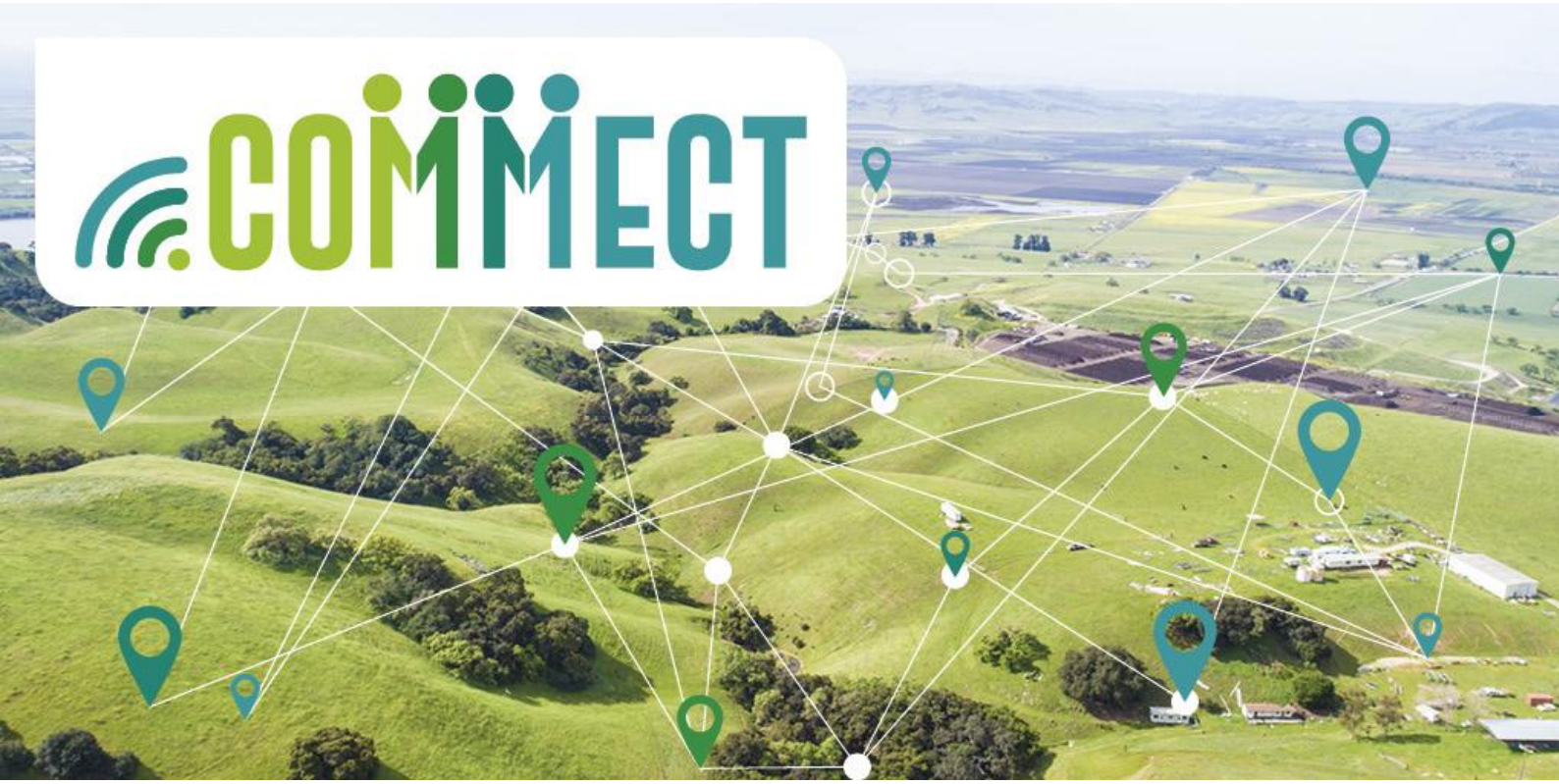
Bridging the digital divide and addressing the need of Rural Communities with Cost-effective and Environmental-Friendly Connectivity Solutions



Deliverable 6.3

Report on Dissemination and Communication Activities Version 1

February 2024

PUBLIC

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COMMECT

Bridging the digital divide and addressing the need of Rural Communities with Cost-effective and Environmental-Friendly Connectivity Solutions

Grant agreement No. 101060881

Report on Dissemination and Communication Activities version1

WP6 Dissemination, Exploitation and Standardisation

Deliverable ID	**D6.3**
Deliverable Name	**Report on Dissemination and Communication Activities Version 1**
Lead Partner	IBLA
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COMMECT Project Abstract

Over the last years, the importance and need for broadband and high-speed connectivity has constantly increased. The Covid-19 pandemic has even accelerated this process towards a more connected society. But this holds mainly true for urban communities. In Europe a 13% lack access persists, and mainly concerns the most rural and remote areas. Those are the most challenging to address since they are the least commercially attractive. COMMECT aims at **bridging the digital divide**, by providing quality, reliable, and secure access for all in rural and remote areas. The **goal of extending broadband connectivity in rural and remote areas** will be achieved by *integrating Non-Terrestrial Networks with terrestrial cellular XG networks, and low-cost Internet of Things (IoT). Artificial Intelligence, Edge and Network Automation will reduce energy consumption both at connectivity and computing level.*

Participatory approach with end-users and ICT experts working together on development challenges will be the key **for the digitalization of the sector**. To ensure the rich exchange of best-practice and technical knowledge among the actors of the agro-forest value chain, COMMECT will set up **five Living Labs across and outside Europe**, *where end-users "pain" and (connectivity) "gains" will be largely discussed, from different perspectives.*

COMMECT aims at contributing to a balanced territorial development of the EU's rural areas and their communities by making smart agriculture and forest services accessible to all. COMMECT will facilitate that, by developing a **decision-making support tool** able to advise on the best connectivity solution, according to technical, socio-economic, and environmental considerations. This tool, incorporating collaborative business models, will be a *key enabler for jobs, business, and investment in rural areas, as well as for improving the quality of life in areas such as healthcare, education, e-government, among others.*

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Executive Summary

The project COMMECT aims at bringing connectivity to remote and rural areas to address the needs of local communities. COMMECT adopts a participatory approach where end-users, researchers and experts work together to identify the pains and develop efficient solutions inside each Living Lab (LL). COMMECT Living Labs cover five sectors and are deployed in five countries: Viticulture in Luxembourg, Forestry in Norway, Livestock Transport in Denmark, Olive Tree farming in Türkiye and sustainable agriculture and preservation of natural environment in Serbia.

This deliverable describes the global communication activities of the COMMECT project and the participatory approach in the project through the organization of workshops with end-users and stakeholders in each Living Lab, to collect feedback and adapt the strategy of deployment in the field of connectivity solutions.

The first part of the deliverable is devoted to the detailed description of the communication and dissemination activities carried out in the first 18 months of the project. The progress of these activities is evaluated according to the target Key Performance Indicators (KPIs) identified at the start of the project, while the future steps which will allow to strengthen further the diffusion of the COMMECT activities in the targeted audiences are outlined.

The second part of the deliverable describes the workshops and trainings organized in the different LLs. At least two workshops were organized in each LL. The first round of workshops focused on the identification of end user needs, through surveys and/or interviews. While the second round was organized as face-to-face workshops to showcase the first results and collect feedback from different participants.

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Glossary of Terms

AI	Artificial Intelligence
DIH	Digital Innovation Hub
IVV	Institut Viti-Vinicole
KPI	Key Performance Indicator
LL	Living Lab
ML	Machine Learning
NG-IoT	Next Generation Internet of Things
NSA	Non-Standalone
OEM	Original Equipment Manufacturer
WP	Work Package

1. Introduction

The objective of this deliverable is to report the progress of the communication and dissemination activities related to COMMECT, as well as the workshops and training activities in each Living Lab, which have been organized in the first 18 months of the project. In alignment with our goal to make our research widely accessible and impactful, all COMMECT project papers are available on Zenodo [1]**,** an open-access platform.

This deliverable is divided in two parts. In the first part, the progress made from the previous Deliverable 6.2 (which referred to the first six months of the project) are described in detail. More specifically, all the communication channels used to disseminate the COMMECT activities and achievements are reviewed (e.g., visual identity, website, social media, media and multimedia production, scientific publications, conferences, and publicity materials, synergies with other EU projects and beyond). Moreover, we provide a table through which we discuss the level of advancement related to the various Key Performance Indicators (KPIs), which were set in our original plans and reflect on the future plans for enhancing the effectiveness of our communication and dissemination activities.

The second part of the deliverable focuses on the organization of workshops and training events. Two sets of workshops have been organized in each region with the main stakeholders. The aim of the first set of workshops was to define both the end user needs and the use cases. The COMMECT partners of each Living Lab used several methods to collect feedback from the main stakeholders in the value chain. The digital and remote solutions which have been developed within the first 18 months of the COMMECT project are based on this first set of workshops, and thus they address concrete needs of end-users and local stakeholders.

The co-creation process of the connectivity solutions is fundamental during the different phases of design and development, to ensure adoption of the technologies, by the main stakeholders. Therefore, a second set of workshops took place in different LLs, with the aim to collect feedback from the stakeholders about the connectivity solutions: are they meeting the user needs? Could the connectivity solutions be implemented in the LL within the local socio-economic framework? Was the feedback collected about a possible business model and a financial model for the sustainability of the solutions, beyond the project duration?

The deliverable is organized in two chapter: The first chapter reflects the outcomes of T6.1, ‘Dissemination and communication activities’, while the second chapter presents the activities carried out in T6.2, ‘Workshops and Trainings Organization’.

2. Dissemination and Communication activities

The COMMECT communication and dissemination plan is articulated in three different phases as presented in the 'Dissemination, Communication and Exploitation Plan' Deliverable D6.2 [2]. Hereafter we recall each phase, with the related activities.

Phase 1: Create awareness - To raise awareness, a wide range of communication, dissemination and marketing tools were used in the early phases of the project. This included a COMMECT visual identity with an appropriate project logo, project website, social media channels (Twitter, LinkedIn, YouTube), project flyers and consistent presentation templates. The unique visual identity is a key aspect as it can improve the project´s brand recognition among end-users, stakeholders, and the lay public, and stimulate exchange and follow-up actions. The project website was made publicly available in December 2022, and the social media channels were also launched in the first months of the project. These represent the main dissemination platforms through which the project partners communicate to their targeted audiences.

Phase 2: Continuous information - As the first activities have taken place and the first results have become available, the Consortium has started to actively engage in various dissemination activities such as writing conference papers and academic article drafts and participating into third-party events and conferences to further raise awareness amongst stakeholders. This is enabling bilateral exchanges with stakeholders and is beneficial for new insights for the project. COMMECT's multi-actor approach recognizes the importance of the LLs engaging not only with industrial potential partners, but also with the whole local communities. Good results have been already achieved through specific dissemination activities such as publishing articles in local newspapers and demonstration workshops. In this respect, it is important to highlight that the Consortium will take local languages into great consideration in the case of published newspaper articles and Practice Abstracts and, more generally, in the interactions with the local community, therefore adapting the communication approach to communication to the needs of the places where the LLs have been implemented. Regular social media campaigns (constant updates about COMMECT news and results, production of high-quality contents, focus on key events, coordination between the various social media channels and the project website, etc.) are keeping the information flow upright and increasing the interest of multiple audiences.

Phase 3: Result orientation - During this third phase, the dissemination and communication efforts will be very closely interlinked with exploitation activities. The main results of the project will be mature enough to be shared with target communities using both online and offline channels. In the last year of the COMMECT project, a *final Stakeholder Symposium* will be organized to channel the project output, *attract interest from potential stakeholders and share knowledge with related projects and initiatives (clustering events)*. Besides the engagement with local actors and communities, COMMECT will also connect with international organizations, associations, and networks.

As showed in Figure 1 we are currently in the middle of Phase 2, covering the first 18 months, and this is the perfect moment to reflect on the results that have been already achieved and on the necessary steps to do for improving further the effectiveness and breadth of our communication and dissemination activities in their various forms.

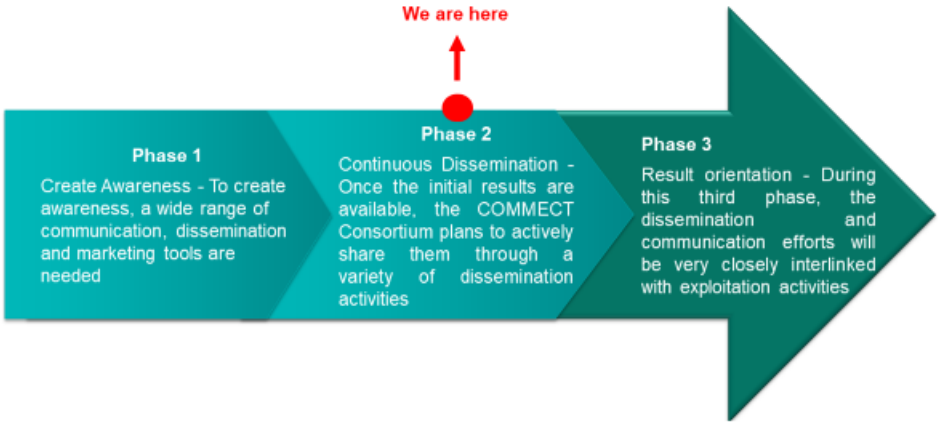

Figure 1 Phases of COMMECT communication and dissemination plan

2.1. Visual Identity

In the first 18 months of the COMMECT project, the communication and dissemination team has worked hard to create a clearly and instantaneously recognizable visual identity. We created a project logo, which is able to convey a unique and distinctive representation of the project.

Our logo is based on a chromatic scale of four main shaded colors, which goes from light green to light blue. These colors and the graphic elements that we chose (i.e., the Wi-Fi logo on the bottom left and two Ms with two circles representing two individuals holding hands) emphasize the main concepts associated to the project: rural areas, connectivity, and rural communities (see Figure 2).

Figure 2: The COMMECT Logo

In addition to this, we have created a specific project layout, which is used for all the document templates. In this way, all the documentation and materials used to present COMMECT activities and findings in both internal meetings and public events have a consistent and clearly identifiable style.

This unique template is used in PowerPoint presentations, deliverables, practice abstracts, project minutes, etc.

2.2. Website

The COMMECT website **(https://www.horizoneurope-commect.eu)** was launched in December 2022. All the project activities are constantly and readily disseminated through this key medium.

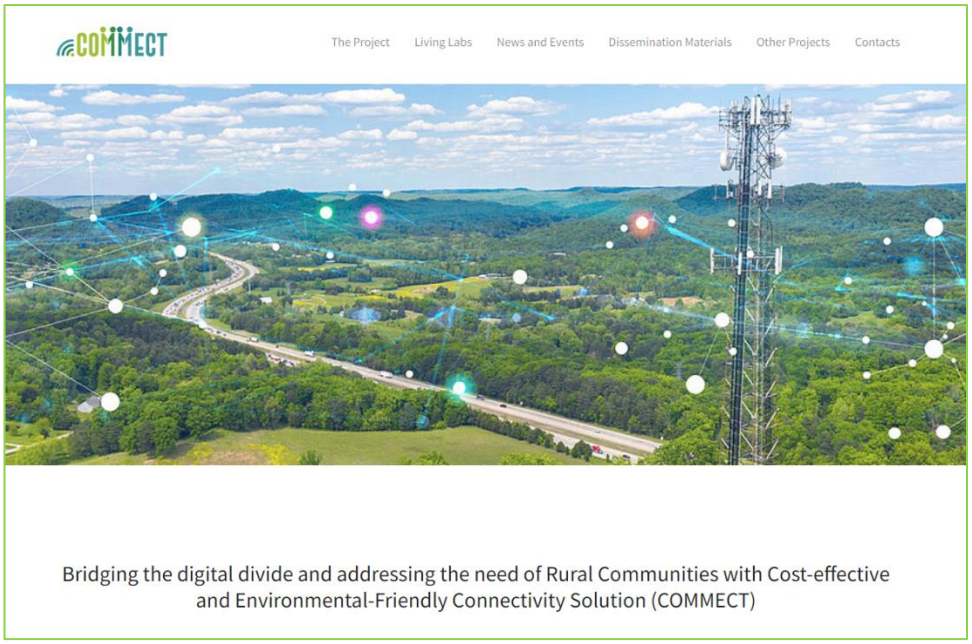

Figure 3: COMMECT website's main page

The website was developed through TYPO3 (a free and open-source web content management system written in PHP). The colour and all the visual elements that characterize the project are clearly present in the COMMECT website. Figure 3 shows the website's main page. The website consists of eight sections: I) The project, II) Living Labs, III) DST, IV) Business Models, V) News and Events, VI) Dissemination materials, VII) Other projects, and VIII) Contacts, containing written information, high quality images, photos, videos, and graphics. The first page provides generic information about the project (its objectives, methodology and the project partners). The second page is dedicated to the Living Labs (at the core of the project methodology). A sub-page is dedicated to each LL, and it showcases its related use cases. Each use case describes the challenge faced, aim of the proposed connectivity solution, the function of the solution and also the benefit of the solution. The third page of the website present the Decision Support Tool (DST), one of the most innovative results of the project. Visitors of the website, can access the DST, using the *url* available in this page. Another page presents the collaborative business, the reason behind them, and the approach toward their implementation within the LLs. News and events are also shared via the website, and classified as news, project meetings, workshops, and conferences. All the dissemination material is made available on the website, and it includes public project deliverables, publications, printed material (posters, project flyer, business cards, and videos). The website will be continuously updated to make sure that it remains relevant and a valuable resource, to reach a large audience, and promote exchange of knowledge between different stakeholders

From its launch in December 2022 to December 2023, the COMMECT website was visited 24789 times from all over the world. The statistics in Figure 4 show the visitors map and the visits over the time. It is worth highlighting the pic in number of visits of the website during the first week of October, which corresponds to the participation of different partners in the

Synergy Days 2023. The statistics of the website visits were reported using '*Matomo Analytics'* [3].

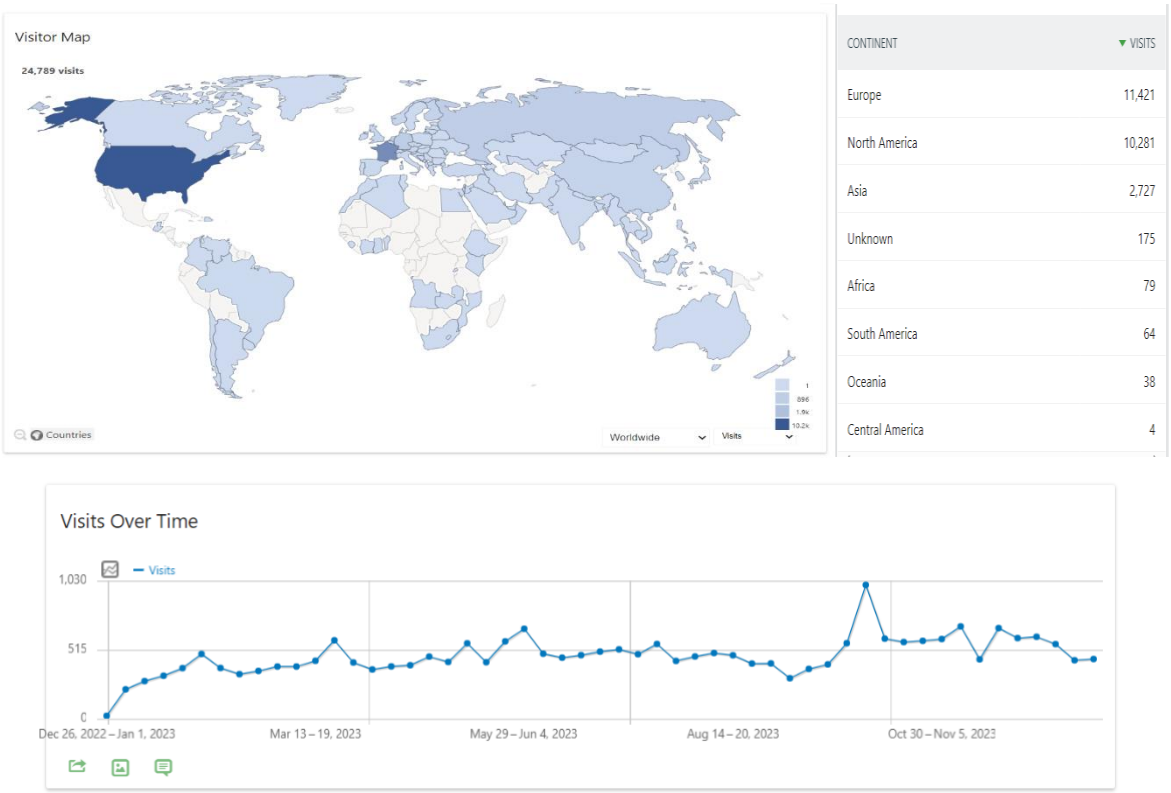

Figure 4: COMMECT website's statistics (monthly and yearly)

Our social media campaign was officially launched in December 2022 and comprises profiles on LinkedIn and Twitter/X, together with a YouTube channel (see Figure 5). These three dissemination channels allow us to reach different audiences (from professionals and academics to public) interested in different aspects of the COMMECT project.

We use Twitter/X to disseminate the results of the COMMECT project to the broader audience possible. All the COMMECT events, initiatives, publications, etc. are communicated through this very popular social media channel. Currently, the COMMECT project has 245 followers on Twitter, many of which are other EU platforms or funded projects (EU Rural Pact, SmartAgriHubs, Smart Rural 27, etc.).

LinkedIn is primarily used to communicate with a more specialized audience interested in the scientific results and practical applications of the project (e.g., academics, policymakers, and practitioners). The campaign on LinkedIn has already led to remarkable results: the COMMET page can already count on 359 followers and a high number of likes and reposts.

YouTube, which was launched in May 2023, is primarily used to disseminate high-quality audio-visual materials related to the project. The first three videos uploaded on YouTube were produced by the WP6 leader with the support of the project coordinator and a professional team at LIST. The project partners will invest more in producing high-quality videos about Living Labs, DST, and other relevant results, during the second phase of the projects, when the project results will be more mature.

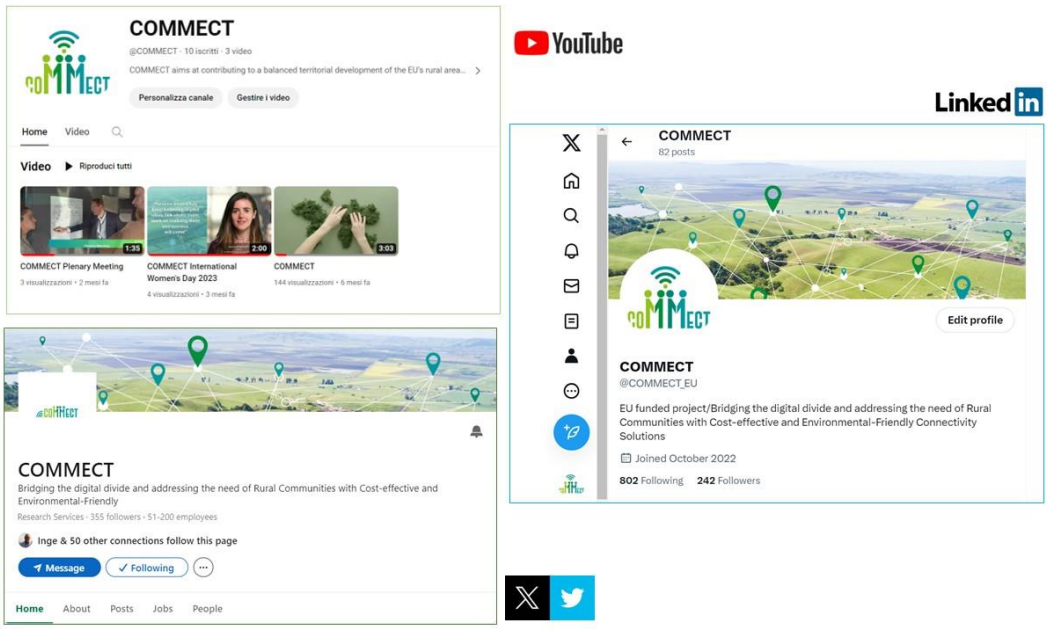

Figure 5: COMMECT social media channels (Twitter, LinkedIn and YouTube)

2.3. Media and Multimedia Production

2.3.1. Videos

In the first 18 months of the project, we produced three videos, which have been disseminated through our YouTube channel, website and social media pages.

The first video "COMMECT International Women's Day 2023" [4], was uploaded on 8 May 2023, which corresponds to the International Women's Day. The video was prepared for this occasion, to promote, and recognize the role played by several women in the COMMECT project. In the video, several women who lead the project: our coordinator Maria Rita Palattella) and others who play key roles appear accompanied by a sentence about leadership in science and technology that they wrote themselves. The aim of this video was to stress the key role played by women in the COMMECT project (i.e., "A leading EU project led by women", as we claim).

A second video 'COMMECT' [5], based on a series of evocative images and speeches by the coordinator, WP and LL leaders is used to promote COMMECT on the Internet and in the various physical meetings where the project is presented (for example, during the participation at the Synergy Days Conference 2023).

Finally, a third video 'COMMECT Plenary Meeting' [6], describing the main activities and the outcomes of the first COMMECT Plenary Meeting, which took place in Oslo (Norway), was produced and uploaded in the various social media channels in October 2023. This video is based on a series of photos taken during the event and written text describing the main objectives and outcomes of the meeting.

Frames from the various videos can be seen in Figure 6. The Living Labs will feature more videos showcasing the various use cases, providing insights into the project's practical applications. Efforts will also be made to produce higher-quality videos effectively communicating the project's impact and progress to a wider audience.

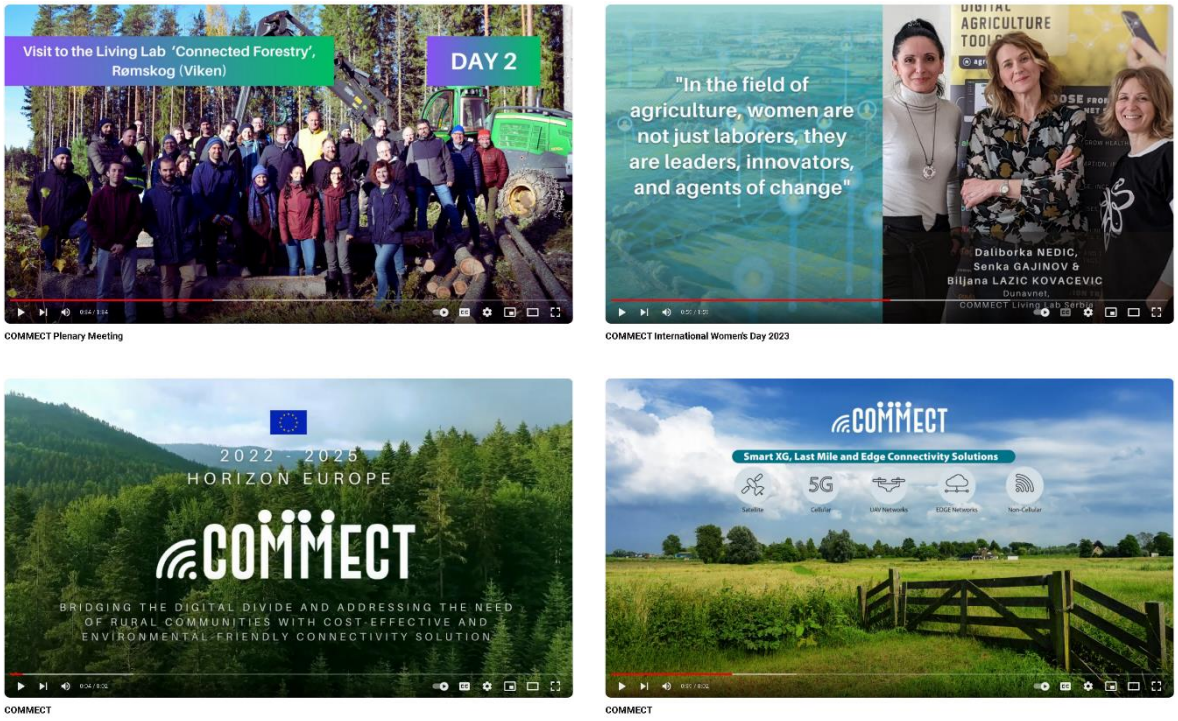

Figure 6: Frames from COMMECT videos

2.3.2. Press releases

The COMMECT project appeared in three press releases realized by different partners of the project. The first press release "*LIST leads project digitalising rural areas across Europe and beyond*" was published by MERKUR, a Magazine from the "Chambre of commerce" in Luxembourg. The release was published following the kickoff meeting of COMMECT, announcing the start of the project, and the strategic role of LIST, leading the project aiming to digitalize rural areas across Europe and beyond [7].

The second press release "*Skogbruket skal digitaliseres*" (Forestry must be digitalized), was published by Telecom Revy, a Norwegian website focusing on the telecommunication industry. The website published a long article [8] about the activities carried out by the COMMECT's Norwegian partners Telenor (TNOR), Klosser Innovation (KI), and Inland Norway University of Applied Sciences (INN) in the context of the local Living Lab 'Connected forestry'.

Another press release was organized by the Danish LL partners following the workshop organized in September 2023 [9] . The press release entitled "*Transportbranchen skal hjælpe med god netforbindelse i landdistrikter og fjerntliggende områder*" (The transport industry must help with good connectivity in rural and remote areas.), highlighted the importance of good connectivity in rural and remote area to improve transport industry. The objectives of COMMECT project and related LLs were announced, with a focused presentation on the Danish LL connectivity solutions.

2.3.3. News in online and offline newspapers and magazines

The media coverage of COMMECT is ensured by the continuous presence of the project in the online and offline newspapers and magazines. At the project start, the national innovation agency of Luxembourg "Luxinnovation", shared in their news an overview of the project COMMECT "Bridging the digital divide" [10]. The communication not only presented the project objectives, but also shared the experience of the COMMECT coordinator in creating a competitive consortium for Horizon Europe programs.

In the same context, the project coordinator had an interview at the Luxembourgish national radio in July 2023 [11]. This is a podcast of the Luxembourg National Research Fund (Fonds National de la Recherche – FNR), in collaboration with the Lëtzebuerger Journal (see Figure 7). Researchers working in Luxembourg are regularly invited to discuss about their lives and passion for science with the aim to show who the men and women behind research are. In this context, our coordinator, Maria Rita Palattella had the possibility to illustrate the COMMECT project, its main objectives and expected impact, as well as how to manage effectively a large consortium comprising high level scientific and industrial partners from many different countries. The interview was followed by a publication of an online article in "Letzbuerger Journal" summarizing the interview [12].

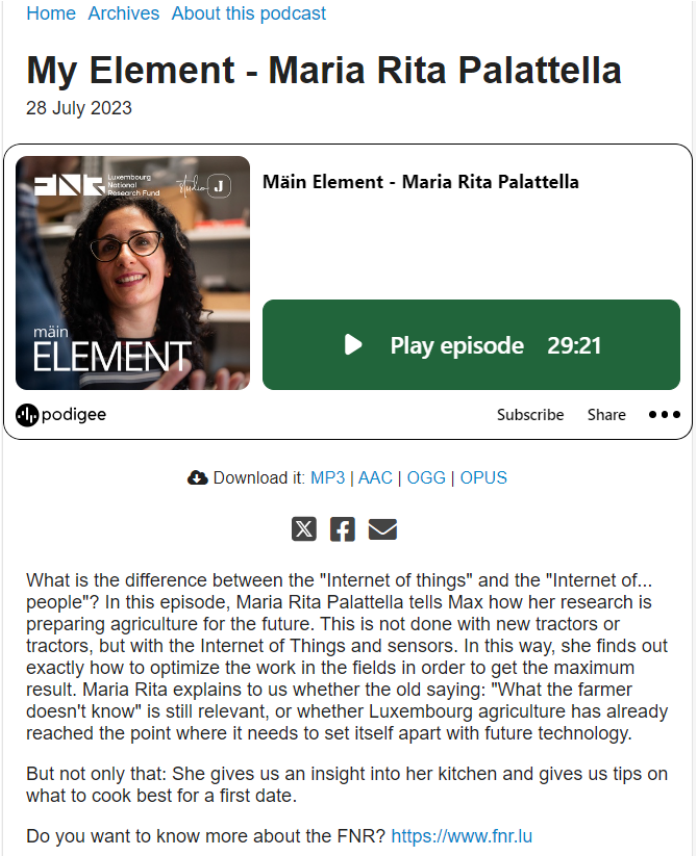

Figure 7: Interview by Maria Rita Palattella with the national radio in Luxembourg [11].

Many other communications in online and offline magazines were organized by the different project partners. Segolene Charvet from IBLA had an interview with "lequotidien.lu" [13] where she shared the role of COMMECT in the digitization of viticulture in the Moselle region. Another interview 'WEINBAULICHE PRAXIS TRIFFT AUF FORSCHUNG: Mit dem Projekt Commect die Digitalisierung im Weinberg voranbringen' (VITICULTURE MEETS RESEARCH: Advancing digitalization in the vineyard with the COMMECT project), with a local offline newspaper "De Letzeburger Bauer" (see Figure 8) was realized with the participation of LIST (Miriam Machwitz) and IBLA (Segolene Charvet) to exchange about COMMECT and the LL Luxembourg objectives [14]. The Norwegian LL also shared a communication in "Nationen" a Norwegian daily publication focusing on agriculture and rural areas [15]. The newspaper published an article about the COMMECT project and how the adoption of 5G technology may enhance the forestry industry in Norway. Other publications were also shared on the websites of the LL Norway partners, KI [16] and INN [17], "5G skal sette fart på skogbruket" (5G will speed up forestry) to announce the start of the project, its objective and the specific use cases

of the LL. Recently, TNOR also published an article entitled “Tester ut droner i skogbruksnæringen” [18] (Testing out drones in the forestry industry). The publication gives updates about the activities in the LL Norway and future plans.

Weinbauliche Praxis trifft auf Forschung

Mit dem Projekt Commect die Digitalisierung im Weinberg voranbringen

In Europa sind immer noch 13% der Bevölkerung unzureichend digital vernetzt. Das Sammeln von Erkundungsdaten oder der Einsatz von digitalen Lösungen können in diesen Gebieten nicht eingesetzt werden. Mit dem EU-Projekt Commect will man in den kommenden Jahren Grundlagen erarbeiten, um diese Datenübertragung zu verbessern, aber auch Wege aufzeigen, wie Daten aus Fern- und Naherkundung rasch und sinnvoll im Praxisalltag genutzt werden können. Koordinatorin ist Maria Rita Palattella vom Luxembourg Institute of Science and Technology (List).

Wein-Serie

Mit Drohnen erreicht man heute eine Auflösung von 1-2 cm. Foto: Miriam Machnitz

Um einen umfassenden Austausch von bewährten Verfahren und technischem Wissen zwischen den Akteuren der agroforstlichen Wertschöpfungskette zu gewährleisten, sind für Commect fünf sogenannte „Living Labs“ inner- und außerhalb der EU zurückbehalten worden, darunter Digitalisierung des Weinbaus in Luxemburg. In den Living Labs werden die Probleme der Endnutzer und die Vorteile der Konnektivität erörtert.

Nachfolgend informieren Ségolène Charvet vom Institut für Biologisch Landwirtschaft an Agrarkultur (Ibla) und Miriam Machwitz vom Luxembourg Institute of Science and Technology (List) über den Stand der Dinge beim nationalen Living Lab.

Frau Charvet, Frau Machwitz, wie steht es denn bezüglich Internet und mobile Daten um das Weinbaugebiet Luxemburger Mosel?

M. Machwitz: Es geht bei unserem Projekt nicht in erster Linie darum, das Internet auszubauen. Die Abdeckung ist entlang der Mosel grundsätzlich gut. Wir möchten vorhandene Technologien hier optimal einsetzen, um nützliche Daten über lokale Wetterbedingungen oder den Pflanzenzustand dem Winzer zukommen zu lassen. Beispielsweise sind LoRa-Netzwerke energieeffizienter als das mobile Netzwerk. Wenn es Abdeckungslücken gibt und wenn wir Wettersensoren im Feld installieren, dann können die Daten z.B. über Satellitenkommunikation übertragen werden. In Commect geht es insbesondere um die Verbindung und Übertragung, so dass die Winzer schnelle Informationen über den Zustand ihrer Flächen erhalten. Witterungsereignisse werden immer lokaler und extremer, so dass Wettersensoren auf verschiedenen Flächen relevanter werden.

Wieviele Institutionen sind beteiligt und wieviele Mitarbeiter sind involviert?

M. Machwitz: Bei unserem Living Lab sind neben List und Ibla noch SES Techcom und Luxsense beteiligt. Insgesamt sind 15 Mitarbeiter involviert, aber diese arbeiten nicht ausschließlich an dem Projekt.

S. Charvet: Beim Projekt arbeiten wir aber mit allen Agrarakteuren zusammen, also auch der Asta, dem IVV und der Berufsvertretung. Es ist wichtig, dass alle Hand in Hand arbeiten.

Wie lange wird dieses Einzelprojekt noch laufen? Sind Folgeprojekte angedacht?

M. Machwitz: Es läuft insgesamt über drei Jahre und wir haben das erste Jahr gerade abgeschlossen. Ich denke, dass ein Antrag für ein Folgeprojekt gestellt wird. Grundsätzlich versuchen wir immer, laufende Projekte in irgendeiner Form weiterzuführen.

S. Charvet: Dadurch, dass wir verschiedene Partner sind, kann das Projekt auch verschiedene Wege nehmen. Das hängt ein wenig davon ab, wie die Winzer die Nutzung des Projekts sehen. Wenn Satellitenbilder als besonders interessant angesehen werden, dann geht man evtl. mehr in diese Richtung. Es ist noch nicht so ganz klar im Moment, worauf wir aufbauen wollen.

Für die Zeit nach dem Projekt muss eine Lösung dafür gefunden werden, wie die aufgebauten Installationen für die Wetterstationen und -sensoren ins bestehende Netz integriert werden können. Und ob sie überhaupt dort integriert werden oder aber in andere Systeme. Commect möchte in erster Linie nützliche Lösungen entwickeln, die verschiedenen Akteuren hilft. Mit den Technikpartnern sowie Experten für die Wirtschaftlichkeit muss man sich schließlich ein nachhaltiges Businessmodell dafür überlegen, wie die im Projekt entwickelten Dinge in Zukunft am besten weiter genutzt werden können.

Sie haben bezüglich Commect kürzlich einen Workshop in Hörmillen angeboten, bei dem zwei auf den Weinbau bezogene Tools präsentiert wurden. Aus welchen Bereichen stammten die Teilnehmer?

S. Charvet: Es waren Winzer von der Luxemburger Mosel und ein Firmenvertreter aus Deutschland beteiligt. Von Winzerseite waren unterschiedliche Betriebsgrößen vertreten. Das war von Vorteil. Jeder Betrieb hat einen anderen Bedarf in Sachen Datenfluss.

Eines der Tools beim Workshop war die Vorhersage von Peronospora. Wieviele Wetterstationen werden hinzugekommen?

S. Charvet: Es werden zwei volle und vier vereinfachte Stationen hinzukommen. Die vereinfachten messen Temperatur und Blattnässe. Man muss genau schauen, wo diese Stationen platziert werden, damit z.B. die Blattnässesensoren sich an einer Stelle befinden, die stärker von Feuchtigkeit betroffen ist. Sonst wird das Risiko unterschätzt.

M. Machwitz: Es ist deshalb wichtig, gemeinsam mit den Winzern zu entscheiden, wo auf der Fläche die Wetterstation hingestellt wird.

Werden die Vorhersagedaten zu diesen neuen Wetterstationen auf agrimeteo.lu zu finden sein?

M. Machwitz: In den nächsten beiden Projektjahren ist zunächst das Ziel, die Daten der neuen Station bei Vitimeteo verfügbar zu machen. Wie es dann weitergeht, ist noch nicht entschieden.

Was macht ein Winzer, wenn an seinem Standort kleinräumig ganz andere Tagesniederschlagsdaten zu verzeichnen sind als an der nächstgelegenen Wetterstation mit Peronospora-Vorhersage?

M. Machwitz: Wir hatten von einem Winzer eine Rückmeldung bekommen, dass seine Rebfläche von den vorhandenen Wetterstationen überhaupt nicht repräsentiert wird. Seine Flächen haben aktuell einen sehr weiten Abstand zu einer Wetterstation. Deshalb fährt er in den kritischen Phasen täglich dorthin und schaut sich die Situation vor Ort an. Wir hoffen, dass wir an solchen Standorten die Vorhersagen mit Sensorik unterstützen können. Vieles geht auch über Erfahrung. Spritzungen aus Angst vor einer Infektion, die sich im Nachhinein als unnötig herausstellen, sollen vermieden werden.

Das zweite Tool bei Ihrem Workshop bezog sich auf die Abbildung von Weinbergen mittels Satellit, Drohne oder Smartphone. Was wurde konkret präsentiert?

M. Machwitz: Wir haben im Prinzip Abbildungen auf drei Ebenen präsentiert: Aufnahmen, die innerhalb der Flächen gemacht wurden, Aufnahmen mit der Drohne und schließlich Satellitenaufnahmen, wo man sich die komplette Luxemburger Mosel anschauen kann. Somit leisten wir einen Beitrag zur Erstellung eines sog. digitalen Zwillings der Weinberge. Bei den Satellitendaten hatten wir einen Datensatz mit 3 m Auflösung zur Verfügung. Die neuesten Satelliten haben bereits eine Auflösung von 30 cm.

Bei den Drohnendaten lag die Auflösung bei 1-2 cm. Mit Drohnen arbeiten wir beim List jetzt schon seit sechs Jahren, vor allem um Krankheiten zu detektieren und zu kartieren, z.B. Esca.

Wie lautet das Feedback bezüglich solcher digitaler Abbildungen aus Beratung und Praxis?

M. Machwitz: Wir dachten, dass das Interesse für die gröber aufgelösten Satellitenbilder nicht so groß ist. Aber die Teilnehmer waren daran sehr interessiert und haben sich gerne angeschaut, was in diesem Bereich möglich ist. Großes Interesse besteht auch an einer 5- bis 7-jährigen Langzeitdokumentation zur Entwicklung der Rebparzellen, was relativ kostengünstig zu bewerkstelligen wäre, weil Daten mit 10 m Auflösung kostenlos zur Verfügung stehen.

Manche Winzer haben davon gesprochen, dass sie auf einer bestimmten Fläche dieses oder jenes Problem haben und sie es gut fänden, wenn wir diese nächstes Jahr mal aufnehmen könnten. Insgesamt war es sehr positiv, dass wir bei manchen Dingen erfassen konnten, welche Probleme auftauchen und dass tatsächlich Bedarf zum Nachforschen besteht. Das waren Probleme, die wir nicht direkt auf dem Schirm hatten, wo wir jetzt aber die Möglichkeit haben, in diese Richtung Daten zu erheben und diese zur Verfügung zu stellen.

S. Charvet: Das Projekt lebt vom engen Austausch zwischen der Forschung und den Winzern. Praktiker können sich jederzeit melden wenn sie an einer engen Zusammenarbeit interessiert sind. Es können dann Aufnahmen gemacht werden, zwar nicht vom ganzen Betrieb, aber von einzelnen Parzellen.

M. Machwitz: Ein Interessent kann auch ganz konkret anmelden: „Ich möchte, dass diese oder jene Fläch beflogen wird, weil die Reben dor nicht so richtig wachsen.“ Solch Dinge sind für uns interessant un das Projekt lebt eben von solche Aktionen.

Helmut Li

Ségolène Charvet Foto: Ibla

Miriam Machnitz Foto: privat

Figure 8: COMMECT in Luxembourgish newspaper

LL Turkey activities were also disseminated through the official website of the ministry of agriculture and forestry in Türkiye following the workshop organized in October 2023 [19].

It is also worth mentioning how the connectivity solutions developed by the COMMECT team for livestock trucks were recently cited in a prestigious magazine such as IEEE Spectrum [20] (see Figure 9).

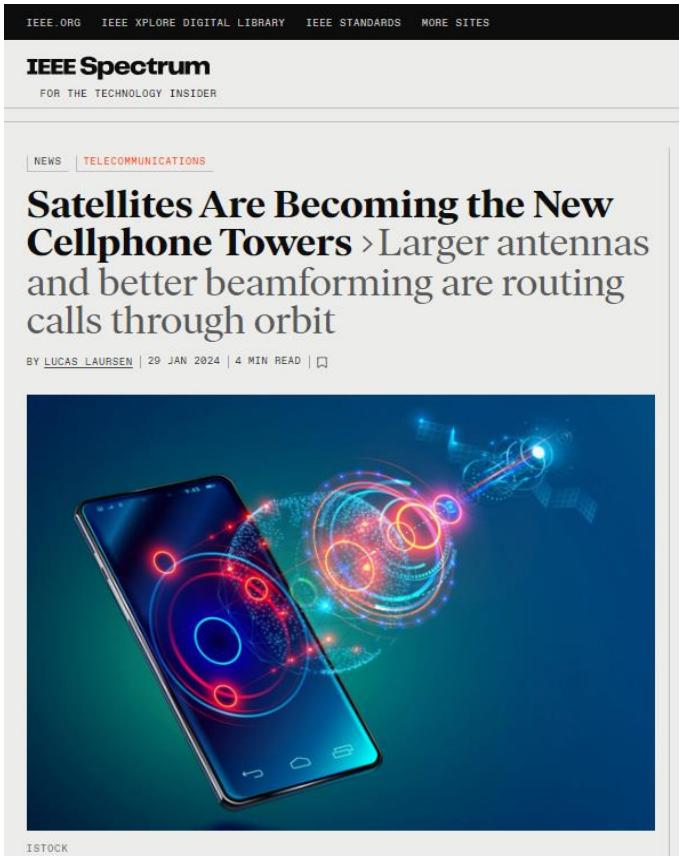

Figure 9: Frontpage of the article mentioning COMMECT solutions in IEEE Spectrum [20].

2.3.4. Publicity material

Marketing and publicity materials were prepared and used during different events to keep the visual identity and attract a larger audience. A roll-up, Figure 10, was designed and used by the project consortium during meetings, workshops, and scientific events. In the Serbian LL, the roll-up was even translated to the local language to be used in local events (See Appendix B).

With the aim to reduce environmental impacts, the consortium opted for little business cards instead of A4 flyers (see Figure 11). The business card provides the basic info about the project: Title, Logo and website (link and QR Code).

Figure 10: COMMECT Roll-up

Figure 11: COMMECT Business card

2.4. Consortium meetings

To monitor the project, ensure technical progress and identify and mitigate potential risks and conflicts, the consortium is organizing periodic (bi-weekly) online meetings at WPs and Task levels, in addition to face-to-face meetings at LL level.

In the first 18 months of the COMMECT project, the Consortium organized tree face-to-face meetings: a kickoff meeting, a plenary meeting, and a general assembly.

The Kickoff meeting (KOM) was organized on 8 and 9 September 2022 in Luxembourg by the coordinator LIST (Figure 12). This meeting corresponded to the official launch of the project. The plans and objectives for the subsequent months were discussed and clearly outlined at the end of an engaging two-days meeting.

The General Assembly took place in Aalborg (Denmark) on 25 and 26 April 2023 (Figure 13). During this fruitful meeting, a work plan for the upcoming months was presented by the coordinator (LIST). Lot of collaborations and interactions were foreseen among the partners of the COMMECT multi-disciplinary consortium. This has ensured the design of clear and detailed plan entailing innovative connectivity solutions that will find large adoption and have concrete socio-economic and environmental impacts. In the same occasion, a remote online plenary meeting was organized, on the last day, to inform all the partners about the decisions taken during the general assembly.

Finally, the face-to-face plenary meeting was hosted by TNOR in Oslo (Norway) on 17-19 October 2023 (Figure 14). This meeting was characterized by stimulating presentations and discussions, useful demonstrations in the local LL ('Connected Forestry'), and many ambitious plans for the future months.

Figure 12: Kickoff meeting

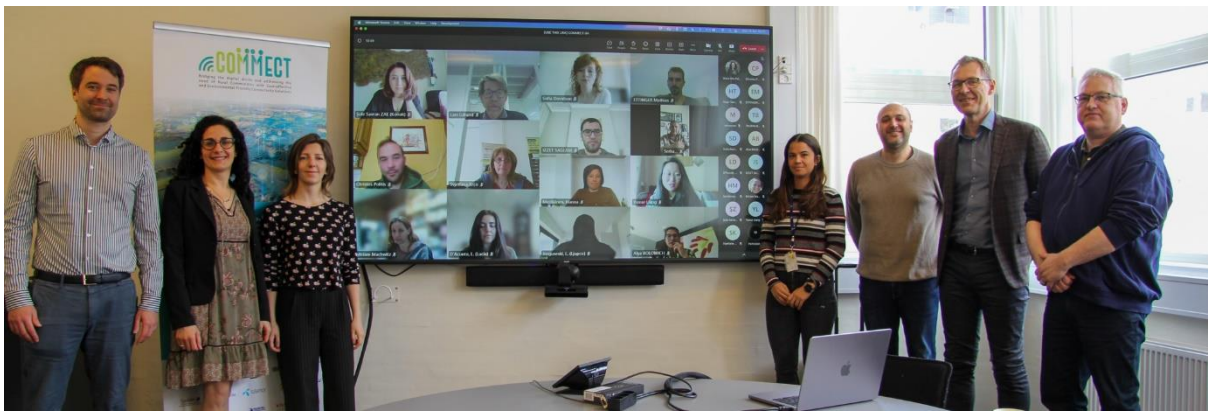

Figure 13: General assembly and Hybrid Plenary in Denmark, April 2023

Figure 14: Plenary meeting, Oslo, October 2023

2.5. Scientific events and publications

2.5.1. Scientific publications

The project partners contributed with scientific publications in several international venues since the beginning of the project (see Table 1).

Table 1 List of scientific publications in the first 18 months of the COMMECT project

Publication Title	Conference/ Journal	Authors	Open access link
5G in Rural Forest enables Real Time decision support and new Remote Operation solutions	ICECCME 2023	TNOR, KI	https://zenodo.org/records/12545998
Connecting Rural Areas: An Empirical Assessment of 5G-Terrestrial LEO-Satellite Multi-connectivity	27th VTC2023 Spring	AAU	https://zenodo.org/records/11952206
An Empirical Analysis of Multi-Connectivity between 5G Terrestrial and LEO Satellite Networks	GLOBCOM Workshop 2022	AAU	https://zenodo.org/records/11942849

Multi-Connectivity for Livestock Transport in Rural Areas	EuCNC & 6G Summit 2023 (Poster and long abstract)	AAU, AU, TNO, SES, LIST	https://zenodo.org/records/12065792
Conditional Handover for Non-Terrestrial Networks	WINCOM 2023	TCELL	https://zenodo.org/records/12071039
Centralized and Decentralized ML-Enabled Integrated Terrestrial and Non-Terrestrial Networks	IEEE Future Networks World Forum	TCELL	https://zenodo.org/records/12546900
In Rural Areas Internet Connection Problems and Solution Recommendations Experienced in the Process of Using Smart Agriculture Methods in Olive Farming	PROTOIL 2023 & International Journal of Innovative Approaches in Agricultural Research IJIAAR 2023	TOB, TCELL	https://zenodo.org/records/12798793
iCORA – a large-scale experimentation platform for end-to-end 5G services	GLOBCOM Workshop 2023 WS20-1: FutureG Experimental Test Platforms for Advanced Systems Implementation and Research	TNOR	https://zenodo.org/records/13860066
Experimentation-as-a-Service for Validating 5G Use Cases in a Large-Scale 5G Platform	2024 Joint European Conference on Networks and Communications & 6G Summit (EuCNC/6G Summit)	TNOR	https://zenodo.org/records/13860290

The COMMECT members TNOR and KI presented the paper “5G in Rural Forest enables Real Time decision support and new Remote Operation solutions” at the International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME 2023) [21]. The paper discusses how industry and society in rural areas can benefit from next generation network technologies. Based on interviews with stakeholders from the forest value chain in Norway, the study focuses on three distinct impactful use cases where premium 5G cellular network is employed. Potential impact dimensions are identified and operationalized in three groups: business, user/society, and environment. The next step is to publish the results from the test and validation of the implementation of the solutions in the LL within the three use cases.

Another paper was presented by AAU at the 27th IEEE Vehicular Technology Conference entitled “Connecting Rural Areas: An Empirical Assessment of 5G-Terrestrial LEO-Satellite Multi-connectivity” [22]. The paper contains the first set of results related to one of the

connectivity solutions that the COMMECT project will propose for the LL Denmark. The main objective of the paper is to show, using an experimental approach, how cellular-satellite multi-connectivity can help providing low-latency seamless connectivity along the route for the livestock transport trucks. The authors performed some mobility tests in a rural area in Denmark over real 5G Non-Standalone (NSA) and satellite networks.

From the same partner, another conference paper was published “An Empirical Analysis of Multi-Connectivity between 5G Terrestrial and LEO Satellite Networks” [23]. The paper presents an initial empirical evaluation of both broadband satellite and terrestrial cellular connectivity solutions and studies how the maximum end-to-end latency can be reduced by using multi-connectivity between terrestrial and LEO satellite networks. Results suggest that the integration of terrestrial and Non-Terrestrial Networks (NTN) is a competitive solution to fill the existing coverage gaps and provide seamless service to low-latency and high throughput requiring applications.

COMMECT project was also presented in “2023 EuCNC & 6G Summit: 6G for a Green and Digital Transition - Gothenburg, Sweden” via the collaboration of different members (AAU, AU, TNO, SES and LIST) with a poster titled “Multi-Connectivity for Livestock Transport in Rural Areas” [24]. According to this publication, the transport of livestock is an essential part of the supply chain of animal breeding for food production. The regulations imposed by the European Union to ensure animal welfare require constant monitoring and reporting of the animals’ health status and conditions before, during, and after transportation. However, the poor coverage and connectivity performance in rural areas hinder compliance with the regulations and the optimization of the livestock trading process. The COMMECT partners introduced the main connectivity challenges for the livestock transport sector and proposed potential solutions to overcome them. They also discussed how further digitalization would help optimize the livestock trading process.

Two conference papers were published by the COMMECT partner TCELL. The aim of the first paper, titled “Conditional Handover for Non-Terrestrial Networks”, presented at the 10th International Conference on Wireless Networks and Mobile Communications (WINCOM), is to present an overview of Conditional Handover (CHO) and signaling challenges related to NTN coverage and mobility functionalities, along with their potential solutions [25]. The second paper, titled "Centralized and Decentralized ML-Enabled Integrated Terrestrial and Non-Terrestrial Networks" [26], presented at IEEE Future Networks World Forum, tries to go over the integration of terrestrial and non-terrestrial (TNTN) architectures, as given in the 3rd generation partnership project standard releases, by proposing possible alternative scenarios. For this purpose, the capabilities, and challenges of Centralized Machine Learning (CML) and Decentralized Machine Learning (DML) are explored from the vantage point of these scenarios.

Moreover, the partners of the LL Türkiye, TOB and TCELL, published a journal paper in the “International Journal of Innovative Approaches in Agricultural Research (IJIAAR) 2023”, entitled “In Rural Areas Internet Connection Problems and Solution Recommendations Experienced in the Process of Using Smart Agriculture Methods in Olive Farming”. In this paper connection problems and solution recommendations were underlined and recent developments in this area were discussed with cost-effective and environmentally friendly approaches [27]. The paper was also presented at International Congress on Oil and Protein Crops PROTOIL 2023.

Recently, TNOR published another paper titled “iCORA – a large-scale experimentation platform for end-to-end 5G services” at IEEE GLOBCOM Workshop 2023 [28]. The paper presented the 5G and beyond 5G experimental perform which TNOR uses to support different 5G use cases and different internal and external EU projects, included COMMECT. On the same subject, TNOR published a conference paper, titled “ Experimentation-as-a-Service for Validating 5G Use Cases in a Large-Scale 5G Platform”, at the EuCNC/6G Summit 2024.

For the last half of the project, efforts are being made to increase the number of publications in high-impact, open-access journals to ensure wider dissemination and accessibility of the research outcomes. Additionally, the strategy for metadata enrichment has been improved, with all publications now available on Zenodo. This platform not only provides open access to the research but also includes comprehensive metadata to improve discoverability and usability by the scientific community and the public.

2.5.2. International scientific events

The COMMECT partners presented the project and its main objectives and outcomes in several international conferences, congresses, and meetings.
For instance, the results of the first COMMECT workshop organized in Türkiye were presented during the international Congress on Oil and Protein Crops PROTOIL 2023, by TOB (Figure 15). Studies regarding LL Türkiye were disseminated through a specific **presentation** and **conference paper** titled “In Rural Areas Internet Connection Problems and Solution Recommendations Experienced in the Process of Using Smart Agriculture Methods in Olive Farming”. The paper was published in the International Journal of Innovative Approaches in Agricultural Research (IJAAR) [27].

Figure 15: TOB presenting COMMECT at PROTOIL2023

From the same LL, TCELL, presented studies on non-terrestrial networks (NTN) applied to COMMECT in two international conferences: the International Conference on Wireless Networks and Mobile Communications (WINCOM2023) and IEEE Future Networks World Forum. The **paper** titled "Conditional Handover for Non-Terrestrial Networks" [25] was presented in the first conference, while the **paper** entitled “Centralized and Decentralized ML-Enabled Integrated Terrestrial and Non-Terrestrial Networks” was presented in the second one [26].
The COMMECT project was also presented during the IEEE Globecom 2023 workshop on Cellular UAV and Satellite Communications (CelUAVSatCom). In this event (Figure 16), AAU presented a **paper** about the experimental work carried out in the context of the project and, more specifically, how integration of terrestrial and non-terrestrial networks can help bridge the digital divide in rural areas. In the same event, TNOR also presented the **paper** titled “iCORA – a large-scale experimentation platform for end-to-end 5G services” in the workshop: WS20-1: Future Experimental Test Platforms for Advanced Systems Implementation and Research (see Figure 17).

Figure 16: AAU presenting COMMECT at GLOBECOM2023

Figure 17: TNOR presenting COMMECT at GLOBCOM 2023

TNO also presented a poster at EUCNC 2023 Summit in Gothenburg (Sweden). The **poster** illustrated connectivity solutions for livestock transport in rural Area from the LL Denmark (see Figure 18).

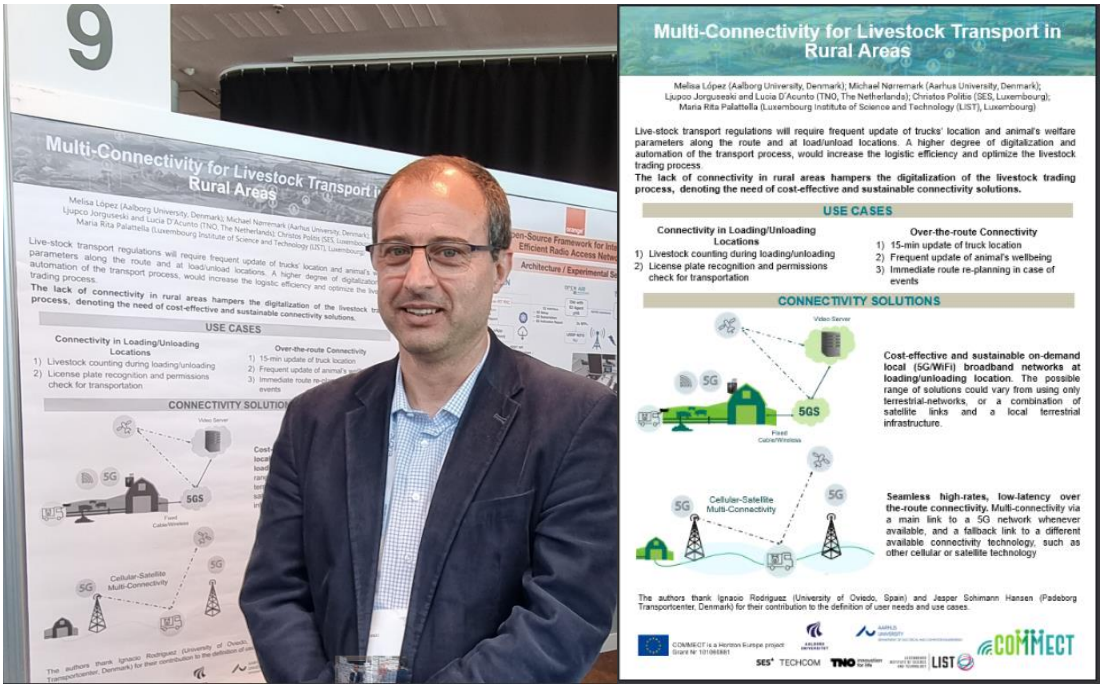

Figure 18: TNO presenting COMMECT at EUCNC2023

Moreover, the project coordinator also participated in the in the 9th IEEE World Forum on the Internet of Things (WF-IoT 2023), held online, where she presented COMMECT project and different LLs activities in the **session** "*Where the Internet of Space meets the Internet of Thing"* [29]*. The presentation was on "The value of Space assets for IoT applications*".
DNET was also present in many international events to present COMMECT and the activities carried in various LLs. In two editions of the Agri Summit Tech, in Belgrade and in Sarajevo, DNET presented COMMECT project and activities conducted in the various LLs to a professional audience. In the later event, DNET was part of the **panel discussion** on "*Data-Driven Decision Making for Smarter Agriculture*," through which our members had the opportunity to share insights on how artificial intelligence is reshaping agriculture through data analysis. This is considered a key event for the COMMECT Consortium since most of the EU projects disseminated their results in the same conference.

DNET participated also in ETSI IoT Conference 2023. In this conference, DNET presented the COMMECT project activities during a **session** titled 'COMMECT: Building Digital Bridges for Rural Areas' (see Figure 19). More specifically, the existing gap between current practices and the possibilities of new technologies was explained focusing on how the COMMECT project plans contribute to solve problems and bridge the digital divide in rural regions.

Figure 19: DNET presenting COMMECT at ETSI IoT2023

The 'Digital Around the World Conference 2022', online, was an insightful arena to discuss key topics such as digitalization of agriculture, the necessity of multi-actor approaches, how to build trust, and data sharing. LIST presented the approach specifically adopted by the COMMECT project in this regard during the **panel** "From harvesting crops to harvesting data" organized by the DEMETER project and chaired by DNET (see Figure 20).
LIST had other contributions in several EU Conference (such as EU AgriResearch Conference and Horizon Europe Day - Chrëschtmaart), in which the project coordinator shared key information and insights about the project with an engaged audience of experts and professionals (Figure 21). Lessons learnt from the close exchange with end-users and stakeholders, were disseminated through these conferences and were greatly appreciated. From the participation in the EU AgriResearch Conference, the take-away message was the importance of LLs to co-create together with farmers, foresters, and rural communities innovative and impactful solutions, tailored to their needs.
The project coordinator also participated to the 'Horizon Europe Day - Chrëschtmaart Edition', an EU event where a **panel** of Luxembourgish participants provided ideas and examples from successful Horizon Europe projects. This panel included success stories from various institutions, including LIST (Figure 21).

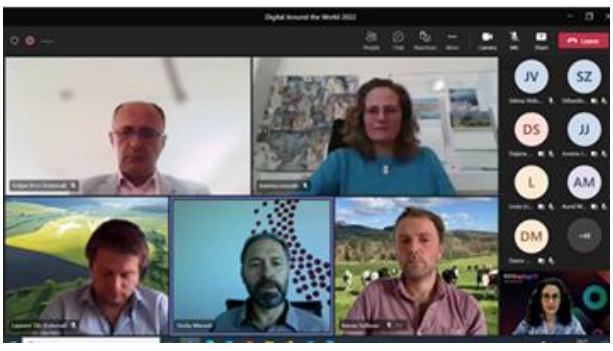

Figure 20: LIST and DNET presenting COMMECT at Digital around the world 2022

Figure 21: LIST presenting COMMECT at Horizon Europe Day 2022

Of great relevance is also the participation of LIST at the EU event "Strengthening digital skills of rural people to benefit from the digital era", organized by Rural Pact Community. Specifically, the COMMECT coordinator Maria Rita Palattella (LIST) was invited to join a **panel discussion** with practitioners and experts about the main elements that lead to successful initiatives

regarding the implementation of digital skills in rural areas. The title of the panel was “Learning from inspirational projects and practices”, where the COMMECT Consortium represented by LIST shared experiences on the need of building synergies between different approaches to enhance ICT infrastructure and digital skills. The recording of the video and presentations was made available at [30].

HWDU also presented COMMECT project during the **session** “Digital Innovation – Key enabler of the Green Transition” that took place at: “Digital with Purpose Global Summit 2023” in Lisbon, Portugal [31].COMMECT was presented as an use case to apply life cycle assessment (LCA) and enhance the calculations of avoided emissions when applying ICT. This is in line with the activities carried out in WP3.

Another key conference, where different partners from COMMECT consortium participated, is the Synergy Days organized by SmartAgri Hubs (more details about the event are provided in Section 2.6.)

In addition to the scientific events described above, the dissemination activities of the COMMECT took place through participation in international fairs (e.g., Interagro, see Figure 22, 90th Agricultural Fair, see Figure 23), webinar (e.g., Korea-Serbia Smart City Webinar and the IoT Day) and even the promotion of key events, such as the World Environmental Day, on the social media channels of other projects (e.g., SEEED).
During these events, numerous visitors had the chance to delve into the COMMECT project, understand its objectives and activities, as well as the distinctive features of the LLs. This knowledge was imparted through speeches and visual supports, including presentations and roll-ups.

Figure 22: DNET presenting COMMECT at Interagro 2023

Figure 23: DNET presenting COMMECT at the 90th International Agricultural Fair 2023

A full list of international events where the COMMECT members participated from the start of the project till M18 is provided in Table 2.

Table 2: List of international events in the first 18 months of the COMMECT project.

Date	Event	Place	Type and audience	Participants
04-08.12.2023	IEEE Global Communications Conference	Kuala Lumpur (MY)	International Conference	AAU
23.11.2023	DSC Europe	Belgrade (RS)	International Conference	DNET

13-15.11.2023	IEEE Future Networks World Forum	Baltimore (US)	International Conference	TCELL
02-04.11.23	International Congress on Oil and Protein Crops PROTOIL 2023	Antalya (TR)	International Congress	TOB
26-28.10.2023	10th International Conference on Wireless Networks and Mobile Communications	Istanbul (TR)	International conference	TCELL
23-26.102023	World Forum on Internet of Things WF-IoT 2023	Online	International hybrid Conference	LIST
4-5.10.2023	Synergy Days Conference 2023	Thessaloniki (GR)	International Conference	LIST, TNO, TNOR, DNET
27.09.2023	Digital with Purpose Global Summit	Lisbon (PT)	International Conference	HWDU
20-22.9.2023	Interagro 2023	Bijeljina, BiH	International Fair	DNET
4-6.7.2023	ETSI IoT Conference 2023	Sophia Antipolis, France	International Conference	DNET
8-9.6.2023	Agri Summit Tech, Belgrade, Sebia	Belgrade (RS)	International Conference	DNET
08.06.2023	Strengthening digital skills of rural people to benefit from the digital era	Online	International webinar	LIST
08.06.2023	Promotion on our partner's SM channels (SEEED) regarding World Environmental Day	Online	Social media post for international audience	DNET
31.05.2023	EU AgriResearch Conference	Brussels (BE)	International Conference	LIST
20-26.5.2023	90th Agricultural Fair, Novi Sad	Novi Sad (RS)	International Fair	DNET
6-9.05.2023	EUCNC 2023 Summit	Gothenburg (SE)	International Conference	TNO

21.04.2023	IoT Day	Novi Sad (RS)	International Meeting	DNET
23.03.2023	Korea-Serbia Smart City Webinar	Online	International Webinar	DNET
15.02.23	27th IEEE Conference on Information Technology (IT) 2023	Zabljak (ME)	International conference	DNET
06.12.22	Horizon Europe Day-Chrëschtmaart Edition	Esch-sur-Alzette (Luxembourg)	National conference	LIST
20-21.10.2022	Digital Around the World 2022 Conference		International virtual Conference	LIST, DNET

2.5.3. National scientific events

In addition to international events, the COMMECT members presented the projects' objectives, methodologies, and results at LL level in several national events.

From the LL Luxembourg, LIST participated to the event 'Weinbergsbegehung: Meeting the Winegrowers in Luxembourg', both in 2022 and 2023 (Figure 24). In the first occasion, the COMMECT coordinator presented the project, while in the latest edition the activities and experiments carried out within the project and its relevant progress were illustrated to an engaged audience of local winegrowers, by the LL leader.

Figure 24: LL Luxembourg presentation in Weinbergsbegehung 2022 and 2023

LIST and IBLA participated to the conference named 'Weinbautag (IVV)', both in 2023 and 2024 (see Figure 25), an event where they illustrated the COMMECT project to winegrowers, showing how it contributes positively to the critical topics of climate change and sustainability.

Moreover, LIST, IBLA and LXS were involved in the "40. Colloquium of the International Working Group for Soil Management and Quality Management in Viticulture", which is a national event where the COMMECT partners discussed, via a **presentation** and **poster** (Figure 26), about key topics in the field of viticulture, exchanged ideas on research

approaches, and shared best practices with academics, policymakers and practitioners through talks and poster presentation, the event registered more than 100 participants.

Figure 25 LL Luxembourg presentation in Weinbautag 2023 and 2024

Figure 26: Presentation of the COMMECT project during the " 40 Colloquium of the International Working Group for Soil Management and Quality Management in Viticulture."

Recently, the connectivity solutions designed for the LL Luxembourg “Digitization of viticulture” were presented via a **poster** during the “Future workshop” organized by MyConnectivity.lu in December 2023 (see Figure 27). The event hosted more than 200 attendees to explore the future of connectivity in Luxembourg and discuss on the potential of 5G, space and connectivity [32]. The team from LIST participated with a booth about “IoT, 5G and Satellite for Smart Agriculture” where COMMECT project was presented.

Figure 27: Poster presented by LL Luxembourg at "Future Workshop by MyConnectivity"

The LL Norway shared different news in online platforms to disseminate the LL activities (see section 2.3.3). But also participated to some national events to target specific audience. For instance, TNOR participated to the event "5G- So what?" organized by NOKIOS (see Figure 28). The event was about highlighting the new technology's role in helping with social challenges. Examples from the COMMECT project, and specifically LL Norway were presented. The LL was also present in the "S kogen inn I fremtiden" (The future of the forestry) conference, an event in collaboration with Bio Valley, Paper Province, Klosser Innovation and Norwegian Wood Cluster hosted in Kongsvinger [33]. The event focused on how to increase value and profitability within the forest industry with some of the stakeholders from LL Norway,

Figure 28: TNOR presenting COMMECT at "5G- So what?"

Other partners were actively engaged in important national events in other countries. LL Denmark was present in different national events to meet local stakeholders (meeting with SamMark.dk, conference on the Future Transport in Copenhagen, Transport Fair in Herning), learn new use cases from the industry and exchange with Tech providers (meeting with Mobicom-Pro). Moreover, the Danish partner PTC participated to the 'Telcom Industry Forum'. The event saw the participation of 50 key actors in the fields of telecommunications, fiber

network, and broadcasting, together with several delegates from the Confederation of the Danish Industry. The invited attendees discussed how to expand the fiber net as well as how to enhance the use of 5G networks. At the end of the event, PTC was invited by the Danish Department for the Use of New Technologies to participate in upcoming workshops and meetings organized by the corresponding Ministry. In those occasions, PTC had and will have the opportunity to present and discuss the technologies explored within COMMECT, notably in the Danish LL on Livestock Transport.

The COMMECT partner TOB presented the COMMECT project in many national events in Türkiye. These include Horizon Europe Info Day 2022, a hybrid meeting in Ankara, organized by TOB. 59 institutions conducting research in the field of agriculture in Türkiye participated in the meeting, and more than 500 persons attended. The title of the TOB presentation, specifically referring to COMMECT, was “A success story and inspiring project”.

COMMECT was also presented by the Turkish partners in the ‘Institute Research Committee Meeting’, the annual project evaluation meeting organized by the Research Committee of the Olive Research Institute. The presentation related to COMMECT focused on the story and main processes characterizing the project.

Finally, TOB presented COMMECT project in two other events named “Horizon Europe Info Day” in 2023. The first of these events was organized by the General Directorate of Agricultural Research and Policies (TAGEM) and saw the participation of researchers working under the General Directorate of European Union Foreign Relations. This meeting took place in Ankara. The second meeting was organized by the Scientific and Technological Research Council of Türkiye (TUBITAK) with the participation of academics from five universities conducting research activities in Türkiye; this meeting took place in Kırklareli.

The activities of LL Serbia were selected as a good practice example at events organized by the Government of Serbia and UNDP: ‘Circular Round Table 2022’ and ‘Prihvati Cirkularni izazov 2023’ (i.e Embrace the Circular Challenge 2023’), as a solution that promotes the circular economy (see Figure 29). During these events, the DNET team first presented plans for the development of energy-sustainable digital agricultural practices in the Serbian LL, focused on optimizing agricultural production, preserving biodiversity, and preventing pollution in the Nature Park. One year later, the progress achieved was presented.

Figure 29: DNET presenting COMMECT at "Prihvati Cirkularni izazov 2023"

A full list of national events where the COMMECT members presented LL activities from the start of the project till M18 is provided in Table 3

Table 3: List of national events in the first 18 months of the COMMECT project.

Date	Event	Place	Type and audience	Participants
07.02.24	Weinbautag (IVV)	Greven-macher (LU)	National conference	LIST, IBLA , LXS
20.12.23	Horizon Europe Info Day	Ankara (TR)	National conference	TOB
14.12.23	Future Workshop by MyConnectivity	Luxembourg (LU)	National conference	LIST
14.12.23	Institute Research Committee Meeting	Izmir (TR)	National Research meeting	TOB
01.12.23	Horizon Europe Info Day	Ankara (TR)	National conference	TOB
23.11.23	Horizon Europe Info Day	Kirklareli (TR)	National conference	TOB
15.11.23.	Prihvati Cirkularni izazov	Belgrade (RS)	National Conference	DNET
07.09.23	Weinbergsbegehung	Luxembourg (LU)	National meeting	LIST
10-13.05.23	40. Colloquium of the International Working Group for Soil Management and Quality Management in Viticulture	Luxembourg (LU)	International Conference	LIST, LXS, IBLA

27.03.23	Telecom Industry Forum	Denmark (DK)	National meeting	PTC
20.01.23	Turkiye Research Program Evaluation Meeting	Ankara (TR)	National research meeting	TOB
01.02.23	Weinbautag (IVV)	Greven-macher (LU)	National conference	LIST, IBLA , LXS
17.01.2023	Skogen inn I fremtiden	Kongsvinger (NO)	National conference	KI
21.12.22	Circular Round Table 2022	Belgrade (RS)	National conference	DNET
21.11.22	Horizon Europe Info Day	Ankara (TR)	National conference	TOB
10.22	5G- So what	Norway (NO)	National conference	TNOR
05.09.22	Weinbergsbegehung	Luxembourg (LU)	National meeting	LIST

All these important events saw a wide participation of national or international audiences, and were disseminated in a timely manner through our website and social media channels by means of an effective combination of written notes, high quality videos and photos.

2.6. Synergy Days 2023

Among other events, it is worth highlighting the participation of a COMMECT delegation to the Synergy Days Conference 2023, i.e., one of the most important conferences connecting the digital innovators operating in the agri-food sector in Europe (see Figure 32).

The conference took place in Thessaloniki, Greece, on the 4th and 5th October 2023 and represented a great opportunity to present the project to a competent and engaged audience, as well as to connect with other EU-funded projects and create synergies with them.

The event, organized by SmartAgriHubs, was attended by over 300 people, including representatives of EU projects, digital innovators, and various stakeholders from the European agri-food sector. Besides technical sessions focusing on relevant topics such as sustainable agriculture, 5G for smart communities and the relevance of EU policies, the conference also offered a wide portfolio of workshops, organised by EU projects.

COMMECT, together with its sister project XGain, organised two workshops, which focused on the main activities, outcomes, and issues successfully addressed in the project.

The first workshop, entitled "*Connectivity, business models and socio-economic impact: What is the Interlink*?" aroused great interest among many Synergy Days participants, as confirmed by a fully booked meeting room (see Figure 30).

Figure 30: workshop "Connectivity, business models and socio-economic impact: What is the Interlink?"

In a second workshop, entitled "*What are the best digital technologies for my use case?",* the COMMECT members presented the first preliminary version of the Decision-making Support Tool (DST) currently described in deliverable D3.3 [34] , which is designed to provide suggestions on the availability and suitability of technology proposals, including connectivity and computational aspects, in the context of different use cases in rural areas (Figure 31).

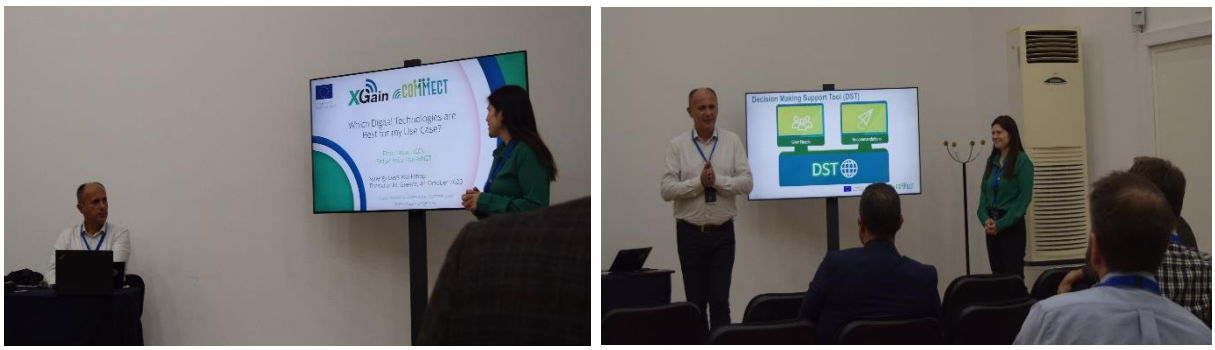

Figure 31: Workshop "What are the best digital technologies for my use case?"

Finally, our coordinator Maria Rita Palattella (LIST) participated in the plenary session 'Synergy Projects', where she summarized the main idea behind the project, in 3min pitch.

In considerations of the great experience in Thessaloniki, COMMECT has already confirmed its participation to the next edition in Barcelona (Spain), in October 2024.

Figure 32: Selection of photos taken during the Synergy Days 2023 in Thessaloniki (Greece), 4-5 October 2023

The Synergy Days organizers had published a video highlighting the key moments of the events. The video includes frames from the workshop and the pitch of COMMECT. The video is available at [35].

2.7. Collaboration and synergies with other EU and national projects

The COMMECT partners have already established important contacts with other projects funded by both the EU and national research councils. The objective is to develop these connections further in the next 18 months of the project with the aim to create fruitful and durable collaborations, even in the light of possible future joint research projects. Hereafter we list the main projects with which COMMECT has established a collaboration.

H2020 DEMETER: The participation of common members such as DNET and LIST has fostered an important collaboration with the H2020 **DEMETER** project (i.e., long-term viability, and sustainability of Europe's agri-food sector through its digital transformation). The Serbian partner DNET was the leader of the pilots in DEMETER and focused on the interoperability of digital farming systems. LIST participated in the project with the HEMS Pilot (winner of the second Open call). COMMECT is leveraging on the lessons learnt from DEMETER, about farmers' needs, challenges toward adoption of digital solutions, fears about data sharing, among others. COMMECT project leader was also invited to participate in the Panel Session "From harvesting crops to harvesting data", in the 'Digital Around the world conference' organized by DEMETER (see section 2.5.1).

HE XGAIN: **XGAIN** is another key project with which sharing acquired knowledge, competences, and experiences. XGAIN is the sister project for COMMECT: both projects were accepted in the same EU call for proposals and the respective teams are working closely fruitfully and effectively. In addition to the frequent virtual interactions (online meetings) between the two teams, members from both projects organized workshops and events in the context of Synergy Days Conference 2023 (see Figure 33). These initiatives received a lot of attention and are considered as a real success by the organizers, who were able to engage a broad and extremely interested audience. COMMECT also had a follow-up meeting with XGAIN late in October 2023 regarding the methodology ADOPT, proposed for impact assessment.

HE QUANTI-FARM: During the Synergy Days, the COMMECT partners had the opportunity to exchange also with the EU project **QUANTIFARM** [36]. Some members of the QUANTIFARM consortium presented during a workshop an interesting framework for the assessment of the social, economic and environmental impacts of digital technologies in agriculture. The tool was important for the activities carried out in WP3 of COMMECT project. Both project members had fruitful discussions that were translated by a follow-up online meeting, after the Synergy Days, to establish collaboration between the projects. It is worth mentioning that TNO is partner in both projects, COMMECT and QUANTIFARM, which is helping to foster future collaborations.

Figure 33: COMMECT and XGAIN coordinators at the Synergy Days 2023

H2020 SmartAgriHub: The cooperation with **SmartAgriHub** has been materialized in the participation in the Synergy Days 2023 and will be strengthened through the participation in other events organized by the EU organization, including the new edition of the conference in 2024.

H2020 iNGENIOU: COMMECT established connections with **iNGENIOUS** another H2020 aiming to design and evaluate various Next-Generation IoT and to provide smart networking and data management solutions with AI and Machine Learning. COMMECT is building on the experience acquired in this project and reusing and upgrading the Smart IoT Gateway (developed initially in the context of iNGENIOUS), in the LL Luxembourg to process and route the data to satellite or terrestrial backend networks.

JU-SNS IMAGINE-B5G: TNOR, as partner of COMMECT, and IMAGINE-B5G has established a collaboration between the two projects. Initially, TNOR defined the drone-based situational awareness use case in COMMECT LL2 Norway as a relevant scenario for applying 5G technology. A similar use case was later developed in the IMAGINE-B5G research program under the "*Agriculture and Forestry*" industry vertical. It followed the collaboration among the two projects, on this common use case. Third-party service providers "iLINK" and

"Local AI" were funded via IMAGINE B5G in an open call to support the development of the drone related functions in the situational awareness use case. Results from lab and field trials of early use case prototypes have been shared between the two projects. However TNOR did not used any equipment/service cost for that use case from COMMECT. The IMAGINE B5G use case ends in October 2024. The COMMECT project are assessing different ways of continuing the collaboration (including service cost payment) with the third-party service providers to implement their own solution, after October 2024.

Finally, the various LLs are connected to several projects at the national level. Among others, these include **Smart Forest in Norway** (i.e., a project aiming to improve the efficiency in the forestry sector through the adoption of digital technologies)

TUBITAK: TUBITAK is the Turkish national research institute and, simultaneously, the Horizon Europe's national contact point. It is the most prominent governmental institute and provide grants to PhD students. COMMECT leverages on the work done by a PhD student (whose grant was funded by TUBITAK) adressing some of the reseach questions addressed in the LL Türkiye. For this reason, TCELL acknowledged COMMECT and TUBITAK in the published papers.

FIDAL, 5G-MediaHub: iCORA is a large-scale technology platform developed by Telenor Research and Innovation in the Telenor group (TNOR). COMMECT and other EU research projects (FIDAL, 5G-MediaHub and IMAGINE-B5G) have contributed to the funding of the platform infrastructure such as servers with different core/management functions for the platform and service cost for maintaining the network functionality. There are no connections between COMMECT and FIDAL and 5G-MediaHub, on actual research work, carried in the different projects, but since all research programs contributes financially to iCORA, these projects have acknowledged iCORA in all conference articles, published by TNOR.

Ramon y Cajal Fellowship: The Ramón y Cajal (RYC) program for contracts from the Ministry of Science and Innovation is to promote the incorporation of research personnel, both Spanish and foreign, with an outstanding track record for them to acquire the skills and abilities that allow them to obtain a stable position in a research organization of the Spanish System of Science, Technology and Innovation. The fellowship was awarded to Ignacio Rodriguez, who was initially involved in the COMMECT activities on behalf of Aalborg University (AAU), in 2022. Ignacio continued collaboration on the work leading to the publication "Connecting Rural Areas" after relocating to the University of Oviedo in Spain for fulfilling the requirements of the fellowship, and finished his contributions to the paper when in his new position.

2.8. Progress of the communication and dissemination plan

In order to monitor the effectiveness of the dissemination activities, a set of target key performance indicators (KPIs) were defined in the 'Dissemination, Communication and Exploitation Plan' deliverable D6.2 [2]. In this Section we discuss the progress of the various Key Performance Indicators (KPI) as outlined before the start of the project.

The table below indicates the various channels through which the communication and dissemination activities are taking place (Column 1), the related results in April 2023 (i.e., the first time in which they were publicly presented at the Executive Board Meeting; Column 2), the results after 18 months from the launch of the project (i.e., the current results; Column 4), the objective targeted by the end of the project.

As showed in Table 4, most of the objectives are in line with the target KPIs.(i.e., website, press releases, news about COMMECT on the traditional and online press, business cards, and participation in workshops, conferences and other events number of followers on LinkedIn

and Twitter, videos and collaboration with other projects). Regarding Twitter and LinkedIn, it should be also highlighted the significant increase of followers in percentage terms between April 2023 (i.e., the date in which the first data collection took place, in correspondence of the COMMECT Plenary Meeting) and February 2024 (i.e., the 18th month of the project). In detail, Twitter saw an increase of 150% of followers, while such an increase was 115% in the case of LinkedIn.

Regarding the KPI related to YouTube (i.e., number of followers and views), the lower number of followers and views can be certainly explained by the fact that the channel was launched significantly later than our Twitter and LinkedIn account. The dissemination strategy about YouTube will be strengthened in several ways: first, by means of a higher number of reposts and retweets; second, by uploading more videos which will clearly lead to more views; third, by linking all the videos between each other, to create a sort of playlist, which will increase the number of views and related potential followers.

Finally, regarding scientific publications, it is worth mentioning that the COMMECT members have already published 7 conference papers, one in high-ranked and well-known IEEE Conference, Globecom (one of the flagship conferences, in the communication and networking field). More scientific publication will be issued after getting the first results related to the implementation of connectivity solutions in the various LLs.

2.8.1 Revision of dissemination strategy

The communication and dissemination strategy of the COMMECT project has been updated to improve its impact and accessibility. Efforts have been directed towards making research outputs more accessible and impactful to a broader audience. Ongoing efforts are focused on improving and adding content to the website, making it a useful resource for stakeholders. Updated sections include each Living Lab, showcasing the use cases and collaboration with different actors.

Social media activities on platforms such as LinkedIn, Twitter, and YouTube have been intensified to enhance our online presence. LinkedIn and Twitter have shown good activity and follower growth, the focus is now on improving the quality and impact of YouTube videos. High-quality videos showcasing the use cases from each Living Lab will be produced to communicate the project's progress and impact.

The use of Zenodo for publication ensures that all research outputs are freely accessible, with metadata to improve discoverability and reuse. This approach aligns with our commitment to open science and improves the overall impact of our dissemination activities.

Table 4. KPIs: comparison between M6, M18 and targeted KPIs by end of the project.

Channel	April 2023 (M6)	February 2024 (M18)	Objective by (M36)
Press Releases	2	3	3/year
News in online and offline newspapers and magazines	4	11	At least 5/year
Website*	n.a.	3623	3000 visitors/year

Twitter	98 followers	245 (+150%)	1000 followers (total)
LinkedIn	167 followers	359 (+115%%)	1000 followers (total)
YouTube	n.a.	10/176	300 followers (total) / 3000 views
Business cards	-	2000	1000 flyers (total)
Videos	1	3	8-12 videos (total)
Publications in scientific journals	-	1-	At least 12 (total)
Workshops/ **conferences, congresses, and meetings/** **fairs/** **conference papers/** **posters/other activities (total)**	5/ 11/ 0/ 0/ 1/0 (17)	10/ 30/ 2/ 8/ 3/2 (55)	20 (total)
Collaboration with related projects	3	6	12-15 (total)
Final video	-	-	1 (total)

2.9. Upcoming communication and dissemination activities.

The COMMECT dissemination and communication team is constantly working to enhance further the impact of the project by spreading the project's activities and achievements to different types of audiences (e.g., academics, policymakers, practitioners, general public).

In the upcoming 18 months of the project (corresponding to the second half of Phase 2 and Phase 3; (see Figure 1), the COMMECT Consortium will publish research articles in high-impact peer reviewed journals. By virtue of the multidisciplinary nature of the research activities conducted within COMMECT, the articles will be published in top journals in various scientific fields such as telecommunications; environmental, agricultural, and biological sciences; geography, planning, and regional science; business and economics. In this regard, it is worth mentioning that the Consortium was approached by the responsible of an interesting and relevant initiative such as **Open Research Europe** [37]. This is a platform, managed by the EU, whose aim is to publish peer-reviewed articles across all disciplines and accelerate the impact of research with rapid publication, open peer review, and indexing in databases such as Scopus and PubMed. After several exchanges with Open Research Europe, the COMMECT Consortium has decided to support this EU initiative and start to disseminate some research outcomes in the Q2 and Q3 in 2024.

Moreover, the COMMECT partners have already planned to participate in many events of international relevance, which are listed in Table 5. In most of these events, partners actively submit scientific publications or are at least intending to if not done yet. For instance, TNOR already had an accepted paper in EUCNC conference, which was held in June 2024, titled

"Experimentation-As-A-Service for Validating 5G Use Cases in a Large-Scale 5G Platform" [38]. Also, LIST, with AAU, TNO and TNOR submitted a tutorial proposal, titled 'Paving the way toward global connectivity with 5G, NTN and IoT' for the same conference. Other partners are writing a paper leveraging on the research results achieved in Tasks T2.2 'Local 5G private networks', to be submitted for the same conference. SeAMK and LIST are also preparing an abstract/paper on the results of environmental impact assessment related to task T3.2 'Environmental Sustainability Assessment framework', to be submitted for LCA Food 2024.

Table 5. List of events that COMMECT partners plan to attend in 2024.

Date	Event	Place	Type and audience	Participants
04.2024	ETSI Conference on "Non-Terrestrial Networks, a Native Component of 6G"	Sophia Antipolis (FR)	International conference	TCELL, LIST, AAU, SES, TNOR
04.2024	IoT Day	Novi Sad (SR)	International conference	DNET
05.2024	91st Agricultural Fair	Novi Sad (RS)	International conference	DNET
06.2024	AgriSummit.tech	Belgrade (RS)	International conference	DNET
06.2024	EuCNC & 6G Summit	Antwerp (BE)	International conference	AAU, LIST, TNO, TNOR
07.2024	BEST European Academic Summer Course on Space Technology	Aalborg (DK)	Academic Summer Course	AAU
TBD (Fall 2024)	IEEE Vehicular Technology Conference	Washington, D.C. (US)	International conference	AAU
09.2024	LCA Food 2024	Barcelona (ES)	International conference	SeAMK, LIST
10.2024	Synergy days 2024	Barcelona (ES)	International conference	LIST, TNO, TNOR, DNET

In addition to this, an innovative format aiming to keep our audience informed about the COMMECT project will be launched soon. Instead of the traditional document containing information about the recent activities and results (i.e., newsletter), we will ask all the partners this key information, which will be reported in the form of dialogues and interviews on our website and social media channels. We consider this a new, engaging and potentially fruitful way to disseminate our project activities and outcomes.

In addition to this, the COMMECT Consortium is exploring another opportunity offered by the various EU organizations to enhance the visibility of the project further. There is the possibility to join **Wikifarmer** (i.e., an online platform with a global reach aiming to empower farmers and other stakeholders of the agrifood sector through free knowledge sharing and bring science and practice closer together [39]). Wikifarmer approached COMMECT a few months ago and we have had various meetings with the promoters of the initiative in the meantime. We are currently considering seriously the possibility to join this EU platform.

Moreover, COMMECT is following closely the **Gender Alliance for Innovation in Agriculture (GAIA)** [40], which is an organization focusing on women as excellent farmers, advisors, agri-business actors, entrepreneurs, and Digital Innovation Hubs, who can make significant contributions to the digital transformation of European agriculture. We are similarly considering the possibility to join this association.

More professional videos will be produced in the coming months to disseminate project activities and results, with the aim of attracting both specialized and wider audiences. Among other things, we will produce videos in the various LLs with the aim of showing the progress made and the good results already achieved in Luxembourg, Norway, Denmark, Türkiye, and Serbia. This will allow us to demonstrate the results of the COMMECT project through videos showing what is really happening in our LLs and the voice of the protagonists.

Finally, the COMMECT partners have prepared several practice abstracts in the deliverable D6.5 submitted in January , which will be disseminated in a specific page of our project website (after approval by the EU commission). In the first batch of practice abstracts, the COMMECT members describe the main lessons drawn from the activities carried out in each LL, with the aim to provide and share knowledge and practical recommendations to the interested audiences.

3. Workshop and Training Organization

The connection and interaction between researchers and end-users is critical in the project. COMMECT partners are using participatory methods to collect the feedback of the end-users and to adjust the research orientation. The Living Labs have been using several approaches, like questionnaires and especially workshops.

Two sets of workshops have been implemented in each region in the first year and a half of the project. The principal concept of Living Lab requires co-creation, based on close collaboration among different actors and partners in each Living Lab. It allows to jointly propose digital solutions and to periodically collect feedback from the main stakeholders during the development of connectivity solutions for rural areas and communities.

The digital solutions developed within the first 18 months of the COMMECT project are based on the first set of workshops. These solutions have to be very concrete and applicable for the local stakeholders.

The aim of the second set of workshops is to collect feedback from the stakeholders about the connectivity solutions: are they addressing the user needs? Could the connectivity solutions be implemented in the Living Lab within the local socio-economic framework?

As presented in the following sub-sections, more details of the workshops are revealed per each Living Lab, allowing to better understand the interactions among COMMECT partners and stakeholders, jointly discussing the user needs, on-demand digital solutions, as well as the business model.

3.1. Living Lab Luxembourg

3.1.1. First Workshop

Concept and framework of the workshop

In the initial phase, our strategy involved conducting bilateral interviews with winegrowers and presenting our project during the annual general assembly known as the Viticulture Day in the region, which was scheduled for February 2023. Instead of opting for a traditional workshop, we chose to employ a survey methodology to engage and motivate winegrowers towards embracing new digital solutions, deeming it a more promising approach.

The Viticulture Day “Weinbautag” stands as a crucial professional and educational platform covering various viticulture and viniculture topics, including cultivation, cellar management, marketing, and viticulture policy. To maximize feedback, Miriam Machwitz (LIST) and Jörg Pauly (IBLA) presented the COMMECT project to the audience during the Viticulture Day.

The bilateral interviews, conducted to evaluate the digital support requirements for viticulture management, took place with various winegrowing enterprises in Luxembourg from December 2022 to January 2023. Each interview, spanning 1-2 hours, involved a carefully curated set of questions that delved into pivotal topics such as decision-making in Peronospora control, irrigation/drought stress management, and fertilization management. The selection of the nine farms aimed to represent the diverse spectrum of enterprises within Luxembourg's viticulture sector, including self-marketers, grape producers, organic farms, and conventional farms. With interview templates and questionnaires that were collaboratively prepared by LIST, LXS, and IBLA, these interviews yielded invaluable insights into the specific needs of winegrowers

and provided a comprehensive understanding of their current utilization of digital tools within wineries.

Implementation of the first workshop: Method

Within the LL Luxembourg, Jörg Pauly, working as an advisor for winegrowers at IBLA, conducted the interviews. The interview method was designed to gather in-depth information and personal insights into the digitalization of viticulture. However, maintaining focus on the interview objectives and avoiding diversions into unrelated topics proved challenging. Interviewees often expressed interest in discussing various issues, despite the intended scope of the conversation. Despite these challenges, the interviewer gained an impression of the winegrowers' overall interest in the digitalization topic.

Wrap-up: End User Need and Use Cases

Out of approximately 268 winegrowers (Agrarstatistik, 2020), 41 responded, indicating a satisfactory response rate. This approach allowed for a quick and diverse collection of information within a short time frame.

Over half of the winemakers surveyed were between 61 and 65 years old, while 27% had ages between 21 and 50. 59% of the wineries were grape growers who deliver their harvest to the Luxembourgish cooperative, and about one-third of the participating wineries market their wines themselves. A significant number of wineries with more than 10 hectares of vineyards participated (41%), with 44% having a size between 2 and 10 hectares. Conventional viticulture is practiced by 95% of the companies, almost allowing to represent Luxembourg's entire viticulture. Based on the interviews with winegrowers, the following priorities were identified within the defined thematic areas. The primary concern is Peronospora control, a significant disease in viticulture. Winegrowers rely on various weather forecasts, comparing them to make decisions on treatment scheduling. They consider their own experience, forecasts from the VITIMETEO model (see D1.1 for more details about this application), and information from advisory newsletters. Improving the forecast accuracy of VITIMETEO is not only deemed beneficial but also essential, and one key strategy involves establishing a more densely distributed network of weather stations.

The second priority revolves around irrigation and the management of drought stress. Typically, only young plants are irrigated, with occasional irrigation of yielding plants on extremely shallow sites. Winegrowers express the need for a digital determination of usable field capacity or soil water balance to schedule irrigation effectively. They find soil moisture sensors for decision support valuable, and there's interest in using drone imagery to assess the vitality status of vineyards.

The third key topic is fertilization management. Currently, adjustments to fertilization based on known heterogeneities (soil and vine stand) are made manually by varying travel speeds or settings of the fertilizer spreader. While some farms have GPS-capable fertilizer spreaders, winegrowers express a need for digital information to record spatial heterogeneity (soil and vine stand).

About 2/3 of the surveyed wineries already use or will -in the near future- use a digital field management system to support operational processes and documentation.

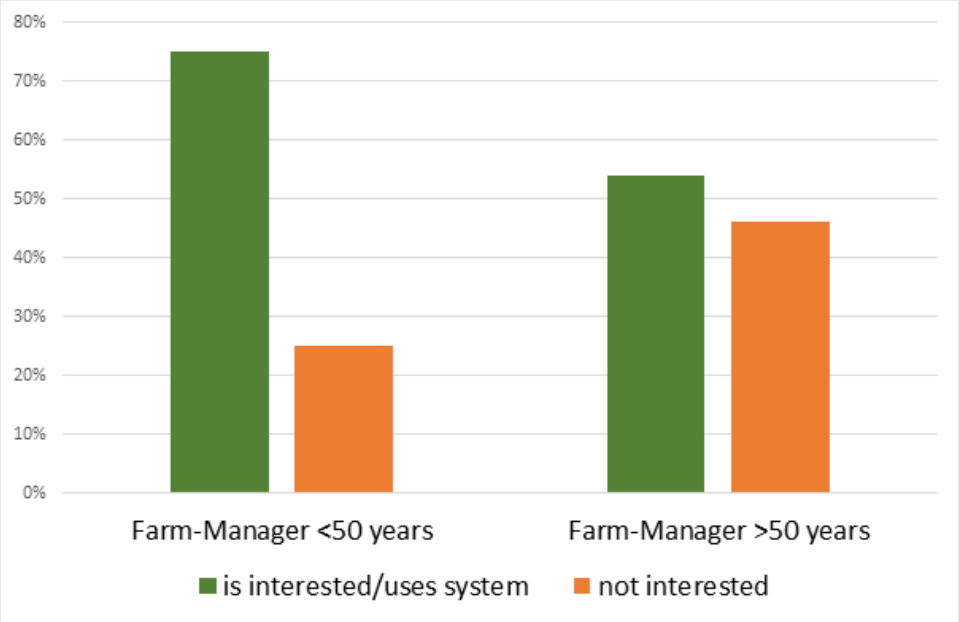

Figure 34: Interest in using a field management system depending on the age of the farm manager.

The demonstrated high level of interest in adopting such a system is particularly noteworthy, with younger farm managers showing a pronounced enthusiasm for its utilization (Figure 34). The preferences for the VITIMETEO forecasting system showed a more uniform picture with respect to the age of the winegrowers. The preferences for this tool were about 40% of the respondents across all age groups (Figure 35).

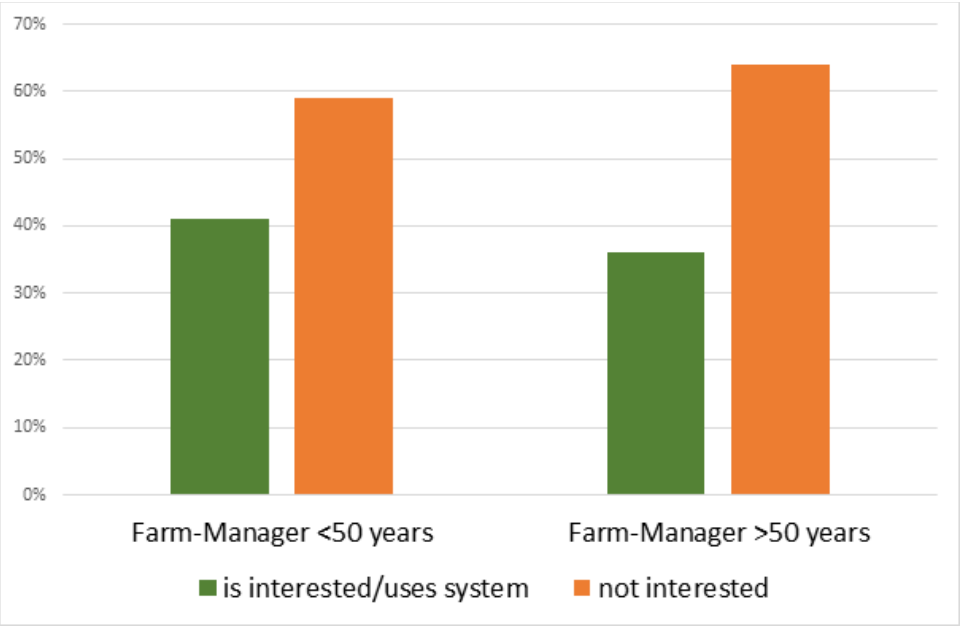

Figure 35: Interest in using the downy mildew forecasting system VITIMETEO depending on the age of the farm manager.

Upon concluding the survey, participants were provided with several proposed solutions for designing digital support in vineyard management (refer to Figure 35). These solutions were evaluated by respondents, who assigned points according to their perceived relevance. The findings highlighted a prominent interest in direct sensor-based cultivation recommendations accessible via smartphones. Moreover, there was a notable demand for improved estimation

of Peronospora infection situations, particularly utilizing leaf wetness sensors and air temperature measurements.

For the winegrowers, obtaining high-resolution information on soil quality and soil water content appears to be of lesser importance. This finding aligns with the observation that irrigation measures are specifically implemented in response to certain irrigation situations:

- Young plants in the 1st-3rd standing year.
- Yielding plants younger than 10 years.
- Irrigation of replanted single vines.

Lower priority was given to the images, which can be used to estimate vigour conditions. However, there are some pioneer users which showed high interest in such data during bilateral exchange and during the workshop in November 2023 (see Figure 36).

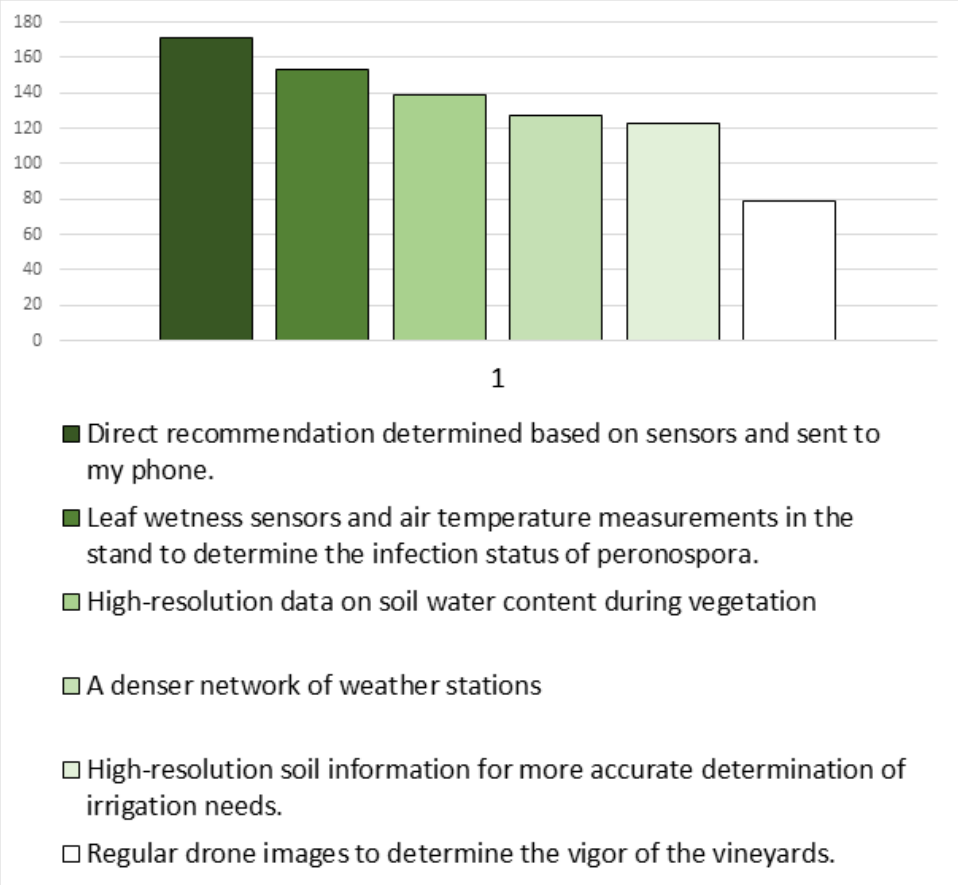

Figure 36: Ranking query of tools that will be relevant in the future for decisions in the areas of plant protection, irrigation, and fertilization for viticulture management.

From those results, the Living Lab Luxembourg has decided to select 2 main use cases:

UC 1.1. In-Field Microclimate and Crop Monitoring in Vineyards
UC 1.2. Digital Twin for Digitalized Management of Vineyards

The outcomes of the first workshops constitute a good basis for developing both use cases, which are described in the Deliverable 1.1.

3.1.2. Second Workshop

Concept and framework of the workshop

The second workshop took place on the 14th of November at the winery “Cep d’Or”. Choosing such a location proved to be instrumental in engaging winegrowers, offering them a firsthand look at the production environment, focusing on the development of unique characteristics of the products. This venue, more private than a municipal or administrative space, fostered a comfortable and immersive atmosphere. The workshop consisted of two sections: First, a living lab meeting collaborating with TNO to discuss the business model, LL objectives, and initial steps. Then, the second workshop was intended for stakeholder and end-users, including winegrowers, the Ministry of Agriculture and a company providing software for winegrowers.

The first session was realised in English. All the members of the LL Luxembourg were invited (LIST, IBLA, LXS, SES), as well as the representative of the public institute of oenology and viticulture (IVV). In total 13 people participated. In this session, future activities planned in the LL (e.g., installation of the IoT devices in the field, etc.) were discussed, together with definition of the business models (BMs). A questionnaire was used for collecting input from all the participants, and brainstorming on different stakeholders’ interests, and potential impacts (socio-economic, environmental) affecting the definition of the business models.

Figure 37: Discussion with LL-Partners and Stakeholders – second Workshop Luxembourg (November 2023)

After this session internal to the LL members, a workshop with the end-users and stakeholders took place in the evening, to collect feedback from winegrowers about the first steps of the deployment of the use cases UC 1.1 and UC 1.2, defined for the LL Luxembourg. IBLA, LIST and LXS presented the challenges of the viticulture and the two use cases of the COMMECT project. All Luxemburgish winegrowers have been invited to participate to this workshop. 6

winegrowers were present as well as 9 other partners and stakeholders (Company for state-of-the-art management software, Institute for viticulture, LIST, IBLA and LXS).

Each use case was discussed in a small group of 9. Each group was a mix of winegrowers and other stakeholders. The participants had to write down their own ideas. The ideas were put together on a whiteboard and a summary was done with all the participants.

Figure 38: Second Workshop LL Luxembourg: Discussion with winegrowers (November 2023)

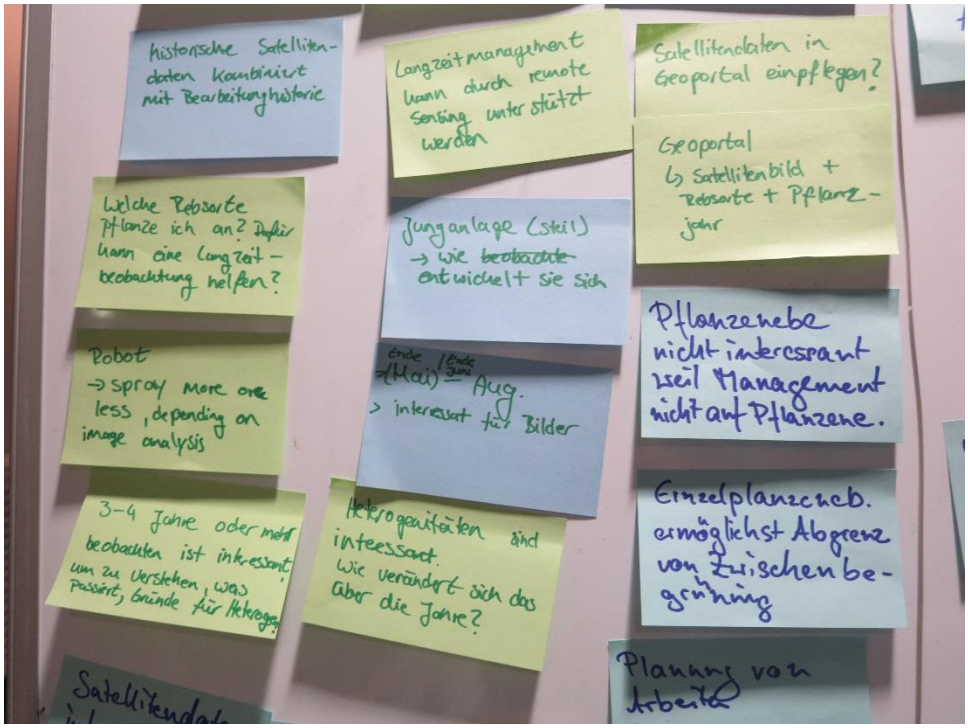

Figure 39: Results of the second workshop – LL Luxembourg

Wrap-up: effect of the use cases, the connectivity solutions themselves and possible business model for the LL

The first use case (In-Field Microclimate and Crop Monitoring in Vineyards) already developed through a well-known tool for the winegrowers to take decisions, was widely discussed through LL's presentations. For the participants, new weather stations and leaf wetness sensors are very important, especially to cover remote areas with a bad representation of weather stations or areas with a special microclimate. Until now, the weather forecasting system has not covered the variability of the vineyards, while at the same time local variability is increasing due to climate change. The heterogeneity of the precipitation is increasing on even very small local scales. In addition, the participants expressed their needs for the installation of sensors in order to monitor the soil temperature and wetness.

The participants demonstrated a particularly high level of interest in utilizing digital twin maps, with images at various scales, for long-term monitoring of vineyards. The concept involves the observation of vineyards over several years, providing valuable insights for decision-making.

This method serves as an objective repository, facilitating the documentation and analysis of variations between years and the influence of global warming. This approach can be used as an objective database to document and analyse the variability due to the global warming between years. Relying solely on the previous year's data, which is more readily available in the minds of winegrowers, may not be as effective.

Having a reference base spanning the last 5 years allows for a more comprehensive understanding. Winegrowers can then leverage the vineyard situation over five years, considering similar weather conditions, to make informed decisions regarding actions such as spraying or fertilizing. Digital twins prove to be an effective tool for managing the heterogeneity within each vineyard, facilitating precise application of fertilizers in the right locations.

Both tools should be available on the smartphone. One possibility for the business model could be based on software solutions of partner or other compagnies, which have already developed some mapping-tool for the winegrowers. Either the tool will be financed through public funds or through the winegrowers themselves by buying the software.

In general, it is difficult to motivate farmers in Luxembourg for a detailed and constructive discussion. Since we reached this challenge of a very active discussion within this workshop, we have a good basis to continue the work in our LL.

3.1.3. Other Meetings

It is important to anchor the results of the use cases in the actor's landscape in Luxembourg particularly the winegrower's representatives and the administrations.

For that, IBLA has presented the project to the "Fonds de Solidarité Viticole" to involve them better in the project. This organisation represents the three winegrowers' organisation (Private winegrowers, Cooperative and wine trade wineries) as well as the representatives of the Ministry of Agriculture. It tackles on the marketing issues and has an own budget on wine growing (grapes Producers, Producers with direct marketing and wine trading enterprises). It is the only framework with representatives of the whole winegrowers' organisations. Furthermore, a meeting with the agriculture' s administration "ASTA" on December 19th, 2023, has been organised. The main objective was to present the state of the current development of the project and to extend the existing COMMECT results in the future (after the Project).

ASTA was showing interest for the use cases, particularly the implementation of new leaf-wetness-sensors and weather stations in the Moselle valley. It is important for the ASTA, that the new stations will be checked during the first year before they could be integrated in the official network of weather forecasting from ASTA and in the official Vitimeteo visualisation website for the region. In detail, it is important to test the data transfer from the stations in the system as well as the sensors in the field for consistency with the other weather stations. From the experience of ASTA, the average temperature is always rather reliable, but temperature extremes might cause errors of 2-3 °C for weak sensor qualities.

Beside quality checks, the additional value of having more weather stations in the regions needs to be analysed. Additionally, to the weather stations, ASTA showed a general interest in the observation of fields and the entire region with earth observation data (drone and satellite), which is referring to the UC1.2. The general impression of the meeting was very positive, and it was appreciated to keep the administrative stakeholders informed about the plans of the project.

Several possibilities for financing the maintenance of the weather stations and leaf-wetness-sensors have been discussed. The winegrower's representative as well as the administrations could be involved in the business model.

The different partners of the LL Luxembourg are in constant exchange among them and with IVV, the main advisor of the LL. Besides the periodic online meetings, they frequently meet in the LL field to discuss specific topics, related to the implementation of the connectivity solutions designed for the two use cases. (see Figure 40)

Figure 40 LL Luxembourg field visits in June 2023, and January 2024.

3.1.4. Future Workshops and training

The LL Luxembourg plans another workshop by November 2024 after the vegetation and harvest period. By then, the additional weather stations and leaf wetness sensors installed in the LL will be operational since January 2024. Meanwhile, it is necessary to demonstrate that the accuracy of disease estimation can be enhanced by deploying these devices in the field. Furthermore, the digital twin will be more developed, and we can collect more feedback about their use from the winegrowers. We will invite more stakeholders in that workshop from several administrations, in order to speak about the possible exploitation of the project results.

3.2. Living Lab Norway

3.2.1. First Workshop

Concept and framework of the workshop

Through having had worked previously on other arenas such as “The future of the forest” and collaborations with other forest clusters such as Paper Province and Norwegian Wood Cluster, KI already had existing contact with some of the stakeholders in the forestry value chain. In collaboration with them the LL partners managed to map out the value chain more in its

entirety and through this map attempt to identify who are the major stakeholders and who would be most imperative to have attend a physical workshop. It was decided early on by the partners in the LL that a physical workshop was feasible due to proximity between several stakeholders and the LL partners themselves. A face-to-face workshop was deemed to be most productive as it was set to be a full day event where one could maximise the time invested. The primary stakeholders that were invited included: Forest Owner's associations, forest machinery producers and forest technology software developers. The SmartForest research project was also invited to encourage sharing of already existing R&D within the industry. Over 21 people attended the workshop and over half represented the value cain whilst the other half were representatives from partners in the LL. The workshop was held in Kongsvinger, Norway.

In preparation for the workshop the LL partners held several online meetings to plan how best to collect data from the stakeholders to identify the most relevant use cases. In the end a questionnaire in the format of a matrix was designed.

This matrix included the following questions that where to be addressed in a row:

- What is the problem/obstacle/possibility.
- What is done today.
- What is a potential new solution.
- Which are the expected effects.
- Which stakeholders are involved.
- Where does it take place in the value chain.

The overall impression of the workshop was that it was successful. The participants were enthusiastic and shared their insights openly. Enough data was gathered to provide a solid foundation for the next steps of the project and identifying the user needs.

Implementation of the workshop

The workshop was held on the 31st of October 2022, and it started with the LL leader presenting the COMMECT project and the agenda for the day. A representative from one of the largest forest owners' associations in Norway continued with a presentation of the forestry value chain, to illustrate and share with the LL partners what happens along the steps in the supply and value chain. The SmartForest research project representative also shared some of the possibilities that their project had been looking into regarding technological and digital opportunities. After dividing the participants into four groups, each consisting of five to six people, the workshop continued into its next phase where the actual data collection took place, and the participants completed the matrixes made beforehand.

After the workshop had concluded, KI collected all the data filled in the matrixes and tried to categorise and bulk some of the input to try and narrow it down to some major "pain points" to help shape some user needs and use cases. It was then sent out to the participants for feedback where they were asked to confirm if the summarising seemed appropriate. After this another round of summarising and bulking of the answers was done in order to reduce the selection, this time the participants were also asked to prioritise the selection based on how important one area/solution is and how easy to implement it would be using the scales 1-5, 1 being not important or easy to implement, and 5 being very important or very difficult to implement. After this we were left with 12-14 areas that we managed to generate end user needs and use cases from.

Wrap-up: End User Need and Use Cases

Six user needs where identified based on the data collected from the first workshop, as defined in deliverable 1.1.

One of the main priorities was overall improving connectivity solutions for forestry work, especially in relation to logging and transport activities. These activities are temporary during the year, and typically occur during a period of 2 months or more. Currently, the lack of connectivity is causing less productive workflows and potential economic losses as well as increases health and safety risks. Further there was specified a need for a significantly improved flow of relevant data between the various stakeholders and end users in order to minimise data silos.

The end users also highlighted the importance of operator safety. It is important to provide safer working conditions for the machine operator. The operator is exposed to fatal injuries when working (often alone) sitting inside, but also being outside and around the forestry machines. With no or little network coverage, communication options are few or non-existing (pending). Operating in tough terrain also consists of a certain level of strain injuries to the operator's body.

Lastly in order to avoid and reduce the amount of damage done to terrain and vegetation during the forestry activities it was expressed that better documentation (i.e. mapping) of the forest close to protected areas is necessary.

From the user needs, the following use cases were defined:

UC2.1 Remote operational support from expert for forest machine operator.

UC2.2 Reliable and seamless connectivity for complex situational awareness in the forest.

UC2.3 Digital decision support for the forest machine operator.

3.2.2. Second Workshop

Concept and framework of the workshop

The second workshop was held on the 13th of June 2023 (see Figure 41), at the same location as the first one and almost all the same participants from the first workshop were invited to this one as well. However, included in this workshop was also some suppliers/vendors from the technology industry such as Biodrone, Ericsson, Inmeta Consulting, Microsoft and Digital Utsikt. These suppliers were companies that were specifically chosen because they have technology/solutions that could be compatible with the identified use cases. The purpose of this workshop was to collaboratively map out ways to solve the use cases identified earlier.

The methodology and structure of this workshop was like the first but with some changes. The technology suppliers were given time to present their solutions and technology, so that all the participants were familiar with it and could consider it in the right context regarding the use cases. In total over 20 people attended the workshop.

We did not cover socio-economic needs and environmental issues specifically in the workshop, nor did we discuss business models at this point. The aim of the workshop was to agree and decide on the most appropriate technological solutions that would best address the existing user needs and the identified use cases.

Implementation of the workshop

The workshop was initiated by the LL leader from KI and representatives from TNOR. An overview of the results from the first workshop was presented with the identified use cases. Followed by the technological suppliers presenting their solutions that could be relevant to the use cases.

The technological suppliers present were Biodrone (digital presentation), InMeta, Ericsson, Digital Utsikt and Microsoft. Once the presentation of each supplier was done, all the participants were split into three groups. There were two representatives from the LL at each table and they represented one use case, so the participants moved from table to table in groups to answer one question tied to the use case.

The questions that the LL generated beforehand were as follows:

1. Describe point by point the desired work and dataflow in the use case (with best case using new technology). Discuss which technologies are relevant.
2. Describe point by point which actors/ecosystems that are tied to the various parts of the work and dataflow. Discuss what can be achieved through having this work and dataflow.
3. Describe the technological and procedural challenges tied to realising this use case. What are the critical success factors necessary to achieve it?

As a result of retrospect, we found out that it is more efficient to stick onto one specific use case during the discussion of groups, rather than only repetitively answering one single question around for each use case. In this way, more time can be spent into the in-depth discussion.

The original structure required each new group to understand what the previous group had discussed before they could embark on their own question for that use case. However, it did allow for more nuanced perspectives to be provided on all use cases for all questions.

Figure 41. Second workshop LL Norway (June 2023)

Wrap-up: effect of the use cases, the connectivity solutions themselves and possible business model for the LL

The end users were pleased to contribute towards identifying real potential solutions connected to the original identified user needs. They felt they have been highly involved throughout the process and as such been able to influence in the right direction based on their needs.

Through the workshop the use cases came more to life but still lacked more concrete connectivity solutions however this was resolved later internally in the LL. It became very clear during the workshop that there were strong parallels between UC2.1 and UC 2.3, so some groups were looking at how to apply one solution that could encompass multiple user needs.

The use of drones was identified to be applicable for all three use cases and this was something most if not all stakeholders were on-board with.

The solutions that have been identified through UC 2.1 and UC 2.2 address and meet the user needs that have most strongly been emphasised by the majority of the stakeholders including improved connectivity solutions for forestry operations, digitalisation, improving data flow between stakeholders and end-users and operator safety.

Based on the feedback from the stakeholders and end users who were present they seemed to have a reasonable understanding of what the digital solutions entailed. In regard to UC2.1 and being able to connect the forest machine operator to remote expert assistance in decision making and error control it became clear that this was a real focal and pain point for many stakeholders, because this is strongly connected to what the end production will be and to what extent the timber can be utilized fully.

3.2.3. Other meetings

LL Norway held another meeting (Figure 42) in January-2024. This meeting was co-organised with TNO, WP3 leader, to define and to establish possible business models together with stakeholders, for better developing the use cases of LL Norway.

The stakeholders who attended this gathering are a machine supplier (John Deere Forestry), some contractors (such as Machine Contractor Association) and forest owner associations (Glommen/Mjøsen, Nortømmer). Additionally, it was explored whether the State Administrator and Forest Fire Insurance are relevant to the use case of forest fire.

Before starting the processes below, the LL tried to develop a Business Model Radar based on our current knowledge of the value propositions per user.

The following process was completed during the workshop: First, a theoretical overview of the collaborative business model was developed: What does this mean, and what are the business advantages? After that, the business model radar was presented. A proposition of a generic description of an example of a collaborative business model where Telenor is standing at the centre of development. Finally, the presentation of the use case was summarized.

It was necessary to discuss the possibility of finding a driving partner in an ecosystem-based business model, apart from TNOR. What would it require? What roles and responsibilities can the actors in the room be involved? Which of the use cases have significant enough gains

for them to commit to a development process? Which actors are missing and need to be included in a collaborative business model (related to the two different business cases)?

Within this meeting, a plan for pilot testing of the use case was developed, which included an analysis of the related cost.

LL Forestry envisions that a technology actor is likely to take the lead in developing the digital solutions for the use cases.

Figure 42. Group discussions during the third workshop of LL Norway (January 2024)

3.2.4. Future Workshops and training

Currently no other workshops have been confirmed but follow up sessions with stakeholders and the relevant technological vendors in order to move forward with a viable business model will be pursued.

3.3. Living Lab Denmark

3.3.1. First Workshop

Concept and framework of the workshop

The first workshop was replaced by individual interviews with end users of ICT from the livestock trading and hauler sector. The Danish LL aimed at achieving a better understanding of the end-users' needs by interviewing the different stakeholders involved in the livestock trading and haulage processes. To collect the user needs and to achieve a good understanding of the livestock trading and haulage process, the Danish LL followed a collaborative approach with the involved end-users and stakeholders. Starting with desk research, and by having discussions with the main stakeholders (well known to the LL leader and connected to the Padborg Transport Center), the other identified end-users and stakeholders were suppliers of data logging devices on trucks and trailers, farmer organisations, farmers, truck drivers, truck and trailer technicians, truck and trailer manufacturers, livestock trading companies, livestock trading organisations, hauler companies, hauler organisations, animal science institutions. Danish authorities for both livestock registration and welfare, and finally relevant authorities for data supply and infrastructure.

Once the most relevant stakeholders were identified, the Danish LL created a questionnaire for the interviews based on the guidelines developed and described in D1.1. It included questions that facilitated the identification of the end-users' needs, how these needs are currently addressed or not, how they could be addressed with connectivity solutions, and why the unmet needs are not yet solved.

Implementation of the workshop

For accomplishing a comprehensive cycle of livestock trading and hauler sector, which requires analysis in the context of wireless network access technology and ICT applications in the domain, a three-steps process was followed:

1. In the first step a literature review including internet studies was conducted. Based on the literature review and the first talk with the main LL stakeholder, a company in the livestock trading and hauler business, the main stakeholders concerning animal transport, and their suppliers of equipment were specified. They were categorized into stakeholder groups. The first interview, together with the review of available literature, and Internet sources were used to prepare a questionnaire as well as a precompiled list of already publicly discussed wireless network and ICT applications in the livestock trading and haulage domain. The guide consisted of 24 questions that were clustered into the following three parts: a) asking the interviewees about user needs that could be addressed by means of livestock transport ICT, b) asking the interviewees to evaluate a list of precompiled livestock transport application scenarios (which the LL COMMECT partners found within the preliminary review) as well as to describe other promising wireless network access technology scenarios they were aware of and c) reviewing with stakeholders a list of possible constraints that are hindering the successful implementation of the application scenarios in the livestock trading and haulage domain.

2. In the second step, the LL partners PTC and AU conducted 8 semi-structured interviews. At least one representative of the stakeholder groups specified in the first stage was interviewed, such as livestock traders, livestock haulers, farmers, livestock transport organisations, ICT suppliers, farmers associations and technical manager for livestock trucks, trailers, trailer equipment and drivers. The interviews took about 60 to 90 minutes. The interview partners on the manager level came from the stakeholder groups that were specified in the first step of the research methodology. The evaluation of the interviews enabled insights into both the present and future user needs of the stakeholders for the whole livestock trading and hauler sector concerning the digitisation of the sector and the application of related wireless network access technologies. In sum, a list of 7 wireless network access application scenarios were discussed with the interviewees, (either picked from the precompiled list or mentioned by the interviewees themselves). By analysing these application scenarios, relevant constraints and requirements were identified that need to be in place for the successful implementation of the application scenarios. By aligning this initial list of constraints and requirements with the input from our interviews, a final list of use cases was compiled.

3. In a third step, the LL COMMECT partners PTC and AU cross-checked the findings from the above-mentioned steps by involving the primary stakeholder and domain experts, through further expert interviews, presentations at stakeholder, and expert meetings. The discussion concentrated on where intersection points exist and how use cases could be formed to make the potential wireless network solutions applicable.

Wrap-up: End User Need and Use Cases

One of the derived user needs comprised the need for improved navigation systems where seamless data transmission was discussed as a precondition for the mentioned ICT solutions for intelligent traffic systems (ITS). Livestock transport is a specialised and highly regulated type of transport, where many parameters should be adapted, especially those who potentially influence on the provisioning of reliable livestock transport over such a long distance of several hundreds of kilometres, ranging from the consignor of the livestock in Denmark to the consignee inside or outside the European Union. Export of livestock to countries outside the EU was also mentioned as relevant for the need of seamless connectivity. Stable connectivity for livestock transport to non-EU Countries is of highly relevance for the trading and hauler companies to comply with regulations for tracing and tracking of each livestock load outside the EU. The European Commission regularly negotiates how these regulations should be formed, and it was expected by many stakeholders that connectivity for stable data transmission could play a role in these negotiations.

The stakeholders also prefer more frequent reporting of journey logs that is currently based on online data transmission via 2G. There was a need to investigate novel connectivity solutions before closing the outdated 2G based data logging systems. There was usually agreement on that livestock transport will face a much higher degree of digitalisation in the future. The user need was therefore concerning connectivity solutions that could support any future data-driven solutions for livestock transport, without having the stakeholders able to define these solutions in detail. More detail was concerning another and urgent user need. There is an urgent need to relieve the truck drivers and inspectors for counting pigs during loading. There is a need for novel system for automated counting of pigs, for example by a cloud system and video streaming from the loading ramp of livestock trailers. Furthermore, cloud solution exists for automatic license plate recognition and boom, but they do not always work due to lack of connectivity at the locations where automatic control of trucks and trailers are needed to avoid spreading of diseases. The systems known today transmit images of number plates online and the processing is done on a could platform. There was also a discussion of the need to develop a low-cost tool for high resolution coverage analysis, such that IoT and ICT developers could analyse the environment/surroundings for connectivity, quality, reliability etc. on each spot where they intend to apply their IoT/ICT solutions, in order satisfy their customers. A summary of user needs in relation to livestock transport is shown in Figure 43.

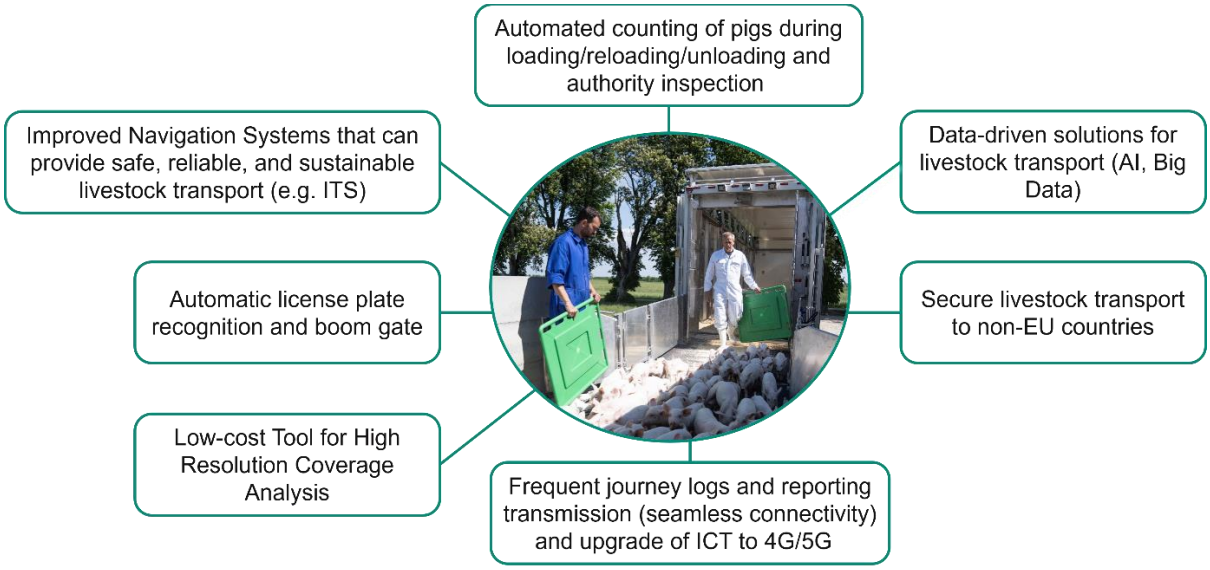

Figure 43: Summary of user needs acquired from interviews – LL Denmark

Based on the specific user need details and background information, the LL Denmark has decided to select 3 main use cases:

UC 3.1 Monitoring of Livestock Transport along Rural Routes

UC 3.2 License plate recognition

UC 3.3 Monitoring of Livestock Loading/Unloading processes

3.3.2. Second Workshop

Concept and framework of the workshop

On August 28th, 2023, the 1st F2F Workshop, Figure 44,on Connected Livestock Transport by the COMMECT Denmark Living Lab was held in Padborg, Denmark, in association with ITD, which is a private business association for the professional transport and logistics companies . The aim of this workshop was to bring together relevant stakeholders to collaboratively explore the three use cases mentioned above, in relation to connectivity requirements, potential business models and the factors affecting the adoption of innovative strategies and ICT in the transport sector. Overall, the workshop achieved the active participation of 19 relevant stakeholders, divided between 2 from livestock trading and livestock transport haulers, 1 from the farmers organisation, 2 from large hauler companies, 5 from transport and logistic organisations, one from a large technology provider for haulers, 8 participants from research institutions (all COMMECT partners).

The workshop was held at the ITD premises in Padborg, Denmark, located within the Padborg Transport Center area. The location was selected to increase the interest of stakeholders to attend the workshop, as the Padborg Transport Center comprise an area of 5 km2 consisting of premises of more than 200 companies directly or indirectly related to transport and logistics. The agenda for this second workshop is attached in the Appendix A.

After a brief introduction of the COMMECT project, the first workshop session aimed to identify user needs and defined use cases. After a get-together-lunch, the second session tackled on

the Danish living lab connectivity solutions (TNO, AAU, VITECH). The workshop day ended with a separately organized session on business modelling for connectivity (TNO).

Implementation of the workshop

The first part of the workshop consisted of a round of presentations of participants. An introductory presentation was given by Jesper Schimann Hansen (PTC), with the aim of introducing the workshop as well as providing an overview of the current livestock transport situation, available technologies, and innovative solutions useful in the transport of livestock. The presentations also included a very short overview of the COMMECT project by Michael Nørremark (AU), aiming to familiarize the participants with the COMMECT project and its main objectives.

The second part of the workshop focused on creating discussion and collaboration on several related topics through a unique working group format. The goal here was to stimulate discussion and develop constructive solutions around key questions and developments facing the livestock trading and transport sector in Denmark and the EU. The discussion part of the workshop was managed by appointed moderators/facilitators. The discussion was split in three parts according to the corresponding theme, each part began with an introductory pitch and a question set via the interactive live polling tool, Mentimeter, which were accessible via a browser or App for OIS and Android devices. The goal was to introduce the topics and stimulating participation in discussion of the topics.

Figure 44: Workshop with stakeholders from the transport sector, livestock trading companies, farmer and hauler organisations (August 2023).

The discussion was split in three sessions according to the corresponding three themes of workshop facilitating opening questions. Each session began with an introductory pitch and a question set via the Mentimeter with the goal of introducing the topic and stimulating participation on the topic. This was then followed by an open discussion facilitated by a series of related questions and sub questions that were presented to the participants. Participants were first asked to start a round of discussion and then write down their responses to each question on post-its which were collected and added to a board/canvas. Each post was referenced with the question number and occupation of the post-its writer. After the discussion

had completed, the working group moved on to the next opening question or theme. More specifically, the three facilitating question categories were:

- Use cases. Demands from the pig trading and transport sector stakeholders to improve quality and efficiency. Key themes are challenges, value improvement, problems, and translation to defined use cases. The specific questions were:
- Connectivity solutions. What technical solutions/digitization, policies and/or intensives are preferred. Identification of research directions, collaboration schemes, cross-border and educational efforts. The specific questions were:
- Exploring business models. The key themes are transport data collection and processing requirements, value proposition, collaboration, and finance. The participants first were replying to survey questions a paper individually. They discussed the theme in the plenary. These steps were repeated for each theme. The questionnaire deals with the topic: Data requirements, Value proposition, Collaboration, Financials

The specific questions per category can be found in the Appendix A.

The discussion was very fruitful in terms of providing various viewpoints on the relevant topics. Specific answers collected on post-it notes were documented and archived, as well as notes taken by two COMMECT partners.

After the completion of the working group discussions the final part of the workshop included networking while wine and tapas were offered by Padborg Transport Center.

Wrap-up: effect of the use cases, the connectivity solutions themselves and possible business model for the LL

The workshop revealed a need to work on the redefinition of the motivation (and possible the requirements) for the UC 3.1. Some motivations requiring connectivity on-the-route:

- In situations where the journey log has errors, the livestock transport documentation is wrong. In most cases it takes about 5 man-hours to solve a wrong transport documentation. The situation in Denmark is that about 2.8% of the documentations are wrong.
- Sensor information to be sent to the cloud due to expensive edge-cloud solutions.
- Risk assessments (e.g. livestock compartment temperature, transport duration, disease areas, traffic) is easier with online sensor information.
- Intelligent transport systems (ITS) and future autonomous trucks?
- Helping the driver with route planning. Route recalculation is done locally in the truck, but connectivity is needed to load the maps (including resting places and/or washing stations), current traffic conditions, etc. The final decision is with the driver, so having information that aids decision-helping would be very useful for them.
- Communication and data sharing between drivers.
- Seamless connectivity has requirements in terms of seamless switching between cellular network operators. Connectivity issues have been specially observed when roaming (mostly when driving across the border).
- There are issues to increase coverage because antennas cannot always be placed at most optimal location on trucks, trailers, containers etc.
- Coverage investments by cellular network operators are based on household locations, so very low population areas still lack connectivity for the whole road transport sector.
- Document/code scanning of parcels is also impacted by connectivity issues.

The lead of UC 3.1 are OEMs (i.e., Original Equipment Manufacturers), but the solutions for livestock transport should not be initiated alone, otherwise the demand is too small. Also, the authorities and organisations should first agree and then set up a standard, otherwise the

market response is too low. The COMMECT project consortium should keep in mind that the connectivity and ICT solutions that the LL propose by use cases are useful not only for livestock transport and logistics, but also for the hauler and logistics business (which could provide higher market responses to the solutions). The ICT systems including newly developed connectivity solutions should be largely scalable, such that everyone using trucks could use it. Hardware/software are typically changed every 8 years in the hauler business. Currently, the livestock hauler business is facing a replacement of existing systems based on cellular networks because of the closing down of 2G and the need to switch to 4G. This requires new hardware followed by software updates. An example of current data logging and connectivity costs were given at the workshop, with total deployment cost of 500 €, and a monthly cost of 50 € for each truck.

The UC 3.2 and UC 3.3 was well acknowledged by participants. All participants agreed that the video feed and automation would be very useful, as well as the license plate recognition and boom automation. However, the LL was recommended to acquire input to use cases from the farmers and veterinarians that are performing the inspection of pigs' prior the delivery to transport. The problem with rejected pigs is that there is no place for returning the pigs that shouldn't be transported. It is therefore necessary to involve farmers more in developing the solutions that involves video streaming and AI to reject pigs and intercept prior delivery to loading facility, such that the rejected pigs can stay in the farm. Some of the motivations for demanding additional connectivity at the loading/reloading/unloading locations are listed as follows:

- The current level of digitalization in the farms is very low (some farmers do not even use email). One major issue to address is how the livestock transport truck/trailer can be automatically connected to the farm's network. There needs to be authorized from the farmer's side (e.g., WiFi login and password).
- Drivers cannot lose time connecting to private networks. It should be done in an automatic and secure way.
- In loading/unloading locations, in general, one of the main challenges is communication between the different systems/platforms (e.g., trucks, local WiFi, warehouse).
- For the hauler business, remote connection on ferries is necessary (from Norway, Poland etc.), but there is no connectivity at all. Although some solutions exist to overcome the problem, these solutions remain too expensive.

The environmental impact was considered a bit challenging for the use cases, but zero emission and reduced GHG emission are suggested by participants, which relies on ITS, and notably efficient driving for electric trucks battery saving. All of these technologies will require connectivity solutions as experienced from electric cars.

3.3.3. Future Workshops and Training

More workshops and events will be held in LL Denmark in 2024, for better investigating the user needs from the discussion with stakeholders, further analyzing and addressing common objectives, challenging tasks, as well as specifying the business model that matches the LL's technological development in the long term.

3.4. Living Lab Turkey

3.4.1. First Workshop

The workshop was held on 20th December 2022 in Olive Research Institute (see Figure 45 and Figure 46). The title of the workshop was "Digitalization in olive agriculture, problems and solution proposals" and it was held with the participation of 36 producers and producer representatives from 19 different districts of Turkey. All of them are engaged in olive farming.

The purpose of the workshop was to present COMMECT project objectives, activities and identify and collect data on end-user needs.

Concept and framework of the workshop

We must consider all the stakeholders involved in the value chain to determine the needs of olive producers. Initially, 65 olive farmers were interviewed to clearly define the user needs. First, users' level of knowledge and interest in digital farming systems were discussed. Secondly, the connectivity problems or experience in using digital agriculture systems were determined.

The interviews were carried out with olive farmers in the period December 2022 and February 2023. Producers were randomly selected, ranging from individual farmers of 36 districts of 8 different provinces (e.g., Bursa, Balıkesir, Çanakkale, İzmir, Manisa, Aydın, Denizli, Muğla). Questions about decision-making in olive pest and disease control, irrigation, fertilization management, digital connection problems and usage information issues were widely discussed to cover the interest of all the stakeholders. Those interviews provided a good opportunity to collect necessary data for the successful implementation of solutions that will meet the needs of end users in olive farming.

Implementation of the workshop

A presentation was given by LL leader of M.K. Savran. He explained the aims, benefits and activities of the project to help the participants understand the purpose of the workshop.

The problems encountered by olive producers were discussed. Feedback was received on how digitalization can contribute to agriculture. Particular attention was paid to connectivity issues and the usage of outdated technology by older farmers. The effectiveness of agricultural technology advances implemented in Türkiye was evaluated.

Figure 45: First Workshop Türkiye (December 2022)

Wrap-up: End User Need and Use Cases

As a result, in addition to the coverage area problems, it was determined that training studies on digitalization should be carried out. Also, early warning systems are considered useful, but the solution can only be achieved through organization, instead of an individual action.

On the other hand, the challenge of finding agricultural workers and the need for skilled workers was analysed. It is known that some of the approximately 5.5 million refugees living in Türkiye have experiences working in agriculture. Obviously, the experience of refugees is valuable to Turkish LL. We need to find a way to properly attract their interests and gradually guide them towards the digitalization in olive production.

Figure 46: LL-Partners – First Workshop Türkiye (December 2022)

As a result of the interviews with the participants, it was decided to prepare a new questionnaire and to get the opinions of the producers on the subject.

Early warning systems on the olive grove were introduced to the participants. Opinions on this system were received and the meeting was concluded.

3.4.2. Second Workshop

The second workshop was held on October 6, 2023, at the Izmir Olive Research Institute (see Figure 47). In the event, the COMMECT project was introduced. After an introduction on "why digitalization in olive agriculture could be important for stakeholders". The workshop was co-organised with TNO to discuss the business models.

Concept and framework of the workshop

News about the 2nd Workshop was published on TOB official website and social channels: Instagram and X (Twitter) accounts.

Figure 47: Dissemination of Second Workshop on web, X and Instagram (October 2023)

In addition to 32 participants from stakeholders, 3 project members from TNO organization attended. The opening speech was given by Ünal Kaya, the Director of the Institute. Afterwards, M. K. Savran, responsible for the COMMECT project at TOB, presented the project scope, objectives, and ongoing activities. Andrea Kertens and Virag Szijjarto, participants from TNO, made their presentations in English, which has been translated later in Turkish.

Figure 48: Introduction of the early warning system to workshop participants (October 2023).

Implementation of the workshop

After all presentations were completed, questionnaire forms were distributed to stakeholders. Every section of questions was discussed one by one, and unclear issues were explicated. Accurate and efficient results were acquired from the questionnaire by using a question-and-answer format.

Figure 49: A scene from second workshop during TNO presentation (October 2023)

Wrap-up: effect of the use cases, the connectivity solutions themselves and possible business model for the LL

One-by-one interviews were held to collect the opinions of participants and stakeholders and to fully explain the expected project outcomes. The workshop answered the concerns and questions of participants and demonstrated the possibility to transfer the project outputs to concrete benefits. It was also discussed on the possibilities to disseminate the project outputs by provincial and district institutions, under the Ministry of Agriculture, that have a widely extended network. Opinions were expressed that device costs must be financially supported by farmer unions like TARIS, MARMARA BIRLIK.

At the end of the workshop, stakeholders, especially agricultural insurance, showed close interest to the use cases, and there were requests for training on tools that could be put into practice with representatives of large producer cooperatives. Also, business owners showed their economic interest for using the devices in olive farming in the production regions.

Figure 50: LL-Partners – Second Workshop Türkiye (October 2023)

3.4.3. Future Workshops and Training

In 2024, digitalization training in olive agriculture will be given to 3 different groups of refugees and rural farmers. During the training, weather stations and digital traps used in the COMMECT project will be introduced and detailed information will be given about how to use them in olive farming. The needs of these communities will also be evaluated during the training. Additionally, it is aimed to organize 2 more workshops in 2024. In these workshops, how to bring together different stakeholders in the olive value chain and how digitalization can be widely disseminated in olive agriculture will be discussed.

Within the scope of the COMMECT project, the first training program for refugees and rural communities was given on January 26, 2024, in Akyurt rural village of Tire district of Izmir province. A group of 20 people attended the training. There was also 1 translator for every 5 Syrian refugees in this group.

Figure 51: First training organization of Turkish LL (January 2024)

The problems of olive farmers were investigated during the training. Later, information about the project was presented by LL Türkiye leader Kerem Savran. The advantages of digitalization in olive production on production processes were highlighted. The major issue that manufacturers encountered is the installation cost of the system. They would be interested if financed through the Ministry, non-governmental organizations or cooperatives.

At the end of the training, requests were received to provide practical information in the next training.

3.5. Living Lab Serbia

3.5.1. First Workshop

The workshop was held on 16th December 2022, in Gospodjinci village. It gathered 44 participants: farmers, representatives of farmer association Solar Agro (ZZSA) and representative of a solar trailer supplier. The overall goal of workshop was to present COMMECT project objectives and activities and to gather farmers needs to be used as inputs to define the LL use cases.

The workshop method used was a combination of interactive session, presentation and group discussions thus encouraging active participation from farmers. During the introduction session, the possibilities and expected benefits of introducing the digital farming solutions was presented followed by COMMECT project presentation. The second part of the workshop was organized as an open discussion where farmers were able to explain the current practice they are relaying on, problems they are facing with and to define their needs.

Implementation of the workshop

Used method ensured that the workshop was informative, participatory, and data-driven, resulting in a comprehensive understanding of user needs and valuable insights for the project. DNET prepared the questionnaire for the workshop to collect more information from the farmers and better understand their needs. Farmers provided the answer orally. All participants were divided into several groups per specific topics. They discussed the main challenges and problems in irrigation practice, pest and disease management, power accessibility, network connectivity issues and nature park protection. The collected information was gathered and used as a basis for defining user needs that were prioritized based on impact on sustainability and alignment with project goals.

Figure 52: First workshop with farmers from farmer association Solar Agro and solar trailer supplier (December 2022)

Farmers in agriculture areas face a significant obstacle due to poor mobile network coverage, hindering the introduction of digital solutions. To address this, there is a need for stable network connectivity at the community level, enabling the gathering of measurements from devices for informed decision-making. With only 20% of deployed irrigation systems in use, all powered by fossil-fuel generators, farmers require a solution that shifts to renewable energy sources. This transition not only reduces environmental footprint but also decreases production costs. The influence of agriculture activities on surrounding nature parks necessitates real-time insights into environmental conditions. Farmers need technologies for monitoring air quality, water quality, and noise levels to actively contribute to environmental preservation. To enhance agriculture practices, farmers seek solutions for real-time insights into specific parameters and automated analysis of gathered measurements, enabling better decision-making based on environmental conditions. For improved collaboration, farmers require a dedicated space for exchanging agricultural data, sharing best practices, discussing challenges, and finding solutions. This collaborative platform aims to engage multiple stakeholders, including local farmers, associations, service providers, and government entities. Ensuring the safety of crops and equipment is a challenge for farmers. Hazardous activities in nature parks and unauthorized vehicle access demand a comprehensive solution that ensures the safety of crops, equipment, and contributes to nature park conservation.

Defined use cases demonstrate commitment to address user needs while simultaneously targeting socio-economic and environmental concerns. UC 5.1 aims to create a shared rural infrastructure thus providing stable power supply and network connectivity in rural area. Using mobile solar generators promotes cost-effective energy and reduces reliance on fossil fuels. UC 5.2 is focused on implementing edge ML computing for events detection to secure farmers assets while monitoring crops growth and field activities. The shared platforms (environmental – UC 5.3 and agriculture – UC 5.4) provide necessary information for improving agriculture practices and nature park management contributing to park preservation, improving agricultural skills and reducing environmental footprint. Shared community platform (UC 5.5) serving as a central hub for collaborative learning and information sharing will foster knowledge exchange among farmers, promoting sustainable practices and community collaboration for socio-economic benefits.

3.5.2. Second Workshop

Concept and framework of the session

Within COMMECT's Work Package 3 activities, on October 2nd in Novi Sad, Serbia, TNO partner from the Netherlands led a thematic session on business modelling for Living Lab Serbia stakeholders. During this session, DNET presented proposed LL solution, while TNO representatives introduce the business models options with a specific focus on collaborative business model. The primary goal of this workshop was to foster discussion among participants from various sectors, including farmers, representatives from farmers' associations, solar generator suppliers, service provider and mobile operators, regarding collaborative business model and LL's proposed solutions. TNO representatives prepared a survey questionnaire and together with DunavNET gave the intro of COMMECT project and defined use cases for Serbian Living Lab. Afterward, TNO presented the business modelling options. Discussion was focused on four themes: data requirements, value proposition, collaboration, and financials.

Figure 53: Survey questionnaire for involved stakeholders.

Participants were actively involved in the discussion stressing the main obstacles in adopting digital solutions while at the same time expressing willingness to implement such services in everyday practice.

Farmers, once again, expressed a need for real-time data monitoring, diseases prediction and irrigation optimization support, while also seeking general improvements in personal and business aspects. Machinery tracking, including anti-theft measures for assets like solar trucks and machinery, was identified as very important.

Figure 54: Discussion with farmers and solar trailer supplier (October 2023)

Challenges identified during the workshop include user adoption, trust, and the demand for precise, real-time data. Collaboration among key stakeholders, including farmers, DunavNET, telecommunication companies, device suppliers, solar generator providers, and farmer associations, plays an important role. The workshop's takeaways highlight the importance of understanding each stakeholder's role, recognizing the farmers' focus on quality of life, the value of information sharing, and the enhancement of end product development. Future steps include further engagement with farmers and their associations to grasp user needs, observe the solution in action, explore farmers' technology adoption preferences, and identify additional features for development.

Future Workshop(s) and Training

In spring 2024, after deploying devices in the fields, the training session for farmers is planned with the aim to teach farmers how to use the technology provided. The session will provide an overview of the agroNET platform, with practical demonstrations for easy integration into daily farming. The training will also focus on addressing any challenges or queries that farmers may have, fostering a collaborative environment for mutual learning. By the end of the session, farmers should feel comfortable navigating the platform. This training is an important step in successfully implementing of digital solution, ensuring farmers can make the most of its capabilities for improved farming practices. Additionally, as the lab test of devices has been completed by January 2024, the workshop with farmers will be soon scheduled for their installation.

3.6. Lesson Learnt from the Workshops

The organization of workshops in each LL is a great opportunity for the project partners to stay in contact with the stakeholders of the project, coming from different economic backgrounds. In addition, the networking component of those methods allow people to sit together and to exchange in an informal way, sharing their point of view, and knowing each other better. The use of questionnaire and interview methods are complementary tools, to directly gather feedback in a comfortable way and motivate people who are not used to speaking a lot in a group discussion. With those several methods, the LLs could regularly gather feedback and could reach out a stable network of motivated participants. For all the LLs, the organisation of workshop enhances the visibility of COMMECT project and the awareness for connectivity solutions in the rural areas. In the near future, LLs are looking forward to exploring new networking channels and exchange methodologies, to listen closely to the needs of stakeholders. Followed by efficient, customized and practical training plans, it will allow to better synchronize the progress of technical development with the general targets from business model.

4. Conclusion

Within the framework of COMMECT project, this deliverable focuses on the dissemination and communication activities in each LL. In the first part, the dissemination activities carried out in the first 18 months of the project are detailed. The COMMECT project was widely disseminated through Internet, media, press and scientific publications. The project was presented in several national and international workshops, conferences and scientific summits.

The second part of the deliverable provided a detailed presentation of the interviews and workshops organized in the different LLs, to consistently collect feedback from stakeholders, about user needs, connectivity solutions and business models is provided. The constructive discussion ranges from “What to address” to “How to address”, aiming at providing the best solutions to end users and developing suitable and feasible technical solution.

Lastly, it is important to accelerate the training process among the farmers, further diffusing the benefits of digitalization into the agricultural production, as well as motivating the farmers to apply and to share customized digital solutions in practice.

In next phase of COMMECT project, all LLs are looking forward to strengthening the connections with stakeholders by engaging in more promising activities, addressing the concrete need from end users, while evolving the business model and developing practical solutions in the field. In addition, with consistent technical progress and an expanded network, COMMECT is consolidating its influence and elevating it to a higher level through both face-to-face interactions and social media channels. COMMECT actively pursues academic and industrial objectives on both national and international scales.

Appendix A: Method of the workshops

LL Luxembourg

First Workshop: Wine Farm Surveys to determine the user need

Wineries - Interviews

Table 6. Promotional Events in LL Luxemburg

No	Cultivation System	Marketing Structure
1	Organic	Self-Promotion
2	Organic	Grape Grower for Vinsmoselle
3	Conventional	Self-Promotion
4	Conventional	Grape Grower for Vinsmoselle

Table 7. Interviews in LL Luxemburg

No	Operation	Interview on:
1	Self-promoting organic farms	CW 12-17.12 2023
2	Self-promoting organic farms	CW 12-17.12
3	Self-promoting organic farms	January 2023
4	Self-promoting organic farms	12.12.2023 13:00
5	Self-promoting organic farms	January 2023
6	Grape Growers for Vinsmoselle	14.12.2023 9:30
7	Grape Growers for Vinsmoselle	January 2023
8	Grape Growers for Vinsmoselle mediation Harald Beck	January 2023
9	Self-promoting Conventional farms	2-13 January 2023

Interview – questions

On the use of digital information sources in management decisions in Luxembourg viticulture

1. Topic: Peronospora

- What is your experience in the field of Peronospora control in the last 5 years?
- How do you shape your Peronospora control decision-making with regard to
- Scheduling
- Choice of Fungizides

- What sources of information do you use for your decision-making?

- Predictive models of the VITIMETEO family
- Local Rainfall Information
- Weather Apps
- Own experiences based on previous years/exchange with other winegrowers
- Differentiation between favorable and infection situations
- Telephone/email contact to the official advisory (IVV/IBLA/DLR Mosel)

- Where are information gaps and where are uncertainties in decision-making?

- Do you use IT equipment?
    - If so, what and why?
    - If not, why? What do you need?

2. Topic: Drought Stress/Soil Moisture

- Has drought stress been a relevant topic for you in the last 5 years?
- Are you expecting this problem will become more important in the next few years?
- Which plants do you already water?
    - New and young plants (1-3 years)
    - Younger plants (<15 years)
    - Old plants (>15 years)
- How do you irrigate?
- Do you differentiate between different types of soil and take them into account when making decisions?
- Would soil moisture sensors help you make decisions?
- Do spatial patterns occur within the surfaces?
- Can you explain the patterns (soil/greening/topography)
- Would satellite/drone data help you interpret it?

3. Topic: Site-specific fertilization

- Are you already using site-specific fertilization?
- Are you planning to fertilize site-specifically in the future?
- What data do you use to make decisions?
- What other information would you need?
- Which fertilizers (mineral/organic) are applied site-specifically

- **Would you use remote sensing data on different scales in fertilization decision-making?**
- Drones
- Geoportal
- Satellites

4. Topic Ranking

- Arrange the 3 mentioned topics according to the relevant meaning for you

Second workshop

Agenda:

14:00: Start of the LL-Meeting

Introduction - presentation of the project- Overview of the use-cases

14:10: LL and next steps – Moderation through LIST (Miriam Machwitz as LL-Leader)

15:00: Business Model

16:00: End of the first part

17:00: Start of the second workshop: Introduction.

17:10: Use case1 Discussion (in 2 groups)

17:45: Wrap-up about the Use-Case 1

18:00: Use Case 2 Discussion (in 2 groups)

18:30: Wrap-up about the Use-Case 2

19.00: Uhr End of the workshop – Wrap-up

LL Denmark

The first workshop occurred on August 28th, 2023, from 9:30-17:00 CET, followed by networking, wine and tapas. The workshop agenda was as follows:

09.30 – 10.00 Arrival and signing participant list (coffee)

10.00 – 10.45 COMMECT Project Intro and introduction to workshop process (Jesper Schimann Hansen and Michael Nørremark).

10.45 – 12.00 1st workshop session on identified user needs and defined use cases.

12.00 – 13.00 Lunch.

13.00 – 14.30 2nd workshop session on Danish living lab connectivity solutions (TNO, AAU, VTECH).

14.30 – 15.00 Coffee break.

15.00 – 16.15 3rd workshop session on exploration of business models for connectivity (TNO).

16.15 – 16.45 Wrap up the day

16.45 – 17.00 Break

17.00 – 18.30 Networking, Wine and Tapas

Appendix B: COMMECT Roll-up translated in local language for LL Serbia

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