Enhancing Competitiveness, Resilience and Sustainability of Remote Farming, Forestry and Rural Areas through Holistic Assessment of Smart XG, Last-mile and Edge Solutions' Gains

D2.1: Key stakeholders mapping and functional requirements elicitation and analysis

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Glossary of terms and abbreviations used

Abbreviation / Term	Description
CoP	Community of Practice
CSO	Civil Society Organisation
GA	Grant Agreement
GDPR	General Data Protection Regulation
LL	Living Lab
KFT	Knowledge Facilitation Tool
KPI	Key Performance Indicator
NGO	Non-Governmental Organisation
R&I	Research and Innovation
SRL	Societal Readiness Level
TRL	Technical Readiness Level
UC	Use Case
WP	Work Package

1 Executive Summary

Deliverable 2.1 “Key stakeholders mapping, functional requirements elicitation, and analysis” presents an outlook of the chosen methodological approach for co-creating the stakeholder mapping, its main rationale behind, and the general documentation of activities. In addition, further chapters highlight and discuss the main findings and results from Task 2.1 (M1-14) of WP2, together with relevant conclusions for the remainder of the ongoing XGain project (2022-2026).

Pivotal to the collaborative activities of T2.1 has been the pop-up “Have-Your-Say” co-creation lab series in each territorial/thematic area of XGain. These events were also prompting technical and, to some degree, business capacity building to develop the XGain Knowledge Facilitation Tool (KFT) and site-specific solutions in six use cases with varying maturity levels across Europe. Generally, T2.1 processes were co-designed together with partners leading use cases and further WP2 tasks, mirroring the inherent co-creation approach.

Overall, this deliverable documents the collaborative work that led to the successful stakeholder mapping, which included the set-up and launch of on-site series of workshops of the key co-creation process. This process would eventually develop into a fully-fledged living lab ecosystem over the further duration of the project. In this sense, T2.1 identified in a first step the relevant R&I networks, needs, challenges and (social) innovation-related parameters in the predominantly rural environments. The six use cases are located in the Isles of Scilly (UK), Catalonia (ES), the vicinities of Thessaloniki (GR), the forests of Lithuania (LT), at the experimental farms in Flanders (BE), and the maritime environments around Šibenik (HR). In all use cases, the stakeholder mapping included 80 plus relevant stakeholders per related field (farming, forestry and health care) to engage various relevant types of stakeholders and, in the context of follow-up activities to T2.1, to define end-users of the XGain use cases and solutions.

While each use case presents a unique business context and the targeted ecosystem – from agriculture and aquaculture over forestry to e-health – a tailor-made (and broad enough) methodological approach enabled by the subsequent provision of toolboxes was set up to establish the necessary steps, in close collaborations with the relevant use case and technology partners. Between M3 and M11, co-creation consisted of a series of consultations, the organisation of a one-day workshop in all use cases, an adapted transect mapping, several informal conversations, and requirements assessments linked to neighbouring tasks of WP2 as well as in-depth conversations with use case partners and relevant stakeholders.

Generally, this process yields relevant and well exploitable results (Chapter 5) further on in the project for the envisaged living labs, the co-creation process and the co-design methodology, in particular with regard to the stakeholder mapping, where all relevant key KPIs could be reached successfully. To assemble the stakeholder mapping, an embedding within use case-specific considerations and progress (over time) regarding TRL and SRL has been necessary; these findings are presented in the deliverable (Chapter 2.3). Broadly forestalling a few insights with regard to the mapping results, the presence of private sector stakeholders from regional levels is higher than others are and quite equally distributed across use cases, particularly, if taking their different sizes and business model scopes into account. Female participants are represented by roughly 20% of all mapped stakeholders; however, this number needs to be taken with caution, since not all use cases identified gender thoroughly in their respective lists. Local stakeholders, generally, are scarcely represented, demonstrating the possible target group of XGain and the KFT being primarily found at agro-technical, policy, research and entrepreneurial levels.

All elaborated mappings and analysis (cross-use-case and site-specific) remain open to further updates. This is because T2.1 has been conceived from its start as initiating a co-creation process, foreseen to be continued throughout the further project lifespan, despite no further research activities being formally entailed in this task. As a side note, within this overall co-creation dynamic of T2.1, it was collaboratively decided to move the functional requirements elicitation and analysis to T2.4, where it has been intrinsically tied to the architecture design and, by extension, the KFT development process without curtailing the relevant findings and conclusions of the present deliverable. D2.1 considers using and valorising the emerging pool of transdisciplinary knowledge in an agile way, which is key to enable further innovation processes and a fair transition in XGain.

2 Introduction

The deliverable "Key stakeholders mapping, functional requirements elicitation, and analysis" (D2.1) presents in a synthetic form, the tailor-made methodology behind the activities carried out in Task 2.1 (M1-14) related to the **Pop-up "Have-Your-Say" co-creation labs** in each territorial and thematic area of XGain. The mix of approaches adapts key learnings from previous European projects and strategies build from internal co-creation process, seeking end users' involvement, mobilisation and engagement in an emancipatory participatory process. This process was also promoting technical capacity building to develop the XGain Knowledge Facilitation Tool (KFT) and site-specific solutions in six use cases with varying maturity levels across Europe. The following chapters include different methodological steps for the engagement of the local or regional stakeholder groups; at the same time, the document provides the first results in terms of needs and expected potential of engagement during the project duration and beyond.

Methodological approaches and activities were structured along three major phases, comprising (1) a stakeholder mapping, (2) the initiation of the XGain co-creation process and (3) the analysis and synthesis of results and suggestions to support further knowledge transfer and trust building between end users, stakeholders and XGain partners.

Co-creation needs iterative processes and flexible adaption of methods to bring best results: a two-fold consultation (including co-creation workshops or interviews and an online survey) gained stakeholder feedback on use-case specific needs and functional requirements of the KFT.

Learnings are outlined in the conclusion part of this document laying also the base to synthesize with findings in T2.3 Use case requirements and specifications, dimensions and target KPIs (M1-M17) and T2.4 XGain Knowledge Facilitation Tool Architecture Design and Technical Specifications (M01-M18). Activities and results are also preparing the floor for T2.2 Ensuring a Fair Social, Digital, Environmental and Economic Transition (M01-M16).

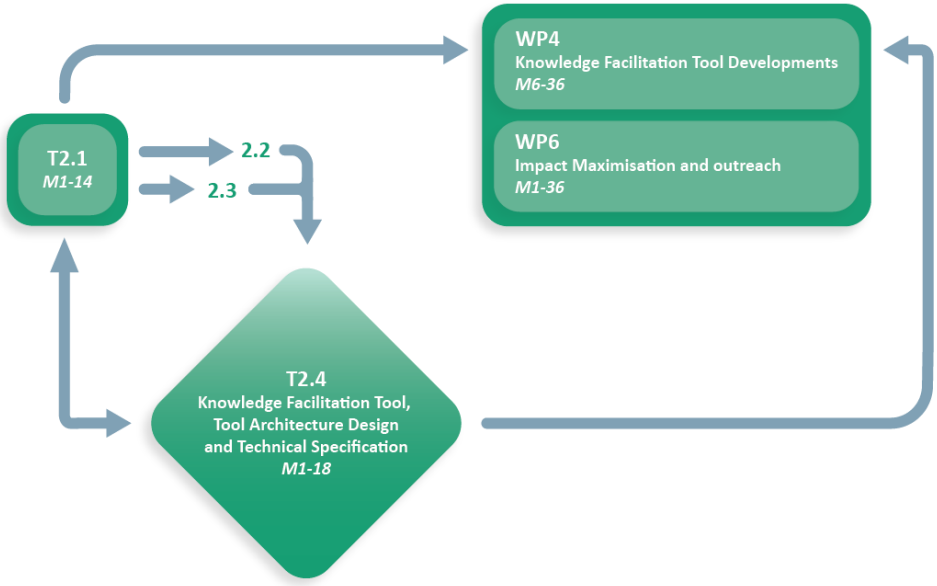

Figure 1: Overview on the knowledge transfer from T2.1 in XGain

2.1 Mapping XGain Outputs

Purpose of this section is to map XGain Grant Agreement commitments, both within the formal Deliverable and Task description, against the project's respective outputs and work performed.

Table 1: Adherence to XGain GA Deliverable & Tasks Descriptions

XGain GA Component Title	XGain GA Component Outline	Respective Document Chapter(s)	Justification
D2.1: KEY STAKEHOLDERS MAPPING AND FUNCTIONAL REQUIREMENTS ELICITATION AND ANALYSIS This deliverable provides assessment of end-user needs according to the results of the co-creation activities.			
TASKS			
Task 2.1 Stakeholder Mapping and End-user Needs Analysis through Processes of Co- creation	The task aimed to support six use cases by using different participatory and co-creation methods and approaches (e.g. online and co-creation face-to-face workshops) to enable farmers, associations, and communities to identify their needs and hence the functional requirements of the XGain knowledge facilitation tool. Under this task, stakeholder mapping and identification (according to the quadruple helix) were carried out together with use case leaders to enable the participation of different stakeholders in the XGAIN activities.	GA/Annex I p.7 GA/Annex I – Part B (p.3-4 and 8-11)	This task lays the groundwork for the further co-participatory activities foreseen in WP2, WP4, and WP5. The activities carried out in task 2.1 and deliverable 2.1 contributes to overall XGain objectives 1, 2 and 5.

2.2 Deliverable Overview and Report Structure

Chapter 1 provides an executive summary, offering an overview of the chosen co-creation method for stakeholder mapping in T2.1. It summarises the co-creation lab series conducted in 2023, which has been crucial for the development of the XGain KFT and site-specific solutions provided by six European use cases. The chapter also highlights the stakeholder mapping and stakeholder engagement process.

Chapter 2 introduces the methodology used for the pop-up "Have-Your-Say" co-creation labs. The chapter outlines the three main phases of the methodology and the iterative, flexible nature of XGain co-creation approach.

Chapter 3 outlines the rationale behind stakeholder engagement, participatory research and co-creation, emphasizing the importance of multi-stakeholder collaboration, societal readiness and societal context in

innovation. Moreover, the chapter also discusses the stakeholder analysis focusing on the representation of different stakeholder groups, gender distribution, and readiness levels of use cases.

Chapter 4 offers a comprehensive analysis of six use cases in Catalonia, Dalmatia, Lithuania, Flanders, Central Macedonia, and the Isles of Scilly presenting the primary outcomes of the co-creation workshops. Subsequently, it delves into a detailed analysis of the feedback and insights from the co-creation workshops. These sessions enabled extensive discussions regarding challenges, requirements, opportunities, and contributions to the KFT. During the co-creation workshops, a few participants expressed specifications that fall outside the objectives of the KFT development. While these requests may not align with the original goals, they remain under consideration for potential inclusion.

Chapter 5 revolves around the results of a survey completed by 20 key stakeholders from various XGain regions. The primary aim of this survey was to gain additional insights related to specific aspects of the KFT. The findings identify the most relevant KFT features, potential sectors for employing technology solutions, user preferences for profiles and language as well as considerations regarding knowledge transfer materials and performance indicators.

Chapter 6 concludes collaborative and participatory approaches that have significantly contributed to the success of the XGain project and gives an outlook how findings and tools generated can be used for ongoing and future activities within XGain to support the project's transition and maximize its impact.

Chapter 7 is the "References" section, acknowledging sources and attributions used in the document. Annexes contain a visual representation of the various stakeholders involved in the XGain project. The names and contacts of the stakeholders have been deleted due to the GDPR.

3 Stakeholder engagement and co-creation process

3.1 Rationales behind the XGain stakeholder engagement and co-creation process

T2.1 is the major task foreseen to produce a methodological framework to enable participatory research and co-creation iterations. As a first step, a stakeholder mapping included 80 plus stakeholders per related field (farming, forestry and care) to engage various relevant types of stakeholders and then, to define end-users of the XGain use cases and solutions.

Co-creation can contribute to the legitimation of innovation processes and co-ownership or accountability of results sourced by multi-stakeholders (i.e. Hochgerner, 2018). The European Commission uses the concept of co-creation in their definition of public engagement in responsible research and innovation (RRI), which they define as 'co-creating the future with citizens and civil society organisations, and bringing on board the widest possible diversity of actors that would not normally interact with each other, on matters of science and technology' (European Commission 2016).

The XGain co-creation process aimed for participatory processes enabling a further transition from a Triple helix model with a collaboration between public sector, academia and private sector to a Quadruple helix model, where the civil society is involved. In the initial project phase, civil society was represented e.g. through NGOs. In this way, T2.1 efforts can interpreted as an agile and practical way to create engagement and collaboration across the Quadruple Helix, including manifold stakeholder groups jointly developing meaning and value and bringing in a community or local perspective. XGain approach fosters also social value chain aspects that go beyond the progression of activities of an organisation operating in a specific industry performing in order to deliver a valuable product to the end customer considering extended impacts on the communities and local stakeholders.

Building further on these perspectives, a trade-off between creating legitimacy and the emergences of new value chains requires deliberation early in the innovation process, a certain site-specificity and an action-oriented perspective. Short-term laboratories, in this context so called Pop-up co-creation labs, were implemented in five XGain use case regions in form of workshops with multi-stakeholders to co-create knowledge and outcomes (conditions of one use case demanded further differentiation of methods).

Pop-up labs are compact workshops that lead to concrete results in a highly focused working atmosphere and within a very limited time. The co-creation concept took advantage from European projects (with contributions from ZSI) such as LIVERUR, RIPEET, BLOOM, LIVIN as well as learnings from projects such as SISCODE and PERSE on concise formats. The applied approach aimed to enable local, regional and trans-regional collaboration in knowledge production and in sustainability transitions at the technology – society – natural environment nexus. In this context, participants of pop-up co-creation labs contributed equally with target, system and transformational knowledge, as a basis for the XGain transition aiming for a more socially accepted change through XGain solutions and related services.

Furthermore, T2.1 processes were co-designed together with partners leading use cases and further WP2 tasks, mirroring the inherent co-creation approach. In the beginning, XGain partners participated in mutual learning and strategic visioning exercises during an internal meeting and workshop series. At this occasion, approaches and processes were co-reflected iteratively and contributed to the use-case-related objectives and findings explained in the following.

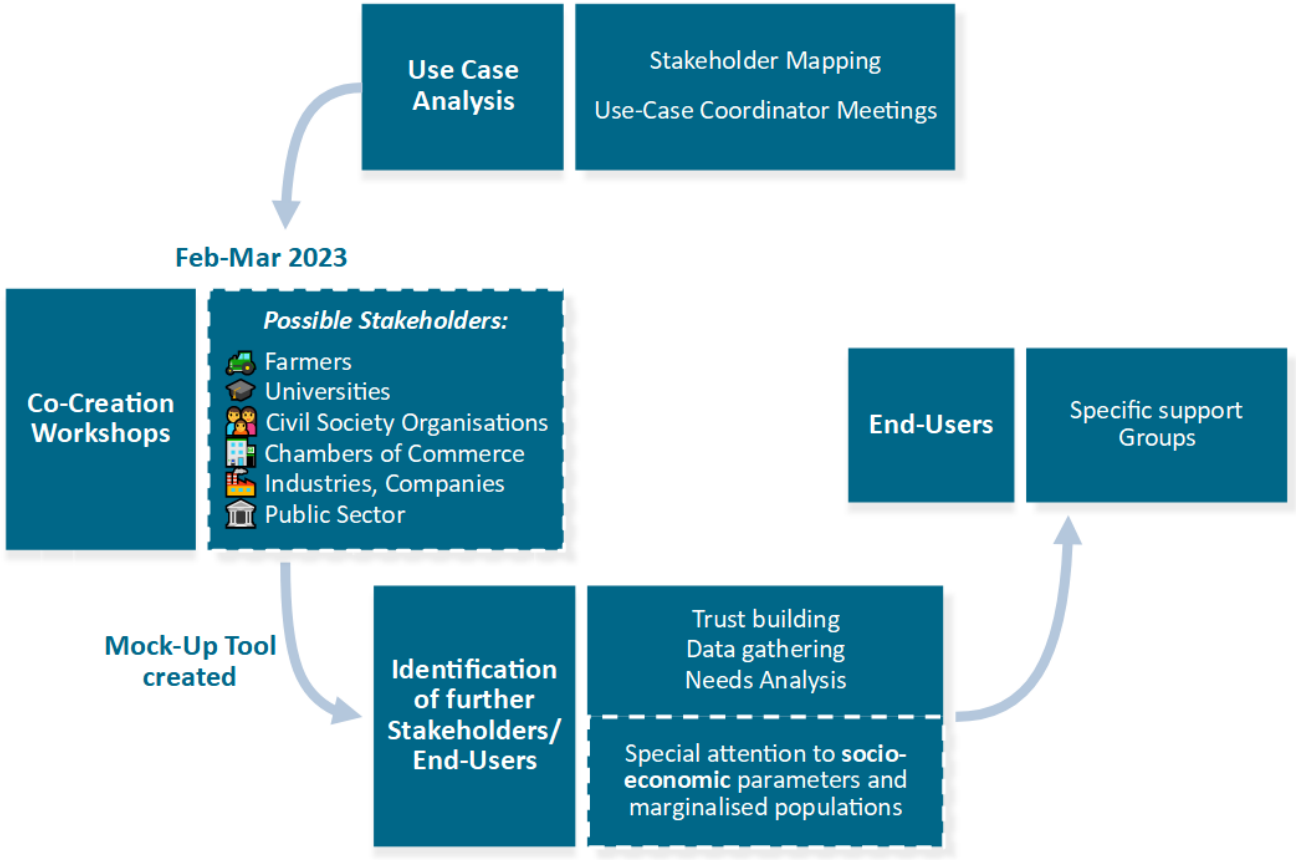

Figure 2: Overview on major strategy and approaches of the XGain transition

3.1.2 Key aspects of the XGain stakeholder mapping

The applied concept of multi-stakeholder groups refers to stakeholders with different vertical and horizontal powers and different needs and engagement levels linked to the objectives of the XGain project: The T2.1 stakeholder mapping explored a wide range of stakeholders relevant to the co-creation process and potential end users of the XGain solutions addressed public and private sectors and civil society. Some of the use cases also addressed a wider group of stakeholders in tourism, local services, agriculture and environmental protection, to acquire a multidisciplinary group perspective.

All identified stakeholder groups have a major role to play in co-creation and the further usage of XGain solutions, and were analysed along three key issues:

- Role, responsibilities and expected engagement level of the stakeholder group

- Key linkages between the stakeholder group and XGain objectives and solutions
- Insight into needs and challenges that relates to the XGain KFT

This approach helps designing XGain solutions by providing a deeper understanding of needs and potential engagement of stakeholders, the information exchange and relationship linkages between them. Against this background, consortium partners can easily create the initial strategic engagement approach and envision the local value creation and information exchange.

Another goal of T2.1 stakeholder mapping was to translate the process of stakeholders mapping into an easy-to-follow document for future use in mapping potential stakeholders at local and regional level. It laid the ground to build regional and trans-regional partnerships (see also the chapter Conclusion for the XGain Knowledge Alliance) and to support each stage of any project implementation and exploitation process.

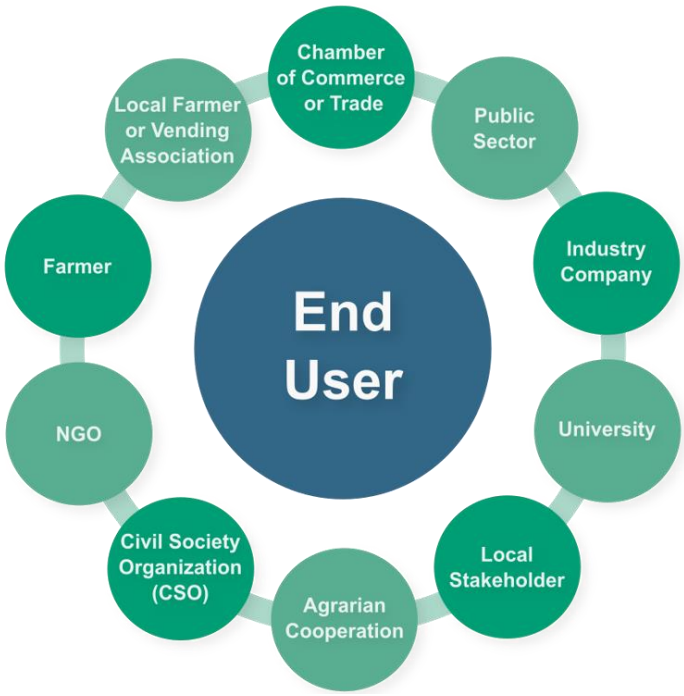

Figure 3: Major categories of the XGain stakeholder mapping

3.1.3 Key aspects of the XGain co-creation – design and methods

For WP2 Task 2.1, task leader Centre for Social Innovation (ZSI) developed a multi-layered and iterative method cycle design. Overall, this design approach draws on the principal rationale of empowering use cases to

- develop their respective co-creation process between November 2022 and August 2023,
- support them bilaterally in the collection and interpretation of data,
- plan workshops as well as moderating them,
- identify stakeholders in a guided manner for their mapping,
- conduct a pre-assembled survey together with I2CAT (one of the technology partners of XGain)
- enable further activities leading to the use case-specific assemblage and synthesis beyond T2.1

The XGain co-creation activities encompassed an **internal workshop** with the title **"SET-THE-SCENCE"** in February 2023, the Pop-up "Have your say" co-creation lab series in the local context of use cases, another **internal workshop "Analysis and Cross-fertilization"** in June 2023. These steps were followed by an optional **online survey** on the design of the **KFT** in July and August 2023 in order to support the co-design of the KFT in T2.4. Even though workshops and online survey presented the scope of the project and the KFT, many users proposed features/aspects that are not in the scope of the project.

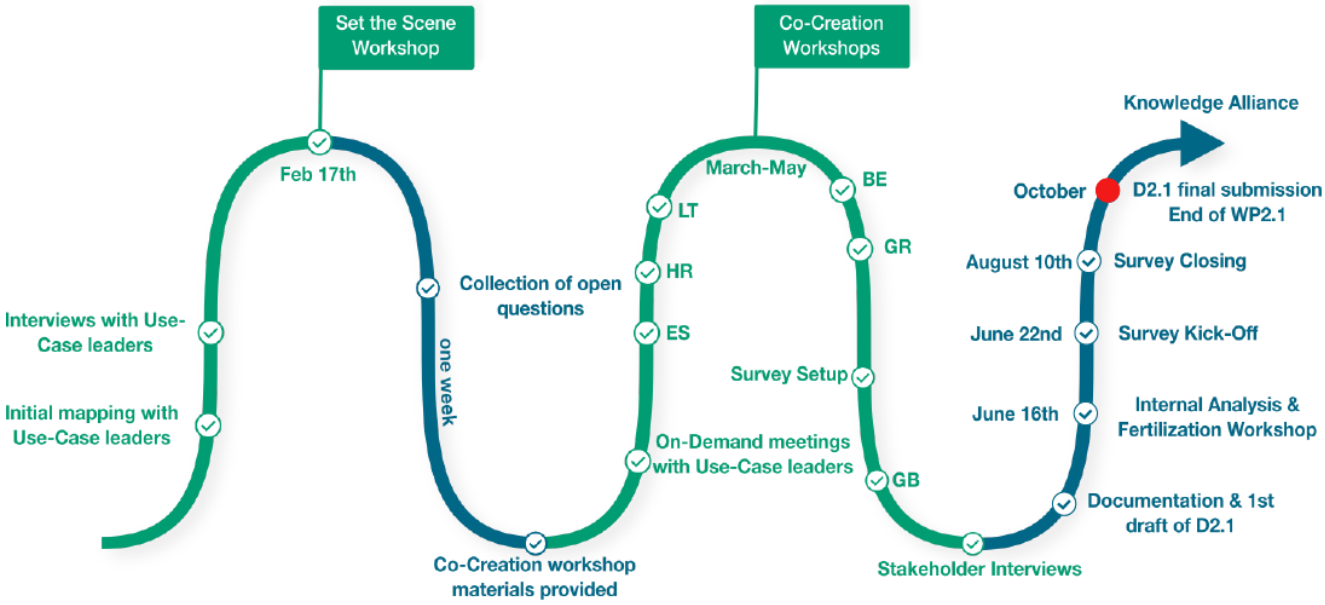

Figure 4: Timeline of T2.1

As can be deferred from Figure 4, the highly inductive method cycle initiated with a serious of bilateral scoping interviews with use case lead partners, asking them to describe the relevant challenges and needs, as well as the status of TRLs, going hand in hand conducting an initial mapping of stakeholders per use case. As an outcome of this first round of engagement, categories for the mapping process were distilled in addition to preliminary "focus dimensions" for later workshops: needs and challenges, KFT development-related insight in addition, clarification as well as prioritization of relevant stakeholder groups.

In order to find a common understanding and consent, which kind of stakeholders should be involved into the co-creation process, the following definitions were agreed by the consortium (further definitions were discussed and included in the XGain Glossary).

- *Stakeholders comprise of end-users and further environments or actors influencing the project outcomes and results.*
- An end user is an individual that a software program or hardware device is designed for. The term is based on the idea that the overarching goal of a software or hardware product is to be useful to the consumer. The end user can be contrasted with the developers or programmers of the product.
- XGain Pop-up co-creation labs provide a new form of cooperation between experts from STI and civil society that focuses on mutual learning in an experimental environment. Actors from science and practice come together to develop and try out scientifically and socially robust solutions based on a common understanding of the problem.

In general, XGain used a Living Lab (LL) approach working on human-centric, open innovation ecosystem of relevant stakeholders focusing on user support, services provision and wide adaption. Through LLs, researchers/innovators can observe and understand user behaviour patterns, even those that are not immediately obvious. XGain aims to demonstrate the design in progress of the KFT and each application results in series of heterogeneous use cases in terms of location, connectivity needs, local needs, edge and connectivity, potential solutions and operational business models. In addition, the initial business models provided for the use cases will be evaluated in parallel with the assessment of the proposed ecosystem of technologies. Core elements of the tailor-made co-creation process were the **Pop-up co-creation labs** with a workshop format. Based on the preliminary T2.1 mapping – providing a first overview of core stakeholders and potential end users of the XGain cases, solutions and the KFT – internal and external participatory research and co-creation activities were implemented.

Major goals were to (a) set the scene and to prepare use case lead partners for their role as hosts of labs (b) to involve multi-stakeholders in the XGain co-creation process (c) inspiring mid-term and long-term partnerships or alliances with stakeholders based on non-hierarchical partnerships sharing perspectives and expertise in mutual learning exercises. On a practical level, workshops aimed to implement (a) a needs analysis and data collection determining social, ecological, legal or technical and economic constraints, (b) co-creating innovative solutions involving end-users and further stakeholders. Furthermore, workshops supported trust building, the stakeholder expectation management, the inclusion of marginalised perspectives, a joint problem definition related to use cases, mutual learning and the co-ownership of the results related to XGain solutions.

The labs were implemented on-site and online (the latter was applied to the use case in Isles of Scilly) in six European regions including **Catalonia**, **Dalmatia**, **Lithuania**, **Flanders**, **Central Macedonia** and **Isles of Scilly**. The labs were based on adaptable concepts for each use case scenario. Main approach was a World Café concept from the Art-of-Hosting portfolio providing a way of harnessing the collective knowledge and the self-organizing capacity of groups. The method was applied to create an inspiring environment to connect multiple ideas and stakeholder perspectives on the XGain “fair transition” (also preparing the ground for T2.2). Participants were engaged in several rounds of small-group conversation on three tables including (a) the co-reflection on potentially relevant stakeholders and environments on table one, (b) a discussion on needs and challenges on table two and, (c) the presentation (with discussion) of the KFT in form of a virtual mock-up on table three.

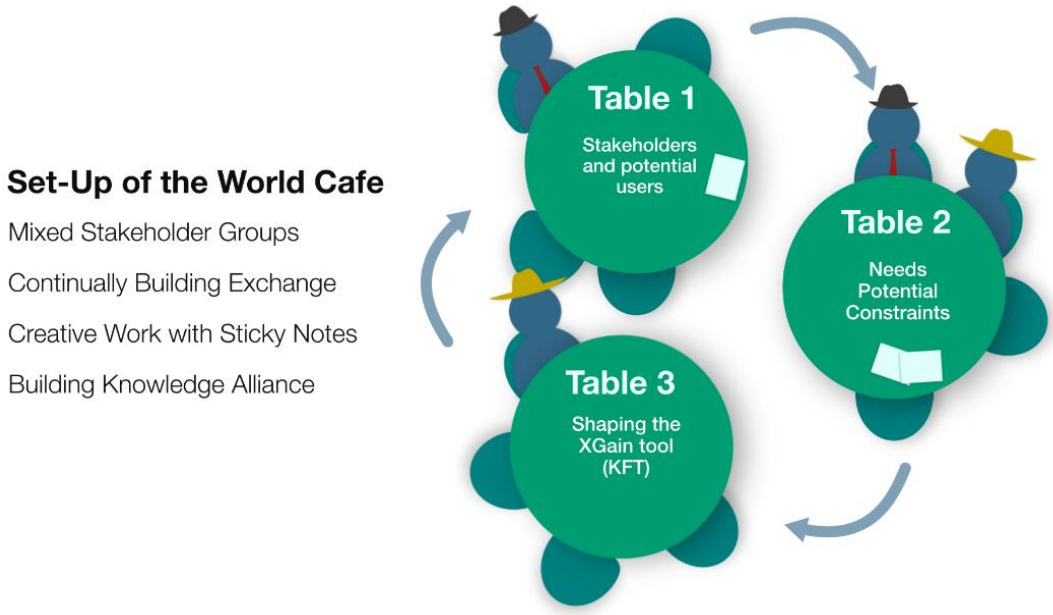

Figure 5: XGain World Café Setting

Figure 6: Screenshot of the Mock-up presented as video during the co-creation workshops

Optionally, lab hosts (use case leaders) were invited to consider a so-called Transect Walk, which was implemented in Croatia in form of an explorative boat trip around use case area with the workshop participants. In general, this method is a systematic walk or, in the case of XGain a joint journey, in the initial phase of the fieldwork, along a defined path (transect) across the community and project area together with for example local people to explore the water and sanitation conditions by observing, asking, listening, looking and producing a transect notes. It is best to discover a route, which covers the greatest diversity of needs and solutions and further aspects to describe the territory. Moreover, the boat trip became an opportunity for talks making site-specific tacit knowledge visible.

Table 2: Timetable of the XGain co-creation workshops in 2023

USE CASE REGION	WORKSHOP MODE	LEAD PARTNER	DATE
Catalonia	on-site workshop	I2CAT	08.03.2023
Croatia	on-site workshop	BENCO	17.03.2023
Lithuania	on-site workshop	ART	29.03.2023
Flanders	on-site workshop	ILVO	18.04.2023
Greece	on-site workshop	CAPT	05.05.2023

Isle of Scilly	on-line (interviews)	JS	May – June 2023

3.2 Stakeholder Analysis

Figure 7: Stakeholder needs

As described in chapter 3 (on methodology), ZSI adopted a partly open-ended but pre-configured co-creation approach. This means that a stakeholder mapping form was developed at the beginning, including prior consultations with task leaders within WP2, followed by a presentation, discussion and adaptation with UC leaders. The initial stakeholder mapping form contained the following categories to be filled in by each UC.

Table 3: Stakeholder categories in the mapping

Categories	Information to be filled in
Name Organisation	Full name of the mapped organisation
Organisation Type	Drawing from the quadruple helix approach to policy-society innovation development, the form pre-defined a series of organisation types to be selected for each organisation entry. These were: • Public Sector • Industries, companies • Universities/Research • Local Stakeholder pro XGain advancement • Local Stakeholder contra XGain progress • Agrarian cooperation • Civil Society Organisations (CSO), including NGOs – referring to environmentalists, conservationists, labour rights movements, etc. • Chambers of Commerce/Trade • Farmer
Territorial scale	Referred to clustering the scale-related relevance of the identified stakeholder, according to three pre-defined scales: “Local”, “Regional”, and “National”, according to the XGain Glossary. However, over the co-creation process, UC leaders adopted a

	diverging clustering: “Subregional (autonomous)”, “Regional”, “National” and “International”.
Contact person name	Name of the main contact person at the selected stakeholder
Contact person email	Mandatory entry of main contact email, in some cases generic for an entire organisation
Contact person gender	For the sake of simplicity, we kept this selection to “male”/”female”/”non-binary & other”.
Contact person age group	Tentative assessment per age groups (20-30, 30-40, 40-50 and 60+).
Representation of Groups	Targeted at assessing and closer defining the role of mapped stakeholders on an individual basis. In addition, at including stakeholders in the mapping belonging to socio-economically and gender-based definitions of vulnerable groups discussed in T2.2 and described in D2.2, such as women and immigrants. Answer options have been: “Farmer already invested in high tech”; Farmer interested but not invested in high tech”; “Hired farm worker”; “Women interested but not invested in High Tech”; Immigrant interested but not yet engaged in High Tech”; Governmental representative of farmers”; “Governmental representative of rural development”; “High Tech person in business”, and “Others/Multiple”, whereas the latter should be specified further in the comments column.
Relevance to farm behaviour	Assessment of information relevance, such as “to inform farm businesses orientation” or “to inform of business constraints” or “not relevant”.
Relevance to environmental analysis	We aimed here at assessing stakeholder’s relation to environmental issues around specific Use Cases, such as (pre-defined list of options): “Water use in agriculture”, “Carbon Emissions”, “Land/Soil Quality”, “Animal Health”, “Aquaculture”, “Environment not relevant”, and “N/A”.
Level of importance	Within the XGain ecosystem, UC leaders were asked to assess the role of each of their mapped stakeholders. Initially, the selection was between: 1 – “likely stakeholder in the innovation pilots”; 2 – “candidate to participate in the innovation pilots”; 3 – “relevant actor in the field”.
Comments	UC leaders were asked to provide any additional information, especially if under “Representation of Groups” the answer option “Multiple/Others” was selected.

This assessment was further assessed through the internal co-creation process with a score from zero to 4 according to the following scales shown in the Figure 8. Mapping result giving an overview per use cases can be found in the Annex of this document.

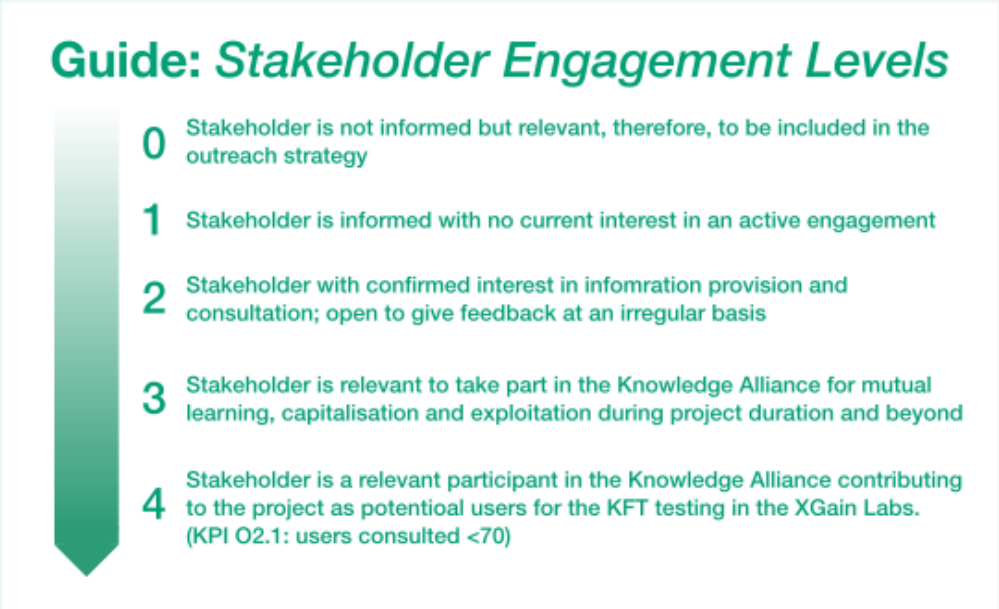

Figure 8: Stakeholder engagement level

3.3 Cross-use case analysis

An overall analysis across all use cases with regard to the organisational affiliations of the mapped stakeholders shows the predominance of representatives from the public sector, research and the private sector. Farmers and agrarian cooperation are also represented at an average level. However, as expected earlier in the co-creation process, CSO members, trade-related, vulnerable groups and local venders are less represented.

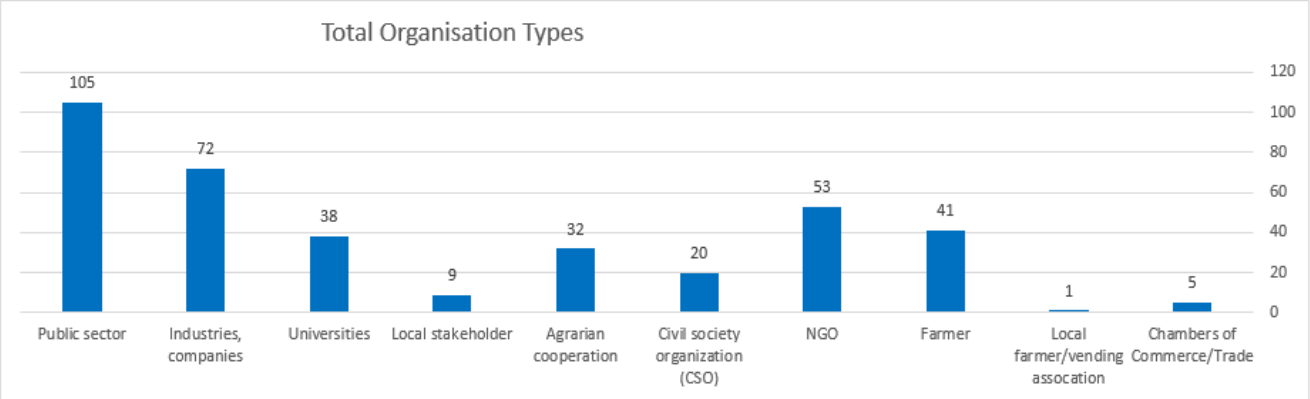

Figure 9: Total organisation types

With regard to the prevalence of territorial scales, the regional scale of mapped stakeholders across all UCs has been included most frequently, followed by the national scale of relevance. This result should be seen in the light of the previous one: policy-makers at the regional (e.g., provincial) level figure are more often in the mapping than European or international policy-makers.

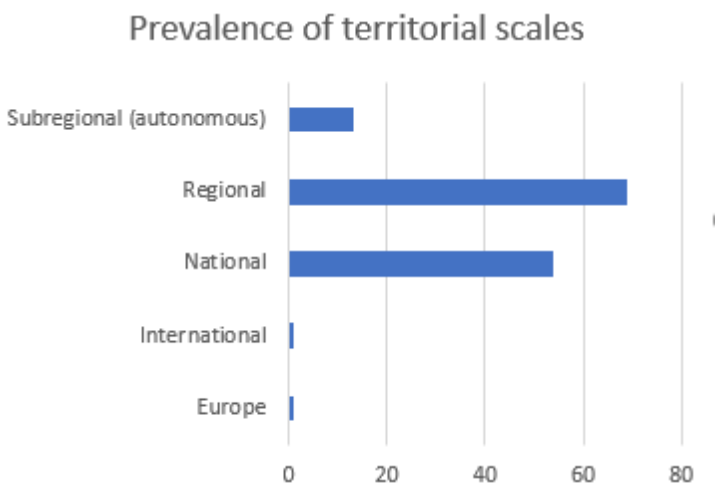

Figure 10: Prevalence of territorial scales

Continuing this stream of data crossing, we see below that – despite a relatively large number of not categorized stakeholders in terms of group belongings and representations (52 out of 148) - a comparatively larger number of governmental representatives of rural development as well as high tech persons in business belong to the regional level of relevance. Similarly, 36 stakeholders earmarked "others/multiple" were in the comments' section predominantly identified as researchers, again mostly relevant at the local and regional level.

Farmer already invested in high tech	13
Farmer interested but not yet invested in high tech	3
Governmental representative of farmers	9
Governmental representative of rural development	15
High tech person in business	18
Others/Multiple, please specify in comments	36
(Leer)	
TOTAL	**96**

Figure 11: Example for the mix of stakeholders including farmers

In terms of comparative findings, it is noteworthy that in the UCs of Flanders and Central Macedonia, not a single **farmer** has been included in their respective stakeholder lists; however, both lead the numbers in terms of **public government** representatives in their lists. The UC with **most farmers** involved is Dalmatia. **Private sector** representatives are **more equally distributed** across UC, particularly if taking the different sizes and scopes of UCs into account. **Female participants** are represented by **roughly 20%** of all mapped stakeholders; however, this number needs to be taken with caution, since not all UCs identified gender thoroughly in their respective lists. **Local stakeholders**, generally, are very little represented, demonstrating the target group of XGain being found rather at agro-technical, policy, research and entrepreneurial levels.

3.3.1 Readiness levels of use cases

XGain entails the following remote rural and rural-to-urban agricultural/aquaculture, forestry and e-health (fields of) use cases that cover local, community-related and regional characteristics respectively. Overall, they involve a wide number of economic sectors and services. The following list presents the sectors to be addressed by the KFT tool as an outcome of the cross-use case analysis:

In all UCs, the selection and implementation of connectivity solutions to agricultural, aqua cultural as well silvicultural activities were rather in their initial stage. Complementing the assessment of TRLs, use case leaders assessed also Societal Readiness Levels (SRLs) thinking of societal context and social responsibility of the use cases and the project. This concept refers to how ready is society to accept a particular innovation. SRL is an assessment concept incorporating ethical, legal, economic, and social factors. If the societal readiness for the social or technical solution is expected to be low, suggestions for a realistic transition towards societal adaptation are required. SRL1 is the lowest and SRL9 is the highest level.

Generally, most use cases were initially in need of refining their business models, and in particular, of finding acquisition and funding models for further edge technology-supported solutions. At the positive side, most use cases had already progressed in establishing a proven and relevant network of potential end users, as well as other stakeholders. This preliminary mapping, however, needed to be expanded for stakeholders in policymaking (again, across community, local and regional dimensions), relevant technology intermediaries, and innovation funding agencies. Important common challenges entailed access to remote areas, mobilising hard-to-reach stakeholders, particularly in the agricultural sector, identifying relevant partners in universities and policy-making and above all, ensuring their active participation in a project where the actual KFT development, usability experience and design depended on their engagement, prior to providing a proper foresight into it.

Table 4: (Self-) Assessment of UCs between 2022 and mid-2023: Societal and Technological Readiness Levels (SRLs/TRLs)

		Catalonia	Central Macedonia	Isles of Scilly	Dalmatia	Lithuania	Flanders
TRLs	Initial Value	**4**	**4**	**4**	**4**	**4**	**4**
	April '23	**6**	**6**	**5**	**6**	**6**	**5**
	July '23	6	6	5	6	6	5
SRLs	Initial Value	**3**	**3**	**3**	**3**	**3**	**3**
	April '23	**6**	**5**	**4**	**4**	**6**	**4**
	July '23	6	5	4	4	6	4

3.3.2 Gender distribution

The gender distribution of stakeholders across various use cases reveals variations in representation. In the case study of Central Macedonia, females constitute 58% of stakeholders, with males at 42%, indicating a higher representation of women in this particular context due to traditional gender roles in the care sector. This diversity offers a unique perspective, especially in fields like social protection and elderly care, where women's experiences can inform tailored solutions. However, gender information is often missing for some stakeholders,

suggesting a need for improved data collection practices. Inclusivity and transparency in gender data can enhance efforts to promote gender equality and meaningful stakeholder engagement.

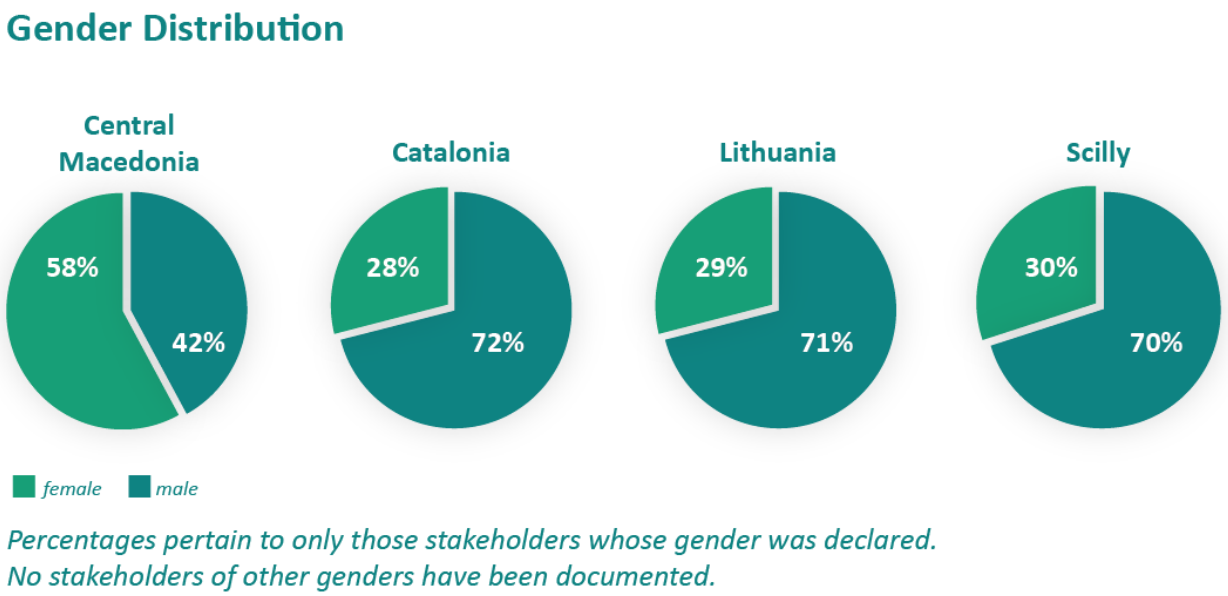

Figure 12: Gender distribution of stakeholders

In the Isles of Scilly Remote Community use case, there is a gender distribution of approximately 70% male and 30% female stakeholders, with implications for equity and inclusivity. Similarly, in the Lithuania Farming and Forestry project, 71% of stakeholders are male, while 29% are female, with gender data missing for some individuals. This distribution highlights the need for proactive measures to address gender imbalances, such as mentorship programs, flexible participation options, and collaboration with women's organisations.

All results highlighted in this chapter are interim and brief snapshots at the end of T2.1.

4 Use Cases

In the following, all six UCs and the feedback gained during the co-creation workshops are showcased after being critically analysed in the cross-fertilisation workshop in June.

Figure 13: XGain Use cases in six European regions

As already pointed out, during the co-creation workshops, a few participants expressed specifications that fall outside the objectives of the KFT development. While these requests may not align with the original goals, they remain under consideration for potential inclusion.

4.1 Catalonia, Spain

Use Case Partner: *i2CAT, Barcelona*

Summary of the use case:

- Integration of agricultural drones and technology in rural Catalonia's development
- Emphasis on collaboration within local agricultural cooperatives and communities of interest
- Aims for a prosperous and sustainable agricultural future
- Incorporation of renewable energy sources to promote sustainability

Main inputs from the workshop:

- Embracing new working dynamics like telework
- Building cooperation networks and using tools like KFT to attract talent
- Focusing on helping users find solutions to specific challenges they encounter

- Emphasizing sustainability, addressing biosecurity concerns, and assisting in decision-making and risk assessment

Figure 14: Illustration of Catalonia with drones

4.1.1 Stakeholder Mapping

4.1.1.1 Organisation Types

- **Active Public Sector Engagement**: Local authorities are eager to adopt advanced technology, which can lay a strong foundation for the project's success.
- **Industry and Academic Collaboration**: Involvement from various industries and universities suggests opportunities for partnerships and research support, benefiting both farming practices and education.
- **NGOs' Valuable Role:** NGOs bring experience in driving positive change, making them valuable partners in promoting sustainability in agriculture and environmental monitoring.
- **Potential for Small-Scale Farmers/Vendors:** Although a local farmer/vending association is missing, the project can actively engage them to ensure their perspectives are represented.

Figure 15: Catalonia stakeholders

The list of stakeholders shows that public bodies are highly involved, indicating a strong interest from local authorities in adopting advanced technology. This early engagement of the public sector could greatly help in laying the foundation for a successful KFT implementation and further business development, especially when it comes to questions of infrastructure, but also acquisition models and R&I related funding.

The list also reveals the presence of various industries and companies, which suggests potential partnerships and collaborations to implement high-tech solutions in farming. Their involvement can lead to the integration of cutting-edge technologies in agricultural practices, contributing to improved productivity and sustainability.

4.1.2 Co-Creation Workshop

The XGain Co-Creation Workshop, organized by i2CAT, took place on 8th March 2023 in El Molló, Mora d'Ebre. The workshop's objectives included identifying key stakeholders, discussing challenges and opportunities, and designing the KFT. During the workshop, various key stakeholders and target audiences were identified, encompassing tech and service providers, the agricultural and public sectors, as well as other communities such as NGOs.

4.1.2.1 Results of the workshop

Challenges and Needs:

- Economic challenges due to lack of investment, outdated infrastructure, and poor services
- Migration of young talents to urban areas
- Need for programs to attract and integrate migrant workers
- Concerns about infrastructure, old buildings, and roads, and limited support services for innovators
- Accessibility issues, especially for the elderly, in terms of technology

- Environmental challenges like climate change, human activities, and ecological problems

Opportunities for Improvement:

- Embracing new working dynamics like telework
- Exploring undeveloped sectors like tourism
- Building cooperation networks and using tools like KFT to attract talent
- Coordinating rural resource exploitation through rural managers
- Finding alternatives to increase productivity, motivation, entrepreneurship, and local potential

4.1.2.2 Inputs to KFT (Knowledge Facilitation Tool)

During the XGain Co-Creation Workshop, the working groups focused on shaping the XGain KFT to ensure inclusivity for all citizens, especially those interested in innovation. The tool's main goal will be to help users find solutions to specific challenges they encounter. Below are the most important aspects related to the KFT development.

Usability:

- Ensure accessibility for all users, particularly those interested in innovation
- Recognize the need for local experts in sectors like agriculture to assist users in understanding and implementing technology

Support for Innovation and Marketplace:

- Focus on helping users find solutions to their specific challenges
- Address the lack of knowledge among potential users about innovating with advanced technologies
- Include regional references such as contact points and technology providers
- Consider offering expert guidance to help users improve their services with technology
- Explore potential collaborations with small companies to enhance their interest

Other Services and Functionalities:

- Emphasize sustainability, both economically and ecologically
- Assist in decision-making and risk assessment, including mitigation strategies such as for bird flu
- Highlight the availability of infrastructure and initiatives related to new technologies
- If possible, automate the retrieval of topographic, meteorological, and demographic information for user convenience

4.1.3 Results and Insights

- **Fostering Regional Ties**: Strengthening connections with regional Research and Innovation (R&I) funding agencies is essential for upscaling and maximizing the success of KFT development and testing, as well as use case implementation in real business environments.
- **Environmental Monitoring Focus**: There are suggestions to develop the KFT and potential technology solutions around the use case of environmental monitoring, particularly for river development and harvesting cycles.
- **Collaboration Opportunities**: Exploring collaborations with agricultural technology intermediaries as potential KFT end users and educational initiatives for local and regional rural development has been proposed.
- **Sustainable Energy Exploration**: The presence of wind power near Mora d'Ebre offers opportunities to enhance the sustainability of technological solutions at the community level. Partnering with local and regional energy providers can further green the agricultural sector in the area, aligning with sustainability goals.

4.2 Central Macedonia, Greece

Use Case Partner: *CAPTAIN COACH, Thessaloniki*

Summary of the use case:

- Central Macedonia's goals: eHealth robots for elderly care, high data rate services, and tourism improvements
- Acknowledgment of the potential of 5G and connectivity tech in rural communities
- Plans for deploying eHealth robots, utilizing edge technology for real-time care, and addressing digital literacy and social engagement among the elderly

Main inputs from the workshop:

- Addressing the social isolation and disconnection felt by older adults in rural areas
- Stakeholders suggested alternative orientations for the KFT, focusing on voluntary activities, cultural events, and interconnection among policy-making bodies
- Emphasis on a user-centric approach for CAPTAIN Box device acceptance, including transparent communication, user testing, and robust privacy features

4.2.1 Stakeholder Mapping

4.2.1.1 Organisation Types

The data highlights a diverse group of stakeholders in Central Macedonia, including the public sector, industries, companies, NGOs, and academic institutions. Their collective expertise and resources are seen as crucial for successfully implementing eHealth initiatives, particularly in providing advanced and user-friendly eHealth robots for elderly care. The involvement of the public sector reflects strong government support, ensuring necessary infrastructure, regulations, and funding. This collaboration aims to improve the quality of life for the elderly population in the region and create an effective eHealth ecosystem benefiting caregivers and elderly individuals.

- **Government Support**: The public sector, represented by municipalities, regions, universities, and research institutions at both regional and national levels, shows strong government support for eHealth robot projects. This support is expected to ensure necessary infrastructure, regulations, and funding.
- **Potential of Companies and Industries**: Companies and industries are seen as valuable contributors with technical expertise and innovation that can lead to advanced and user-friendly eHealth robots tailored for elderly care.
- **CSOs and NGOs**: Civil Society Organisations (CSOs) and NGOs have direct connections with local communities and can understand the needs of elderly individuals. Their involvement is likely to promote the acceptance of eHealth robots among the elderly population.
- **Academic Institutions**: Academic institutions are essential for research, validation of eHealth robot effectiveness, and improving elderly care through technology. Their regional and community linkages ensure solutions are tailored to local needs.

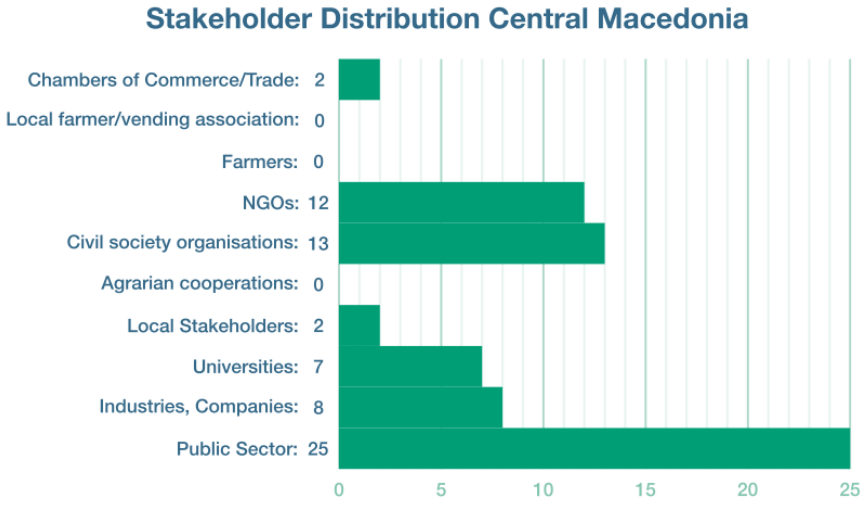

Figure 16: Greece stakeholders

4.2.2 Co-Creation Workshop

CAPTAIN Coach and the Regional Development Fund of Central Macedonia at the Olympic Museum in Thessaloniki, Greece organized the XGain co-creation workshop on the 5th of May 2023. Approximately 40 potential stakeholders were invited from the public sector, universities, companies, and nursing homes, but only 4 of them attended the workshop. Despite the limited number of potential stakeholders, the outcomes from the table discussions were positive. Due to the small attendance, it was decided not to create three separate tables but to integrate all participants into one group, with each person from CAP, RDFCM, and ICCS moderating a specific topic.

4.2.2.1 Results of the workshop

Challenges and Needs:

- Convincing older adults to accept the CAPTAIN Box device into their homes, especially due to concerns about the built-in camera
- Older adults in rural areas already feel socially isolated and disconnected from the world and the public.
- Some elderly individuals may perceive the cost of the device or service as expensive.
- The device needs to be thoroughly tested with elderly users to gauge their reactions.
- The socializing aspects of the device are important for the well-being of elderly users.

Opportunities for Improvement:

- Leveraging existing home help groups like "Help at Home" to identify and approach potential users.
- The project can connect rural areas to cities, providing access to valuable information.
- Utilizing their knowledge of village infrastructure for gathering additional information.
- Advocating for a campaign to motivate and inform elderly individuals about tailored programs and activities, although there may be reluctance from policy makers.

4.2.2.2 Inputs to KFT (Knowledge Facilitation Tool)

The workshop discussion focused on the adoption of the KFT tool in Central Macedonia and stakeholders identified critical challenges impacting its meaningful use. These challenges have prompted them to suggest alternative orientations and functionalities for the tool.

- **Coverage Issue**: The primary concern for adopting the KFT tool in Central Macedonia is the inadequate coverage by Mobile Network Operators and Internet Service Providers.
- **Interconnection Desired**: There is a desire for the tool to facilitate interconnection among policy-making bodies and similar organisations to promote synchronization and awareness of new opportunities.
- **Lack of Interest**: Unfortunately, the stakeholders at the workshop did not express significant interest in adopting the KFT tool for its current purpose.

- **Potential for Simplified Implementation**: Despite the lack of interest, there is still potential for implementing a simplified scenario and corresponding KFT recommendations.

4.2.3 Results and Insights

- **User-Centric Approach**: Ensuring acceptance of the CAPTAIN Box device among older adults requires a user-centric approach, including transparent communication, user testing, and robust privacy features.
- **Customization and Communication**: The device can be customized to provide information on voluntary activities, cultural happenings, and cultural clubs/societies while facilitating improved communication among policy-making bodies.
- **Key Success Factors**: Successful implementation relies on affordable pricing models, collaboration with existing support networks, public awareness campaigns, and continuous testing and iteration.
- **Localization and Engagement**: Localization efforts and engagement with the Smart Village Leader Network are essential to address the unique needs of elderly individuals in the region.
- **Business Model Uncertainty**: A major uncertainty in this use case revolves around the early stage of its business model development, which has not been adapted to the local context. This is compounded by its status as a university spin-off without full regional public and/or private sector support, impacting KFT design insights.

4.3 Isles of Scilly, United Kingdom

Use Case Partner: *CAFA Tech*

Summary of the use case:

- The remote community in Isles of Scilly focuses on addressing the network coverage challenges in remote islands, characterised by scattered agriculture and tourism (frequently combined).
- The project will demonstrate connectivity solutions and applications tailored to the needs of Scilly Organics, an organic farm on the Isles of Scilly.
- The system includes a mobile robot for soil measurements, a tethered drone for aerial imaging, and a 5G router for connectivity.

Main inputs from interviews with local stakeholders:

- Internet capacity constraints speed, and reliability problems during peak summer months are among the connectivity issues faced.
- Stakeholders express a need for better understanding of digital farming devices, their benefits, and potential market expansion.

- Businesses seek support in installing, maintaining, and understanding digital systems and devices on farms, as well as interpreting their outputs.

4.3.1 Stakeholder mapping

4.3.1.1 Organisation Types

The majority of stakeholders fall within the age range of 40-50 years. Farming is the primary background of the stakeholders, and there is a growing interest in adopting high-tech solutions for agricultural advancements and environmental analysis.

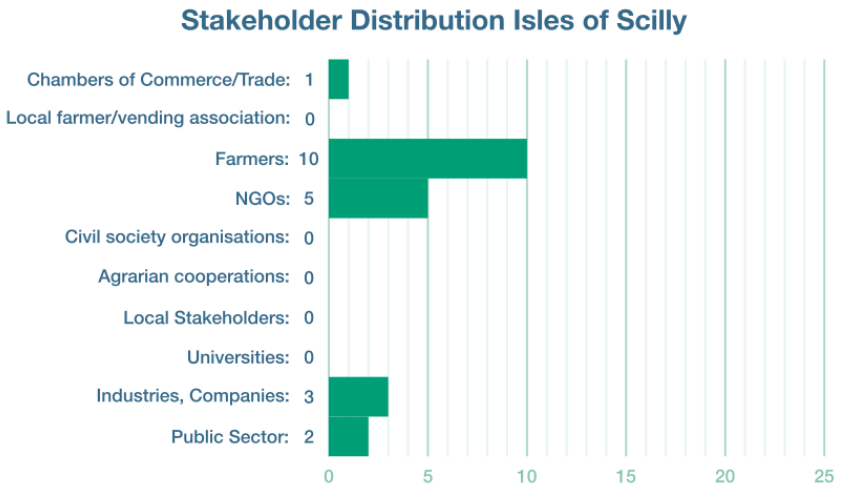

Figure 17: Scilly stakeholders

Collaborating with various organisations, including NGOs, industries, and the public sector, adds value and expertise to the use case, aiming to benefit the local farming community and the environment in the region.

Most stakeholders (farmers and organisations) have an interest in improving farm behaviour through digitalization and precision agriculture techniques. Some stakeholders are already invested in high-tech solutions, indicating a willingness to adopt advanced technologies for agricultural practices. NGOs, such as Farm Carbon Toolkit and Soil Association, focus on environmental analysis and promoting sustainable farming practices.

4.3.2 Interviews with local stakeholders

In this specific use case, a distinct approach was taken, different from the workshops utilized in other cases. Instead, the engagement with stakeholders involved conducting a series of interviews conducted by Jonathan Smith (JS) between May and June 2023. The interviews encompassed various user types, including farmers, land managers, tourism businesses, local landowners (such as the Duchy of Cornwall and Tresco Estate), the Local Council (Council of the Isles of Scilly), and representational organisations across the UK, specifically those related to organic farming and land-based businesses.

The methodology employed for this task involved interviews with eleven participants, with representation from nine different farms on the Isles of Scilly, chosen through personal contacts to offer a diverse perspective on

farming and sectors. These farms produced a wide range of products, including meat, dairy, vegetables, fruit, and flowers, covering four of the five inhabited islands in the region.

Additionally, two other key interviews were conducted with the Duchy of Cornwall, the primary landowner, and the Council of the Isles of Scilly, the local authority. The interviews were conducted in person or via phone/Zoom, using a predefined interview template designed to address pertinent questions for the task. However, the interviews were conducted in a conversational style to ensure the acquisition of high-quality information, with a particular focus on understanding the challenges and opportunities unique to each interviewee.

4.3.2.1 Results of the interviews

Challenges and Needs:

- The mobile network, consisting of 4G and limited 5G coverage, faces challenges with localized 5G availability on St Mary's and patchy 4G coverage due to topography.
- Farms encounter various challenges, including water scarcity for irrigation, low soil organic matter levels, costly and unreliable transportation of goods to and from the mainland.
- Internet limitations include capacity constraints during peak summer months, speed and reliability issues in some areas.
- Stakeholders need better knowledge of digital devices for farming and their potential benefits, including market expansion, data understanding, and system automation.
- Investment is required to enhance the resilience and speed of local internet systems.
- Businesses require expert assistance for installing, maintaining, and understanding digital systems and devices on farms, along with support for interpreting outputs.

Potential Solutions:

- Public investment should focus on strengthening the resilience, speed, and robustness of local internet systems.
- Facilitate knowledge sharing about available digital devices, their benefits, training requirements, and opportunities for learning and inspiration.
- Establish a public forum for businesses to express their needs and engage with local government, mobile operators, and regulators to address connectivity issues.

4.3.2.2 Inputs to KFT (Knowledge Facilitation Tool)

Additionally, to the interview series in May and June, a workshop was scheduled with farmers on September 26, 2023 but had minimal attendance with only one participant. This limited turnout prevented consortium partner CAFA from adequately assessing the requirements related to KFT.

4.3.3 Results and Insights

The Islands of Scilly face unique challenges, which would require a specific set-up of solutions to improve the connectivity situation for local farmers.

- **Aerostats would potentially provide a low-impact solution;** however, handling the occurrence of strong winds and currents in the area may hinder such applications to be fully employed.
- In terms of business case and innovation acquisition support locally, it is suggested to **foster ties to mainland UK early on**, where regionally and locally relevant policy decisions are made. This is particularly relevant when it comes to bringing network and service providers on board as to avoid the duplication of efforts, but also taking into account ecological and touristic criteria of "do not harm" in the area.
- **A fully developed stakeholder list is therefore urgently required**, as well as fostering the local Knowledge Alliance through repeated local events, newsletters and stakeholder engagement.
- Similar to the previous use case in Greece, it is advisable to **bracket this use case for the time being with regard to the KFT development** and testing, upon further notice related to the realization of the ADOPT analysis workshop planned in T2.2.
- Instead, **resuming the inclusion of this UC in WP5 and WP6 having a strong focus on sustainable** (economic and ecological) business model development in close collaboration with touristic and environmental monitoring applications.

4.4 Lithuania

Use Case Partner: *ART21*

Summary of the use case:

- The project aims to enhance crop assessment tech using drones and hyperspectral cameras.
- XGain's value lies in enabling real-time analysis, reducing chemical use, and aiding forest monitoring.
- Impact extends to various sectors, bridging connectivity gaps. Business models include service offerings and the solution reduces environmental impact. Existing equipment involves drones and cameras, with added edge processing devices.

Main inputs from the workshop:

- Identified the issue of forest pollution, particularly trash, and proposed the use of drones for efficient monitoring of vehicle movement to detect forest polluters.
- Concerns were raised about limited 5G and connectivity options in forested areas.
- Stakeholders found value in the KFT providing a comparative analysis of different alternatives, including the current user solution.

4.4.1 Stakeholder Mapping

4.4.1.1 Organisation Types

The stakeholder list includes a diverse spectrum of professionals and organisations in various sectors and industries. Predominantly represented are farmers, agrarian cooperation entities, industry and company representatives, non-governmental organisations (NGOs), public sector bodies, and academic institutions. These stakeholders are engaged both regionally and nationally, contributing to a comprehensive representation of interests.

- **Engagement Levels Vary:** Stakeholders range from uninformed to highly involved.
- **Diverse Interests:** Stakeholders have varied interests, including technology, environmental conservation, forestry, and agriculture.
- **Use Case Benefits:** The stakeholder list is valuable for a 5G use case focused on precision agriculture, environmental monitoring, and forest management.
- **Collaborative Success:** Project success hinges on collaboration among diverse stakeholders.
- **Direct Farmer Benefits:** Enhanced crop assessment tech benefits farmers and agrarian cooperation entities.
- **Addressing Connectivity Challenges:** Smaller farms with connectivity issues can benefit from hybrid data solutions enabled by XGain.

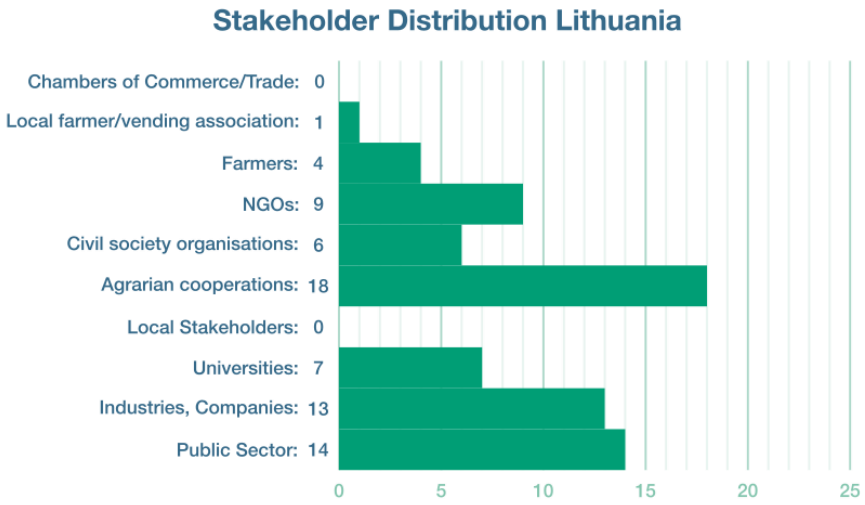

Figure 18: Lithuania stakeholder

4.4.2 Co-Creation Workshop

The XGain Co-Creation Workshop, organized by ART21, took place on March 29, 2023, in Vilnius, Lithuania and was attended by 12 stakeholders from the forestry and farming sectors in Lithuania. These stakeholders represented a variety of organisations, including public sector institutions, associations, NGOs, research

institutes, and academia. One intended participant representing local communities was unable to attend due to personal reasons. The workshop was organized and facilitated by three researchers from ART21, with additional support from ZSI, I2CAT, and other consortium members.

The primary objective of the workshop was to convene stakeholders, introduce them to the XGain project's goals, activities, and expected outcomes, and solicit their feedback and insights on the Lithuanian Use Case, which involves data transfer via 5G in rural areas, and the Knowledge Facilitation Tool (KFT). The workshop included presentations on the overall project, the Lithuanian Use Case, and a KFT mock-up by the technical provider, I2CAT. The KFT mock-up generated significant interest, questions, and discussions, with participants expressing a desire to explore its potential applications in their organisations.

The workshop also featured a lively World Café discussion, where stakeholders actively engaged in sharing their views and ideas. After the workshop's conclusion, many participants continued discussions among themselves.

4.4.2.1 Results of the workshop

Needs in the Forestry Sector and Potential Solutions:

- **Forest Pollution Monitoring:** Participants highlighted the issue of forest pollution with trash and suggested that drones could efficiently monitor vehicle movement to detect forest polluters, especially in private forests where the owner bears the responsibility.
- **Biological Diversity and Productivity:** Technologies like drones could assist in monitoring biological diversity and forest productivity. Participants expressed the need to gather information such as soil type, groundwater levels, wetlands identification, counting dried woods, wood species, feed base monitoring, and more. This data could support forest health monitoring and evaluation
- **Wildlife Population Monitoring:** Participants suggested using technology to monitor wild animal populations, track disease spread among animals (e.g., wild boar disease), and assess their impact on biodiversity.
- **Forest Fire Prevention and Observation:** Stakeholders involved in forest fire prevention noted that the current monitoring system, which relies on designated towers, has limitations. They proposed using drones for real-time forest fire prevention and observation.

Constraints in Using Drone Technologies in Forestry:

- **Limited Connectivity:** The workshop participants raised concerns about limited 5G and connectivity options in forested areas. They suggested the need for mobile 5G stations or alternative solutions like Starlink to address this constraint. The Knowledge Facilitation Tool (KFT) should consider connectivity aspects.
- **Inaccurate Equipment Specifications:** Participants highlighted issues with the accuracy of technical equipment specifications used by public authorities for forest monitoring. This inaccuracy should be addressed through technology development and reflected in KFT suggestions.
- **Scattered Forest Plots:** Forests, both state and private, are often scattered across smaller plots, making it challenging to monitor. KFT needs to accommodate multiple terrain and topographic information inputs.

- **Cost of Adoption:** Participants noted that technologies proposed by XGain could be expensive to adopt, especially for small forest owners.
- **Regulatory Challenges:** Various regulations affect technology use in rural areas, including rules for operating drones and restrictions near sensitive areas like country borders, military zones, and airports. These regulations can impact the feasibility of technology solutions.

4.4.2.2 Inputs to KFT (Knowledge Facilitation Tool)

The discussions on the Knowledge Facilitation Tool were one of the most active ones, as workshop participants were keen on learning more about the tool and considered it having a good potential to benefit them, if designed right. Thus, the comments, suggestions and questions were raised during multiple occasions.

This section overviews the points raised by the theme related to KFT.

User Input and KFT User Interface Feedback:

- **User Profiles:** Workshop participants suggested that the KFT could benefit from having different user profiles to cater to the varying needs of stakeholders. For example, private forest owners and farmers may have different requirements than public authorities or researchers.
- **Simplified Input:** Some participants found the current version of the KFT to require overly detailed and informed input, which could be a barrier to usage. They proposed that the tool could automatically generate certain information or synchronize with other tools/maps to simplify user input.
- **Explanation Sections:** Participants recommended including explanation sections (e.g., an "i" icon for information) to clarify technical options (e.g., 4G, 5G) for less tech-savvy users and highlight differences between options.
- **Pre-filled Fields:** To assist less tech-savvy users, there was a suggestion to incorporate pre-filled fields and spread tech input across multiple steps to guide users in making selections.

Results and Solutions Generated by KFT:

- **Contextual Considerations:** Participants emphasized that the KFT should consider factors such as the user's region, seasonality, and regulatory restrictions when suggesting solutions and service providers.
- **Technology Provider Information:** Users wanted the KFT to offer information about potential technology providers, including proximity, existing usage by other users, and both local and international providers.
- **Technical Specifications:** For public authorities, it was important that the KFT's information and suggestions included specific technical parameters. This would assist in creating public procurement technical specifications.
- **Comparative Analysis:** Participants found value in the KFT providing a comparative analysis of different alternatives, including the current user solution.

4.4.3 Results and Insights

- **Enhance Connectivity Solutions:** Address the challenge of limited 5G and connectivity options in rural areas by exploring the deployment of mobile 5G stations or alternative connectivity solutions, ensuring seamless data transfer for the XGain project.
- **Tailor the Knowledge Facilitation Tool (KFT):** Customize the KFT to accommodate different user profiles, simplify input processes, and provide explanatory sections, making it user-friendly and accessible to a wide range of stakeholders.
- **Promote Collaborative Efforts:** Foster collaboration among diverse stakeholders, encouraging information sharing, and the development of technology solutions that address forest monitoring challenges, while also considering regulatory and cost-related constraints.

4.5 Dalmatia, Croatia

Use Case Partner: *BENCO Baltics, Vilnius, operating in Šibenik, Croatia*

Summary of the use case:

- The Dalmatia region in Croatia faces fragmented connectivity, limiting digitalization due to poor 3G/4G/5G coverage.
- XGain's solution focuses on innovating oyster farming. Limited connectivity delays this transition, especially in coastal rural areas where farms often lack commercial attractiveness for major network operators.
- The proposed solution enables remote monitoring, efficient farming practices, academic benefits, and scalability while also contributing to economic development and ecosystem sustainability.

Main inputs from the workshop:

- Encouraging the younger generation of farmers, who are more tech-oriented, to adopt these solutions.
- Ensuring that solutions meet environmental protection regulations.
- The KFT tool should provide solutions, companies to contact, price ranges, cost/benefit analysis, and clear explanations for non-expert users.

4.5.1 Stakeholder Mapping

4.5.1.1 Organisation Types

The stakeholder list comprises individuals and organisations with diverse backgrounds. The top professions include farmers, individuals from universities, and representatives from various sectors. The most common age

range is between 30 and 40 years. The stakeholders are associated with universities, public institutions, NGOs, and industries. Their interests range from high-tech advancements and business orientation to governmental representation of rural development. The stakeholders come from a wide range of backgrounds and sectors, reflecting the multifaceted nature of the aquaculture and farming industry:

- **Stakeholder Diversity:** Stakeholders encompass various territorial scales, including regional, national, and subregional (autonomous) levels, indicating a wide geographical coverage and interest in local and national contexts.
- **Varied Engagement Levels:** Engagement levels among stakeholders vary, ranging from active interest and involvement to being informed or not yet involved.
- **High-Tech Interest:** There is significant interest in high-tech advancements, with some stakeholders already invested in high-tech solutions, indicating a forward-looking perspective and a willingness to embrace technological innovations in aquaculture.
- **Governmental Collaboration:** Several stakeholders actively participate in governmental representation of rural development, showcasing collaboration between the private sector and governmental bodies to promote sustainable growth in the aquaculture sector.
- **Comprehensive Approach:** While some stakeholders directly impact farm behaviour, others are indirectly involved in environmental analysis, suggesting a holistic approach that considers operational factors and the broader environmental context.

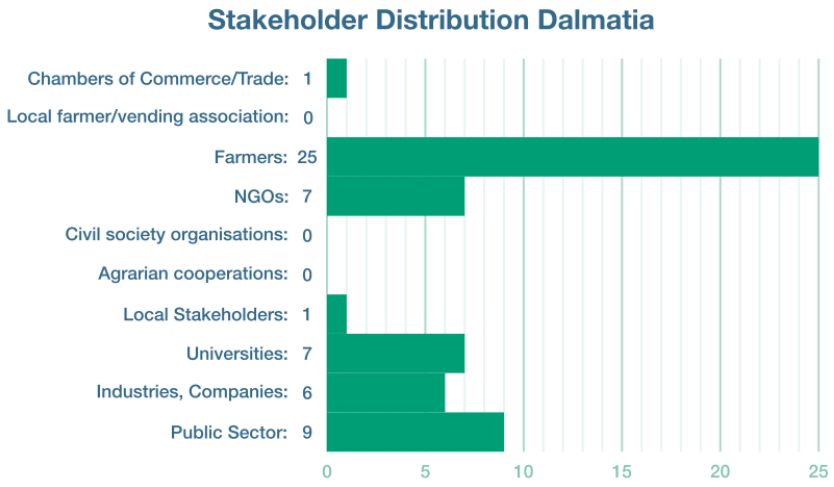

Figure 19: Dalmatia stakeholder

4.5.2 Co-Creation Workshop

The workshop, organized by Benco Baltic d.o.o., took place on March 17th in Šibenik, Croatia. Stakeholders from various sectors, including public and policy-making, NGOs, academia, and farming, as well as several local stakeholders, were invited. In total, 13 stakeholders, along with 5 representatives from the consortium member companies: ZSI (Zentrum für Soziale Innovation), Benco Baltic, and Astrocast, attended the co-creation workshop.

All participants in the workshop were active and engaged throughout the entire event. Discussions and the sharing of insights and essential ideas began during the welcoming of participants and continued in more detail

during the World Café event. During the World Café session, participants were mixed and divided into three groups to ensure diverse representation among stakeholder types.

4.5.2.1 Results of the workshop

These challenges and needs were discussed during the workshop, highlighting the importance of addressing them to successfully implement the XGain project and the KFT.

Behavioral Challenges:

- **End-user Education:** The biggest challenge identified is the age of farm owners, who often lack tech-savviness and resist adopting digital technologies due to mistrust or the need to leave their comfort zone.
- **Proof of Concept:** Demonstrating the real value and effectiveness of the Knowledge Facilitation Tool (KFT) and connectivity solutions is crucial to gaining user interest and trust.
- **Sharing Good Practices:** Spreading awareness and educating end users through trusted sources, such as early adopters and community members, is essential.
- **Targeting Younger Generations:** Encouraging the younger generation of farmers, who are more tech-oriented, to adopt these solutions.
- **Installation Assistance:** Providing support in installing the system.
- **Sustained User Engagement:** Maintaining contact with users over an extended period to ensure continued engagement.

Environmental and Geological Challenges:

- **Minimally Invasive Solutions:** Implementing solutions that are minimally invasive and do not disrupt the environment.
- **Environmental Regulation Compliance:** Ensuring that solutions meet environmental protection regulations.

Technical Challenges:

- **Open Data Sharing:** Promoting open data sharing among institutions and farmers.
- **Low-Power Consumption:** Developing technologies that can operate efficiently with low power.
- **Device Location:** Ensuring the ability to locate devices in case of theft or accidents.

Financial Challenges:

- **Cost/Benefit Explanation:** Providing clear explanations of the cost/benefit of digital solutions.
- **Flexible Pricing:** Offering various pricing options for different user needs.
- **Renting or Servicing Technology:** Considering the possibility of renting or servicing technology to accommodate varying usage patterns.
- **Guidelines for Equipment Purchase:** Providing guidelines, requirements, and vendor information for purchasing equipment.

4.5.2.2 Inputs to KFT (Knowledge Facilitation Tool)

The discussion at World Café Table No. 3 focused on shaping the development of the XGain Knowledge Facilitation Tool (KFT) and gathered insights from various stakeholders, including farmers, university researchers, and policymakers, who have specific interests and needs related to the KFT:

- They have specific inquiries related to their farming activities, such as monitoring water layer thickness and addressing challenges like sea breams eating oysters.
- Support features are crucial, including a forum for sharing tested solutions and user guides.
- The tool should provide solutions, companies to contact, price ranges, cost/benefit analysis, and clear explanations for non-expert users.

Additional considerations and inputs for the KFT include:

- Detailed weather input to account for seasonal effects.
- Environmental impact assessment, including infrastructure requirements.
- Leveraging existing infrastructure at the user's location.
- Compliance with environmental regulations and legal aspects.
- Adapting to local climate and environmental conditions.
- A forum for users to share opinions and solutions.
- Support features, including a customer support center, explanations, and technical support.
- Output features, including solutions for data storage, analytics, and monitoring, alongside connectivity.
- A platform for users to share data with the community.
- Reviewing and testing solutions in relevant environments.
- Cost/benefit analysis and detailed cost information.

4.5.3 Results and Insights

The results stemming from this use case emphasize the importance of early involvement of various stakeholders, particularly from the local and regional agricultural and aquaculture intermediary sectors, academic environmental monitoring, and local/regional public policy-making. These recommendations include:

- **Incorporate Local and Regional Stakeholders Early:** Ensure the active participation of local and regional stakeholders in the development process of the Knowledge Facilitation Tool (KFT). This engagement should be facilitated by the use case leader and tech partners.
- **Obtain Permissions for Environmental Protection:** Address the challenge of obtaining permissions related to environmental protection areas promptly, as this process can be time-consuming. This is essential for the successful implementation of the KFT.
- **Engage Rural Development Agencies:** Collaborate with rural development agencies and agricultural education institutions to promote "KFT literacy" and raise awareness about the benefits of cutting-edge technology in agriculture, especially in regions where tourism is gradually replacing traditional agriculture.

- **Address Sustainability Concerns:** Focus on sustainability, particularly in terms of water quality, biodiversity preservation (such as the positive impact of oyster farming), and energy provision. These aspects should be integrated into future XGain work packages.
- **Create a Dedicated Forum:** Establish a dedicated forum that can serve as a central information hub and facilitate ongoing collaboration among engaged users. This forum can contribute to continuous improvement and long-term support for the KFT.

4.6 Flanders, Belgium

Use Case Partner: *EVILVO*

Summary of the use case:

- The aim is to develop a "digital shepherd" to monitor livestock in Flanders, addressing the digital divide in farming.
- This solution includes camera systems in smaller pastures and drones for remote areas, enhancing livestock health and welfare, reducing stress for farmers, and potentially preventing overgrazing in nature reserves.
- The system's success hinges on 5G connectivity and edge processing optimization, with potential business models involving hardware purchase costs combined with Software as a Service (SaaS) or Hardware as a Service (HaaS) models.

Main inputs from the workshop:

- Emphasis on social innovation and sustainable food systems for transitioning from unsustainable farming models.
- Proposal for two distinct modes of KFT: Generic Mode for users with limited knowledge and Expert Mode for those with in-depth knowledge.
- Goal of supporting decision-making, long-term farm maintenance, and marketing of solutions and practices.

4.6.1 Stakeholder Mapping

4.6.1.1 Organisation Types

The stakeholder list comprises individuals and entities focused on technological advancements in agriculture and rural development.

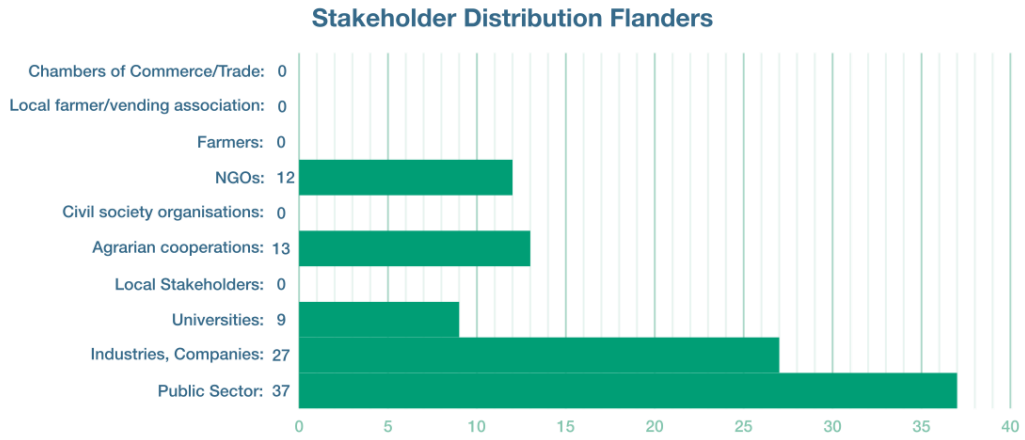

Figure 20: Flanders stakeholder distribution

The majority of stakeholders represent industries, companies, universities, and agrarian cooperations. The highest numbers of stakeholders are from the public sector and industries. These stakeholders include professionals identified as high-tech individuals in business, government representatives, and farmers. While specific age and gender information is not available, the stakeholders span various regions, both regional and national, and some have international reach.

4.6.2 Co-Creation Workshop

The workshop took place in Flanders, Belgium on 18 April 2023 and 23 participants were present. The participants were stakeholders from the region, policymakers and consultants. The major questions raised during the discussion are: Is the 'digital shepherd' valuable to the market? Will the tool include regional specifics, or will it remain a more generic tool? Will the tool require translation from experts, or is it user-friendly for final decision-makers?

4.6.2.1 Results of the workshop

These points highlight the challenges and considerations related to technology adoption and innovation in the farming industry in Flanders, Belgium.

Extensive vs. Intensive Farming

- There is a growing demand for pasture milk and meat in the market and dairy industry.
- Farmers are hesitant to adopt digital solutions, especially in meat farming, where animals are often in remote pastures.
- The concept of the "digital shepherd" is more relevant in meat farming.
- The importance of addressing special needs and requirements in farming with the help of the "digital shepherd."

Social Innovation in Farming

- Social innovation and sustainable food systems can help transition from unsustainable farming models.
- The impact of these innovations on the environment, society, and the economy is uncertain.
- Exploring entrepreneurship in complementary fields to dairy farming can lead to new ecosystems and innovations.

Innovation Awareness

- Farmers need to be made aware of innovations, but they have limited resources for research.
- Consultants can play a crucial role in bridging the gap between farmers and technology.
- There is a shortage of independent advisors in Flanders.

Public Awareness and Education

- The general audience and tech students show limited interest in cattle farming.
- Collaboration with schools and universities to educate on farming in Flanders is suggested.
- The Knowledge Facilitation Tool (KFT) can serve as a capacity-building tool.

Environment and Circularity

- Circular economy concepts are of interest.
- Nitrogen control is becoming important in the region, and technology can help.
- Collaboration with community-based agriculture initiatives is considered.

Commercial Technological Solutions for Cattle Monitoring

- Various solutions, including GPS trackers, virtual fencing, and RFID tags, exist.
- Farmer experience remains crucial for assessing animal welfare.
- The need for technological solutions addressing multiple issues.
- Empowering farmers with self-control and reducing dependence on third parties.
- Addressing challenges related to scalability, data integration, security, weather impact, and farm diversity.

4.6.2.2 Inputs to KFT (Knowledge Facilitation Tool)

In the discussion among stakeholders regarding the development of the digital farm management tool, several key aspects were addressed to ensure its effectiveness and user-friendliness. The primary focus was on the tool's interface, emphasizing the importance of simplicity and user-friendliness. To achieve this, intuitive icons were suggested, aiming to reduce the need for extensive navigation and create a seamless user experience.

Two distinct modes were proposed to cater to different user needs:

1. **Generic Mode:** Designed for users with limited knowledge of digital farm management, offering a general overview and simplifying the input process.
2. **Expert Mode:** Geared towards users with in-depth knowledge, allowing them to input specific details relevant to their farm.

Other aspects to be considered:

- Inclusion of comprehensive information in the tool is crucial.

- The tool should catalogue various techniques and technologies related to digital farm management, including sensors and their cost vs. lifetime trade-offs.
- Technology evaluation should allow users to compare factors like cost, energy consumption, coverage, storage, and compute capabilities of different solutions.
- Environmental considerations should be integrated into the evaluation process.
- Accessibility to a broad user base is vital, accommodating various connectivity solutions and addressing data usage restrictions like data caps.
- The tool's overarching goal is to support decision-making, long-term farm maintenance, and the marketing of available solutions and practices.
- It should demonstrate potential economic benefits, including return on investment (ROI), and provide evidence or user stories to highlight its practical effectiveness and build user confidence.

4.6.3 Results and Insights

- **Customized User Modes:** Develop and implement two distinct modes within the Knowledge Facilitation Tool (KFT) - a Generic Mode tailored for users with limited digital farm management knowledge and an Expert Mode for those with in-depth expertise. This approach ensures accessibility and user-friendliness for a broader audience.
- **Collaboration and Education:** Collaborate with educational institutions, including schools and universities, to raise awareness and educate students and the general public about farming in Flanders. Leverage the KFT as a capacity-building tool to promote sustainable farming practices.

4.7 Photo documentation of workshops

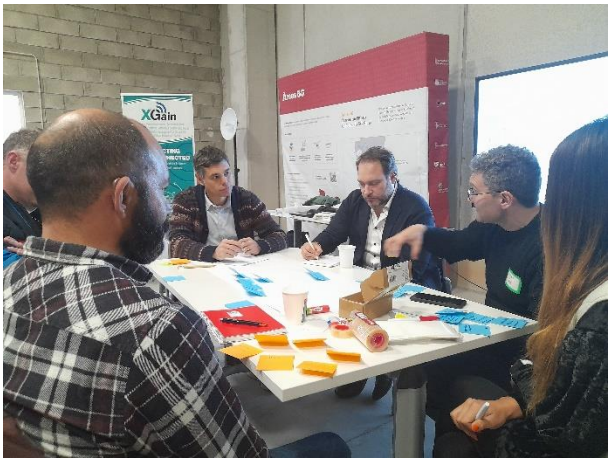

Figure 21: Workshop in Mora d'Ebre, Catalonia/Spain

Figure 22: Workshop in Thessaloniki, Greece

Figure 24: Workshop in Vilnius, Lithuania

Figure 23: Workshop in Flanders, Belgium

Figure 25: Workshop & insect walk by boat -- visiting the oyster farm in Šibenik, Croatia

5 Survey Analysis

The survey was completed by 20 key stakeholders provided by the stakeholders list from different XGain regions, each with varying degrees of expertise in connectivity, networking, and edge computing technologies. These participants come from diverse backgrounds, including health professionals, business professionals, civil society representatives, consultants, researchers, public administrators, entrepreneurs, and policymakers. The primary goal of the survey was to gather additional insights for specific aspects of the KFT. The survey questionnaire consisted of a combination of open-ended questions, multiple-choice questions, and rating scale questions with options ranging from 1 to 5.

5.1 Findings

- The most relevant KFT features include Service Optimization Enablers, Business Models Development and Dynamic Selection, and Environmental, Climate, Social, and Economic Analysis.
- Potential sectors for using remote/edge and/or connectivity-based technology solutions include healthcare, agriculture, forestry, and environmental monitoring.
- Participants express a desire for user profiles that allow them to save preferences and access previous sessions.
- Participants expressed openness to the idea of having a user profile.
- English is the primary language preference for the user interface, with some regional language preferences like Croatian, Catalan and Lithuanian.
- Knowledge transfer materials like FAQs, glossaries, user case stories, tutorial videos, and contact lists are appreciated.
- Some participants are willing to receive technical training to use the XGain KFT.
- Key issues mentioned include slow mobile connections, extreme weather events, emissions monitoring, and remote healthcare.
- Confidence in providing input information varies among participants.
- Specific preferences for performance indicators were not provided.
- Glossaries, Tutorial Videos, Use Case Stories, and FAQs are preferred resources.

5.2 Overall ratings for KFT interface elements

- An advanced page to specify technical requirements in detail: Rated as moderately useful.
- A general summary page of results with the option to navigate to detailed pages: Rated as extremely useful (5).
- A prioritized list of proposed technological solutions: Rated as extremely useful.
- One proposed solution for simplicity: Rated lower.
- An option to compare different technology suggestions: Rated as useful.

- An option to filter solutions based on factors: Rated as extremely useful.
- Results in text form for descriptive analysis: Rated as moderately useful.
- Links to external websites for additional information: Rated as extremely useful.
- Displaying relevant information about technologies proposed by XGain: Rated as extremely useful.

6 Conclusions

After 14 months of intensive collaboration within the XGain consortium and with external stakeholders, the task was completed in October 2023. Analyses (cross-use-case and site-specific) as well as tested tools continue to be at disposal of the XGain stakeholders. Being a strategic task, collaborative and participatory approaches support the further success of the XGain project to a large extent. Ongoing and future activities in XGain can take advantage of the following findings and tools:

- T2.1 initiated a co-creation process, which is crucial for implementation of other tasks during the whole duration of the project. The co-creation process encompassed internal partner collaboration and created contact points for external stakeholders. Using and valorising the emerging pool of transdisciplinary knowledge is key to enable further innovation processes and a fair transition in XGain. In this context, the XGain glossary created during the co-creation process (an additional project activity beyond the formal commitment) is a helpful tool to support the "translation" between disciplines and sectors united in XGain; it was created as a living document and will be kept updated by the XGain coordinator supported by the consortium.

- The XGain stakeholder map is a strategic tool to support the success of the project. Two dedicated research activities included a preliminary research supported by use case partners as well as on-site stakeholder workshops making their professional and tacit knowledge visible to improve the understanding of needs and challenges in local or regional ecosystems. Based on the stakeholder identification, their influence and potential contribution to the XGain transition are in the focus of this tool, which provides a map of stakeholders related to existing or emerging ecosystems. Just like the XGain glossary, the stakeholder map is foreseen as living and working document. It enables an ongoing identification of stakeholders and the assessment of their influence and potential contribution to the XGain transition.

- Furthermore, this deliverable encompasses functional requirements of the XGain KFT, which was another major pillar of the co-creation process. When embarking the WP2 activities, the foundational strategy was to have a structured approach to requirements gathering and analysis. The GA originally mapped the requirement elicitation and analysis for the KFT to T2.1 and T 2.2. However, during the course of the first months of the project, it became evident that T2.4 — focused on presenting both functional and non-functional requirements — was intrinsically tied to the architecture design and, by extension, the very essence of the requirements XGain aimed to gather. This natural synergy led all WP2 task leaders to develop and execute the requirement gathering methodology as a T2.4 activity.

- The primary rationale behind this approach was twofold applying a holistic approach: By incorporating the requirements gathering into T2.4, consortium was able to ensure that the functional and non-functional properties identified through T2.1 and T2.2 were directly aligned with the KFT architecture design process. This offered a more comprehensive perspective on the project's needs. Regarding practicality and efficiency, T 2.4 was about defining the architecture. Merging the requirement gathering into this task made practical sense, as it allowed for a seamless transition from requirements to design. This not only streamlined the project workflow but also enhanced the quality of outputs.

This shift might appear to deviate from the original plan as outlined in the GA. However, it is important to emphasize that this decision was made to support the project's efficacy and quality. While WP2 task leader did consider restructuring the content into Deliverable D2.1, it became evident that housing the content in D2.4 was closer to the actual working methodology. This does not negate the contributions and outcomes from T2.1, such as valuable stakeholder interactions, Pop-up co-creation lab workshops and the T2.1 online survey including research focused on the content and design of the KFT. These insights are transferred to and properly referenced within D2.4.

- Knowledge transfer and social learning are core mechanism of the XGain transition. During the internal co-creation process, members of consortium reflected different possibilities how to enrol further mutual learning with identified stakeholders. To better synchronise XGain activities and to build a robust platform with stakeholder and partnerships for and beyond project, the format of Learning and Action Alliances (LAAs) was considered. In the context of the project named the XGain Knowledge Alliance, the format allows a mechanism through which stakeholders can address complex or "wicked" problems. It provides an open and transparent environment and stakeholders are enabled to harbour conflicting viewpoints and negotiate visions (i.e. Bandura, 1977, Ashley et al., 2012) through social learning. In XGain, the approach is assumed to balance stakeholder needs and to support co-ownership of the XGain solutions such as the KFT. Likewise the glossary, the XGain Knowledge Alliance is an outcome of the open-ended co-creation process and was suggested to support mutual learning, dissemination, knowledge transfer and exploitation activities (such as webinars) in WP6 Impact Maximisation and Outreach (M1-36).

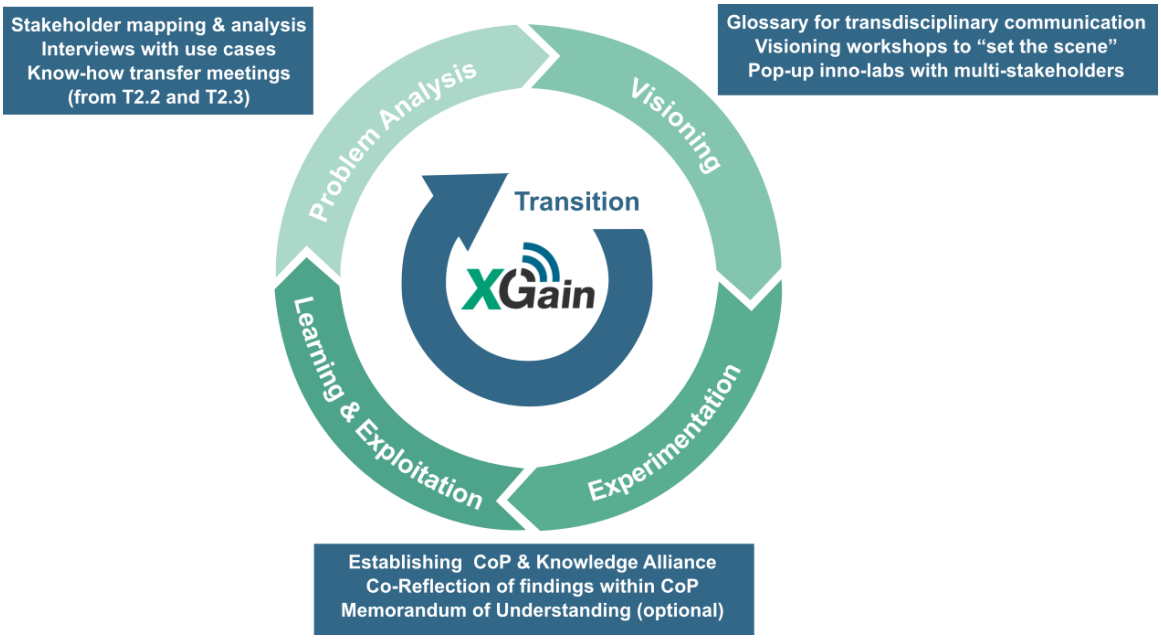

Figure 26: Strategies for mutual learning and exploitation in the XGain transition

7 References

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Annex: Stakeholder mapping

Appendix: Stakeholders List Catalonia

Organisation	Organisation Type	Gender	Engagement Level
Consell Comarcal - Ribera d'Ebre	Public sector	male	4
LEADER	Public sector	female	4
Diputació de Tarragona	Farmer	female	4
COPATE	Public sector	male	4
Entrepreneur	Local stakeholder	female	3
Generalitat Catalunya - Secretaria Telecomunicacions	Public sector	male	4
Ebre Dron	Industries, companies	male	3
President PIMEC tarragona i Pages	Farmer	male	4
ARCA (Associació d'Iniciatives Rural de Catalunya)	Public sector	male	4
T-Valley Ecosystem	Industries, companies	male	2
Reserva Natural de Sebes	Public sector	male	3
asociació ambiental l'Aube	NGO	male	3
URV - Càtedra d'Economia Local i Regional	Universities	male	3
Consel Comarcal - Terra Alta	Public sector	female	4
Parc Natural dels Ports	Public sector	male	4
Parc Natural dels Ports	Public sector	female	4
Parc Natural dels Ports	Public sector	male	4
COPATE	Public sector	male	3
Cambra de Comerç, Indústria i Navegació	Chambers of Commerce/Trade	male	3
Rull Services i Associació Empreses Ecoturisme del Delta de l'Ebre	Industries, companies	female	2
ViTEC-U RiV	Universities	male	4

ViTEC-U RiV	Universities	male	4
ateneu cooperatiu	Agrarian cooperation	male	3
Pentamatik	Industries, companies	male	2
Observatori de l'Ebre	Local stakeholder	male	4
Observatori de l'Ebre	Local stakeholder	male	2
Observatori de l'Ebre	Local stakeholder	male	2
Serveis Territorials TTEE. Acció Climàtica, Alimentació i Agenda Rural	Public sector	male	1
Camping Massaluca	Industries, companies	Information is currently unavailable	2
PIMEC a Terres de l'Ebre	Industries, companies	female	2
consorci Serra de Llaberia	Local stakeholder	Information is currently unavailable	2
Centre de Resiliència Climàtica (Eurecat)	Local stakeholder	male	2
IRTA	Public sector	male	2
Protecció Civil de la Generalitat a TE	Public sector	male	2
Celler Tarroné	Industries, companies	female	2
Bombers de la Generalitat	Public sector	male	0
Associació d'Empresaris de les Comarques de l'Ebre - AECE	Industries, companies	male	0
Associació d'Empresaris de les Comarques de l'Ebre - AECE	Industries, companies	female	0
E-Ports	Industries, companies	male	0
Diàspora Ebrenca	Civil society organisation (CSO)	male	0
Plataforma en Defensa de l'Ebre	NGO	female	0
Plataforma en Defensa de l'Ebre	NGO	female	0

Associació de Voluntaris del PARC NATURAL DEL DELTA DE L'EBRE	NGO	female	0
JÓVENS PER LA CULTURA I SOSTENIBILITAT DE LES TERRES DE L'EBRE	NGO	Information is currently unavailable	0
Incubalia	Industries, companies	male	0
Fundació Catalunya La Pedrera (Món Natura)	NGO	male	0
Associació l'Aube	NGO	male	0
Fundació Empresa i Clima	Industries, companies	female	0
Parc Natural del Delta de l'Ebre	Public sector	male	0

Appendix: Key Stakeholders List Catalonia

The key stakeholders participation is expected to contribute significantly to the project's understanding and implementation of drone-powered technology solutions in the agricultural context. Beyond their roles in facilitating pilot execution, they serve as a bridge between the project and local communities, ensuring that rural perspectives and needs are considered in the project's development. Their involvement underscores the project's commitment to enhancing the rural landscape.

No.	Name of the organisation	Short explanation
1	Ebre Dron	Will participate in the UC and provides information on rural applications for Drones
2	Consell Comarcal	Community-level stakeholder with connections to the rural world and providing space for pilot execution
3	LEADER	Key Stakeholder for rural development

Appendix: Stakeholders List Central Macedonia

Organisation	Organisation Type	Gender	Engagement Level
YKPAAP-Service Of Social Protection And Solidarity, Education, and Sports, Municipality of Lagada	Public sector	male	1
Directorate Of Technical Services, Department Of Environment And Civil Protection, Municipality Of Lagada	Public sector	male	2

Social Care Center of Municipality of Thermi	Public sector	female	1
Deputy Mayor of Social Policy and Solidarity, Gender Equality policies, Social Protection and Culture, Municipality of Oreokastro	Public sector	female	2
Director of Public Health & Social Solidarity of the Region of Central Macedonia	Public sector	female	2
Managing Authority of Central Macedonia	Public sector	female	1
Agronutritional Cooperation Region of Central Macedonia	Public sector	male	1
Institute of Applied Biosciences at the Centre for Research and Technology Hellas (INAB|CERTH)	Universities	male	2
Institute for Bio-economy and Agri-technology at the Center for Research and Technology Hellas (iBO|CERTH)	Industries, companies	male	2
Department of Educational & Social Policy at the University of Macedonia	Universities	male	1
School of Agriculture at the Aristotle University	Universities	female	2
Perrotis College of the American Farm School	Universities	male	1
AgroApps	Industries, companies	male	1
NEUROPUBLIC	Industries, companies	male	1
HALKIDIKI CHAMBER	Chambers of Commerce/Trade	male	1
Greek Exporters Association	Chambers of Commerce/Trade	Information is currently unavailable	0
Ozzie Robotics (https://ozzie-robotics.com/)	Industries, companies	Information is currently unavailable	0
Contacts in AUTH (e.g. AUTH iMed Phys Lab)	Universities	female	2
KEDITH (https://kedith.gr/) & KIFI (https://kedith.gr/ypiresies/kifi/)	Local stakeholder	female	1
LIST with contacts: https://memoryclinic.gr/wp-content/uploads/2021/03/lista-domon-perifereia-Kentrikis-Makedonias.pdf	Local stakeholder	Information is currently unavailable	1

MUNICIPAL SOCIAL ENTERPRISE OF THE MUNICIPALITY OF SYKIES	Public sector	Information is currently unavailable	2
MUNICIPAL ENTERPRISE OF CULTURAL AND SOCIAL DEVELOPMENT OF THE MUNICIPALITY OF AMPELOKIPOI	Public sector	Information is currently unavailable	2
Deputy Mayor of Education, Health, Welfare and Social Protection & Solidarity, Municipality of Chalkidona	Public sector	Information is currently unavailable	0
SOCIAL CULTURAL ORGANIZATION OF THE MUNICIPALITY OF DELTA	Public sector	Information is currently unavailable	0
Deputy Mayor of Social Protection and Public Health Municipality of Delta	Public sector	Information is currently unavailable	0
Open Protection of elderly people, Municipality of Kalamaria	Public sector	Information is currently unavailable	2
Department of Social Services Municipality of Kordelio-Evosmos	Public sector	Information is currently unavailable	2
"Agios Gerasimos" Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0
Nursing homes S.A.	Civil society organisation (CSO)	Information is currently unavailable	0
"Agia Kiriaki" Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0
"Agos Georgios" Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0

Mirtia SA Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0
Diamandidios Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0
Kreouzios Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0
Charisio Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0
Saoul Modiano Elderly Home	Civil society organisation (CSO)	Information is currently unavailable	0
Social Policy of Municipality of Kordelio Evosmos	Public sector	female	2
Municipality of Ampelokipoi Menemeni	Public sector	female	1
3th Health Region	Public sector	male	1
Center for Elderly people, Municipality of Kalamaria	Public sector	female	2
Municipal Center for Social Protection and Solidarity, Municipality of Neapoli Sykies	Public sector	female	2
Region of Central Macedonia	Public sector	female	1
Thessaloniki Action for HeAlth & Wellbeing Living Lab - Thessahall	Civil society organisation (CSO)	female	2
Materia Care Home	Civil society organisation (CSO)	female	2
AGE Platform Europe	NGO	Information is currently unavailable	0

Eurohealthnet	NGO	Information is currently unavailable	0
EUCOPE	Industries, companies	Information is currently unavailable	0
Hellenic Nurses' Association	NGO	Information is currently unavailable	0
European Federation of Nurses Associations	NGO	Information is currently unavailable	0
Greek Patients Association	NGO	Information is currently unavailable	0
Medtech Europe	Industries, companies	Information is currently unavailable	0
EIT Health	NPO	Information is currently unavailable	0
Hellenic Digital Health Cluster	NPO	Information is currently unavailable	0
European Aging Network	NGO	Information is currently unavailable	0
50+ Hellas	NGO	Information is currently unavailable	0
Federació d'Associacions de Gent Gran de Catalunya	NGO	Information is currently unavailable	0

CYPRUS THIRD AGE OBSERVATORY	NGO	Information is currently unavailable	0
Stichting Gouden Dagen	NGO	Information is currently unavailable	0
Zaklada Zajednički put	NGO	Information is currently unavailable	0
Thalpori Elderly Housing	Civil society organisation (CSO)	Information is currently unavailable	2

Appendix: Key Stakeholders List Central Macedonia

These key stakeholders from Central Macedonia will play a crucial role in helping the project better understand and use technology to improve the lives of older adults in rural areas. Beyond their roles as potential users of the Knowledge Facilitation Tool (KFT), they hold vital positions in facilitating communication between the project and local communities. The Municipality of Oreokastro and the Thessaloniki Action for Health & Wellbeing Living Lab (Thessahall) are particularly instrumental in bridging this gap, ensuring that the unique needs and perspectives of rural older adults are integral to the project's development. Meanwhile, the Public Health & Social Solidarity department of the Region of Central Macedonia, as a policy-making authority in the healthcare domain, is well-positioned to align the project with regional health-related policies, fostering a holistic approach to rural well-being.

No.	**Name of the organisation**	**Short explanation**
1	Municipality of Oreokastro	Potential user of KFT and important stakeholder to approach older adults in rural areas for the use case
2	Public Health & Social Solidarity of the Region of Central Macedonia	Policy making department for health related in Central Macedonia.
3	Thessaloniki Action for HeAlth & Wellbeing Living Lab - Thessahall	Potential user of KFT and important stakeholder to approach older adults in rural areas for the use case

Appendix: Stakeholders List United Kingdom

Organisation	Organisation Type	Gender	Engagement Level
Scilly Organics	Farmer	male	4
Scilly Organics	Farmer	male	4
Salakee Farm	Farmer	female	1
Churchtown Farm	Farmer	male	3
Troytown Farm	Farmer	male	2
Hillside Farm	Farmer	female	1
Lunnon Farm	Farmer	male	2
St Martin's Vineyard	Farmer	female	3
Westward Farm	Farmer	male	1
RB Organic	Farmer	male	2
Tresco Estate	Industries, companies	male	3
Isles of Scilly Wildlife Trust	NGO	male	4
Islands Partnership	Chambers of Commerce/Trade	male	0
Above and Below Imagery	Industries, companies	male	3
Farm Carbon Toolkit	NGO	male	3
Council of the Isles of Scilly	Public sector	female	3
Council of the Isles of Scilly	Public sector	female	1
Duchy of Cornwall	Industries, companies	female	1
Organic Growers Alliance	NGO	male	3
Land Workers Alliance	NGO	Information is currently unavailable	0

Soil Association	NGO	male	2

All stakeholders listed are core stakeholders in the context of the UK use case.

Appendix: Stakeholders List Lithuania

Organisation	**Organisation Type**	**Gender**	**Engagement Level**
Information is currently unavailable	Farmer	male	1
Vilnojos ūkis	Farmer	male	1
Information is currently unavailable	Farmer	male	1
GeoNovus, Ltd	Industries, companies	Information is currently unavailable	1
Environmental Coalition	NGO	female	2
Chamber of Agriculture of the Republic of Lithuania	Agrarian cooperation	male	3
LITFOOD	NGO	female	0
National paying agency	Public sector	male	4
Lithuanian Research Centre for Agriculture and Forestry	Public sector	male	4
Kauno kolegija	Universities	female	1
Puidokų ūkis	Farmer	male	0
Lietuvos grūdų augintojų asociacija	Agrarian cooperation	male	0
Lietuvos ūkininkų sąjunga	Agrarian cooperation	male	0
Lietuvos ekologinių ūkių asociacija	Agrarian cooperation	male	0
Lietuvos jaunųjų ūkininkų ir jaunimo sąjunga	Agrarian cooperation	male	0
Jonavos rajono žemdirbių asociacija	Agrarian cooperation	female	0
Lietuvos aplinkosauginių ūkių asociacija	Agrarian cooperation	male	0

Ukmergės rajono žemdirbių asociacija	Agrarian cooperation	male	0
Šakių rajono žemdirbių asociacija	Agrarian cooperation	male	0
Ignalinos rajono žemdirbių asociacija	Agrarian cooperation	male	0
Ministry of Agriculture	Public sector	male	4
State Forest Service	Public sector	male	4
Lithuanian Forest and Land Owners Association	Agrarian cooperation	male	4
Vytautas Magnus University	Universities	male	4
Geomanai	Industries, companies	male	1
GPSpartneris	Industries, companies	male	1
Agrodronas	Industries, companies	male	1
Promaksa	Industries, companies	male	1
Dronai Pro	Industries, companies	Information is currently unavailable	1
Vilniaus kolegija	Universities	female	1
Lietuvos bepiločių orlaivių naudotojų asociacija	Industries, companies	male	1
Dronea	Industries, companies	male	1
Environmental Protection Agency	Public sector	female	1
Ministry of Agriculture	Public sector	female	0
Ministry of the Interior	Public sector	female	0
Lietuvos vietos bendruomenių organizacijų sąjunga	Civil society organisation (CSO)	female	3
Ministry of the Environment	Public sector	female	4
State Food and Veterinary Service	Public sector	male	4

State Forestry Office	Public sector	male	4
Environmental Protection Department under the Ministry of Environment	Public sector	male	2
Baltic Environmental Forum Lithuania	NGO	male	0
Association "Lithuanian Forest"	Civil society organisation (CSO)	male	0
State Service for Protected Areas under the Ministry of Environment	Public sector	female	0
Lithuanian biomass energy association	Industries, companies	male	0
Society of Lithuanian foresters	Civil society organisation (CSO)	male	0
Forestry Contractors Association	Industries, companies	male	0
Private Forest Owners Association	Local farmer/vending association	female	0
Lithuanian Association of Hunters and Fishermen	Civil society organisation (CSO)	male	0
Society of Lithuanian Hunters	Civil society organisation (CSO)	male	0
Confederation of Lithuanian Hunters	Civil society organisation (CSO)	male	0
Lithuanian Beekeepers' Union	Agrarian cooperation	female	0
Association of Lithuanian beekeepers professionals "Austeja"	Agrarian cooperation	male	0
Nature Protection Association "Baltic Wolf"	NGO	male	0
„Nature Restoration Fund“	NGO	male	0
Croatian forests ltd	Industries, companies	female	0
University of Zagreb, Faculty of forestry and wood technology	Universities	female	0
University of Zagreb, Faculty of forestry and wood technology	Universities	male	0
The Croatian Forest Research Institute	Public sector	female	0

technology engineers The Croatian Chamber of Forestry and Wood Technology Engineers (HKIŠDT)	NGO	female	0
Union of forestry engineers and technicians	NGO	male	0
National Association of Private Forest Owners	NGO	male	0
Zelena akcija/FoE	NGO	male	0
EC Forest and Forestry Stakeholder Platform	Public sector	Information is currently unavailable	0
LSFRI “Silavia”	Universities	Information is currently unavailable	0
Estonian University of Life Sciences	Universities	Information is currently unavailable	0
Metsäteho Oy	Industries, companies	Information is currently unavailable	0
Tapio	Industries, companies	Information is currently unavailable	0
Estonian Private Forest Union	Agrarian cooperation	Information is currently unavailable	0
Latvian Forest Owners’ Association	Agrarian cooperation	Information is currently unavailable	0
MTK (Central Union of Agricultural Producers and Forest Owners)	Agrarian cooperation	Information is currently unavailable	0
LRF Skogsägarna - Federation of Swedish Family Forest Owners	Agrarian cooperation	Information is currently unavailable	0

Land & Forst Betriebe Österreich	Agrarian cooperation	Information is currently unavailable	0

Appendix: Key Stakeholders List Lithuania

These key stakeholders represent segments of the project's focus, including state-owned and private forest management entities, regulatory bodies, and potential end-users. Their engagement reflects a broad spectrum of interests, ranging from precision agriculture and environmental conservation to forestry management. The success of the project relies on their collaborative efforts, with specific beneficiaries being state-owned forests, private forest owners, and regulatory stakeholders.

No.	**Name of the organisation**	**Short explanation**
1	State Forest Service	Most potential end-user for state owned forests
2	Lithuanian Forest and Land Owners Association	Private forest owners side - the main end-user
3	State Forestry Office	Most potential end-user for state owned forests
4	Environmental Protection Department under the Ministry of Environment	Main regulatory stakeholder

Appendix: Stakeholders List Croatia

Organisation	**Organisation Type**	**Gender**	**Engagement Level**
Platforma 22 ltd	Farmer	male	4
University of Split	Universities	female	4
University of Zadar	Universities	male	2
University of Dubrovnik	Universities	male	1
Institute of Oceanography and Fisheries	Universities	male	1
Istitute Rudjer Boskovic	Universities	male	4
Cromaris dd	Farmer	female	2

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture - University Split	Universities	male	1
Seashell ltd	Farmer	female	0
DIH Agrifood Croatia	NGO	male	4
Ante Peric	Farmer	male	2
TERRA MEERA craft	Local stakeholder	female	1
Croatian chamber of economy HGK	Chambers of Commerce/Trade	female	2
Sibenik Knin county	Public sector	male	4
MINI KLAONICA PETROVIĆ craft	Industries, companies	male	1
Town of Sibenik	Public sector	male	1
RURAL BUSINESS INCUBATOR KRKA KISTANJE d.o.o.	Public sector	male	2
Town of Knin	Public sector	male	1
Split Dalmatia County	Public sector	male	1
LAG krka	NGO	female	2
LAG more 249	NGO	female	1
LAGUR Galeb	NGO	male	1
Vinary Testament	Farmer	male	1
Vinarija vinoplod	Industries, companies	male	1
Fishing with Frenky	Industries, companies	male	2
EMEDEA Association	NGO	male	3
Public Institution Regional Development Agency of Šibenik-Knin County	Public sector	female	2
Family farm	Farmer	male	3
Mladi u EU	Public sector	female	2

Mladi u EU	Public sector	female	2
OPG Knezevic	Farmer	male	2
Drnis town tourist board	Public sector	female	2
Public institution Local development agency Matica	Public sector	male	2
University of Split, Department of Marine Studies	Universities	female	4
Centaurus Ltd	Industries, companies	male	0
Vesela motika	Farmer	male	0
Town Vodice	Public sector	male	0
Marikomerc Ltd	Industries, companies	male	0
Croamaris dd	Farmer	female	1
Friškina Ltd	Farmer	male	0
Kro fish Ltd	Farmer	male	0
Orada Adriatic Ltd	Farmer	male	0
Kornat ittica ltd	Farmer	male	0
BIVALVI ltd	Farmer	male	0
Kameni doba ltd	Farmer	male	0
Blitvenica ltd	Farmer	male	0
Školjkarstvo Ostriga	Farmer	male	0
Mala argola ltd	Farmer	male	0
Marikultura Mario	Farmer	male	0
Dea ribolov	Farmer	male	0
Gusta Me	Farmer	male	0
Školjkarstvo Antonio	Farmer	male	0

RZ OMEGA 3	Industries, companies	male	0
OPG Ante Sladić	Farmer	male	0
Winery Baraka	Farmer	male	0
Bibich Winery	Farmer	male	0

Appendix: Key Stakeholders List Croatia

These key stakeholders represent a diverse cross-section of the aquaculture and farming industry, encompassing individuals and organisations from various backgrounds and professions. Their interests range from high-tech advancements and business orientation to governmental representation of rural development, reflecting the multifaceted nature of the industry. Of particular note is the keen interest in high-tech advancements, with certain stakeholders already invested in innovative solutions, reflecting a forward-looking perspective and a readiness to embrace technological innovations for the benefit of the aquaculture sector.

No.	Name of the organisation	Short explanation
1	DIH Agrifood Croatia	Active in the innovations of the aquaculture sector. Can bring more stakeholders to the Knowledge alliance. Can disseminate information.
2	Sibenik Knin county	Regional influence and knowledge. In-depth knowledge on policy and regulations.
3	Istitute Rudjer Boskovic	Is a potential user of the KFT and technology developed in the use-case.

Appendix: Stakeholders List Belgium

Organisation	Organisation Type	Gender	Engagement Level
5GlabHowest	Universities	Information is currently unavailable	4
ABS	Agrarian cooperation	Information is currently unavailable	0
ABS	Agrarian cooperation	Information is currently unavailable	0
Actemium	Industries, companies	Information is currently unavailable	0
Agoria	Industries, companies	Information is currently unavailable	0

Agoria	Industries, companies	Information is currently unavailable	0
Agro experten	NGO	Information is currently unavailable	0
Agrovision	Industries, companies	Information is currently unavailable	0
ANB	Public sector	Information is currently unavailable	0
BioForum	Agrarian cooperation	Information is currently unavailable	0
Boerenbond	Agrarian cooperation	Information is currently unavailable	4
Boerenbond	Agrarian cooperation	Information is currently unavailable	0
Boerenbond	Agrarian cooperation	Information is currently unavailable	0
Boerenbond	Agrarian cooperation	Information is currently unavailable	0
Boerenbond	Agrarian cooperation	Information is currently unavailable	0
Boerenbond	Agrarian cooperation	Information is currently unavailable	0
Boerenbond	Agrarian cooperation	Information is currently unavailable	0
CCBT	Public sector	Information is currently unavailable	1
Cegeka	Industries, companies	Information is currently unavailable	0
Connecterra	Public sector	Information is currently unavailable	1
CowCoach	Industries, companies	Information is currently unavailable	4
CRA-W	Public sector	Information is currently unavailable	0
Crodeon	Industries, companies	Information is currently unavailable	1
croptic	Industries, companies	Information is currently unavailable	4
CRV	Agrarian cooperation	Information is currently unavailable	1
Data & Maatschappij/ KU Leuven	Industries, companies	Information is currently unavailable	2

Departement Landbouw & Visserij	Public sector	Information is currently unavailable	4
Departement Landbouw & Visserij	Public sector	Information is currently unavailable	4
Departement Landbouw & Visserij	Public sector	Information is currently unavailable	1
Departement Landbouw & Visserij	Public sector	Information is currently unavailable	1
Departement Landbouw & Visserij	Public sector	Information is currently unavailable	1
Digitaal Vlaanderen	Public sector	Information is currently unavailable	0
Digitaal Vlaanderen	Public sector	Information is currently unavailable	2
EWI	Public sector	Information is currently unavailable	4
EWI	Public sector	Information is currently unavailable	0
Exobotic	Industries, companies	Information is currently unavailable	1
Fedagrim	NGO	Information is currently unavailable	1
Fedagrim	NGO	Information is currently unavailable	1
Friesland campina	Industries, companies	Information is currently unavailable	0
Ghent University	Universities	Information is currently unavailable	Information is currently unavailable
HoGent	Universities	Information is currently unavailable	1
HoGent	Universities	Information is currently unavailable	1
Hooibeekhoeve	Public sector	Information is currently unavailable	0
Hooibeekhoeve	Public sector	Information is currently unavailable	0
Hooibeekhoeve (koesensor)	Public sector	Information is currently unavailable	4
ILVO	Public sector	Information is currently unavailable	4

ILVO	Public sector	Information is currently unavailable	4
ILVO	Public sector	Information is currently unavailable	4
ILVO	Public sector	Information is currently unavailable	2
ILVO	Public sector	Information is currently unavailable	2
ILVO	Public sector	Information is currently unavailable	2
ILVO (boerenraad)	Public sector	Information is currently unavailable	1
Imec	Industries, companies	Information is currently unavailable	4
Imec	Industries, companies	Information is currently unavailable	0
Imec	Industries, companies	Information is currently unavailable	0
Inagro	Public sector	Information is currently unavailable	1
Inagro	Public sector	Information is currently unavailable	2
Inagro	Public sector	Information is currently unavailable	Information is currently unavailable
Inagro	Public sector	Information is currently unavailable	0
INBO	Public sector	Information is currently unavailable	3
Innovatiesteunpunt	Public sector	Information is currently unavailable	0
Innovatiesteunpunt	Public sector	Information is currently unavailable	0
Innovatiesteunpunt	Public sector	Information is currently unavailable	0
Innovatiesteunput	Public sector	Information is currently unavailable	0
Kreavet	Industries, companies	Information is currently unavailable	4
KU Leuven	Universities	Information is currently unavailable	4

KU Leuven	Universities	Information is currently unavailable	1
KU Leuven	Universities	Information is currently unavailable	2
Microsoft	Industries, companies	Information is currently unavailable	3
Microsoft	Industries, companies	Information is currently unavailable	0
Natuurpunt	NGO	Information is currently unavailable	0
Natuurpunt	NGO	Information is currently unavailable	0
Obs'Herbe	Industries, companies	Information is currently unavailable	0
Odisee	Universities	Information is currently unavailable	1
ODYC	Industries, companies	Information is currently unavailable	2
POMWVL	Public sector	Information is currently unavailable	0
POMWVL	Public sector	Information is currently unavailable	0
Proximus (and other network suppliers like SigFox)	Industries, companies	Information is currently unavailable	0
Regionaal Landschap	NGO	Information is currently unavailable	1
Rundeveeloket	Agrarian cooperation	Information is currently unavailable	4
Sesolus	Industries, companies	Information is currently unavailable	1
Signum Engineering	Industries, companies	Information is currently unavailable	0
SLE	Agrarian cooperation	Information is currently unavailable	2
Thomas Moore	Universities	Information is currently unavailable	0
Uantwerpen	Universities	Information is currently unavailable	2
Uantwerpen	Universities	Information is currently unavailable	0
Ugent	Universities	Information is currently unavailable	2

Ugent	Universities	Information is currently unavailable	0
Ugent	Universities	Information is currently unavailable	0
Vito	Public sector	Information is currently unavailable	2
VLM	Public sector	Information is currently unavailable	0
VLM	Public sector	Information is currently unavailable	0
Zoetis	Industries, companies	Information is currently unavailable	2
Zoetis	Industries, companies	Information is currently unavailable	2
DGZ	NGO	Information is currently unavailable	0
DGZ	NGO	Information is currently unavailable	0
MCC	NGI	Information is currently unavailable	0
Regionaal Landschap Schelde-Durme	NGO	Information is currently unavailable	0
Regionaal Landschap Klein en Grote Nete	NGO	Information is currently unavailable	0
Multicap	Industries, companies	Information is currently unavailable	0
No fence (Outside Belgium)	Industries, companies	Information is currently unavailable	0
Agriflanders	NGO	Information is currently unavailable	0
Stichting Limburg Landschap	NGO	Information is currently unavailable	0
Olympia	Industries, companies	Information is currently unavailable	0

Appendix: Key Stakeholders List Belgium

These key stakeholders are essential players in the project's mission to advance technology in agriculture and rural development. They represent and advocate for the interests of farmers at the highest policy-making levels and their expertise in telecommunications is stands out as a vital contributor with its advanced 5G network rollout.

No.	Name of the organisation	Short explanation
1	Departement Landoub & Visserij	This the policy making department for everything related to agriculture and fisheries
2	Boerenbond	This is one of the largest agrarian cooperations in Belgium and represent their interest at the policy making level
3	Proximus	Proximus is a key telecom provider in Belgium and are the most advanced with the roll-out of their commercial 5G network.