interests of participants as much as possible and

identify a common design problem. Second, to engage in a collaborative process where participants, with the facilitation and expertise provided by the organisers, will outline the parameters of a potential solution to the problem.

Indicative methods to apply in this step are:

- Co-design workshop which would function as a design charrette of sorts. As exemplified by the cases presented above this may practically range from highlighting limitations and specificities of a required application to offering concrete design suggestions.
- Focus groups where stakeholders may be split according to thematic categories relevant to each case. This may help streamline the process in case of heavy participation by splitting the design process onto interconnected modules.
- Partnerships with local organisations may provide key infrastructures (like a meeting place and communication channels) as well as a critical mass of participants if this has not been achieved in the previous steps.

Phase II: Design and prototyping #1

Design cycle

This step entails the aggregation of the feedback received from the stakeholder meeting into a concrete design of a solution. This is undertaken by the facilitating organisation, unless a stakeholder illustrates enough initiative and capacities to take the lead, with continuous input from stakeholders informing the process.

Indicative methods to apply in this step are:

- Feedback mechanisms ought to be established for asynchronous and distributed input provided at frequent check-ins from important stakeholders (identified through their enhanced and continuous engagement in the previous stage) as well as when requested by the lead for key design choices.
- A basic way to facilitate this is through the use of social media groups and instant messaging apps.
- Surveys may also be applied at this stage when more broad (but less in depth) feedback is appropriate.

Prototyping cycle

Once a satisfactory, but not complete, design is reached then the prototyping step commences with the maximum stakeholder engagement relevant in each case. The goal is for stakeholders to first contribute meaningfully to the process, making the recreation of the technological prototype as easy as possible. Second, it will allow stakeholders to develop skill sets which will enable them to better utilise, maintain and adopt further innovations along this technological stream.

Indicative methods to apply in this step are:

- Targeted workshops with select members across stakeholder groups to develop the prototype or key components when complexity is an issue.
- Training programs whose sessions will provide stakeholders with a deeper understanding of the technology in question and the skill sets to engage with it.
- Partnerships with local organisations may once again provide key resources to better undertake the process by either facilitating the feedback loops or providing assistance in specific steps in the iterative process which will follow.

Phase III: Piloting and design and prototyping #2

Piloting cycle

Upon the completion of a satisfactory, but not entirely feature complete, prototype, key stakeholders (end users) should be invited to field test them for an appropriate time period (considering project limitations) and provide critical feedback about the functionality and practical utility of the co-designed prototype.

Indicative methods to apply in this step are:

- Feedback mechanisms building on existing ones but with a more narrow scope to receive feedback and provide instructions/troubleshooting when necessary.
- Open public meetings when significant challenges emerge which require wider troubleshooting engagement.

Subsequent design, prototyping and piloting cycles

Follow up cycles should take place until the prototype reaches a minimum level of satisfaction across all involved stakeholders. By this stage, specific stakeholders may have developed the initiative and capacities to lead certain elements of the process allowing for a more distributed and less curated endeavour. Additional stakeholders may also have been identified, leading to broader participation and new directions for the prototyped solution to address. Significant reconceptualising and redesigning may be required should the piloted prototype fail its intended purpose, thus direct and agile interactions with key stakeholders will be pivotal for the timely implementation of co-creation activities. All the above suggested methods should be applied ad hoc according to evolving conditions in each pilot.

Phase IV: Reflection and deployment

This final stage involves the consideration of the entire process and an evaluation of its successes and failures alongside stakeholders. A deployment scheme could be conceptualized at this stage as well (in the event of a particularly successful co-creation period), capitalising on the network formulated and the resources mobilized around the process. This stage will also provide the opportunity for lead organisations to collect feedback on the protocols from stakeholders as those have been taking shape alongside the co-creation process enhancing their applicability across diverse settings. This should ideally take place both physically in one final large gathering of stakeholder but also asynchronously utilising whatever mix of methods best suit each local setting.

7. Concluding remarks

The development of community engagement protocols within OpenAgri provides a practical step toward democratizing digital farming through participatory approaches to technology development. This deliverable has established a comprehensive framework that encompasses various levels of community engagement, from basic information sharing to complete community empowerment, providing flexible pathways for engaging diverse stakeholders in co-creating Agricultural Digital Solutions (ADSs). The documented approaches and methods, drawn from successful case studies and theoretical foundations, offer practical guidance for implementing meaningful community engagement across different agricultural contexts.

The protocols' emphasis on openness and collaborative development creates significant commercial opportunities in the agricultural technology sector. By engaging end-users throughout the development process, solutions are better aligned with actual market needs and more likely to achieve widespread adoption. The open-source approach enables new business models centered around customization, support services, and knowledge sharing, while fostering innovation through shared resources and collective problem-solving. This openness particularly benefits small-scale farmers and agricultural enterprises by reducing barriers to entry and enabling localized adaptations of technologies. Furthermore, the collaborative nature of these protocols can lead to the emergence of new market opportunities through networks of knowledge exchange and shared resources.

A key insight from this deliverable is the critical importance of designing for replicability while respecting local conditions. The success of initiatives like Tzoumakers and L'Atelier Paysan demonstrates how standardized protocols can be effectively adapted to different contexts. The established Working Group within OpenAgri will facilitate this balance, enabling knowledge transfer across SIPs while maintaining flexibility for local adaptation. This approach ensures that protocols can be meaningfully implemented across diverse agricultural settings, technological capabilities, and social contexts, leading to solutions that are both globally relevant and locally appropriate.

The iterative nature of the protocol development process, involving multiple stages of testing and refinement through the SIPs, ensures continuous improvement and adaptation based on real-life implementation experiences. This approach acknowledges that effective community engagement is not a one-size-fits-all solution but rather a dynamic process. The Working Group's role in gathering and incorporating feedback from various implementations will be crucial in developing protocols that are both robust and flexible enough to accommodate diverse agricultural settings.

Looking ahead, these protocols lay the groundwork for a more inclusive and sustainable approach to agricultural technology development. By combining structured engagement methods with flexibility for local adaptation, they can support the development of ADSs that are not only technically sound but also socially embedded and economically viable. The success of these protocols will be measured not just in the number of solutions developed, but in their sustained adoption and positive impact on agricultural communities across Europe. As the project progresses, the continued refinement of these protocols through practical implementation and stakeholder feedback will further strengthen their effectiveness in supporting the democratization of digital farming.

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